BRITISH ANTARCTIC SURVEY

(formerly Falkland Islands Dependencies Survey)

SCIENTIFIC REPORTS

No. 45

THE VASCULAR FLORA OF SOUTH GEORGIA

By

S. W. GREENE, B.A., Ph.D.

Department of Botany, University of Birmingham

LONDON: PUBLISHED BY THE BRITISH ANTARCTIC SURVEY: 1964

BRITISH ANTARCTIC SURVEY SCIENTIFIC REPORTS: No. 45

THE VASCULAR FLORA OF SOUTH GEORGIA

By

S. W. GREENE, B.A., Ph.D.

Department of Botany, University of Birmingham

(Manuscript received 22nd August, 1963)

ABSTRACT

A SYSTEMATIC account of the vascular flora of South Georgia is presented, together with an introductory account of the communities formed by these plants.

The history of botanical exploration of the island is considered in detail and a chronological account is given of all the expeditions known to have studied the island's vascular plants. The earliest observations date from the first landing on the island in 1775. The greatest contribution to knowledge of the native vascular flora resulted from the visits of the German International Polar-Year Expedition of 1882–83 and the Swedish South Polar Expedition of 1901–03. The existence of a substantial alien flora on South Georgia was not recognized until 1949. The first primarily botanical expedition visited the island in 1960–61, and the present paper gives some of the results obtained by this expedition.

The historical review is concluded with an account of the vascular plant collections from South Georgia and notes are given on the location, size, origins and importance of each. The existence of many previously unpublished collections is recorded.

In an introductory account of the island's vegetation, the wholly herbaceous communities formed by the vascular plants are arranged in three formations and six major associations. The widespread tussock formation constitutes a topographical climax behind the shore, while further inland a grass heath formation is the climax vegetation developed on well-drained ground. Where the water-table reaches the surface, the marsh and bog formation is developed: deep peat deposits accumulate under conditions of waterlogging.

Cryptogamic communities of rock and scree are mentioned briefly. They are associations of bryophytes and lichens with scattered individuals of vascular plants which exercise little influence on the structure of the community.

The check list of the vascular flora comprises 51 species of which 24 are regarded as native to South Georgia, 5 as naturalized aliens and the remaining 22 are classed as transient aliens. Two species have been removed from the check list as they were based on incorrect determinations. The status of all the species is discussed, consideration being given to their behaviour and distribution on the island. Maps are provided showing the distribution of the native and naturalized species and have been plotted using a grid with 5-km. squares as sample areas. The dependence of species now classed as transient aliens on artificial habitats around human habitation is demonstrated, but it is acknowledged that in the future some of them may become naturalized.

Descriptions and brief habitat notes are provided for all the native and naturalized species with, for the native species, a summary of their Antarctic and sub-Antarctic range. Notes under each description give the characters which are most useful for identification in the field. Illustrations of diagnostic features of some taxa and an artificial key to all native and naturalized species are included.

CONTENTS

I. INTRODUCTION

THE Scotia Ridge extends eastwards from Tierra del Fuego through South Georgia (but not the Falkland Islands) to the South Sandwich Islands and then westwards through the South Orkney Islands towards the Antarctic Peninsula (Fig. 1). South Georgia, the largest island on the ridge, lies between latitudes 53°30′ and 55°S. and longitudes 35°30′ and 38°30′W. and occupies a very isolated position in the South Atlantic Ocean.

The first landing on South Georgia was made by Captain James Cook on 17 January 1775, when the island was annexed for Great Britain (Cook *in* Beaglehole, 1961). Following Cook's account of his discovery, sealers began visiting the island in 1778, at first in search of fur seals but later taking elephant seals and even king penguins for their oil. Both British and American vessels participated and the men frequently sustained themselves on shore for several months at a time. Their activities reached a climax between 1800 and 1803 when the fur seal stocks were devastated. Thereafter fewer vessels visited the island, but even as late as 1812 there were said to be 3,000 men employed on South Georgia (Matthews, 1931).

