

## SHORT NOTES

### NOTES ON ANTARCTIC LICHENS: V. THE GENUS *Ochrolechia* Massal.

By D. C. LINDSAY

ABSTRACT. Descriptions, new localities and some habitat data are reported for *Ochrolechia antarctica* (Müll. Arg.) Darb., *O. frigida* (Sw.) Lyngé and *O. parella* (L.) Massal. The second known collection of *O. deceptionis* (Hue) Darb. is reported from Nelson Island, South Shetland Islands.

THE genus *Ochrolechia* has received only fleeting attention in the literature on Antarctic lichens. Darbishire (1912) was the first author to report this crustose genus from the Antarctic, recording *O. antarctica* (Müll. Arg.) Darb. and *O. parella* (L.) Massal. from South Georgia, and *O. tartarea* (L.) Massal. from South Georgia and the Danco Coast, Antarctic Peninsula. Hue (1915) reported *Ochrolechia* (as *Lecanora*) *tartarea* var. *frigida* (Sw.) Körb. from the Graham Coast, and described a new species, *O.* (as *Lecanora*) *deceptionis* (Hue) Darb., from material collected from Deception Island, South Shetland Islands. Verseghy (1962) monographed the genus *Ochrolechia* on a world basis but she was unable to examine some of the literature relevant to the Antarctic species or some of the type specimens. For this reason her monograph is incomplete and at times inaccurate in its treatment of the Antarctic species. A record of *O. geminipara* (Th. Fr.) Vain., for example, from the Antarctic is erroneously attributed to Dodge and Baker (1938), who mentioned only *O. deceptionis* and *O. frigida* as part of a key to the Antarctic species of *Lecanora*.

Thus a survey of the literature has produced records of only five species of *Ochrolechia* from the sub-Antarctic and Antarctic: *O. antarctica*, *O. deceptionis*, *O. frigida*, *O. parella* and *O. tartarea*. Skottsberg's material (in Herb. S) from South Georgia, published by Darbishire (1912) as *O. tartarea*, has been examined by the author and found to be a mixture of *O. antarctica* and *O. frigida*. Therefore, *O. tartarea* must be deleted from the list of species occurring in the Antarctic.

The descriptions of the four Antarctic species given below are based on material in the British Antarctic Survey herbarium, at present housed in the Department of Botany, University of Birmingham, and unless stated otherwise all specimens are part of this herbarium. Specimens examined are cited under the appropriate species heading with distribution data summarized by island group or coasts, the latter including all offshore islands.

Nomenclature follows that of Verseghy (1962) but for convenience the species are arranged alphabetically.

#### *Ochrolechia* Massal.

Thallus crustose, smooth, verrucose, rimose or rugose. Apothecia lecanorine, thalline exciple concolorous with thallus, immersed, adnate or sessile, 1–7 mm. in diameter. Disc concave to convex. Paraphyses branched and anastomosing. Asci clavate, 2–8 spored. Ascospores hyaline, unicellular, large (longer than 40  $\mu\text{m}$ .), ellipsoid, thick-walled. Phycobiont *Pleurococcus* ?

#### KEY TO SPECIES

- |   |                       |
|---|-----------------------|
| 1. Thallus always growing over moss or wood, K + yellow .. .. .   | <i>O. frigida</i>     |
| Thallus always growing over rock, K— .. .. .  | 2                     |
| 2. Ascospores uniseriate, 4 per ascus .. .. .   | <i>O. deceptionis</i> |
| Ascospores uni- or biseriata, 4, 6 or 8 per ascus .. .. .   | 3                     |
| 3. Mature apothecia 2–4 mm. in diameter; ascospores 4 or 8 per ascus, 55–70 $\times$ 27–35 $\mu\text{m}$ . .. .. .  | <i>O. antarctica</i>  |
| Mature apothecia 1.5–2.5 mm. in diameter; ascospores 6 or 8 per ascus, 45–55 $\times$ 25–35 $\mu\text{m}$ . .. .. . | <i>O. parella</i>     |

*Ochrolechia antarctica* (Müll. Arg.) Darb.

Thallus saxicolous, white to cream, effuse to subdeterminate, rimose-areolate; areolae 0.4–0.9 mm. in diameter, irregular. Apothecia adnate to sessile, 1–4 mm. in diameter. Disc alutaceous (in herbarium material), irregular, cracked. Thalline margin 0.2–0.3 mm. thick, slightly crenulate. Ascospores 4 or 8 per ascus, uni- or biseriata,  $55\text{--}70 \times 27\text{--}35 \mu\text{m}$ .

