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# ANARE RESEARCH NOTES 73

Faunistic studies at the Windmill Islands, Wilkes Land,  
East Antarctica, 1959-80

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This report is dedicated to R.A. MacKenzie, who took his dogs  
and broke out of Casey and Newcomb Bay in October 1968,  
and rediscovered the world of Eklund, Penney and Orton.

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# FAUNISTIC STUDIES AT THE WINDMILL ISLANDS, WILKES LAND, EAST ANTARCTICA, 1959-80

by

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## ABSTRACT

Biological studies commenced at the American station Wilkes in Wilkes Land, East Antarctica in 1957. In 1959 station operations were taken over by the Australian National Antarctic Research Expeditions (ANARE) and maintained until 1969 when Casey station was commissioned. This report reviews the information on the fauna obtained by ANARE up to 1980.

Studies on invertebrates were limited to ectoparasites of birds and seals. Interest was mostly in the avian and mammalian fauna. Extensive banding of Adélie penguins, southern giant petrels and southern fulmars was undertaken for dispersion and breeding studies. Breeding behaviours of southern fulmars and Antarctic petrels were studied. The main breeding locality of the Weddell seal in the area was located. The southern elephant seal was found to breed at the Windmill Islands, the only known breeding site on the Antarctic continent.



## 1. INTRODUCTION

The first ANARE visit to the Windmill Islands (66°20'S 110°25'E) was in January 1956 (Law 1959). In 1957 the American station Wilkes was established on the Clark Peninsula. ANARE took over Wilkes in 1959, and maintained the station until Casey was commissioned on the Bailey Peninsula in 1969 (Figure 1).

Biological studies were an important component of the research program, commencing with the studies of C.R. Eklund, USARP, on the Antarctic skua and R.L. Penney, USARP, on the Adélie penguin. In 1959-60, M.N. Orton, ANARE, made an extensive ornithological survey of the region which led to Ardery and Odbert Islands being declared a Specially Protected Area under the Antarctic Treaty. Extensive banding of Antarctic skuas, Adélie penguins and southern fulmars was continued by Z. Soucek and K. Hicks under the supervision of M.D. Murray. In addition, studies on the adaptations of ectoparasites of marine birds and mammals were undertaken by M.D. Murray. These studies ceased in 1964 when small boats were withdrawn from the area. Routine observations continued with notable contributions by R.A. MacKenzie in 1968 and J. Ackerley in 1971. In January and February 1972, M.D. Murray conducted a biological survey of the area. The biological studies of that year by D.J. Luders stimulated a considerable effort towards a fuller biological understanding of the area.

## 2. GEOGRAPHY, GEOLOGY AND CLIMATE

The Windmill Islands lie in the north-east of Vincennes Bay. They are the only extensive area which becomes snow-free for some 400 km of coastline east or west. They lie to the western side of the Law Dome along a shoreline running north to south. The topography of the mainland deflects the katabatic winds of the interior away from the immediate area. Most of the winds come from the east. Consequently there are fewer snow drifts from the northern faces, and a variety of nesting sites are available for birds on the islands, as these favoured areas are not heavily snow covered.

During the winter months the sea ice is sufficiently sound for the islands, except the Frazier Group, to be visited over the sea. However, from September the sea ice can rapidly become unstable. The typical pattern of break-out is shown in Figure 1. The more detailed pattern in Figure 10 shows the sea-ice's unpredictability as the whole of the sea ice in Eyres Bay moved out on 4 October 1974. Throughout the year there is usually a large area of open water between the fast ice around the islands and the pack ice to the north.

Protruding from the plateau ice near the sea are the Løken Moraines, Robinson Ridge, five nunataks and the bare rocks of the Clark, Bailey, Mitchell and Browning Peninsulas. Five kilometres to the south is the Vanderford Glacier which protrudes some 9 km into the sea, and 60 km to the north is the shallow Petersen Bank upon which icebergs drifting from the east become grounded.

The islands may be divided by their topographies into three groups. Those offshore to the Clark, Bailey and Mitchell Peninsulas are mostly low lying with altitudes increasing to the south. They are surrounded by shallow water. The Donovan and Frazier Islands in the north are farther offshore, and the latter, in particular, have extensive cliffs rising from the sea. The third group lies between the Mitchell Peninsula and the Vanderford Glacier. Most have steep, rough terrain with cliffs rising from the deep water that extends into the Hiegel and Knowles Passages. Ardery, Odbert and Herring Islands exceed 100 m in altitude. Several small freshwater lakes are found in the valleys between the ridges on Peterson Island and the Browning Peninsula.

Blight and Oliver (1977) give a preliminary account of the metamorphic geology. The rocks consist of a layered sequence of schists, gneisses and migmatites (the Windmill metamorphics) which are intruded by a charnockite (the Ardery Charnockite extending in an arc from Robinson Ridge, Odbert, Ardery, Holl and Peterson Islands to Browning Peninsula) and a porphyritic granite (the Ford Granite found on Ford and Cloyd Islands). These are cut by two swarms of easterly-trending dolerite dykes. The rocks have undergone four deformations. The first two produced tight, isoclinal folds, the third developed broader, less oppressed concentric folds and the last deformation produced gentle warps which plunge steeply southwards.

The mean daily maximum temperature for January is +1°C, and the mean minimum for July is -20°C (Anon 1974). Winds come from the east and east-north-east off Law Dome, and from the south (Philpott 1967). Blizzards occur mostly during the winter. Gusts up to 100 km are common (the highest recorded is about 160 km), but regular katabatic winds are not a feature of the climate, consequently there are many calm days. Precipitation is mostly by snow but rain has been recorded in the summer.

### 3. INVERTEBRATES

Investigations have mainly concerned birds and seals. Few studies have been made of the sparse terrestrial invertebrate fauna. Soil samples were taken in the 1977-78 summer to be examined for yeast, bacteria, algae, fungi, protozoa and other invertebrates.

The Antarctic flea, *Glaciopsyllus antarcticus*, was discovered on Ardery Island by M.N. Orton in the nests of southern fulmars, *Fulmarus glacialis* (Smit and Dunnet 1962, Murray *et al.* 1967). The anopluran louse, *Antarctophthirus ogorhini*, is found on the Weddell seal, *Leptonychotes weddellii*. Extensive investigations were undertaken on its adaptations to a marine existence (Murray *et al.* 1965). Species of mallophagan lice have also been found on birds.

### 4. VERTEBRATES

The first extensive bird survey was reported by Orton (1963). The 12 species recorded are listed in Table 1 with brief notes on their status. Details of banding and recovery are given in Appendixes 1 and 2. In the main, studies were confined to establishing the breeding cycles. Graphical representations are given in Figure 2. The other energy demanding cycle, the moult, was little studied due to the lack of suitable boats to visit the breeding sites on the islands.

#### 4.1 BIRDS

##### 4.1 Emperor penguin *Aptenodytes forsteri*

The emperor penguin appears to be a regular visitor to Vincennes Bay. The majority of records, from August to December, comprise adult and immature birds, with reports of small groups of moulting birds as indicated by deposits of feathers and guano. Between 1972 and 1980 field work on seals led to the southern area around Browning Peninsula being well-travelled in October and November each year, and sightings of emperor penguins increased in frequency. In 1976, at least 34 birds were sighted and 10 birds were seen daily during November until the sea ice broke out in Penney Bay.

A coastal helicopter search south to within 2 km of Hatch Island, (109°16'E; 66°54'S) in January 1973, failed to find possible breeding areas within 85 km south-west of Casey.



#### 4.1.2 Adélie penguin *Pygoscelis adeliae*

The Adélie penguin is by far the most abundant bird species in the area, and breeds on all islands with easy access to the sea when the sea ice breaks out in summer (Figure 3). Eklund (1961) estimated 155 000 breeding birds in 1956-58. Birds arrive at the colony site each year on about 18 October (range 16-22 October over 10 years). The whole colony arrives within 2 weeks. The first eggs are usually laid between 9 and 15 November, and most nests have two eggs by 28 November. Chicks hatch on about 15 December and are fledged by the end of February.

The population on Shirley Island comprises some 45 colonies varying in size from 9 to 1600 pairs. Colonies may become established at new localities, and abandoned areas have been found. Estimates were made of the numbers of breeding birds when the first eggs were being laid on 10 November; 7580 pairs in 1971, 8534 in 1972 and 8012 in 1973. In 1974 and 1976 the counts were made 2 weeks later when the eggs were being incubated and the colony was quiet and less readily disturbed. The estimates were 7303 breeding pairs in 1974 and 7362 pairs in 1976. The size of the breeding colony was approximately 7500 pairs. Estimates have been made of the numbers on other islands based from counts and appraisal of aerial photographs.

Productivity varied greatly from year to year. Chicks on Shirley Island numbered 4366+ and 9687 when counted on 26 or 27 January in 1972 and 1973. Inclement weather in November and December could account for such differences.

Early studies of the breeding behaviour of the Adélie penguin by Penney (1968) were carried out at colonies near Wilkes. The occasional banded bird from his studies was still found in the late 1970s. Chicks were also banded on Shirley Island in 1968.

#### 4.1.3 Southern giant petrel *Macronectes giganteus*

Southern giant petrels have been seen year round. They breed on Nelly, Charlton and Dewart Islands (the Frazier group) some 13 km offshore (Figure 4). These islands have been visited on several occasions since 1958, usually by helicopter in January. Table 2 shows estimates of breeding pairs based on number of chicks. W.J.L. Sladen and R.L. Penney made the first estimate in 1959. In 1972 M.D. Murray visited Nelly and Dewart Islands and banded 100 chicks (Murray 1972). An estimate for Charlton Island was made from the air and from aerial photographs. The probable number of chicks in 1972 was 130-150. G.W. Johnstone visited the Frazier group in 1978, as did K. de Jong in 1979. Their estimates, allowing for annual variation in breeding success, give a breeding population of approximately 150 pairs.

Southern giant petrels breed on ridges of exposed rock (Plate 1). In mid-January there is an obvious variation in the size of downy chicks whose ages probably vary from 2-4 weeks. It would appear, based on observations at Davis reported by Johnstone *et al.* (1973), that egg-laying occurs in late October and early November, and eggs commence hatching in the second half of December. However, on both 24 January 1978 and 30 January 1979, a chick aged about 1 week was being brooded, and an intact egg, obviously addled, was being incubated, indicating that the occasional egg is laid up to at least mid-November. Fully fledged brown chicks were present on 7 March 1968 and on 23 March 1960 when they were commencing to fly. Very dark birds, presumed young of the year, were sighted at Wilkes in April 1960 and 1961.

Adults are timid and readily leave the nest or adjacent slope when approached. However, breeding adults will remain at the nest when the chicks are very young. During the year they feed on carcasses.

Recoveries of banded birds (Appendix 2) show that their dispersal is circumpolar (Figure 8). During the breeding season one was recaptured 7 years and 9 months after banding, within a few kilometres of its birthplace.

One white phase bird was seen on Nelly Island on 24 February 1978.

#### 4.1.4 Cape petrel *Daption capense*

Cape petrels return to their breeding sites in the last week of September or early October. Pairs are re-established during October, and nests are built and occupied by early November. Nests are scattered on the upper gentler slopes and not on steep slopes or cliffs. Nests are usually on the flattish tops, semi-protected near boulders, and tend to be restricted to the higher parts of islands or peninsulas near open water (Figure 5). Nests were located on Chappel, Grinnell, Nelly, Hollin, Ardery, Odbert, Holl, O'Connor, Werlein and Peterson Islands and the Browning Peninsula.

Eggs are laid in the last week of November or the first week of December. Fifty per cent of nests on Ardery Island on 8 December 1960 had eggs. Nests on Ardery Island on 2 December 1961 contained eggs; one nest contained an egg on 27 November 1971. Fifty per cent of nests contained an egg on 5 December 1971 on Odbert Island. Many nests on Peterson Island contained eggs on 12 December 1972. Hatching commences in mid-January (Cowan 1979), and is mostly completed by the end of the month. Birds remain until April but are occasionally sighted in May. There has been one sighting in July.

The only estimate was made by Cowan in 1977-78 (Cowan 1979). Cowan considered there to be 1000-1500 nests on Ardery, Holl, O'Connor and Odbert Islands; most nests were on O'Connor Island.

#### 4.1.5 Southern fulmar *Fulmarus glacialis*

The southern fulmar breeds on the steep slopes and cliffs of Ardery, Odbert, Holl, Peterson, Nelly and Dewart Islands (Figure 6). The major concentrations are on Ardery and Odbert Islands where Orton estimated there were 1500+ and 500+ breeding successfully in 1961-62, and Cowan estimated 1750 and 1600 in 1977-78. From 1960-64 Ardery Island was visited annually to band adults and chicks. The removal of boats from the station in 1964 curtailed these studies. In all, 161 adults and 65 chicks were banded. In January 1972, 40 were recaptured including a pair with egg (also considered to be mates in 1963). One adult with egg was caught near to where it was banded as a chick 12 years previously. Fidelity to mate and nesting site and evidence of a long life were established in these studies (Murray *et al.* 1972). Eight birds were recaptured in 1978 (Cowan 1979) including one recaptured in 1972. A further 14 were recaptured in 1984-85 (Van Franeker and Montague 1987).

Southern fulmars have been seen from October to April. Their pre-laying behaviour was reported by Luders (1977). Numbers increased rapidly in October, when large flocks were seen resting on the sea ice (Plate 2). Luders (1977) thought as many as 18 000 pairs returned. Occupation of the nesting area took about 3 weeks and was slower than that of Antarctic petrels (Figure 2), as was the development of courtship behaviour.

Southern fulmars excavated burrows through the snow to the nest site as soon as they arrived. Laying often started within such a burrow (Plate 3). Eggs are probably laid in the last week of November or the first week of December. Fifty per cent of nests had eggs on 8 December 1960. Eggs were present on 9 December 1961 and 50% of nests had eggs on 5 December 1971. Hatching commenced in mid-January, as no chicks were seen on 15 January 1962 and a few chicks were present on 16 January 1963. Of 20 banded birds, including one pair recaptured on their nest on 19 January 1972 at Mast Head on Ardery Island, 17 were on eggs of which five were chipping, and two were on chicks. These dates give a probable incubation period of 47 days. Departure dates were not determined.