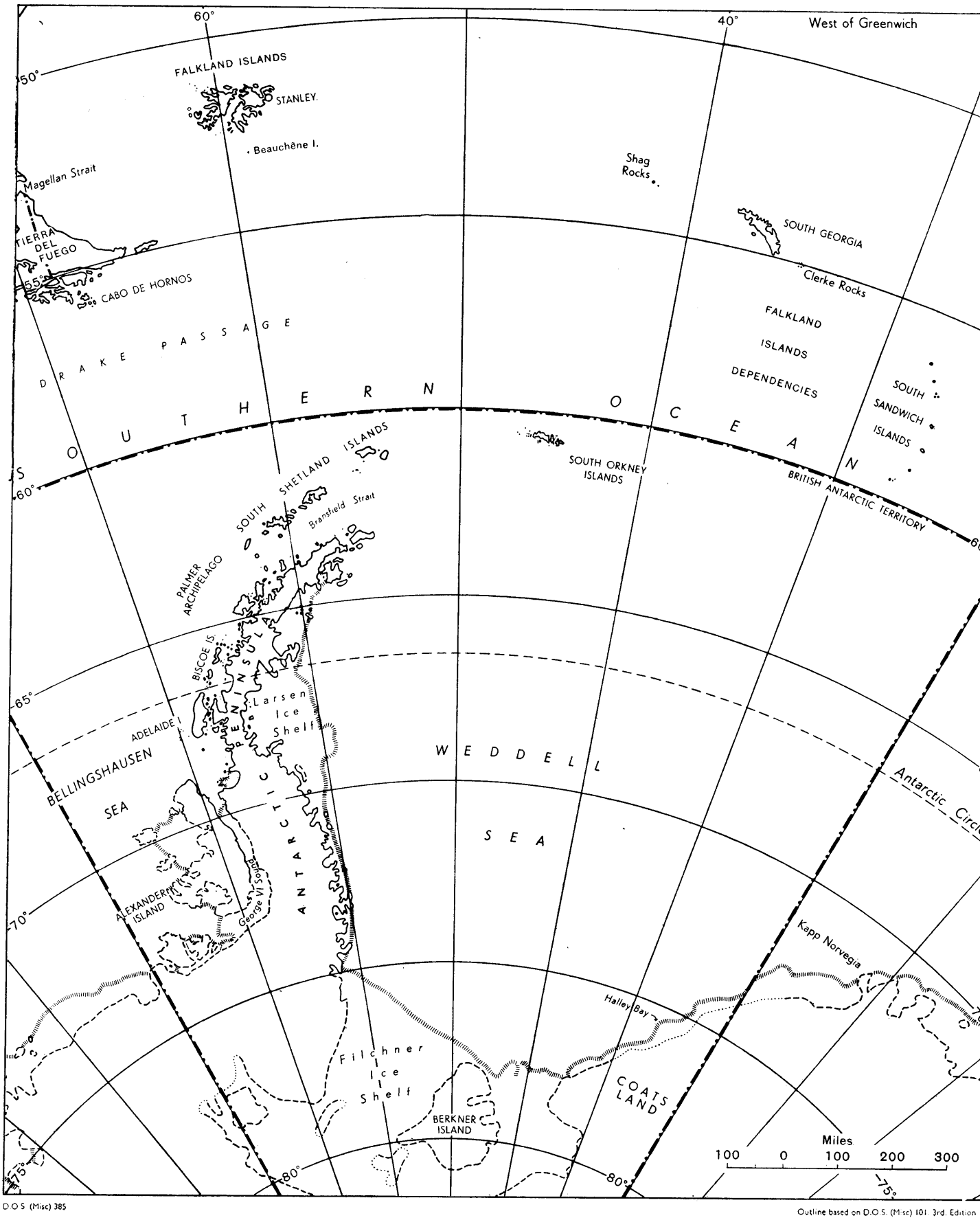
Scientific investigation of the island may be said to have started when the German International Polar-Year Expedition occupied a station on the north shore of Moltke Harbour, Royal Bay from August 1882 to September 1883 (Neumayer, 1891). In November 1904, the Antarctic's first land-based whaling station was opened at Grytviken by Compañia Argentina de Pesca, and since that date the island has been permanently occupied.

From the time of its establishment, the size of the whaling industry increased rapidly, seven stations being in operation by 1912–13. Most companies operated from land stations, but some fished from factory ships anchored in-shore, often with additional facilities on land, as at Godthul. Between the two world wars the industry underwent a steady decline, and it never regained its early vigour, although there was a slight recovery after 1945. For the first time since 1904 no whaling took place from South Georgia during the 1962–63 season.

Although no satisfactory records are available, the growth of the whaling stations and the activities of their personnel must have caused profound changes to the island's native fauna and flora. Alien mammals—horses, sheep, rabbits, rats and two herds of reindeer—have been introduced, although only the rats and reindeer have thrived. Bonner (1958) has commented on some possible effects of the reindeer on the vegetation, while Holdgate and Wace (1961) have summarized what is known about the fate of the other animals. Bannister (1964) has provided a useful list of the whaling stations, together with their localities and dates of operation (Table I).