This is a species with an apparently bicentric distribution in the Southern Hemisphere, having previously been reported from Argentina, Fuegia, the Falkland Islands and South Georgia (Verseghy, 1962) and from New Zealand (Martin, 1966). It is now known from localities in the South Orkney and South Shetland Islands, the first records of this species from within the Antarctic botanical zone.

*O. antarctica* is found on a wide variety of rock substrata at altitudes of 3–80 m., but in the South Shetland Islands, the author noted that it was more frequent on readily friable vesicular volcanics, especially at Williams Point, Livingston Island, than on more massive and frost-resistant rocks which supported a richer lichen vegetation.

All the specimens examined were abundantly fertile, but apothecia containing mature ascospores seem to be uncommon. The size of mature ascospores was found to vary slightly more than the dimensions given by Verseghy (1962), most of them being 67–70  $\mu\text{m}$ . long.

*Specimens examined*

- Falkland Islands** *East Falkland*: near Port Stanley, 2.iv.1967, Lindsay 1668.  
**South Georgia** Moraine Fjord, 20.v.1902, Skottsberg s.n. (S).  
**South Orkney Islands** *Signy Island*: Paal Harbour, 2.iv.1965, R. Smith 431.  
**South Shetland Islands** *Greenwich Island*: Ash Point, 16.i.1966, Lindsay 700a. *Livingston Island*: Byers Peninsula, 14.xii.1965, Lindsay 349; Robbery Beaches, 30.xii.1965, Lindsay 513; Williams Point, 8.i.1966, Lindsay 668.

*Ochrolechia deceptionis* (Hue) Darb.

Thallus saxicolous, white to cream, determinate, no distinct hypothallus, areolate; areolae regular, plane or slightly convex, 0.3–0.9 mm. in diameter. Apothecia adnate to sessile, 0.5–3.0 mm. in diameter. Disc faint reddish brown, concave to convex, with (in older apothecia) radiating ridges. Thalline margin smooth. Ascospores 4 per ascus, uniseriate,  $55\text{--}70 \times 25\text{--}35 \mu\text{m}$ .

This species was formerly known from the type specimen only, which was collected on volcanic rocks at an altitude of 300 m. on Deception Island, South Shetland Islands (Hue, 1915). A second specimen has been collected in the South Shetland Islands, and it is sparingly fertile with apothecia 1–2 mm. in diameter. As with *O. antarctica*, apothecia containing mature ascospores are infrequent.

*Specimens examined*

- South Shetland Islands** *Nelson Island*: Rip Point, 26.i.1966, Lindsay 796. *Deception Island*: 23.xii.1908, Gain 74 (PC, TYPUS).

*Ochrolechia frigida* (Sw.) Lynge

Thallus muscicolous, terricolous or lignicolous, white, effuse, varying from 0.5–2.0 mm. in thickness, papillate, granulose or subspinulose. Apothecia 1–3 mm. in diameter, sessile. Disc rose,  $\pm$  flat, smooth. Thalline margin smooth. Ascospores 8 per ascus,  $35\text{--}45 \times 15\text{--}20 \mu\text{m}$ .

This cosmopolitan species appears to be the most widespread and frequently encountered *Ochrolechia* in the Antarctic, having been collected from localities in South Georgia, the South Orkney and South Shetland Islands, and along the west coast of the Antarctic Peninsula. Darbishire (1912) recorded it (as *O. tartarea*) from localities on South Georgia and the Danco Coast, Antarctic Peninsula.

Apothecia were observed on most of the specimens examined but they were fully developed with asci and ascospores only in collections from the Falkland Islands and the Argentine Islands.

In these specimens, the apothecia attained a diameter of 2.0–2.5 mm. with a nearly plane disc, whereas those on specimens from the South Orkney and South Shetland Islands were under 1 mm. in diameter and cupuliform.

*O. frigida* has been found on a wide variety of substrata, moss, peat and wood, but it is particularly associated with species of *Andreaea*. In its muscicolous habitat, it is unlikely to be confused with any other crustose lichens, except a species of *Caloplaca* (Sect. *Caloplaca*) which is only rarely fertile. However, *O. frigida* is K+ yellow, whereas the thallus of the species of *Caloplaca* is K—.