#### 4.1.6 Antarctic petrel *Thalassoica antarctica*

Two breeding colonies have been found on Ardery Island and one colony on Odbert Island. In 1972 these colonies were about 70, 350 and 90 pairs, giving a total breeding population of

approximately 500 pairs early in the breeding season (Luders 1977). Cowan (1979) estimated there were 250 successful breeders in 1977-78. Another small colony was found on the northern face of Nelly Island in January 1974. The distribution of colonies is shown in Figure 7.

The first observations of behaviour of Antarctic petrels at the nest were made in 1961 (Orton 1968). Their behaviour before laying was reported in detail by Luders (1977).

Antarctic petrels have been sighted year-round, usually after the sea ice has blown out. The arrival at the breeding site is dramatic. On 8 October 1972, D.J. Luders saw six pairs at the Odberth colony. Seventy pairs were present on 10 October. Soon after arrival, courtship display commenced followed by copulation. The birds remained for nearly 3 weeks before departing for 3 weeks prior to laying (Figure 2). During this period most of the snow covering the nesting area melted. Laying commenced in the last week of November or first week of December as most pairs on Odberth Island had an egg on 5 December 1971 and 75% of nests on Ardery Island had an egg on 8 December 1958. Hatching commences in mid-January as a few chicks were seen on 15 January 1962 by M.N. Orton, on 19 January 1972 by M.D. Murray and J. Ackerley, and in 1978 the first hatched chick was seen by A.N. Cowan on 11 January. The incubation period is probably 45 to 50 days. There are no data on when birds leave the breeding areas.

#### 4.1.7 Snow petrel *Pagodroma nivea*

Snow petrels have been seen year-round although fewer are recorded in August. During the winter they were sighted regularly after the sea ice had blown out following a blizzard. They nest throughout the whole area in summer.

R.A. MacKenzie observed 42 nests on the Bailey Peninsula behind Casey in 1968-69. After the chicks left in March 1968, several flocks of about 30 snow petrels were seen on 23 April, and on 24 April all nest sites were visited and cleared, with two birds apparently having laid eggs. All birds left on 25 April. Nest sites were visited and cleared on 15 and 16 August. Footprints were found around one site on 18 September, and on 27 and 28 September three birds were found in their nest sites and footprints abounded elsewhere. Some nest sites were again visited and occupied on 3 to 4 October. The main influx associated with the start of breeding was about 10 November. From 21 to 30 November all birds were absent after which egg laying commenced and the colony built up again. The first egg was laid on 30 November and the last on 10 December. The first chick hatched on 12 January 1969 and the last on 20 January. The last adult was seen on the nest with a chick on 29 January and all chicks had departed by 9 March. Of 42 nests cleared in October, 32 were eventually occupied by breeding birds, 31 eggs were laid and of these only 13 chicks hatched.

Features of this breeding cycle were confirmed in 1974 by A. Jones around Peterson Island, where on 29 September groups of 30-40 snow petrels had been observed. Their numbers increased rapidly and they could be heard throughout the hills. Footmarks and scraping showed that nest sites had been visited. Much activity was noticed on 14 October but 15 October was conspicuous for the absence of snow petrels which were not seen again until 1930 hours on 31 October, when 'in the calm sunny evening, the sky was observed to be glinting white as the sun's rays reflected from the wings of hundreds of snow petrels flying at about 1000 ft. That night the cliffs were noisy with the chatter of birds and from then on nests were always occupied and courtship activities and copulations observed' (excerpt from station log).

The snow petrels were absent from their nest sites on the Bailey Peninsula on 24 November 1974. Their return in the early hours of 9 December woke the occupants of the ANARE station. Most nests contained an egg by 14 December.

Further observations by L. Cole in 1979-80 have clarified the annual cycle. After the chicks had left, the adults returned in April and 85% of the nests were visited. The number of sites visited declined rapidly after mid-May. Nests were not visited in the winter but visits increased from

mid-September when they were apparently visited at night. On 19 October, 52% of nest sites were occupied by one bird during the day and vigorous clearing of snow commenced. Even though the weather was fine, a 90% decline occurred in the number of occupied nests. No nests were occupied for 8 days in mid-October. A rapid increase commenced from 25 October and 46 of 55 sites were occupied on 31 October. At that time two birds were usually present during the day. Active clearing of the nest was in progress, and mating was observed. Most birds were again absent from 17-26 November and egg laying commenced when they returned. Cole also banded 95 birds, mostly on Reeves Hill behind the station.

The orange oil discharged by snow petrels and found on the snow in front of a burrow is also apparently discharged over other birds. A flock of approximately 150 snow petrels was found on Herring Island on 12 November 1972 by D.J. Luders and many were observed to be 'snow bathing' to remove oil from their plumage.

In summary (Figure 2), some snow petrels returned to clean out their nest sites in the Windmill Islands in August, but it was in late September to early October that most returned to excavate burrows and departed in a pre-mating exodus. They returned to court and mate in late October and November. Prior to egg laying all birds departed again for 1-2 weeks and returned to lay in the last few days of November or first 10 days of December. Eggs hatched in mid-January, after an incubation of approximately 32 days. Most returned in April to visit their nest sites before departing for winter. These dates are similar to those for Davis and Mawson (Brown 1966). Pryor (1968) considered that snow petrels deserted and re-occupied the nesting grounds at least twice before egg laying at Haswell Island, but these data indicate that they return four to five times.

#### 4.1.8 Wilson's storm-petrel *Oceanites oceanicus*

Wilson's storm-petrels breed throughout the area. From 1959 to 1963 they were usually seen first in the last week of October, but since 1968, when Casey was opened, they were usually seen in the second week of November. They become abundant within 2 weeks of arrival. Breeding data were obtained in 1968 by R.A. MacKenzie from 11 marked nest sites. These data suggested that eggs are laid within 2-3 weeks of occupation of the nest site, incubation took about 6 weeks and chicks departed 7-8 weeks after hatching. Ten birds arrived 28-30 November. One egg was laid on 16 December, four on 17 December and another two on 23 December. Another bird occupied a nest on 11 December and had laid an egg by 23 December. One chick hatched, after being incubated about 6 weeks, on 31 January (which was the last day it was possible for MacKenzie to examine the nests). The following party reported that on 2 March the chicks were becoming feathered and were ready to leave on 25 March. All had left their nests by 27 March. Other observations of the area at various times of the breeding season substantiate these data. Wilson's storm-petrels have usually departed by the last week in March. In 1961 and 1962 the last sightings of the year were on 5 April.

#### 4.1.9 Antarctic skua *Catharcta maccormicki*

When Wilkes was established, C.R. Eklund commenced one of the first intensive studies of this species (Eklund 1961).

The records for 13 years indicate that the first Antarctic skuas were sighted between 7 and 14 October, with the mean date being 11 October, 1 week before the return of the Adélie penguins. They are usually abundant by 20 October.

On returning some regularly fed at the station and rubbish tip while elsewhere they fed on the afterbirths of Weddell seals and on penguin carcasses revealed as the snow thawed.

Laying took place during the last week of November and first week of December. Observations suggest that the Antarctic skuas around the southern islands between Peterson Island and Odbert

and Ardery Islands may lay earlier than those on Shirley Island near Casey station. On 27 November 1971 many of the nests on Odber Island had one egg and some had two. Eggs were not seen on Shirley Island until 6 December. Laying commenced between 27 November and 9 December from 1968 to 1976, but in 1974 a nest with an egg was found at Odber Island on 11 November. In January 1972 the difference in the size of the larger chicks at Wilkes and those at Shirley was obvious. Chicks commenced flying in late February and in March flocks including young have been seen. The numbers of Antarctic skuas declined during late March and by the end of April all had left (Figure 3).

Antarctic skuas were found throughout the Windmill Islands during the summer and several sightings have been made up to 15 km inland on the Law Peninsula. Many Antarctic skuas have been banded, and a few have been distantly recovered (Appendix 2). One bird was recovered at Casey 14 years after being banded as a chick. The only estimate of total numbers was by Eklund who estimated 2300 adult skuas in the region in 1956-57.

#### 4.1.10 Subantarctic skua *Catharacta lonnbergi*

The first record of a very large, dark skua was on 25 January 1960. Measurements\* indicated it was a subantarctic skua (great skua). Apparently one was present at Casey station from 22 December 1971 to 15 January 1972, and again on 23 December 1973.

#### 4.1.11 Kelp gull *Larus dominicanus*

Kelp gulls have been seen in 1957, on 31 October 1962 and on 18 November 1968. Two birds in adult plumage were seen on 13 November 1971 (Johnstone and Murray 1972), and a bird in mottled plumage was seen on 18 November 1976. Sightings were made when other species of birds were returning to breed as the sea ice was breaking up.

#### 4.1.12 Tern sp. *Sterna* sp.

There have been reports of unidentified terns in 1957-58 and 1976. These were probably Arctic terns, flocks of which may be seen along the edge of the pack ice into Casey.

#### 4.1.13 White-chinned petrel *Procellaria aequinoctialis*

Orton (1963) claimed to have seen a white-chinned petrel on 23 November and 28 December 1961. There have been no subsequent sightings.

### 4.2 SEALS

The status of seals in the Windmill Islands is shown in Table 3. Since the earlier descriptions of Ingham (1960) and Orton (1963), the main breeding area of the Weddell seal in the region has been located. Pups of the southern elephant seal have been found, indicating that this species has commenced to breed in this region of the Antarctic continent.

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\* Measurements obtained:

Weight	1715 g
Tarsus	73 mm
Middle toe and claw	78 mm
Tail	160 mm
Culmen	54 mm
Sex	Male



#### 4.2.1 Weddell seal *Leptonychotes weddellii*

Weddell seals were seen year-round. Until 1969-70, 50-90 seals were killed each year for dog meat. Cows were regularly found pupping on the fast ice to the north-east around the Swain Islands, where in 1959, 1960, 1962 and 1964 newborn pups were reported in September and October. On one occasion a fully developed live pup was removed from its mother's uterus when she was shot on 17 August.

The closure of Wilkes, the cessation of slaughter of seals for dog meat, the termination of studies on the Clark Peninsula, the removal of boats and the building of Casey curtailed seal observations between 1964 and 1968.

Areas to the south could only be visited over the sea-ice up to November. In October 1968, R.A. MacKenzie found Weddell seals with young pups between Herring Island and the continent. Subsequent visits by J. Ackerley in 1971, D.J. Luders in 1972, and A. Jones in 1974 established that this was the main breeding area of the Weddell seal in the region.

Herring Island is 110 m at the highest point, and 3 km long, lying approximately east to west. At the nearest point to the continent, about 2 km to the east, it rises sharply from Penney Bay to 61 m. Directly opposite on the continent is the Peterson Glacier, and below, 200 m off the eastern end of the island is Bousquet Island rising to approximately 30 m. Visible pressure ridges in the sea ice between Bousquet and Herring Islands commence development in August, and rafted sea ice impinges on the islands. The resultant cracks through the ice, in an area where the ice is fast and firm until well into the summer, give the Weddell seals access to an especially favourable area for pupping (Figure 9, Plate 4). The exact site of the pupping area changes annually, as do the pressure ridges. The rafting of the ice becomes dramatic in December, pieces being pushed 3-4 m into the air (Plate 5). The ice in this area usually does not break out until late December (Figures 1 and 10).

In 1972 the first Weddell seals hauled out in the last week of September and pupping commenced 1-3 October (Figure 11). Pupping reached a peak on approximately 12 November when 86 pups and 107 females were seen, after which an increasing proportion of the pups were left unattended. During December pups tended to congregate in groups of six to eight about 5 m apart at the south-eastern tip of Bousquet Island. By January the seals had dispersed.

These observations were confirmed in 1974 by A. Jones who found 19 pups and 33 females on 10 October, 53 pups and 103 females on 16 October and 72 pups and 103 females on 12 November. Again, in 1976 the first pups were born between 11 and 20 October, and six pups were dead by November. During this period only cows with young pups remained on the ice during blizzards. Pups were swimming by 3 weeks. Seventy-five pups were found on 4 November 1978.

Reports by station staff increase as the sea ice breaks away and the Weddell seals increasingly haul out around Bailey Peninsula. During January and February there are several favoured hauling-out sites where ice has remained fast between the islands, such as between the Swain Group and the continent, between Midgley and Hollin Islands and on the northern shores of Ford Island and Bosner Island (Figure 9).

Pupping also occurs around the Swain group, but no more than five pups have been reported annually from 1970-80. There were no reports of more than 20 pups, even when this area was regularly searched for seals for dog meat. This suggests that the main breeding area has always been around Bousquet Island in Penney Bay. The similarity between the counts of pups and females in early November in 1972, 1974 and 1978 further suggests that the breeding population is stable.

#### 4.2.2 Crabeater seal *Lobodon carcinophagus*

Only a few were seen each year (Table 4), mostly in spring when the break-up of sea ice brought the ice edge close to the station.

#### 4.2.3 Ross seal *Ommatophoca rossii*

Two Ross seals were reported during the first year that Wilkes was occupied. None have been sighted since.

#### 4.2.4 Leopard seal *Hydrurga leptonyx*

Leopard seals were seen in most months of the year, particularly when the sea ice commenced breaking up and penguins returned in October and November (Table 5). There have been numerous observations of leopard seals attacking penguins.

#### 4.2.5 Southern elephant seal *Mirounga leonina*

The southern elephant seal was reported by the first Wilkes personnel. C.R. Eklund found 21 hauled out on the north-western shore of Peterson Island in January 1958 (Figure 9). Further observations in 1958-59 indicated two hauling-out sites on the western coast of the island. Thirty-two seals were seen, including two cows. In December 1959, R.L. Penney found nine immature seals (eight males, one unsexed) at the north-western site. Five were ashore, three were in the shallow water of the small bay and one was outside the bay. The site was revisited by M.N. Orton on 9 January and 28 December 1961, when five and seven (six males, one ?) immature seals were found. No further visits were made to Peterson Island until 20 January 1972 when M.D. Murray relocated the hauling-out site and found 12 moulting males, 2.7-3.8 m in length (Plate 6). One had the well-developed proboscis of a mature male but the rest were immature. Since 1972, Browning Peninsula and Peterson Island have been visited regularly.