The growth of the whaling industry also led to the establishment of administrative and ancillary services. Compañia Argentina de Pesca maintained a meteorological station at Grytviken from January 1905 until it was taken over by the Falkland Islands Dependencies Survey in January 1950 (Pepper, 1954). In 1909 a British Stipendiary Magistrate was sent to the island and a permanent British administration established at King Edward Point. The Discovery Committee operated a Marine Biological Laboratory at Grytviken from 1925–31. Apart from the Government Establishment and the whaling stations, no permanent habitation exists on South Georgia, although a number of refuge huts have been established and occupied by expeditions at various points around the coast. Much of South Georgia has now been traversed by man and the best available map of the island (see end pocket) resulted from the South Georgia Survey Expeditions of 1951–57 (Carse, 1958). Roberts (1958) has provided a valuable list of visiting expeditions, and Matthews (1931) has given a good account of the island's history, including details of the sealing and whaling industries. An excellently illustrated account of the natural history, particularly the birds, has been given by Rankin (1951).

The first primarily botanical expedition visited South Georgia during the 1960–61 season (see p. 11), and although the main object of the visit was to study the bryophyte flora sufficient new information was obtained about the vascular plants to provide a basis for the present paper. Apart from brief comments in the section dealing with the plant communities, the bryophytes and other non-vascular cryptogams are not mentioned again as the results of their study will be published in another series of papers.



D.O.S. (Misc) 385

Outline based on D.O.S. (Misc) 101. 3rd. Edition

FIGURE 1
The Scotia Ridge, showing the position of South Georgia.

TABLE I

MAJOR SITES AND PERIODS OF OPERATION OF WHALING COMPANIES AT SOUTH GEORGIA, 1904–1963

Site of Factory	*Company*	*Dates of Operation*	*Remarks*
Grytviken	Compañia Argentina de Pesca	16 Nov. 1904 to 1961–62	Shore station. Floating factory operated also from 1927–28 to 1930–31. Since 1960 registered as Albion Star (South Georgia) Ltd. See also under Husvik.
	Gyogyo Kabushiki Kaisha Ltd.	1 Oct. 1963 to 30 Nov. 1963	Operating in conjunction with Taiyo Gyogyo Co. and Kyokuyo Hogei Co. for a short period before (and possibly after) pelagic season.
Stromness	Sandefjord Whaling Co.	20 Dec. 1907 to 1916–17	Floating factory at first. Building of land station begun in 1912, working by March 1913. Shore station only in 1916–17 after loss of floating factory.
	Southern Whaling and Sealing Co.	1917–18 and 1918–19	Shore station hired to this company for two seasons.
	Vestfold Whaling Co.	1920–21 to 1930–31	Shore station formed by amalgamation of Sandefjord Whaling Co. and Ocean Whaling Co. From 1931 station used as catcher repair shop by South Georgia Co.
	South Georgia Co.	From 1930–31	In use as catcher repair shop.
Husvik	Tønsbergs Hvalfangeri	24 Dec. 1907 to 1930–31 1945–46 to 1956–57 1958–59 to 1959–60	Floating factory at first. From 1910–11 to 1912–13 combined shore station and floating factory. Shore station only from 1913–14.
	Albion Star Ltd.	1960–61	Taken over for one season mainly for its refrigerating plant.
Godthul	Messrs. Bryde and Dahl	8 Jan. 1908 to 1928–29	Floating factory; never shore station.
Leith Harbour	South Georgia Co.	13 Sept. 1909 to 1941–42 1945–46 to 1960–61	Shore station. From 1911–12 to 1915–16 floating factory also operating. Allardyce Harbour also leased by Salvesen's in 1909 but never used.
	Nippon Suisan Kaisha Ltd.	1 Oct. 1963 to ? March 1964	
Ocean Harbour	Ocean Whaling Co.	26 Oct. 1909 to 1919–20	Shore station.
Prince Olav Harbour	Southern Whaling and Sealing Co.	Nov./Dec. 1912 to 1916–17 1919–20 to 1930–31	Floating factory until 1916. Shore station building began *c.* 1917. Meanwhile company hired Stromness. Station bought by Salvesen's after 1931 but never used.

From Bannister, 1964.