#### Specimens examined

**Falkland Islands** *East Falkland*: near Port Stanley, 2.iv.1967, Lindsay 1667.

**South Georgia** Moraine Fjord, 29.iv.1902, Skottsberg s.n. (S). King Haakon Bay, 15.x.1964, Longton 816.

**South Orkney Islands** *Lynch Island*: north side, 16.iii.1966, Lindsay 968. *Signy Island*: Observation Bluff, 2.iii.1966, Lindsay 920; Borge Bay, 17.viii.1966, Lindsay 1046, 28.x.1966, Lindsay 1349, 22.xi.1966, Lindsay 1408.

**South Shetland Islands** *Greenwich Island*: Ash Point, 16.i.1966, Lindsay 710. *Livingston Island*: Byers Peninsula, 3.xii.1965, Lindsay 129, 4.xii.1965, Lindsay 148, 8.xii.1965, Lindsay 211, 22.xii.1965, Lindsay 472, 30.xii.1965, Lindsay 523. *King George Island*: Point Hennequin, 29.i.1966, Lindsay 846; Keller Peninsula, 24.xii.1960, Taylor 283, 28.i.1966, Lindsay 834. *Nelson Island*: Rip Point, 26.i.1966, Lindsay 791.

**Antarctic Peninsula (west coast)** *Danco Coast*: Anvers Island, 9.iii.1967, R. Smith 905a. *Graham Coast*: Cape Tuxen, 26.i.1961, Archibald 28; Argentine Islands, Galindez Island, 15.iii.1960, Taylor 134, 22.iv.1964, Corner 545, 24.iv.1964, Corner 550, 13.ii.1967, R. Smith 762.

#### *Ochrolechia parella* (L.) Massal.

Thallus saxicolous, white to cream, effuse to subdeterminate, rimose-areolate; areolae irregular, 0.1–0.7 mm. in diameter. Apothecia 0.1–2.5 mm. in diameter, immersed at first, then adnate to sessile. Disc rose, flat, smooth. Margin thick, 0.3–0.5 mm. broad, subcrenulate. Ascospores 6 or 8 per ascus, uni- or biseriata 45–55 × 25–35 μm.

Versegly (1962) recorded this species as being widespread in Europe, North Africa and Asia Minor. It has been reported from the Falkland Islands by Zahlbruckner (1917), from South Georgia by Darbishire (1912) and from New Zealand by Martin (1966). As Darbishire's (1912) specimen (in Herb. S) is *O. antarctica*, the present record is the first firm report of this species from South Georgia.

#### Specimen examined

**South Georgia** 159 096, near Pirner Point, 25.ii.1961, Greene 2405.

#### ACKNOWLEDGEMENTS

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#### REFERENCES

- DARBISHIRE, O. V. 1912. The lichens of the Swedish Antarctic Expedition. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 4, Lief. 11, 74 pp.
- DODGE, C. W. and G. E. BAKER. 1938. The Second Byrd Antarctic Expedition—Botany. II. Lichens and lichen parasites. *Ann. Mo. bot. Gdn.*, 25, No. 2, 515–718.
- HUE, A. M. 1915. *Lichenes*. Paris, Masson et Cie. [Deuxième Expédition Antarctique Française (1908–1910), Sciences naturelles: documents scientifiques.]
- MARTIN, W. 1966. Census catalogue of the lichen flora of New Zealand. *Trans. R. Soc. N.Z.*, Botany, 3, No. 8, 139–59.
- VERSEGHY, K. 1962. Die Gattung *Ochrolechia*. *Beih. Nova Hedwigia*, 1962, Ht. 1, 146 pp.
- ZAHLEBRUCKNER, A. 1917. Botanische Ergebnisse der schwedischen Expedition nach Patagonien und dem Feuerlande 1907–09. VI. Die Flechten. *K. svenska Vetensk. Akad. Handl.*, 57, No. 6, 1–62.

VIRUS DISEASE RESEMBLING PUFFINOSIS IN THE GENTOO PENGUIN  
(*Pygoscelis papua*) ON SIGNY ISLAND, SOUTH ORKNEY ISLANDS

By J. W. MACDONALD\* and J. W. H. CONROY

ABSTRACT. Excessive mortality of gentoo penguin chicks was recorded at Signy Island, South Orkney Islands, in January 1969. Multiple ulcers were observed on the feet of almost all live and dead chicks examined and a few live adults. The symptoms are similar to those characterizing puffinosis in shearwaters, fulmars and gulls. The nature of the disease was investigated using virological, histological and experimental techniques, and observations are presented which suggest that the black-browed albatross may have been an intermediate host between shearwaters and penguins.