On 22 November 1972 three seals were seen off the southern end of Peterson Island and another three seals, 4.3 m, 3.4 m and 5.5 m long, were seen in a shallow cove on the northern tip. Two carcasses were reported on the fast ice in the northern inlet. On 12 December nine bulls were seen in a northern cove. Three were longer than 4.6 m and had well-developed proboscises while the remainder were 2.1-3.0 m. At the north-western site one moulting cow was found on a granite slab. When revisited on 24 January 1973 one bull was seen in the north-western cove, and 21 were hauled out on a granite slab. Their estimated lengths ranged from 2.4-5.5 m. The sighting of a female stimulated the intensive searches of subsequent years.

Browning Peninsula was next visited on 26 September 1973 when seven seals and a pup were seen in Eyres Bay by W. Spitzer. On that day there was one bull, a cow and her pup present (this appeared to have been born that day). Another cow was seen on 28 September apparently copulating in the water with the male. On 7 October the cow measured 3.10 m and the pup 1.45 m  $\pm$  3 cm.

An extensive search of Peterson Island was made by A. Jones on 1 February 1974. One bull (probably mature), 20 immature males, eight females and two pups (3-4 months?) were found.

A permanent camp was established on the Browning Peninsula to enable the study of seals from September 1974 to January 1975. On 28 September a cow with newly-born pup was found on an exposed site on the sea ice in Eyres Bay next to the shore and near to a cove where the Browning Peninsula joins the mainland. They had hauled out onto the edge of the sea ice and crawled some 3.7 km to the shore. At 48 hours of age the pup weighed 25 kg and measured: 1.16 m - nose to tail, 28 cm - anterior flipper, 30 cm - posterior flipper and 85 cm - axillary girth. No other seals were seen in the area. On 4 October a major part of the ice of Eyres Bay was swept out after heavy swells, and Eyres Bay was free of sea ice when visited on 9 October. The

pup and female were not seen again though several immature males and one large bull were seen during the next few weeks.

Peterson Island was next visited on 24 December when three southern elephant seals were found on the west bay. A new hauling-out site was found on the north-eastern coast of Browning Peninsula, where 21 seals were found. On 9 January 1975, 52 seals had hauled out, of which 38 were on Peterson Island and 14 on Browning Peninsula. A census was made on 28 January when fifty-one seals were present on three of the five hauling-out sites.

Damage to the field camp and bad weather prevented an adequate search in late 1975. Southern elephant seals were sighted on Peterson Island during November (three) and December (nine) but no pups were found in 1975.

On 25 September 1976, J. Linden found a southern elephant seal cow with distinctive scar in Adélie Inlet, Peterson Island, and on 28 September she was found with a female pup that had been born within the previous 24 hours. Over the next 15 days the pup was weighed and measured (Table 6). It was gradually moved away from the unstable ice edge to the shore. Again, the increasing numbers of southern elephant seals hauling out was noted in December and January; 44 on 1 December, 51 on 27 December and 63 (seen from the air) in late January by J. Tyrrell. No pups were found in 1977. A census was made on 31 January 1979 when 82 seals, including four small seals, were sighted at eight hauling-out sites around Peterson Island.

Southern elephant seals have been sighted regularly throughout the year. The expedition in 1958 discovered that seals (including females) hauled out to moult on Peterson Island. There could have been a drop in numbers subsequently but the data are inadequate. However, between 1972 and 1980 there has been a steady increase in the numbers of seals hauling out to moult (Table 7). The hauling-out sites are shown in Figure 12. A female with pup was found on the Browning Peninsula in September 1973 and pups were found again in 1974 and 1976. Adult bulls have been seen and an apparent copulation observed. Indications are that a breeding colony of southern elephant seals is becoming established (Murray 1981). The localities where pups have been found are shown in Figure 12. One problem being encountered by females is the security of the pupping site. Two of the pups were born on the sea ice very close to the shore. It is known that one female moved across the sea ice to reach the pupping site, yet the sea ice broke out and the pup was apparently lost. Another pup could also have been lost if it had not been pulled onto rock so that its weight could be measured.

No study was made of the age composition of the moulting population nor were counts made in March when numbers could be at maximum as they are at the Vestfold Hills (Tierney 1977).

## 5. DISCUSSION

A rapid increase in the number of southern elephant seals hauling out to moult from 1972 to 1980 has apparently occurred and pups have been born. It appears that the nearby open water allows the seals to approach Peterson Island to breed early in September. Peterson Island has a shoreline with several sites suitable for hauling out, but it appears that the instability of sea ice has caused pup losses. The Weddell seal breeds where pressure cracks develop as continental glacial ice forces sea-ice onto nearby islands. Here the sea-ice remains fast until the pups can swim. Plate 4 shows a typical breeding site.

The southern giant petrels, the largest in body size of the petrels, nest on the Frazier Islands which have ridges free of snow for nesting and are also the most seaward, being 17 km offshore. The sea-ice surround these islands only for a short period of the year. From September onwards,



open water surrounds them, thus enabling the petrels to scavenge in the ocean in addition to land and ice.

Little is known of the breeding behaviour of the cape petrel, but the other three species of similar size provide an interesting comparison. The smaller snow petrel, which is seen throughout the winter, is a strong flier capable of rapidly exploring considerable areas of sea and ice for food. Snow petrels, however, are less capable of removing snow from their nesting sites and consequently nests in sheltered crevices on wind-exposed slopes and flat areas. Their strong and rapid flight enables them to visit the nesting site at intervals from early spring to late autumn to clear away snow from the entrance. They return in August and late September. They then return to mate in October when both birds thoroughly excavate the nesting site and again depart. When they return 2-3 weeks later, only one bird occupies the burrow to incubate the egg or rear the chick. After the chicks have left in early March they return in April before leaving for the winter.

The Antarctic petrel nests on the small and more level parts of the cliffs of Ardery and Odber Islands. They return to court and mate while the area is covered with snow. During their 2-3 weeks absence prior to egg laying, the snow usually melts to reveal their nesting sites. The pre-laying departures of these two species undoubtedly enables them to range widely for food and exploit scattered blooms of plankton, thus enabling them to be independent of nearby food to meet the energy requirements of reproduction.

The strong southern fulmar, however, can dig with its beak, and burrows through the snow to its nesting site where it remains as the snow thaws (Plate 3). It does not appear to depart for prolonged periods prior to egg laying and may feed more locally.

The Wilson's storm-petrel, the smallest of the petrels, arrives last from its trans-equatorial migration. By this time the snow has thawed, the entrances to nesting burrows require little clearing and open water for feeding is nearby (Plate 7). The breeding cycles of these petrels and fulmars show the degrees of synchronisation discussed by Beck (1970).

Also synchronised is the breeding cycle of the Adélie penguin (Penney 1968) which arrives in the area on about 2 October every year. The arrival of the Antarctic skuas approximately 1-2 weeks before the penguins is equally predictable. Initially, those away from the station garbage tip supplemented their marine diet with the fresh placentae of seals and penguin carcasses from the previous year. The Adélie penguin eggs of the current year become available about the same time as the skuas lay their eggs.

The area forms a compact biological unit where eight species of birds and two species of seal breed. It is critical that their breeding cycles be timed to exploit the apparent abundance of food available in February and March. They need to moult and leave the area by April-May, as winter approaches. The larger mammals and birds need to commence breeding the earliest.

The different strategies adopted are clearly seen at the Windmill Islands, particularly in the southern area encompassed by the Vanderford Glacier in the south and the Mitchell Peninsula in the north. The seals and most of the birds breed to exploit a limited radius of ocean for food to meet the energy requirements of breeding and moulting. However, nothing is known of the distribution of their food in the surrounding ocean. Is the plankton distributed uniformly, patchily and widely scattered, or is it only abundant locally, a consequence of the unique features of the area affecting the sea ice regime and the extent of nearby open water? A true understanding of the physiological and ecological adaptations of these species requires, in addition to the more detailed data on their breeding biology, breeding success, and moulting cycles, an understanding of the local marine environment from which they obtain food.

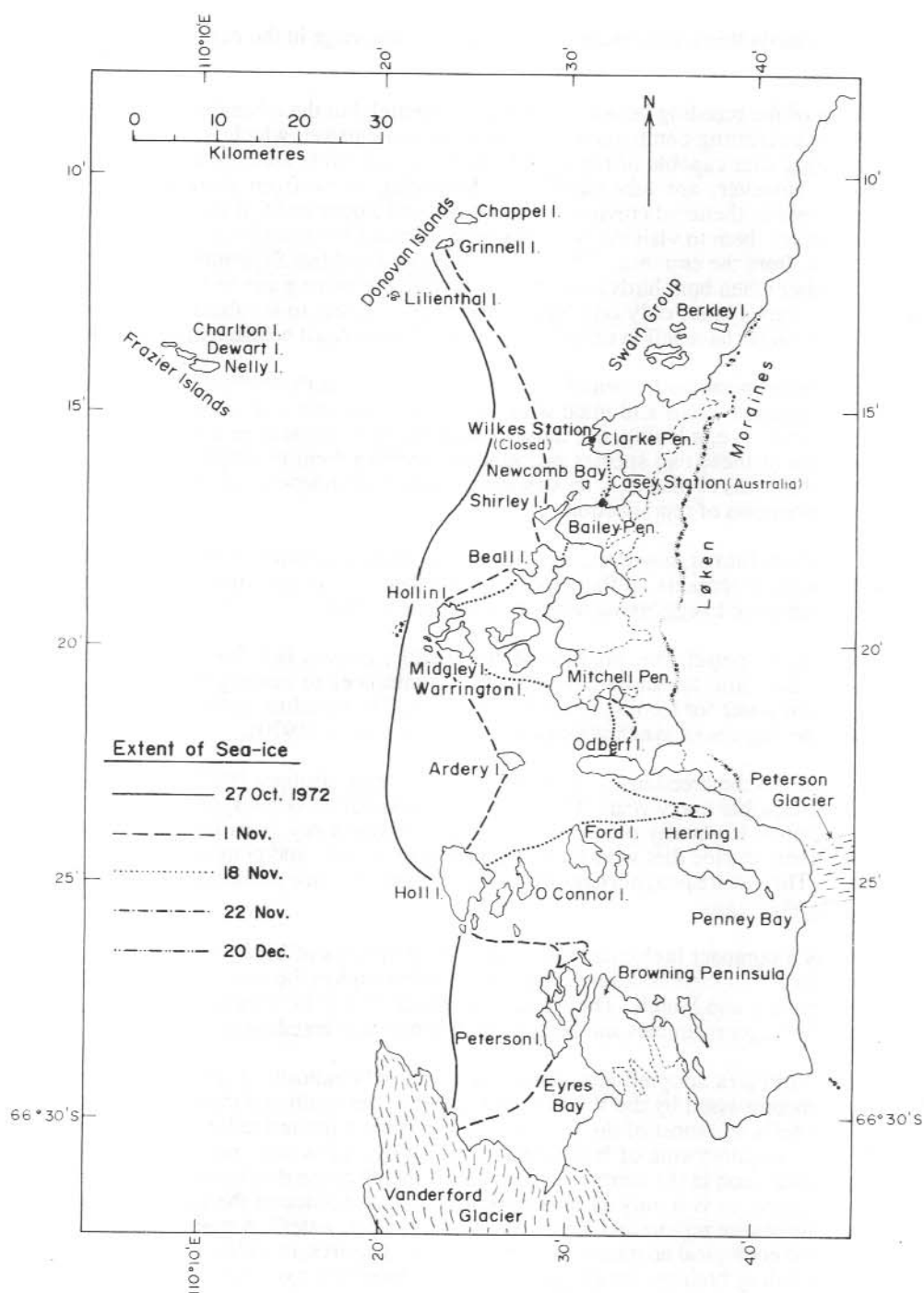


Figure 1. Sea-ice breakout, 1972.

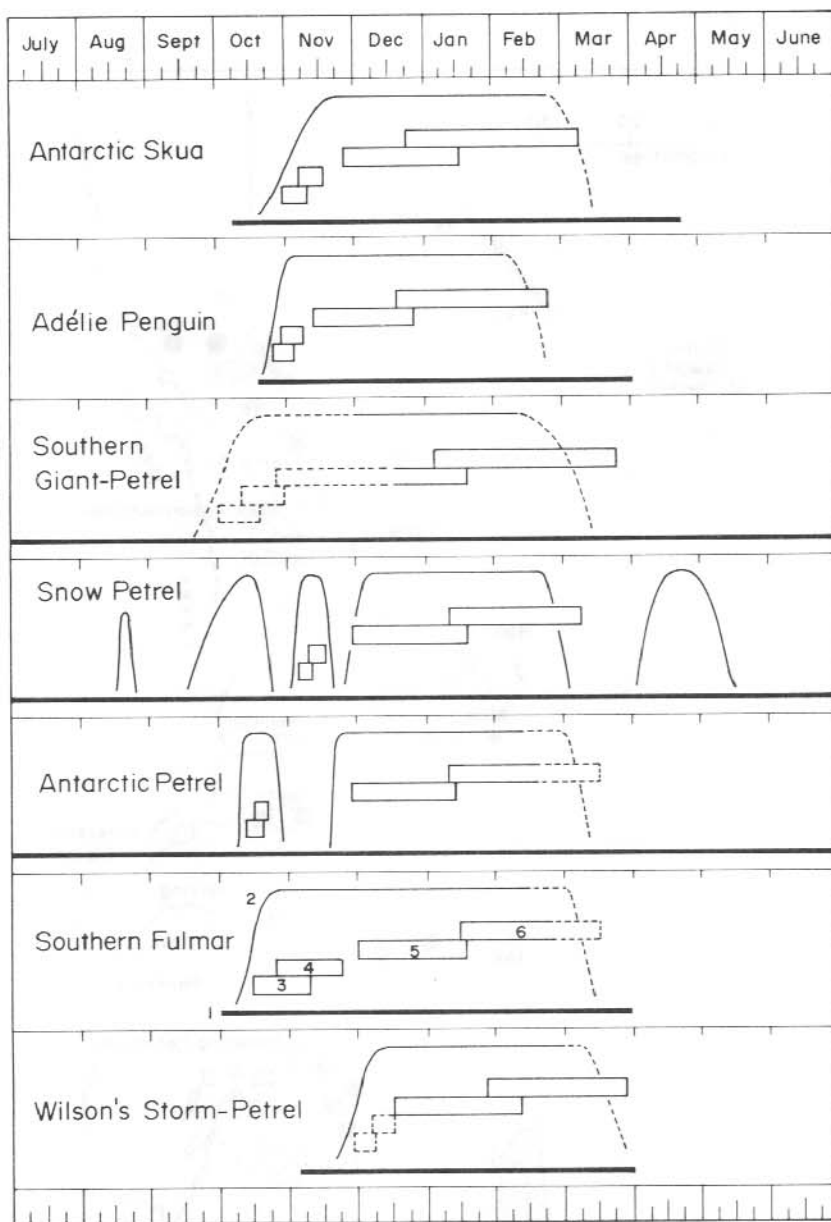


Figure 2. The annual cycle of breeding activity of birds at the Windmill Islands. A key to the format used is given for the southern fulmar. 1. present at the Windmill Islands; 2. present at nest site; 3. courting; 4. mating; 5. eggs present on the nest; 6. chicks present in the nest. A continuous line denotes adequate data, a dashed line inadequate data. The minimal overlap between eggs and chicks of Adélie penguins, snow and Antarctic petrels and southern fulmars indicates highly synchronised breeding cycles.