II. DESCRIPTION OF SOUTH GEORGIA

1. *Topography*

The island is orientated in a north-west to south-east direction, and is slightly crescent-shaped with the concavity facing south-west (see map in end pocket). It is a little over 100 miles long and 20–22 miles at its widest part. A high ridge of mountains follows the long axis of the island and rises steeply to nearly 9,700 ft. (*c.* 2,950 m.) in Mt. Paget. This mountainous spine is flanked by corries and glacial valleys and the few passes which cross it are mainly situated towards the north-western end of the island. Most of the coast is formed of high, often nearly vertical, cliffs. On the north-eastern side of the island there are numerous bays and fjords which provide excellent harbours, but the more exposed south-west coast is less broken. There is no coastal plain but traces of raised beaches and narrow wave-cut platforms, up to a height of about 25 ft. (*c.* 7·5 m.), are to be found at many places along the shore. Numerous small but mountainous islands lie off the coast; of these, the Willis Islands and Bird Island at the north-western end, Annenkov Island off the middle of the south-west coast and Cooper Island at the south-eastern end, are the largest and most important. A general account of the physiography of South Georgia has been given by Holtedahl (1929).

The summer snow line along much of the north-east coast is at about 1,500–2,000 ft. (*c.* 450–600 m.), depending on the exposure, but is much lower elsewhere. The island is heavily ice-covered and large glaciers fill most of the valleys. In some of the valleys the ice has now retreated from the lower reaches leaving irregular mounds of morainic material, and scree slopes have developed along the steep valley sides. In a few places, as in Hope Valley, the Stromness valley and on Hestesletten, the glacial deposits are almost completely level and form extensive, nearly horizontal plains; these are almost the only areas of level ground on South Georgia. In summer ice-free pools are numerous in lowland regions and waterfalls and streams abound; a few of the latter, such as Penguin River in Hestesletten, attain the proportions of rivers.

The mountainous nature of the island and the low summer snow line, together with the extensive ice-cover, restrict phanerogamic vegetation to coastal regions. Low hills and valleys adjacent to the shore provide the most favourable habitats and support the best developed communities. In those valleys which are occupied by glaciers, communities with phanerogams and vascular cryptogams tend to be restricted to the sea cliffs at the valley mouths: lateral moraines, rock ledges and crevices along the sides of the ice, offer habitats mainly to non-vascular cryptogamic communities. Following ice retreat phanerogamic associations can develop—probably fairly quickly—on the more stable areas of glacial detritus on the valley floors. In contrast, the mobility of the scree slopes forming the valley sides restricts the rate of colonization and it is only on their more stable lower parts that phanerogamic communities become established.

2. *Geology and soils*

The most recent account of the geology of South Georgia has been given by Trendall (1953, 1959), who states that most of the island is composed of slightly metamorphosed quartzose and tuffaceous sedimentary rocks which could be* of an early Mesozoic to Cretaceous age. These rocks are slates, silts and grits of greywacke facies, containing a variable amount of calcareous nodules, but they weather to give a mainly acidic soil. Thin bands, up to 2 in. (*c.* 5 cm.) thick, of impure limestone are of irregular occurrence. There is an igneous complex of both acid and basic rocks at the south-eastern end of South Georgia, while sedimentary rocks of Lower Cretaceous age* with interbedded lavas occur on the south coast.

No detailed information is available about the island's soils, but the high precipitation combined with the low temperatures and the nature of the parent rock, result in the widespread development of leached soils and podsols. Humus accumulation is extensive and in areas of waterlogging there are peat deposits 6–9 ft. (*c.* 2–3 m.) or more thick. Peat also accumulates under *Poa flabellata* and Smith (field notebooks, p. 20) recorded that in places this exceeds 15 ft. (*c.* 4·5 m.).

3. *Climate*

South Georgia lies south of the Antarctic convergence and within the region of the west wind drift. According to Pepper (1954) "Pack ice does not normally reach the island at any time of year; the average

* From information supplied by Dr. R. J. Adie.

northern limit of the pack being about 100 miles to the south in the spring and 500 miles in autumn." However, the experience of the sealers and whalers is that pack ice is frequently found in winter at or near the south-eastern end of the island (W. N. Bonner, personal communication). The harbours of South Georgia, in consequence, are usually ice-free apart from scattered bergy bits and brash.

The only meteorological station on the island is at King Edward Point in Cumberland East Bay. This is on the lee side of the Allardyce Range and frequent föhn winds result in a local amelioration of climate. Annual meteorological tables are published in the Falkland Islands by the Falkland Islands and Dependencies Meteorological Service; Pepper (1954) has provided a convenient review of the records for the years 1944–50.