GENTOO PENGUINS have been recorded breeding on the South Orkney Islands for many years (Clarke, 1906; Ardley, 1936) and, although Ardley made no reference to the species breeding on Signy Island (lat. 60°43'S., long. 45°38'W.), a colony existed there when the Falkland Islands Dependencies Survey established its station on the island in 1947. The colony, of about 500 pairs, is at North Point, where Adélie (*Pygoscelis adeliae*), chinstrap (*P. antarctica*) and macaroni penguins (*Eudyptes chrysolophus*) also breed. The gentoo penguin chicks hatch in late December and excessive mortality of chicks was first recorded at North Point on 12 January 1969 where a more detailed investigation, carried out on 20 January, showed several hundred carcasses. Many of the dead birds were lying on their stomachs in a posture similar to the normal resting position of the species and superficially appeared to be in good bodily condition. On the dorsal surface of the feet, both of which were equally affected, multiple ulcers 2-4 mm. in diameter were uniformly distributed over the skin of the digits and the tarsometatarsus (Fig. 1). Invariably, the edges of the lesions, which affected one to four scales, were sharply demarcated by the normal fissures separating them from the scales of the adjoining unaffected skin. In the majority of cases, the dark pinkish brown base of the ulcer was raised above the surrounding normal skin and consisted of "proud flesh" (excessive granulation tissue) indicating the later stages of healing. The remaining lesions had completely healed but their former positions were marked by depressed pale scars. No birds were found with the fluid-filled blisters characteristic of the early stages of puffinosis in Manx shearwaters (*Puffinus puffinus*), fulmars (*Fulmarus glacialis*) and gulls (*Larus* sp.).

Of 30 live adults handled, eight were infected; of 100 live chicks, 94 showed the characteristic lesions; and of 100 dead chicks examined, 96 were infected. No adult carcasses were found. One seriously affected chick was found lying prone on the ground; each time it was helped up, it toppled over having apparently lost its capacity to balance.

More than 100 Adélie and chinstrap penguins (both adults and chicks) in the adjacent rookeries were examined but showed no evidence of the disease. The five pairs of macaroni penguins breeding on the island were also free from infection.

The materials, methods and results of virological and histological examinations were similar to those described in a study of fulmars with puffinosis (Macdonald and others, 1967), except that inclusion bodies were not detected either in the chorio-allantoic membranes or in the lesions in the skin. Attempts to transmit the disease to adult Khaki Campbell ducks by skin scarification were unsuccessful.

Miles and Stoker (1948) first described puffinosis in Manx shearwaters and Macdonald and others (1967) reviewed subsequent additions to the list of hosts. In 1965 and 1966, in some of the colonies of the black-browed albatross (*Diomedea melanophris*) at West Point Island in the Falkland Islands chicks were dying in large numbers. The nature of the malady was not determined, and the mortality from this cause ceased in 1967. However, a description of the dead chicks given by R. Napier of West Point Island to J. W. H. Conroy suggested certain similarities to fulmars suffering from puffinosis. The only external sign was blistering of the feet, and the affected birds were restricted to certain breeding colonies on the island, not necessarily adjacent ones. The sporadic distribution of disease in the albatross is reminiscent of the situation in fulmars where, in spite of widespread infection on North Ronaldsay, the birds on

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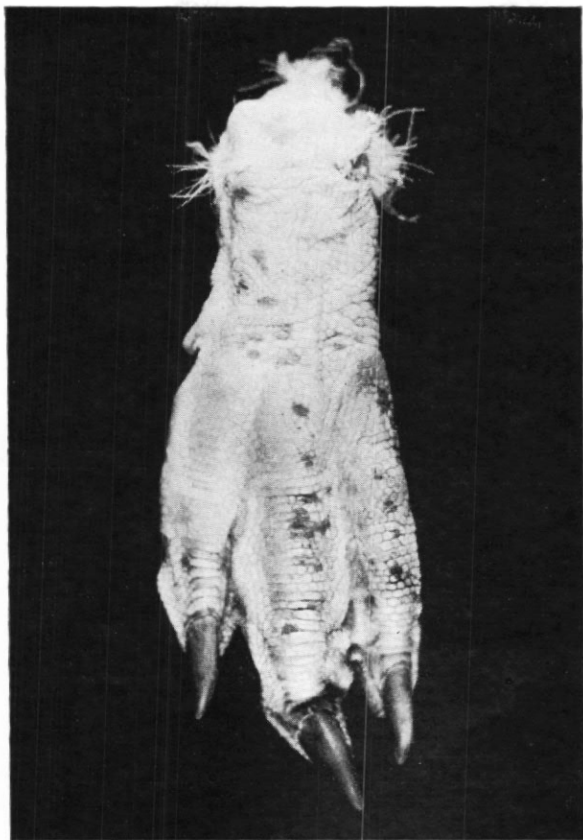