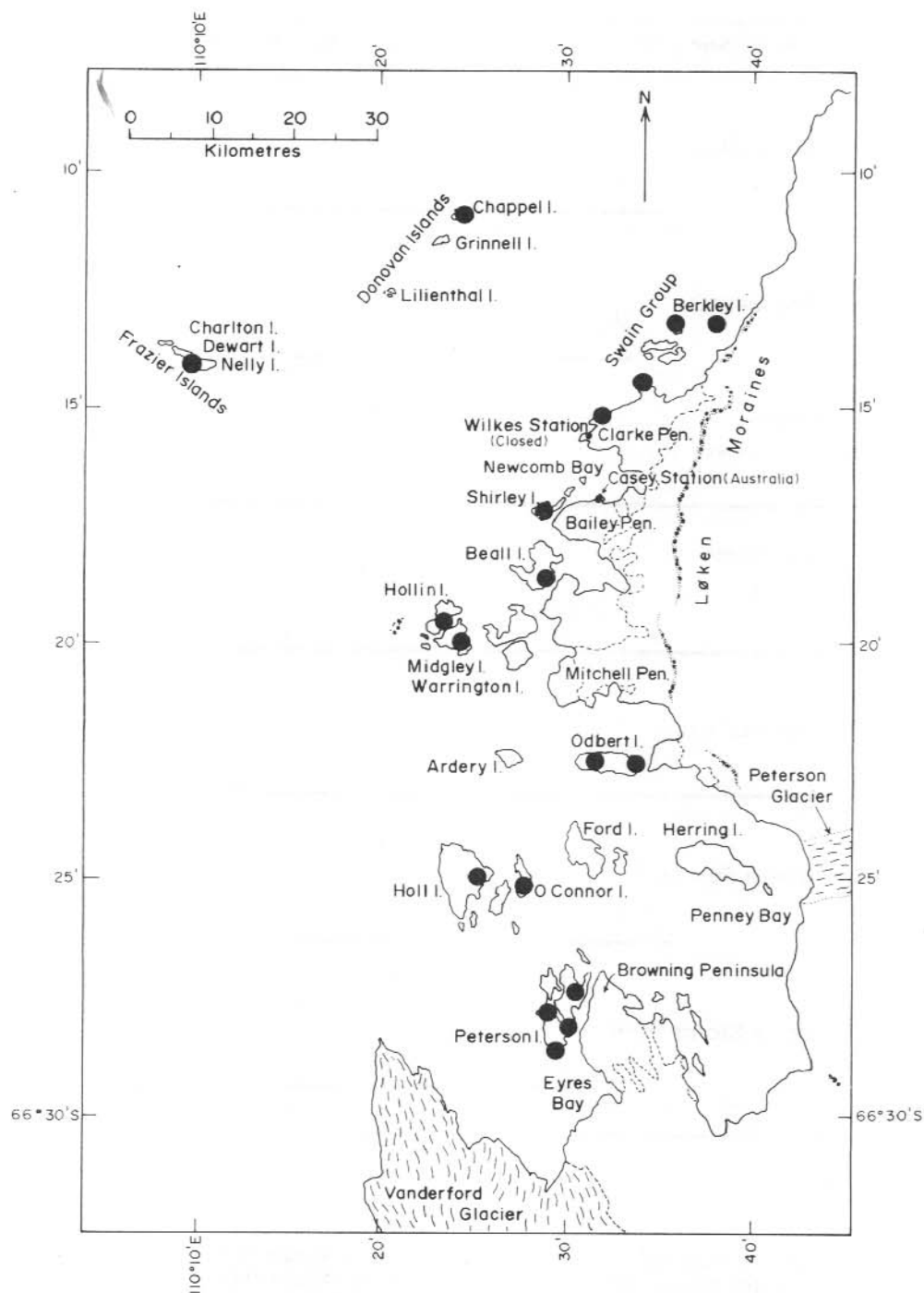


Figure 3. Distribution of breeding colonies of Adélie penguins.

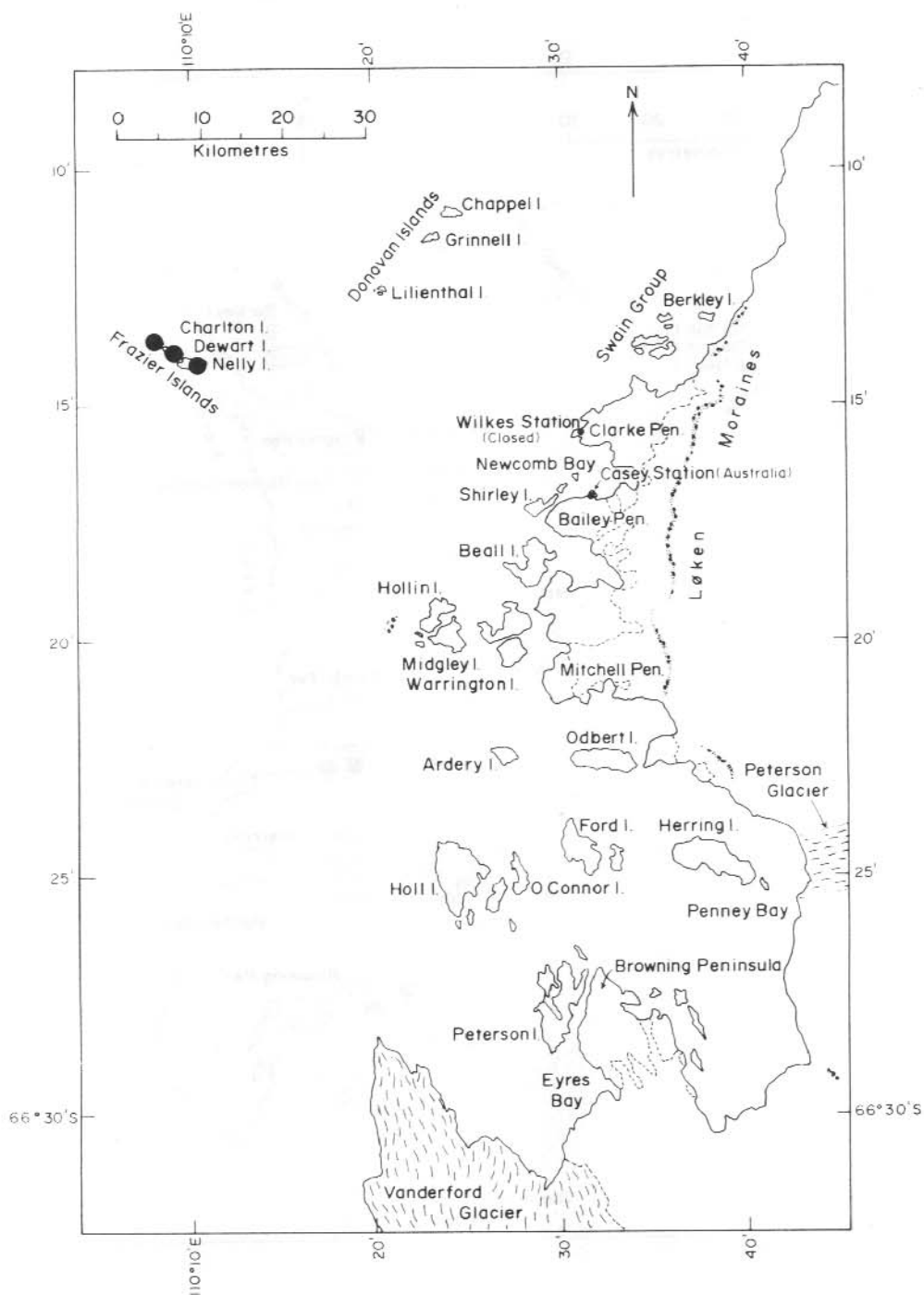


Figure 4. Distribution of breeding colonies of southern giant petrels.

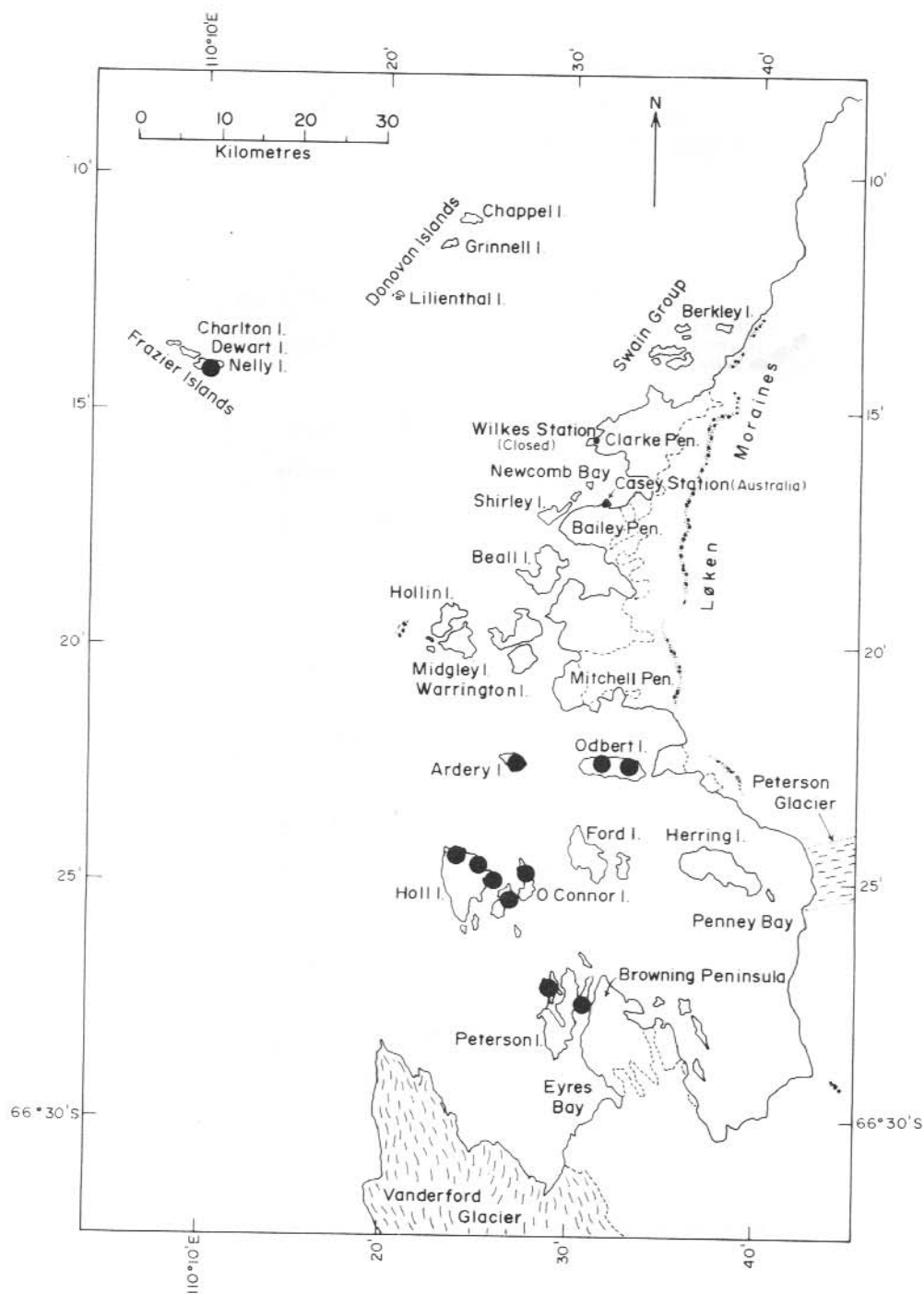


Figure 5. Distribution of breeding colonies of cape petrels.

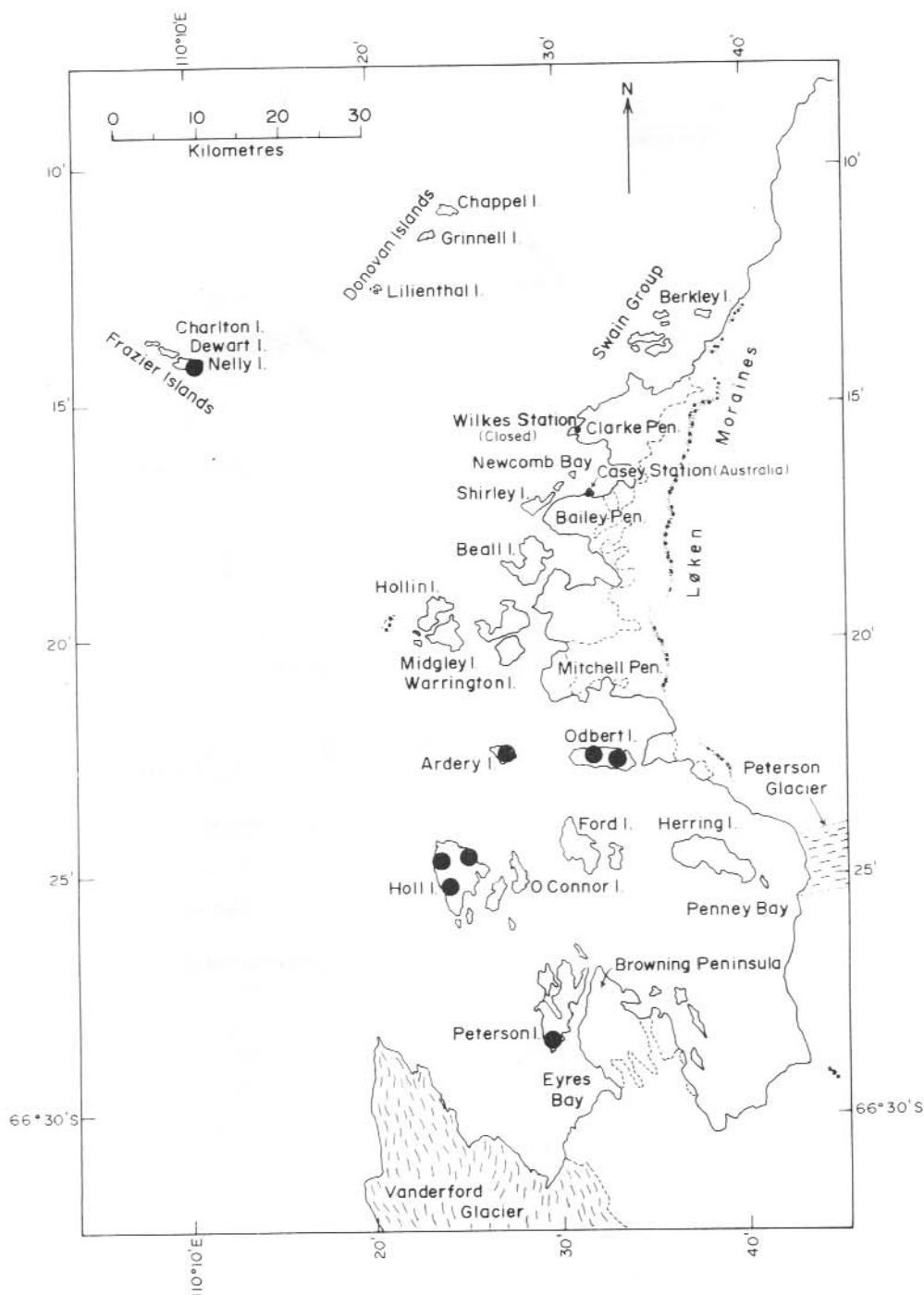


Figure 6. Distribution of breeding colonies of southern fulmars.