The climate of South Georgia may be classed as cool oceanic. There is no well-marked seasonal variation in range of temperature, the range being reduced by the relatively high minimum temperature throughout the year. Pepper found that the mean monthly temperatures were below freezing point from May to September, although the mean temperature for an individual month might exceed 0°C; the coldest month was August with a mean of −2°C and the warmest February, its mean being 5°C. During the summer the highest frequency of maximum temperatures occurs in the range 5°C to 9·5°C, but in the range 0°C to 4·5°C for the rest of the year, except for July when the range falls to −5°C to −0·5°C. Minimum temperatures do not fall below −5°C in summer or below −15°C in winter, but for the year as a whole the greatest frequency lies in the range −5°C to −0·5°C.

Precipitation, like temperature, shows only slight seasonal variation but there is a tendency for a winter maximum. At Grytviken between 1944 and 1950 the average annual total was 1,580 mm. (62·2 in.), rain being most frequent in summer and snow in winter. Even in summer, however, there is an appreciable snowfall, but it seldom lies for any length of time at sea-level. During the winter the whole island is snow-covered and drifting is extensive. Except, perhaps, in the vicinity of glacier snouts and at high altitudes, permafrost does not occur on South Georgia.

The barometric pressure ranges from 950–1,032 mb. and is subject to very frequent fluctuations. Gales are frequent, with the prevailing winds blowing mainly from between north and west. Most of the depressions which affect the island approach from the south-west, from the general neighbourhood of the Antarctic Peninsula. As a result, the south-west coast of the island is the prevailing weather shore and experiences more severe conditions than the north-eastern side.

South Georgia, therefore, shows no marked seasonal extremes of climate but may experience rapid changes over relatively short periods. The north-east coast is less exposed than the south-west coast, and the most sheltered parts of the island lie around Cumberland and Stromness Bays. It is not surprising that the richest vegetation is developed in these regions.

III. HISTORY OF BOTANICAL EXPLORATION

A. The Published Record

1. *The years 1775–1900*

The reports of Cook's landing on South Georgia contain the earliest documented accounts of observations on the island's plants and vegetation. Cook landed at three places in Possession Bay on the 17 January 1775, and although he spent five days surveying the north-east coast, neither he nor any member of his expedition made any further landings. This was probably due to the unfavourable impression Cook formed of the economic possibilities of a land where "Not a tree or a shrub was to be seen, no not even big enough to make a toothpick . . . Our botanists found here only three plants, the one is a coarse strong bladed grass which grows in tufts, Wild Burnet and a Plant like Moss which grows on the rocks . . . The land or rocks bordering on the Sea Coast, was not covered with snow like the inland parts, but all the vegetation we could see on the clear places was the grass mentioned above" (Cook *in* Beaglehole, 1961).

The naturalists on this voyage were John Reinold Forster, his son George, and Anders Sparrman, the latter a pupil of Linnaeus and the only trained botanist. Neither G. Forster (1777) nor Sparrman (*in* Rutter, 1953) in their accounts of the landing mention Cook's "Plant like Moss". Sparrman only noted that "A few tussocks which had been manured by seabirds were green with *Dactylis glomerata*

and a new *Sanguisorba*", while according to Forster they ". . . climbed upon a little hummock, about eight yards high, where we found 2 species of plants; one was the grass which grows plentifully on the New Year's Isles (*Dactylis glomerata*) and the other a kind of burnet (*Sanguisorba*)". In an earlier work, G. Forster (1776) had referred to these two plants as *Sanguisorba officinale* and *Dactylis glomerata*, but later he called the former *Ancistrum decumbens* (Forster, 1789).

So far as is known, a Forster specimen, now referred to *Acaena adscendens* ssp. *georgiae-australis* (see p. 15) is the only plant which has survived from any collections made during Cook's visit, so the identity of the other plants must be conjectural. However, an examination of some of the material of *Dactylis* collected by Forster on "The New Year's Isles" leaves little doubt that his South Georgian grass was *Poa flabellata*.

Three different suggestions have been made as to the identity of Cook's "Plant like Moss which grows on the rocks". In 1886 Hemsley commented that it might have been *Colobanthus subulatus*, while Matthews (1931) suggested that it was a moss of the genus *Polytrichum*; Beaglehole (loc. cit.) in a footnote to the account of Cook's landing identified it as *Colobanthus crassifolius*. The last two authors have confirmed (personal communication) that their identifications were intended as suggestions and were not based on specimens or published records. Cook's plant might have been any of these species, but no identification can be regarded as final, in the absence of a specimen.