Fig. 1. Typical puffinosis ulcers on the skin of the foot of a gentoo penguin (*Pygoscelis papua*).

neighbouring islands remained free from infection (Macdonald and others, 1967). Similarly, the inco-ordination shown by a gentoo penguin chick was a prominent symptom of severely affected fulmars.

Puffinosis has not previously been found in penguins (Sphenisciformes) but, bearing in mind the possibility of interspecies transmission of virus, it is interesting to note that increasing numbers of Manx shearwaters ringed in Britain are being recovered from the coasts of Brazil and Argentina (Bannerman, 1959; Harris, 1966) and they could conceivably provide a source of infection for penguins. In spite of this, however, under normal circumstances there seems little likelihood of the two species coming in contact, since the gentoo penguins remain near their breeding grounds throughout the winter months (Murphy, 1936) and sightings of Manx shearwaters are extremely rare in high southern latitudes. On the other hand, the ranges of the black-browed albatross and gentoo penguin do overlap, the former species being seen at sea near the South Orkney Islands. While the evidence from West Point Island suggests that these albatrosses may be an intermediate host bridging the gap between penguins and shearwaters, they are strictly pelagic and therefore seem an unlikely link. Nevertheless it is an intriguing hypothesis. Sparks and Soper (1967) have summarized the fossil, structural, behavioural and biochemical evidence supporting the evolutionary affinity of penguins and tubenoses (Procellariiformes). The occurrence in penguins of a specific disease previously thought to be restricted to tubenoses provides further evidence of affinities in the evolution of these two groups of birds.

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## REFERENCES

- ARDLEY, R. A. B. 1936. The birds of the South Orkney Islands. 'Discovery' Rep., **12**, 349-76.
- BANNERMAN, D. A. 1959. *The birds of the British Isles*. Vol. 8. Edinburgh, Oliver and Boyd.
- CLARKE, W. E. 1906. Ornithological results of the Scottish National Antarctic Expedition—2. On the birds of the South Orkney Islands. *Ibis*, Ser. 8, **6**, No. 21, 145-87.
- HARRIS, M. P. 1966. Breeding biology of the Manx shearwater *Puffinus puffinus*. *Ibis*, **108**, No. 1, 17-33.
- MACDONALD, J. W., McMARTIN, D. A., WALKER, K. G., CARINS, M., and R. H. DENNIS. 1967. Puffinosis in fulmars in Orkney and Shetland. *Br. Birds*, **60**, No. 9, 356-60.
- MILES, J. A. R. and M. G. P. STOKER. 1948. Puffinosis, a virus epizootic of the Manx shearwater (*Puffinus p. puffinus*). *Nature, Lond.*, **161**, No. 4104, 1016-17.
- MURPHY, R. C. 1936. *Oceanic birds of South America*. New York, American Museum of Natural History.
- SPARKS, J. and T. SOPER. 1967. *Penguins*. Newton Abbot, David and Charles.

WILSON'S PHALAROPE (*Steganopus tricolor*) IN THE ANTARCTIC

By J. W. H. CONROY

THE phalaropes (Phalaropidae) are a group of waders which breed in the Northern Hemisphere and migrate to the Southern Hemisphere in the winter (Wynne-Edwards, 1964). There are three species: the grey phalarope (*Phalaropus fulicarius*) and the red-necked phalarope (*P. lobatus*) have a circum-polar breeding distribution, while the Wilson's phalarope (*Steganopus tricolor*) breeds only in North America (Bent, 1927; Hohn, 1967). Their winter-quarters have not been fully established. The red-necked and grey phalaropes are more pelagic in their migration than Wilson's phalarope which prefers more coastal areas and inland pools (Bent, 1927; Murphy, 1936; Hughes, 1970). Wilson's phalarope has been seen in the Falkland Islands (Bent, 1927), and probably off Tierra del Fuego (Philippi and others, 1954; Humphrey and others, 1970). The breeding biology of Wilson's phalarope has been described by Hohn (1967) and John (1969).