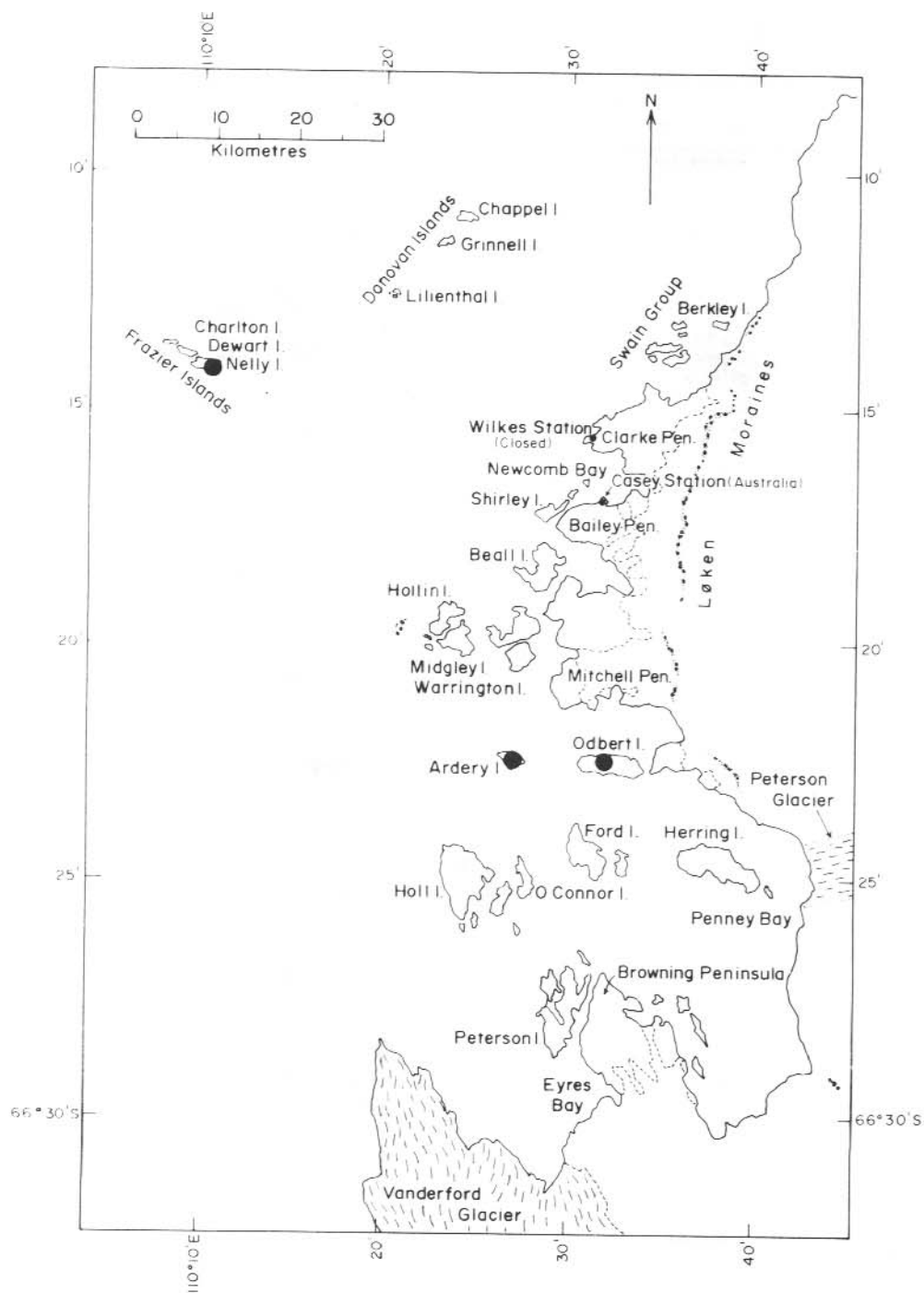


Figure 7. Distribution of breeding colonies of Antarctic petrels.



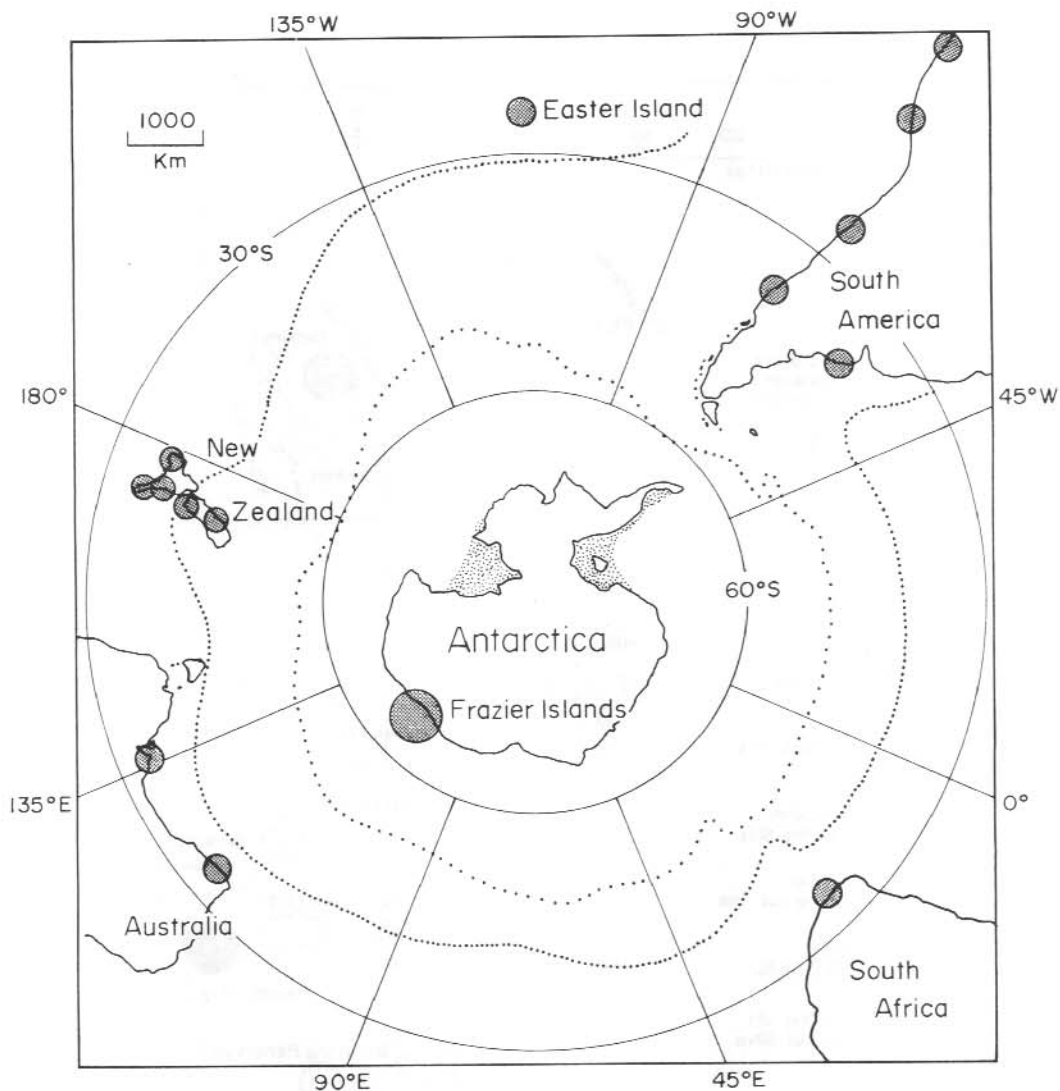


Figure 8. Distribution of distant recoveries of banded southern giant petrels.

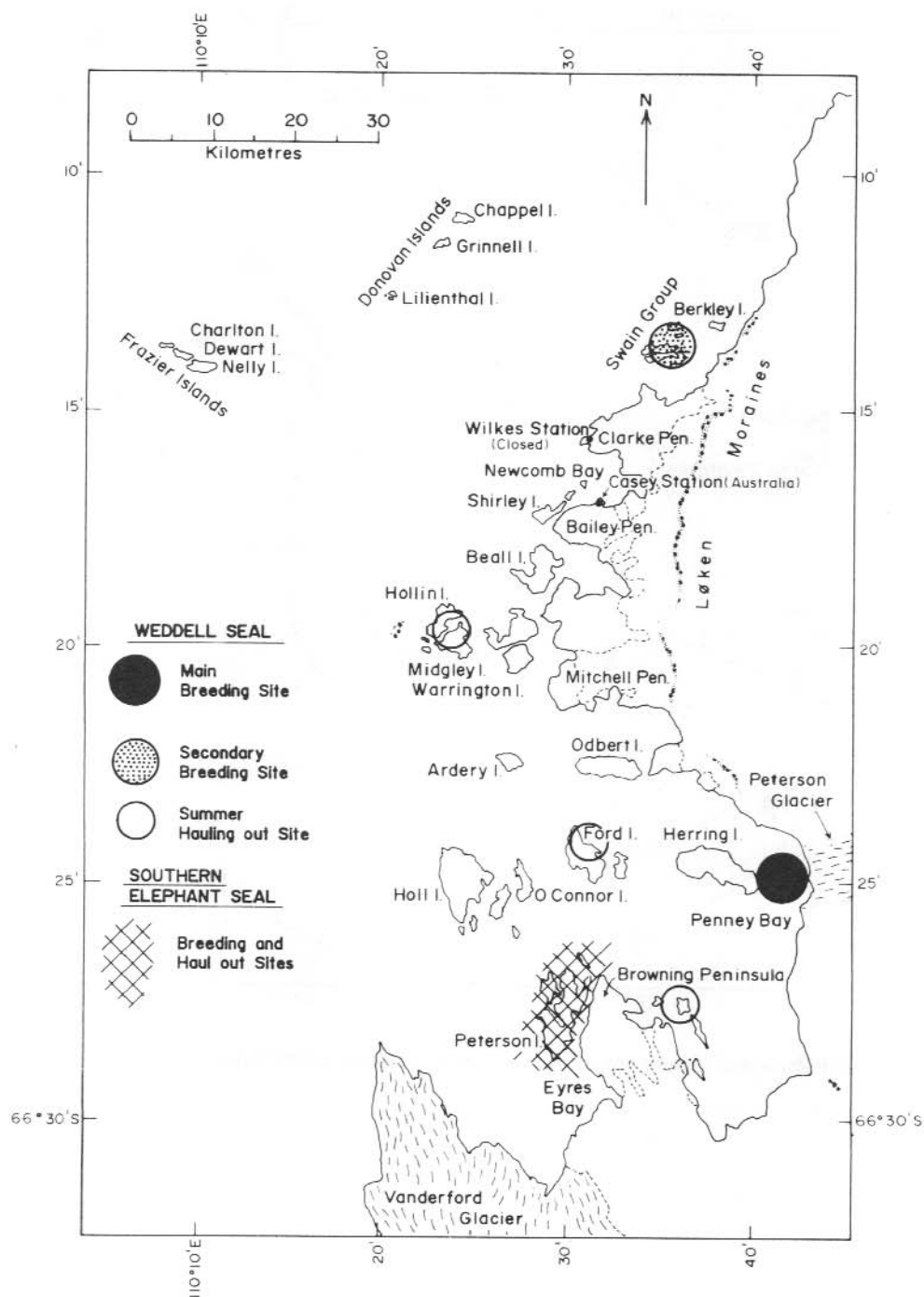


Figure 9. Pupping and hauling-out sites of Weddell seals and southern elephant seals.