From January 1775 until the International Polar-Year of 1882–83, the island was visited mainly by sealers and whalers who added little to the meagre botanical information provided by Cook's visit. One of them, James Weddell, who in March and April 1823 visited Undine Harbour at the north-western end of South Georgia (he called the harbour "Adventure Bay") reported "Our crews here fed plenteously on greens which, although bitter, are very salutary being an excellent antiscorbutic . . ." and later "The tops of the mountains are lofty, and perpetually covered with snow; in the valleys during the summer season, vegetation is rather abundant. Almost the only natural production of the soil is a strong bladed grass, the length of which is in general about two feet; it grows in tufts on mounds three or four feet from the ground" (Weddell, 1825).

Weddell's report of abundant vegetation contrasts sharply with that given by the Russian explorer, Bellingshausen (*in* Debenham, 1945) who surveyed the south-west coast of South Georgia during December 1819. Bellingshausen did not land but noted "On sailing along more than half of the southern coast of the island, we saw not a single shrub nor any vegetation; everything was covered with snow and ice. To wait a week or more for better weather in order to survey the land, frozen and, so to say, dead as it was, seemed to me all the more useless as I should have missed the summer . . ." Earlier, however, when referring to Annenkov Island he noted that "The shore of the island visible from our position consists of rocky hills, the tops covered with snow, and all the valleys filled with ice. Although we kept close along the shore, we looked in vain, even with telescopes, for any vegetation. Excepting here and there a yellowish-green moss, we saw none." Annenkov Island is well covered with *Poa flabellata* tussock, as was verified by the present author from off-shore during March 1961; it is thought likely that Bellingshausen's "yellowish-green moss" was the tops of the tussock stools covered by dead yellowish leaves emerging or recently emerged from the winter snows. Bellingshausen's only other reference to plants on South Georgia was to comment on the existence of mosses in one of the bays at the western end of the island, but it is not certain that the plants referred to were bryophytes.

The first extensive contribution to knowledge of the South Georgia Flora resulted from the visit of the German International Polar-Year Expedition to Royal Bay in 1882–83. H. Will was botanist to this expedition and he provided an account of the island's vegetation in the form of autecological notes on individual species together with information on their distribution in the vicinity of Royal Bay. His results were published in three papers (Will, 1884, 1887 and 1890), his last being the most comprehensive. Will was assisted in his botanical collecting by E. Mosthaff, an engineer on the expedition, and their vascular plant collection (see p. 19 and 17) was worked up by Engler (1886) who listed 13 species, while Prantl (1890) reported 3 ferns (Table II). Engler's paper was republished later (Engler, 1890) in the expedition reports and is a verbatim reproduction of his 1886 publication except for an unimportant change in the title. Both Hemsley (1886) and Goebeler (1890) gave short reviews of the results of the expedition.

It appears that the members of the German expedition were rather restricted in their movements, and while the area between Moltke Harbour and Sacramento Bight (the "Hoch-Plateau") was well covered, the only other places studied botanically were the southern shores of Royal Bay as far as Cape

TABLE II

THE NATIVE VASCULAR PLANTS OF SOUTH GEORGIA, AS REPORTED IN THE LITERATURE

	Visit of Cook's Resolution and Adventure Exped. 1775	*German International Polar-Year Exped. 1882–83*	*Swedish South Polar Exped. 1901–03*	*Swedish Magellanic Exped. 1907–09*	*American Museum of Nat. Hist. Exped. 1912–13*	*F.I.D.S.* 1956–58*	*Falkland Is. Government Biologist 1955–61*
Collector	Forster	Will Mosthaff	Skottsberg	Skottsberg	Murphy	Smith	Bonner
Source	Cook (*in* Beaglehole, 1961)	Engler, 1886 Prantl, 1890	Skottsberg, 1905	Skottsberg, 1912	Taylor, 1914	Philcox, 1962	
PHANEROGAMS							
Acaena adscendens ssp. *georgiae-australis*	X	X	X	X	X	—	X
Poa flabellata	†	X	X	†	X	—	—
Acaena tenera	—	X	X	X	—	X	X
Callitriche antarctica	—	X	X	†	X	—	—
Colobanthus crassifolius	—	X	X	†	—	—	—
Colobanthus subulatus	—	X	X	X	—	—	—
Deschampsia antarctica	—	X	X	†	(X)	—	—
Festuca erecta	—	X	X	X	—	—	—
Juncus scheuchzerioides	—	X	X	†	—	—	—
Phleum alpinum	—	X	X	†	—	—	—
Ranunculus biternatus	—	X	X	X	X	—	—
Rostkovia magellanica	—	X	X	X	—	—	—
Montia fontana ssp. *fontana*	—	†	†	†	—	—	—
Galium antarcticum	—	—	X	X	—	—	—
Juncus inconspicuus	—	—	—	X	—	—	—
Uncinia smithii	—	—	—	—	—	X	—
VASCULAR CRYPTOGAMS							
Cystopteris fragilis	—	X	†	†	—	—	—
Hymenophyllum falklandicum	—	X	X	†	—	—	—
Polystichum mohrioides var. *plicatum*	—	X	X	†	X	—	—
Lycopodium magellanicum	—	—	X	X	—	—	—
Grammitis kerguelensis	—	—	—	—	—	X	X
Ophioglossum opacum	—	—	—	—	—	X	X