On 13 October 1968, during a north-westerly gale, a small bird was seen flying around the British Antarctic Survey field station at Fossil Bluff, Alexander Island (lat. 71°21'S., long. 68°17'W.). On the following day, a similar (probably the same) bird was found dead outside the hut. The bird was described as "6½ in. [16.5 cm.] overall length, back and head light grey-brown, upper wing light brown, under wing light grey at body becoming browner towards the tips. Breast and side of head white. Slender bill black 1½ in. [3.8 cm.] long with slight downward curve and the end of the upper mandible. Legs brown becoming yellow at feet, no web but fringe" (Willey, 1969). The bird was tentatively identified as a Wilson's phalarope, the identification being confirmed by the author when the specimen was returned to the United Kingdom.

Fossil Bluff, on Alexander Island, is the most southerly of the British stations along the Antarctic Peninsula. Even in summer the station is over 100 km. from the ice edge, and when the phalarope was recovered, the ice edge was probably several hundred kilometres farther to the north. This record of a vagrant Wilson's phalarope extends the southern limit of the species by over 20° of latitude.

An examination of the literature shows that few phalaropes have been seen in the higher southern latitudes. There are three records of red-necked phalaropes and three records (all female) of the grey phalarope in New Zealand (Falla and others, 1966), all except one of the records from the east coast. From Australia there are two records of red-necked phalaropes, both from the south coast (Eckert, 1969). Despite the suggestion that the grey phalaropes might winter around New Guinea (Bent, 1927), there have been no recoveries from northern Australia. It is possible that the records from southern Australia are the result of phalaropes accidentally travelling into the high Antarctic latitudes, being carried by the prevailing winds, and when they fly north, coming up on the shore of South Australia.

Holmes (1939) discussed the winter records of Wilson's phalarope throughout South America and the Falkland Islands (one record). They clearly show that these birds prefer inland to coastal regions and suggest that some might winter on the lakes high up in the Andes; several birds, in full winter plumage have been seen on the shores of these lakes up to 4,200 m.

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## REFERENCES

- BENT, A. C. 1927. *Life histories of North American shore birds*. New York, Dover Publications, Inc.
- ECKERT, J. 1969. Red-necked phalaropes in South Australia. *Emu*, **69**, No. 3, 184-86.
- FALLA, R. A., SIBSON, R. B. and E. G. TURBOTT. 1966. *A field guide to the birds of New Zealand*. London, Collins.
- HOHN, E. O. 1967. Observations on the breeding biology of Wilson's phalarope (*Steganopus tricolor*) in central Alberta. *Auk*, **84**, No. 2, 220-44.
- HOLMES, P. F. 1939. Some oceanic records and notes on the winter distribution of the phalaropes. *Ibis*, **87**, No. 2, 329-42.
- HUGHES, R. A. 1970. Notes on the birds of the Mollendo district, southwest Peru. *Ibis*, **112**, No. 2, 229-41.
- HUMPHREY, P. S., BRIDGE, D., REYNOLDS, P. W. and R. T. PETERSON. 1970. *Birds of the Isla Grande (Tierra del Fuego)*. Washington, D.C., Smithsonian Institution.
- JOHN, J. E. 1969. Field studies of Wilson's phalarope. *Auk*, **86**, No. 4, 660-70.
- MURPHY, R. C. 1936. *Oceanic birds of South America*. New York, American Museum of Natural History.
- PHILIPPI B., R. A., JOHNSON, A. W., GOODALL, J. D. and F. BEHN. 1954. Notas sobre aves de Magallanes y Tierra del Fuego. *Boln Mus. nac. Hist. nat. Chile*, **26**, No. 3, 1-65.
- WILLEY, I. M. 1969. Bird report. Adelaide Island, 1968 (B.A.S. No. N/1968/T), 11 pp. [Unpublished.]
- WYNNE-EDWARDS, V. C. 1964. Phalaropes. (In LANDSBOROUGH THOMSON, A., ed. *A new dictionary of birds*. London and Edinburgh, Nelson, 621-23.)

## ERRATUM

*British Antarctic Survey Bulletin*, No. 23, p. 25, second paragraph from bottom of page should read:

"The hard rock faces form attachment surfaces for large algae, e.g. *Phyllogigas* and *Desmarestia* and also encrusting algae of the group *Lithothamnia*. On rock surfaces not colonized by the large brown algae there is generally a sparse covering of red algae, e.g. *Myriogramme*, *Plocamium*, etc."