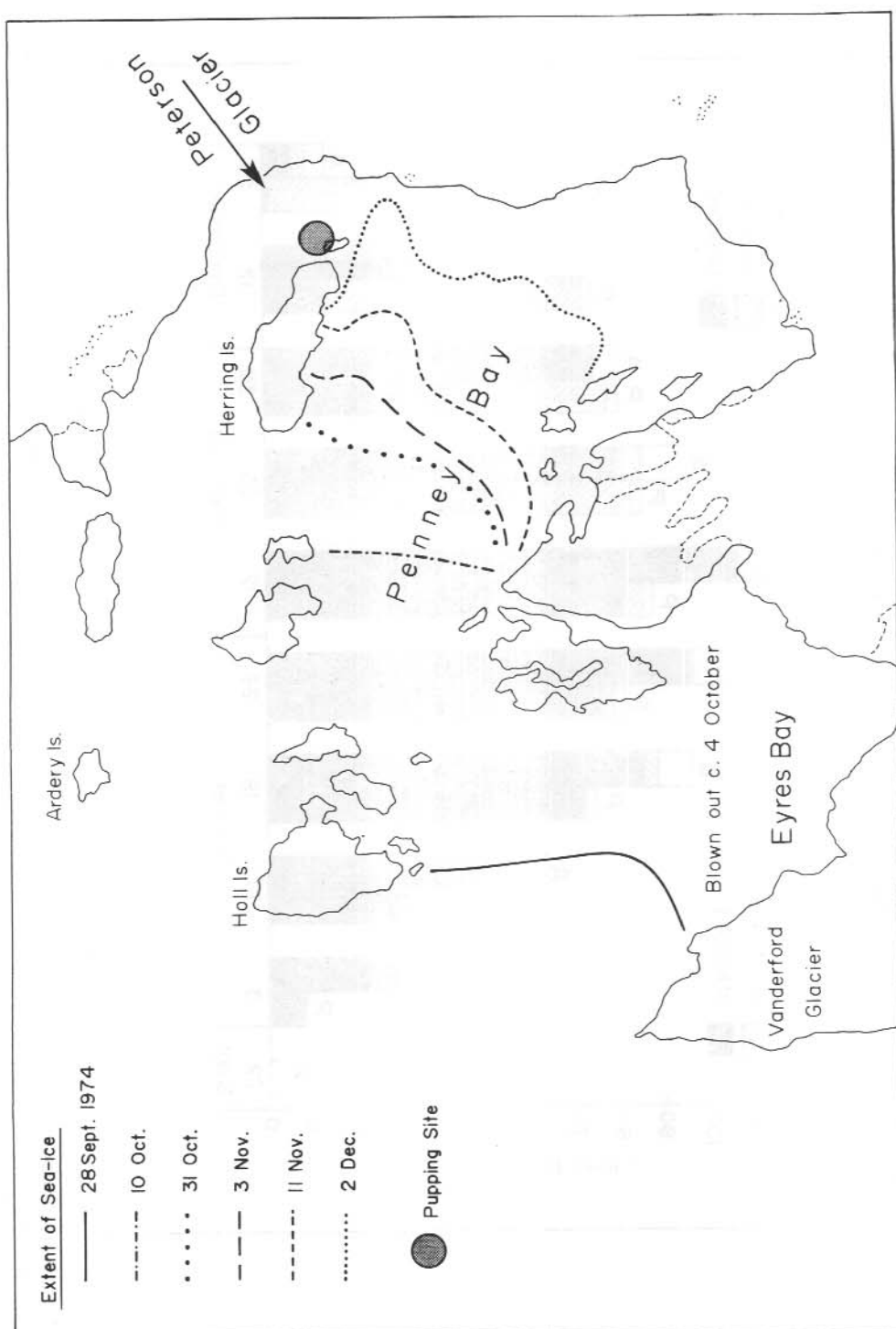


Figure 10. Break out of sea-ice in Penney Bay and intrusion of open sea towards pupping site of Weddell seal, 1974

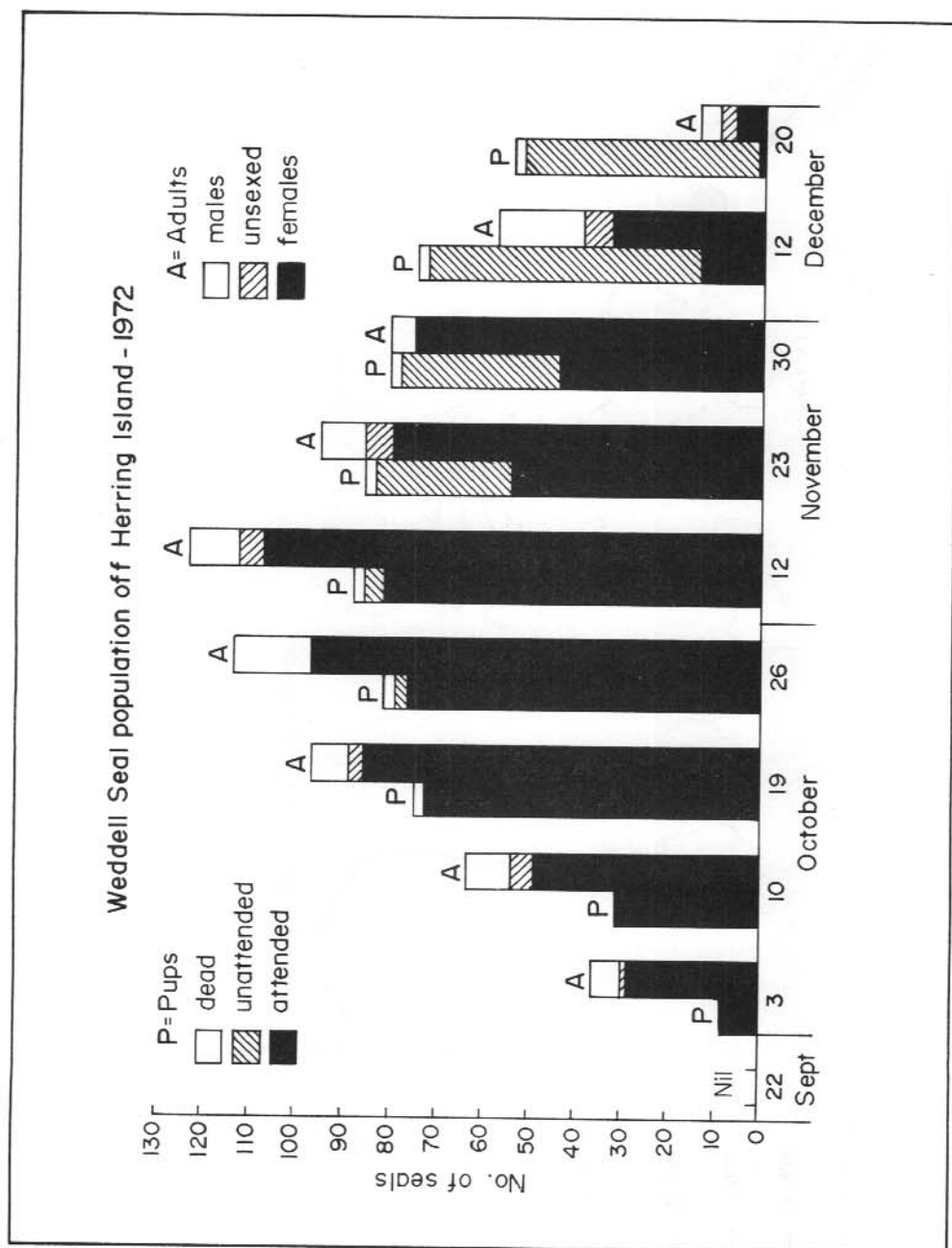


Figure 11. Composition of Weddell seal population during pupping at breeding site, Herring Island, 1972.

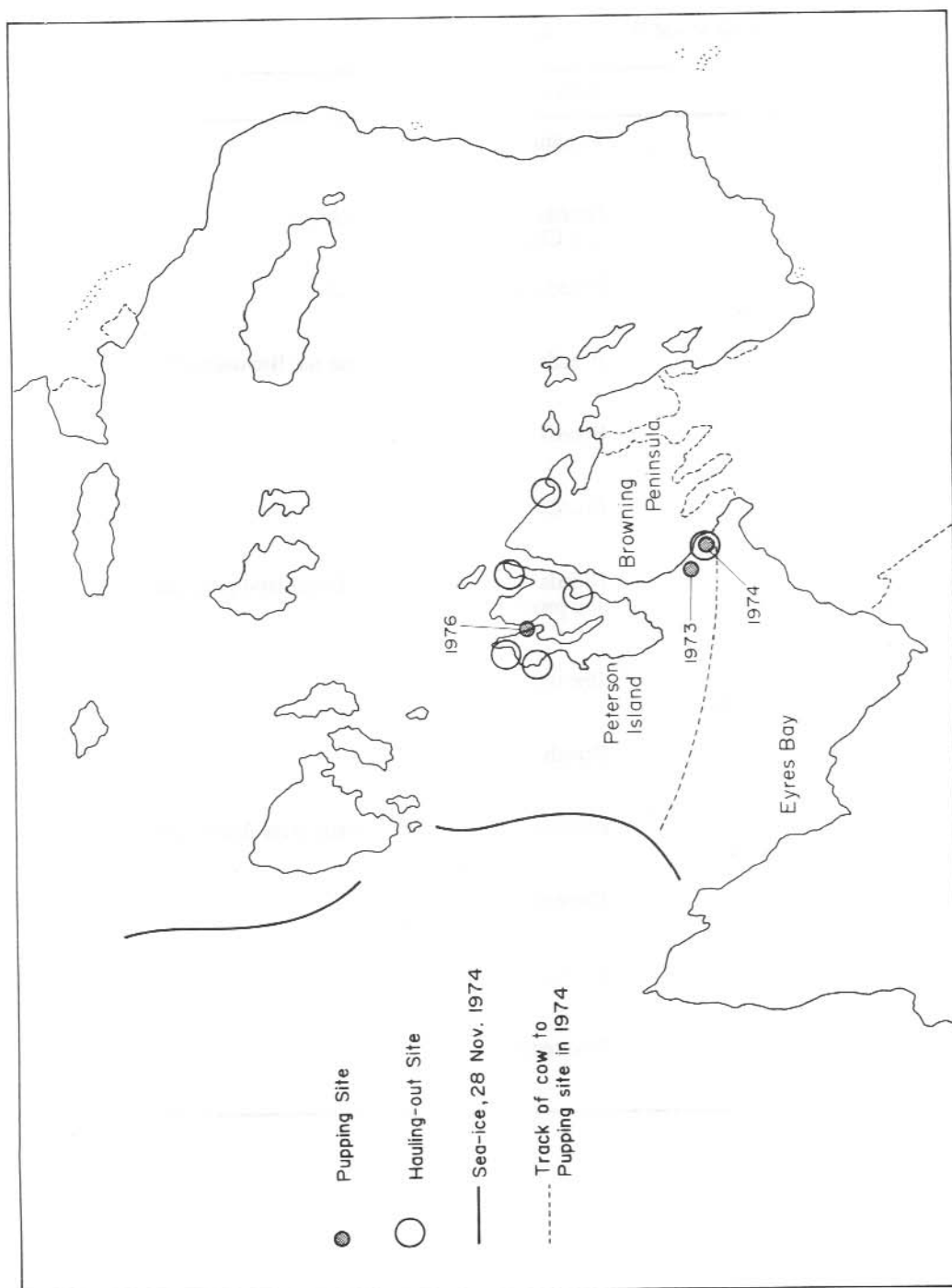


Figure 12. Pupping and hauling out sites of southern elephant seal.

Table 1. Status of birds in the Windmill Islands region

Species	Status
Emperor penguin <i>Aptenodytes forsteri</i>	Regular visitor
Adélie penguin <i>Pygoscelis adeliae</i>	Breeds on at least twelve islands and Clark Peninsula
Southern giant petrel <i>Macronectes giganteus</i>	Breeds on the Frazier Islands
Cape petrel <i>Daption capense</i>	Breeds on seven islands and the Browning Peninsula
Southern fulmar <i>Fulmarus glacialisoides</i>	Breeds on five islands
Antarctic petrel <i>Thalassoica antarctica</i>	Breeds on three islands
Snow petrel <i>Pagodroma nivea</i>	Breeds on most islands and mainland peninsulas and probably nunataks.
White-chinned petrel <i>Procellaria aequinoctialis</i>	One record
Wilson's storm petrel <i>Oceanites oceanicus</i>	Breeds throughout area
Antarctic skua <i>Catharacta maccormicki</i>	Breeds throughout area mostly near Adélie penguin colonies
Subantarctic skua <i>Catharacta lonnbergi</i>	Three records
Kelp gull <i>Larus dominicanus</i>	Six records
(Arctic) tern <i>Sterna spp.</i>	Two records

Table 2. Estimates of breeding pairs of southern giant petrels, Frazier Islands

	Nelly Is	Dewart Is	Charlton Is	Authority
27 January 1959	80-100	20+	*	W.J.L. Sladen
January 1968	72	**	nd	A. Gilchrist
20, 21 January 1972	50+	60+	(10+)xx	M.D. Murray
31 January 1974	76+	nd	nd	A. Jones
28 January 1975	nd	26++	nd	S.C. Karray
13, 17 February 1977	37+	43	nd	A.N. Cowan
24 February 1978	48	48	6	G.W. Johnstone & A.N. Cowan
30 January, 2 February 1979	35	46	5	K. de Jong

\* island not visited

\*\* island visited but no estimate made of birds seen

nd no data

xx estimate based on number of nesting birds seen from air and aerial photographs, i.e. island not visited on foot

Table 3. Status of seals in the Windmill Islands region

Species	Status
Weddell seal <i>Leptonychotes weddellii</i>	Breeds; about 100 pups born annually
Crabeater seal <i>Lobodon carcinophagus</i>	A few sighted each year
Ross seal <i>Ommatophoca rossii</i>	No sightings between 1959 and 1980
Leopard seal <i>Hydrurga leptonyx</i>	Mainly in spring/summer when penguins return
Southern elephant seal <i>Mirounga leonina</i>	Probably one or two pups annually: haul out in spring and summer to moult

Table 4. Occurrence of crabeater seals near Casey

	September	October	November	December	January
1962	3	2	-	-	-
1963	1	-	-	-	-
1965	-	-	-	-	1
1968	3	2	-	1	-
1972	-	-	1	-	-
1975	-	2	-	-	-
1978	-	1	-	1	-
Totals	7	7	1	2	1

Table 5. Occurrence of leopard seals near Casey

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1959	-	-	-	1	-	-	-	-	2	-	-	-
1961-62	-	-	-	-	-	-	-	-	-	-	-	-
1962	1*	-	1	1	2	+	-	1	-	-	2	-
1963	-	-	-	-	1	-	-	-	-	-	-	-
1964	-	-	-	-	3	-	-	-	-	-	-	-
1966	-	-	-	1	-	-	-	-	-	-	-	-
1968	-	-	-	-	-	2	1	1	1*	-	-	-
1971	-	-	-	+	+	1	1	-	-	-	-	-
1972	-	-	-	-	3	1	-	-	-	-	-	-
1973	-	-	2	-	-	-	-	-	-	-	-	-
1974	1	5	-	-	-	-	-	-	-	-	-	-
1975	-	-	-	1	-	-	-	-	2	-	-	-
1976	-	1	2*	2	1	2*x	-	-	-	-	-	-
1978	-	-	-	2	1	-	-	-	-	-	-	-
Total	2	6	5	8+	11+	6+	2	2	5	-	2	-