* Falkland Islands Dependencies Survey, now renamed British Antarctic Survey.
All records have been verified from specimens, except those marked †.
(X) Published in error as *Festuca erecta*.

Charlotte and, further north, parts of St. Andrews Bay ("Little-Hafen"). It should be noted, in passing, that Mt. Krokisius as named by the Germans (see the map facing p. 104 in Neumayer, 1891) is not shown on the present South Georgian map and that the mountain currently bearing this name is what the Germans aptly called "Doppelspitze".

2. *The years 1901–44*

From 22 April to 15 June 1902 South Georgia was visited by members of the Swedish South Polar Expedition, Cumberland Bay being the main area studied (Andersson, 1902, 1905). C. Skottsberg, the expedition's botanist, thus had the opportunity of seeing some of the best developed plant communities on the island, and it is not surprising that he added three new species to the check list of the vascular flora (Tables II and III); one was the alien weed *Poa annua* (Skottsberg, 1905). Skottsberg's survey included the north coast of Cumberland West Bay around Jason Harbour and parts of its southern shore,

TABLE III

THE ALIEN VASCULAR PLANTS OF SOUTH GEORGIA, AS REPORTED IN THE LITERATURE

	Swedish South Polar Exped. 1901–03	*F.I.D.S. 1948–51*	*F.I.D.S. 1956–58*	*Falkland Is. Government Biologist 1955–61*
Collector	Skottsberg	Sladen	Smith	Bonner
Source	Skottsberg, 1905	Philcox, 1962		
Poa annua	X	X	—	X
Agrostis tenuis	—	(X)	?(X)	—
Alopecurus geniculatus	—	X	—	—
Cerastium holosteoides	—	X	X	—
Pisum sativum	—	X	—	—
Poa pratensis	—	X	X	X
Ranunculus repens	—	X	X	—
Rumex acetosella	—	X	X	X
Rumex crispus	—	X	X	—
Taraxacum officinale	—	X	—	X
Achillea millefolium	—	—	—	X
Trifolium repens	—	—	—	X

All records have been verified from specimens.
(X) Published in error as *Agrostis stolonifera.*
?(X) Published in error as *Agrostis stolonifera*, but present determination doubtful (see p. 28).

particularly Bore Valley and the parallel valley immediately west of it, called "Papua Valley" by Skottsberg. He also visited Grytviken and worked as far as Hestesletten and Moraine Fjord. Between 27 April and 30 April he visited Royal Bay and examined the vicinity of the former German base; he also climbed the mountain, named by the Germans Mt. Krokisius (see p. 9).

While still in the Falkland Islands Skottsberg wrote a preliminary report of his results which was published in both Swedish and English (Skottsberg, 1902*a* and *b* respectively). Here he used the names given by Engler (1886) and Prantl (1890), but in his check list (Skottsberg, 1905) he revised the nomenclature. Later he gave brief notes and photographs of the South Georgian vegetation (Skottsberg, 1907), but it was not until after his second visit to the island in April and May 1909, during the Swedish Expedition to Patagonia and Fuegia, 1907–09, that he published what is still the only ecological paper on the vegetation (Skottsberg, 1912). In this publication he refers to his second visit as follows ". . . I mostly had to occupy myself with marine algae—for two days after our arrival winter set in in earnest and all the land was covered with snow. I also visited the Bay of Isles, but could only ascertain that the vegetation seems to be quite identical with that found in Cumberland or Royal Bay, and make some observations on the flora of steep coastal cliffs, where but little snow lay." In spite of the snow, Skottsberg discovered a new native vascular plant—*Juncus inconspicuus*—thus bringing the total number of vascular species known from South Georgia to 20, 19 being native and one alien (Tables II and III). Although on both expeditions he failed to re-find *Cystopteris fragilis* which had been seen by Will and Mosthaff in Royal Bay, it was included in this total. Skottsberg's collections, obtained during both expeditions, are enumerated more fully below (p. 18).