\* male

x female

Table 6. Increase in weight and size of a southern elephant seal pup

Age (days)	Date	Weight (kg)	Length* (cm)	Girth <sup>x</sup> (cm)	Flipper (cm)
1	29.09.76	88	110	85	-
2	30.09.76	90	-	-	-
3	01.10.76	92	115	89	32
4	02.10.76	101	120	90	32
5	03.10.76	107	125	92	-
11	09.10.76	150	135	105	-
13	11.10.76	182	135	110	-
14	12.10.76	190	135	115	32
15	13.10.76	200	-	-	-

\* curvilinear length

x axillary girth



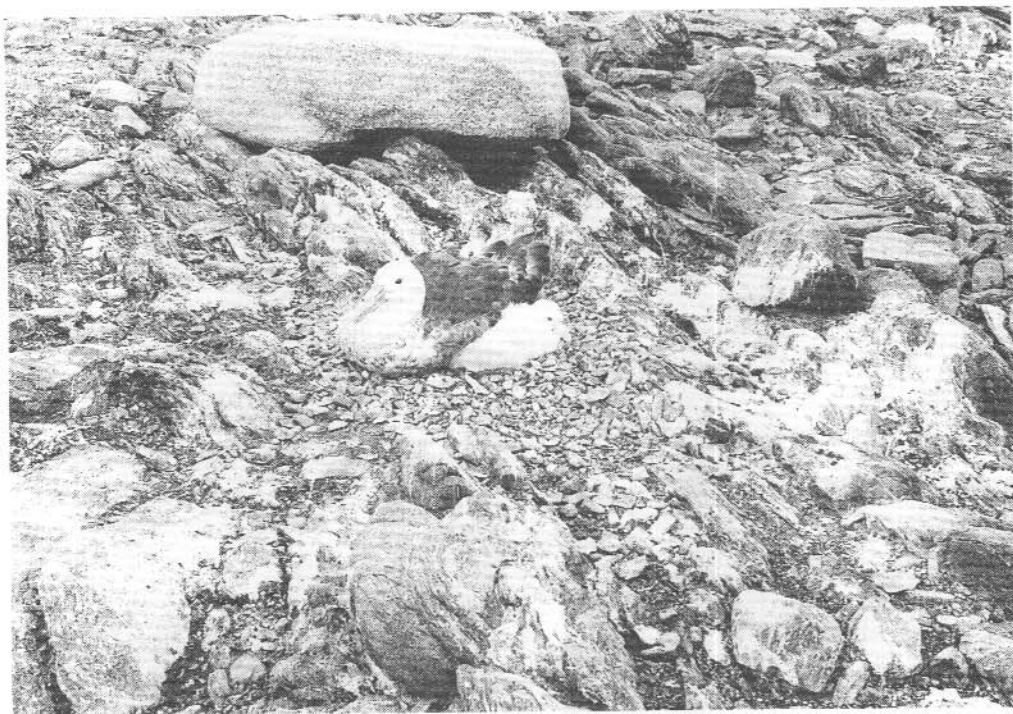
Table 7. Number of southern elephant seals sighted at Peterson Island from 1972 to 1979

Season	Pups seen		Total adults seen on single day in January/February
	August/March	January/February	
1971-72	-	0	12
1972-73	-	0	22
1973-74	1	2	31
1974-75	1	0	52
1976-77	1	0	63
1978-79	0*	0	82
1979-80	?	0	56

\* Four small seals were found but it cannot be established that they were pups of the year.

? One small seal 1.7 m seen; it may have been a pup.

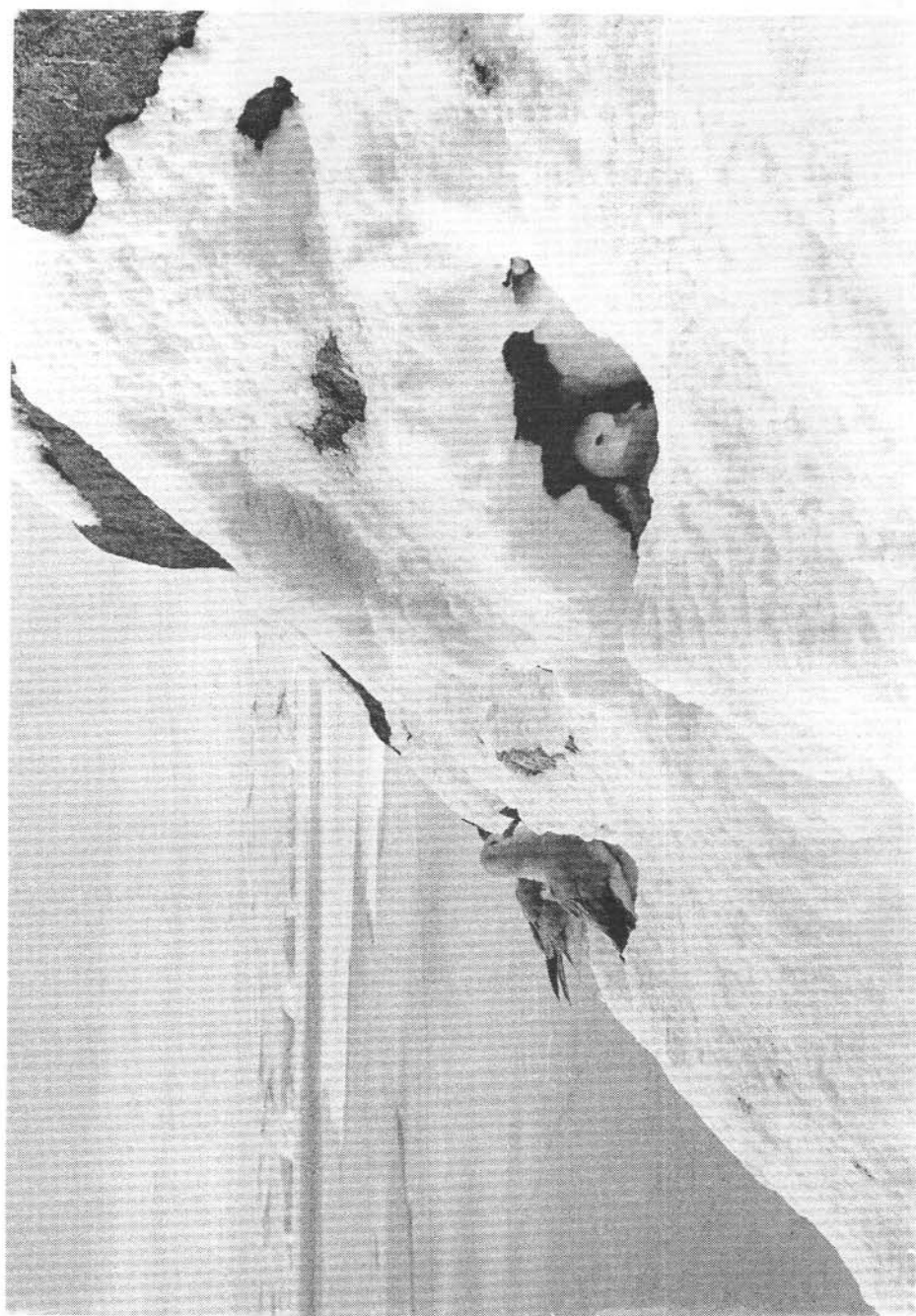




*Plate 1. Southern giant petrel with chick on nest with stone foundation, Frazier Islands.*  
(Photograph by M.D. Murray)



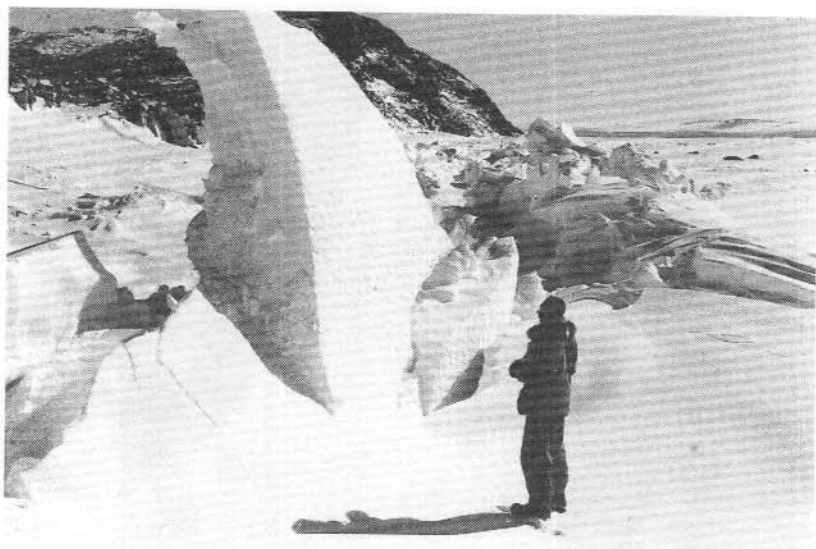
*Plate 2. Southern fulmars resting on sea ice near Ardery Island, October 1972.* (Photograph by D.J. Luders)



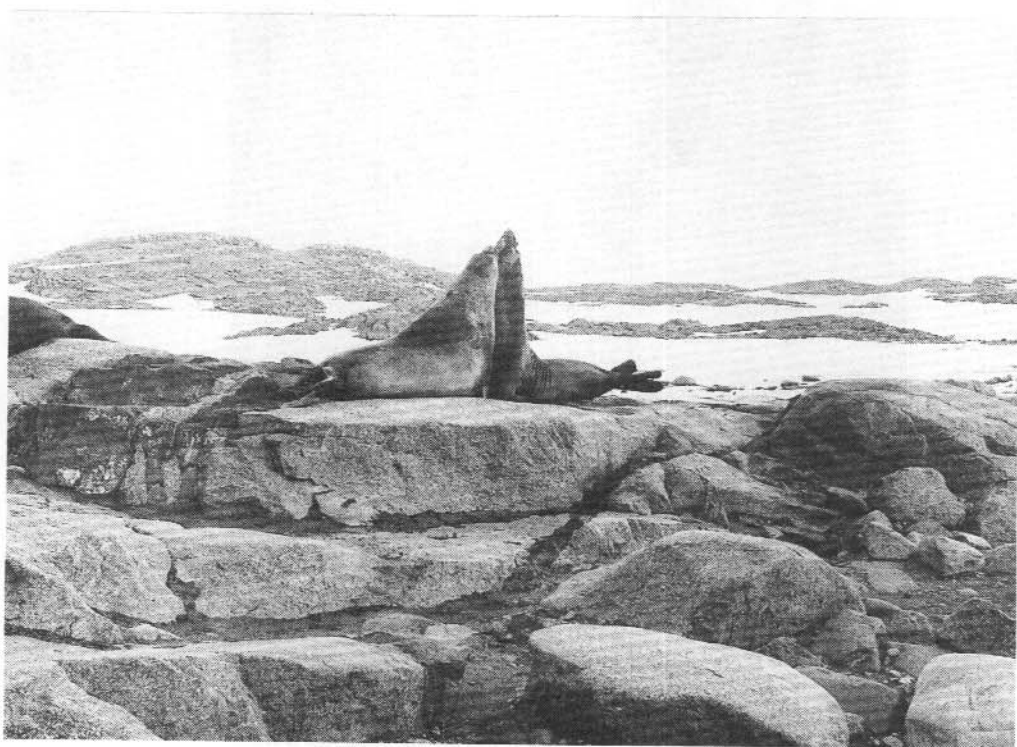
*Plate 3. Southern fulmar nesting in burrow excavated in snow, Ardery Island. (Photograph by M.N. Orton)*



*Plate 4. Pupping site of Weddell seal as seen from Herring Island. Bousquet Island lies between Herring Island and the mainland. The pressure ridges result from the Peterson Glacier on the top left of the photograph. The sea-ice breaks out from Penny Bay on the right and the sea ice around Bouquet Island holds fast. (Photograph by D.J. Luders)*

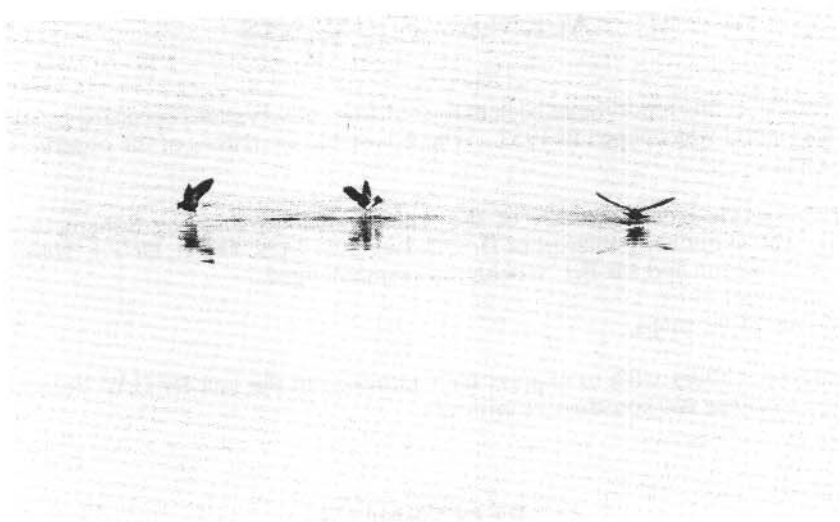


*Plate 5. Rafting of sea ice at Bousquet Island. Herring Island is in the background. (Photograph by D.J. Luders)*



*Plate 6. Immature southern elephant seals at Peterson Island. (Photograph by M.D. Murray)*





*Plate 7. Wilson's storm-petrel feeding in bay near Casey. (Photograph by M.D. Murray)*

## ACKNOWLEDGMENTS

Many of the data in this report have been extracted from observations recorded by expeditioners since Wilkes station was opened in 1957. Where possible the names of the observers have been given in the text.

Mr D. Purchase, the past Secretary of the Australian Bird-Banding Scheme assisted with Appendix 1. The stimulating interest of Dr D.J. Lugg, Dr M.N. Orton, Dr T.J. Tierney, Dr K.R. Kerry, Mr H.R. Burton and Mr E.J. Woehler is acknowledged.

M. Jackson drafted the maps.

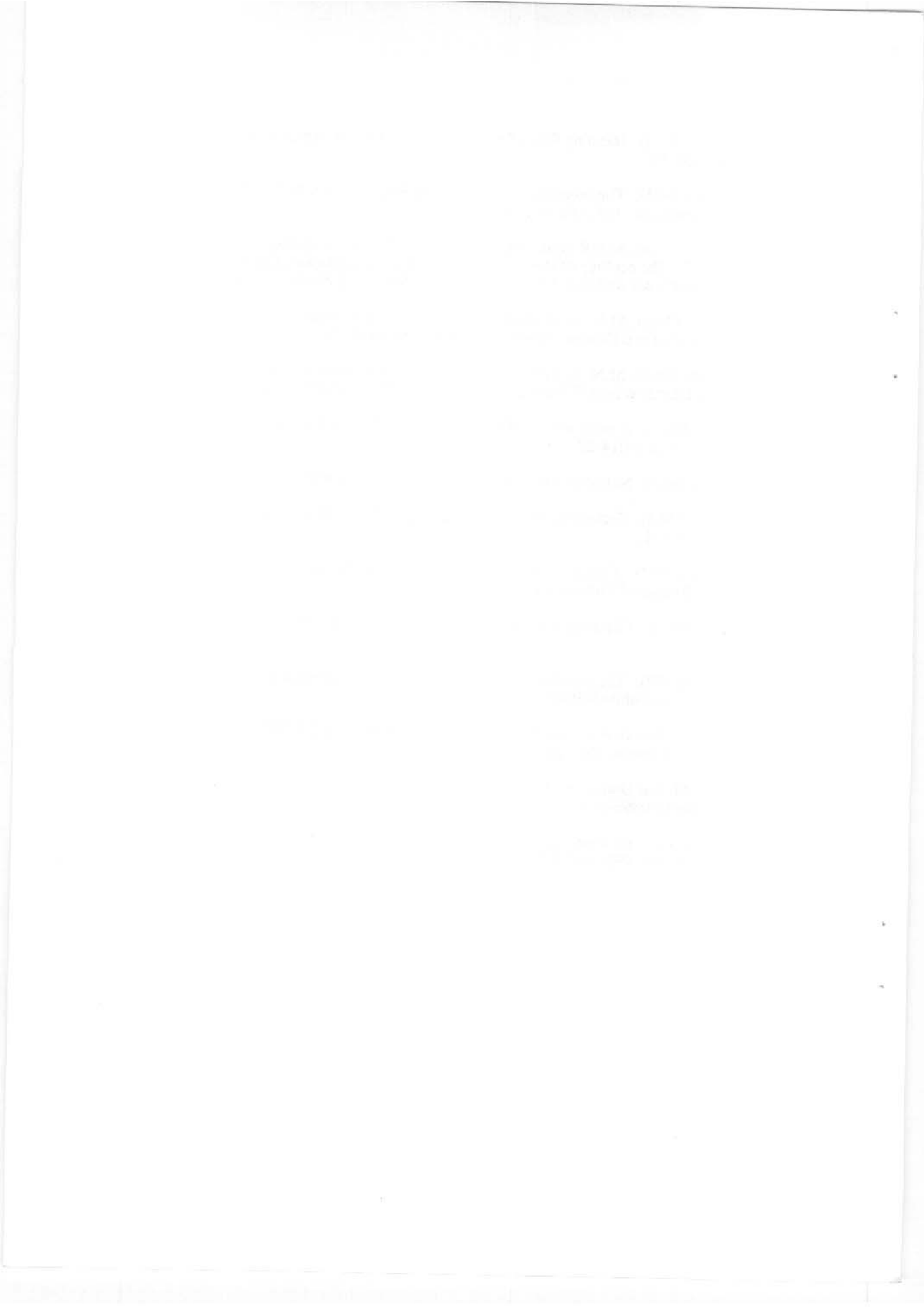
In particular, the authors wish to express their gratitude to the late Dr G.W. Johnstone for his ever-willing assistance and constructive criticism.

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# APPENDIX 1. BIRDS BANDED AT WINDMILL ISLANDS

Date	Pulli	Number 1 Year	Adults	Total	Banding Locality	Band Series*	Bander
<i>Adélie penguin</i>							
1959-61	155	74	1293		Rookery A, Clark Peninsula		
			195	195	Rookery B, Clark Peninsula	#509-57001 to 6000 #509-79001 to 79300	(R.L. Penney (USARP)
			42	42	Frazier Islands		
14-16.2.64	100			100	Rookery A, Clark Peninsula	#509-79301 to 79400	L.G. Murray
20.10.-2.11.68			140	140	Shirley Island	#509-80301 to 10, 12 to 15, 17 to 49, #509-80830 to 39, 50 to 77, 80 to 99, #509-80901 to 8, 10, 12 to 19, 22 to 27, 30 to 47, 49, 50	R.A. MacKenzie

\* All bands are Australian unless indicated otherwise  
# United States Fisheries and Wildlife flipper bands

Date	Pulli	Number 1 Year	Adults	Total	Banding Locality	Band Series*	Bander
<i>Southern giant petrel</i> <sup>+</sup>							
1959	25		0	25	Frazier Islands	130-16101 to 16125	W. Bryden
1959	76		7	83		#568-15001 to 15100, #568-15501 to 15600 #518-37901	}W.J.L. Sladen, }R.L. Penney }(USARP)
1960	46		0	46			
1961	44		0	44		130-16127 to 16170	M.N. Orton
1972	100		0	100		130-49001 to 49100	M.D. Murray
1974	27		0	27		130-73101 to 73127	A. Jones
1975	12		0	12		130-73128 to 73139	S. C. Karray
1977	70		0	70		130-73140 to 73159 130-33451 to 33500	A.N. Cowan
1978	101		13	114		130-73160 to 73195 131-34131 to 34208	G.W. Johnstone
1979	88		0	88		130-40801 to 40888	K. De Jong

\* All bands are Australian unless indicated otherwise

+ All banding of giant petrels is done between late January and early March

# United States Fisheries and Wildlife bands

Date	Pulli	Number 1 Year Adults	Total	Banding Locality	Band Series*	Bander
<i>Southern fulmar</i>						
15.2.60	37	21	58	Ardery Island	#SM 565-75201 to 59	R.L. Penney (USARP)
8.12.60		39	39	Ardery Island	#SM 565-75260 to 300	R.L. Penney (USARP)
15.1 - 21.2.61	28	18	46	Ardery Island	160-20401, 404 to 406, 408 410 to 420, 422, 432 to 440 442, 443, 445 to 450, 453 458, 460, 464, 467, 470	M.N. Orton
19.3.61		1	1	Nelly Island	160-412	M.N. Orton
27.10.61- 15.1.62		72	72	Ardery Island	160-402, 403, 407, 409, 421, 430, 431, 444, 451, 452, 454 to 457, 461, 463, 465, 466, 468, 471 to 524	M.N. Orton
16.1.63		45	45	Ardery Island	160-20525 to 566, 568 to 571	Z. Soucek
19-26.12.63		80	80	Ardery Island	160-26302 to 309, 312 to 317, 322, 323, 326 to 350, 354, 356 to 364, 366 to 381, 384 to 390, 393 to 396	K. Hicks
<i>Snow petrel</i>						
1978-1980	32 3	47 8	79 16	Reeves Hill Station area	081-78101 to 78150 082-42101 to 42146	L. Cole

\*All bands are Australian unless indicated otherwise  
# United States Fisheries and Wildlife bands

Date	Pulli	Number 1 Year	Adults	Total	Banding Locality	Band Series*	Bander
<i>Antarctic skua</i>							
1956-57	46		277	323			{C.A. Eklund (USARP)
1957-58	126		222	458			{C.A. Eklund (USARP)
1958-59	1		1	2		#617-00200 to 900	{W.J.L. Sladen (USARP)
1959-60	9		3	12			{R.L. Penney (USARP)
1960-61	12		16	28			{R.L. Penney (USARP), M.N. Orton
1962-63	2		94	96		120-42501,502 120-42601 to 42694	K. Hicks
1963-64	1		0	1		120-46101	L.G. Murray
1966-67	10		4	14		120-46301 to 46314	J.C. Elliot
1967-68	2		1	3		120-46201 to 46203	
1968-69	8		70	78		120-46204 to 46281	R.A. MacKenzie
1969-70	0		53	53		120-46282 to 46300 120-46401 to 46434	

\* All bands are Australian unless indicated otherwise

# United States Fisheries and Wildlife bands - bands in other series may have been used

# APPENDIX 2. DISTANT AND LOCAL RECOVERIES OF BANDED BIRDS

Band number	Banding data Date	Age	Date	Age	Locality	Recovery data	Manner of recovery
<i>Southern giant petrel</i>							
# 518-94904 (528-15047)	3.2.59	pulli	15.6.59	4-1/2 m	N of Valdivia, Chile (39°26'S, 73°15'W)	Torso found	
# 518-94924 (528-15084)	3.2.59	pulli	26.5.60	16 m	Louth Bay, near Port Lincoln, S. Australia (34°43'S, 135°49'E)		
# 528-15025	3.2.59	pulli	19.10.59	8-1/2 m	S. of Puerto Quenquen, Argentina (38°30'S, 52°44'E)	Captured alive and released	
# 528-15035	3.2.59	pulli	5.5.59	5 m	Near Te Araroa, New Zealand (37°37'S, 178°25'E)	Caught and released with band	
# 528-15046	3.2.59	pulli	6.9.59	7 m	San Juan Beach, Peru (15°22'S, 75°07'W)	Freshly dead	
# 528-15098	4.2.59	pulli	9.5.59	3 m	Off Cape Kaiteriteri, Tasman Bay New Zealand (41°05'S, 173°00'E)	Caught and released without band	
130-16119	27.1.59	pulli	19.10.59	9 m	5mS Puerto, Quenguan Argentina (38°30'S, 58°40'W)	Released with band	
130-16153	23.3.61	pulli	6.10.61	6-1/2 m	Easter Island, Pacific Ocean (27°00'S, 109°20'W) 9000 km ENE	Found alive but died	
130-16162	23.3.61	pulli	July 61	4 m	Stilbaai, South Africa (27°08'S, 109°20'W)	Caught in fishing net	
130-49005	2.1.72	pulli	May 73	17 m	30 km W of Huasco, Chile (28°30'S, 71°35'W) 9200 km ENE	Unknown	
130-49043	20.1.72	pulli	5.6.72	5 m	Waikawa Beach, New Zealand (40°41'S, 175°08'E) 5000 km NE	Found dead	
130-49055	20.1.72	pulli	21.1.73	12 m	near Lima, Peru (12°06'S, 77°03'W) 9350 km ENE	Caught alive	
130-73105	31.1.74	pulli		<7 m	near Albany, Western Australia (35°02'S, 117°53'W) 3600 km NNE	Found dead	
131-34153	24.1.78	pulli	9.10.78	9 m	mouth of Rangitata R., New Zealand (44°04'S, 171°23'E) 4300 km ENE	Found dead	
131-40884	2.2.79	pulli	12.8.79	6 m	Bayleys Beach, New Zealand (35°30'S, 173°30'E) 5600 km NE	Unknown	

# United States Fisheries and Wildlife bands - data extracted from Sladen *et al.* (1968)

Band number	Banding data Date	Age	Date	Age	Locality and manner of recovery	Recovery data
130-16133	23.3.61	pulli	16.12.68	7y 9m	Shirley Island, caught and released	
Banded adult southern giant petrels have been seen breeding on the Frazier Islands but have not been captured.						
<i>Southern fulmar</i>						
There have been no distant recoveries of birds banded 1960-63.						
			Oct 1966		5 recaptured on nests at Ardery Island by J.C. Elliot	
			Jan 1972		40 recaptured on Ardery Island by M.D. Murray and J. Ackerley most within 1-2 m of original banding site, one pair were mates on 21.12.63, one on egg was banded as chick on 15.2.60.	
			1978		8 different birds recaptured on Ardery Island by A.N. Cowan.	
			1984-85		14 recovered at Mast Head, Ardery Island by J.A. Van Franeker and T.L. Montague	
<i>Snow petrel</i>						
There have been no distant recoveries of birds banded 1978-80.						
			1984-85		23 recovered at Reeves Hill by J.A. Van Franeker and T.L. Montague	
<i>Antarctic skua</i>						
<i>Birds banded at colony</i>						
#617-00328	17.11.57	Ad	19.3.39		Mirny 800 km west	
#617-00359	21.2.57	Ad	20.12.58		Scott Base, 3000 km east	
#617-00424	22.2.57	Ad	26.2.58		Mirny 800 km west	
#617-00464	25.2.57	Ad	4.2.59		Indian Ocean (65°08'S, 111°15'E) 130 km north-east	
#617-00566	26.3.57	Ad	3.1.59		McMurdo Sound 3000 km east	



Band number	Banding data		Date	Age	Recovery data	
	Date	Age			Locality and manner of recovery	
#617-00567	26.3.57	Ad	19.2.58		Indian Ocean (65°53'S, 114°01'E) 120 km north-east	
#617-00634	17.11.57	Ad	23.12.59		Dumont d'Urville 1200 km east	
#617-00660	27.11.57	Ad	26.1.58		King Baudoin Station, Breid Bay (70°15'S, 24°15'E) 3600 km west	
Green			4.-.60		Mirny 800 km west	
Green +	56-58		13.12.58		Cape Evans, McMurdo Sound 3000 km east	
Green +	56-68		24.1.59		Davis 1400 km west	
			26.1.59			
			4.2.60			
Green +	56-80		5.1.59		Mawson 2000 km west	
120-46228	10.11.68	Ad	28.12.71		Casey, recaptured and released,	
			11.2.73		Dumont d'Urville, Adélie Land	
617-00859			17.12.63		Recaptured and released at Casey	
			7.12.71		Recaptured and released at Casey station	
<i>Birds banded elsewhere</i>						
DZ 13094**	28.2.69	Ad	2.12.71		Banded at Dumont d'Urville, captured and released at Casey	
DZ 13089**	28.2.69	Ad	5.1.72		Banded at Dumont d'Urville, number read on bird	

Several banded skuas were recaptured each year.

# United States Fisheries and Wildlife bands - data extracted from Eklund (1961)

+ Sightings from Eklund (1961)

\*\* OIS Museum, Paris