Between Skottsberg's last visit to South Georgia and the first visit for botanical collecting by a member of the Falkland Islands Dependencies Survey, there was an interval of 40 years, during which time very little new information was published on South Georgian botany. In 1912, some notes and additions to the Admiralty Chart appeared under the name of the first resident British Magistrate and mention was made of tussock grass occurring at several places on the south-western coast between Cape Nuñez and the Willis Islands (Wilson, 1912), thus confirming Weddell's (1825) remarks on the vegetation of part of this region.

During the 1912–13 season, R. C. Murphy of the American Museum of Natural History visited South Georgia on the whaling brig *Daisy* to undertake ornithological studies. He made a small plant collection, mainly at the Bay of Isles, but he also obtained specimens at Cumberland Bay and Possession Bay (Murphy, 1948, p. 165 and 230 respectively). Taylor (1914) published a report on this collection (see p. 17) which, although it added no new vascular species to the flora, did provide new distribution data for some species. It may be noted in passing that Philcox (1962) is incorrect in saying that Taylor visited South Georgia in 1912; also only sixteen species were collected on this island, ten of them being non-vascular cryptogams. Later Murphy (1936, Vol. 1, p. 221) gave brief notes on the island's vegetation, as did Matthews (1931) and Rankin (1951).

In 1927 Hill, in his monograph of the genus *Lilaeopsis*, reported the occurrence of *L. macloviana*, as a species new to South Georgia, from a specimen collected during the visit of H.M.S. *Sappho* in 1906 (see p. 17). This record, which is discussed in more detail below (see p. 28), has proved to be a mistaken identification of sterile material of *Juncus scheuchzerioides*.

3. *The years 1945–62*

Since 1945, when the Falkland Islands Dependencies Survey* was established as a permanent Antarctic expedition, South Georgia has been visited regularly by the Survey's personnel some of whom have made botanical collections. Recently Philcox (1962) has published some new records from the collections of W. J. L. Sladen and J. Smith (see p. 18). He also included some records from a collection by W. N. Bonner who from 1956 to 1962 was Resident Biologist for the Falkland Islands Government (see p. 15). Taken together, these collections added 14 new species to the island's vascular plant check list (Tables II and III): three were native plants, one being a species new to science (Philcox, 1961). The remaining 11 species were aliens. Philcox is, however, incorrect in regarding *Poa annua* as being an "addition" to the flora of South Georgia, for although Skottsberg did not mention it in his later paper (Skottsberg, 1912), he included it in his check list (Skottsberg, 1905). It is interesting to note that two of the new species (both ferns) were collected in areas visited by earlier expeditions, in addition to new localities, and that almost all the aliens were confined to the vicinities of the whaling stations.

From the foregoing it can be seen that although the first plants were collected on South Georgia nearly 200 years ago, knowledge of South Georgian botany has been based, until very recently, on the contributions made by Will and Skottsberg towards the end of the 19th and at the beginning of the 20th centuries. Following Skottsberg's second visit in 1909 the total known vascular flora numbered 20 species, 19 being regarded as native and one as alien. Records from the recent collections of Bonner, Sladen and Smith have raised this total to 34, 22 being accepted as native and 12 as alien species. While there can be little doubt that the increase in the number of aliens has been due to the establishment of the whaling stations, the increase in the number of native species is, in part, at least, due to an extension of the area surveyed.

B. The 1960–61 Botanical Expedition

This expedition was on South Georgia from 9 December 1960 to 7 April 1961. As the details of the plant collections and the expedition's field routes will be given elsewhere (Greene, *a*, in prep.), only a brief synopsis need be presented here.

The expedition was the first to visit South Georgia to undertake a purely botanical programme and had as its main objective a floristic survey of the island's bryophytes; however, collections and observations were made of all groups of land plants. A small collection of seeds and spores was made on the island and plants of 10 species of vascular plants were successfully raised from this material. These, and additional species from Antarctic regions, are in cultivation at the Botanical Gardens, University of Birmingham.

The expedition's headquarters were at King Edward Point. Visits were made to the Willis Islands and Bird Island, as well as to the following localities on the north-east coast: Elsehul, Right Whale Bay, Bay of Isles, Prince Olav Harbour, a large number of sites in Stromness Bay and Cumberland East and West Bays, the vicinity of Ocean Harbour, Hound Bay, Royal Bay (sites from Pirner Point—between Moltke and Little Moltke Harbours—to near Calf Head) and Larsen Harbour. Landings were made on the south-west coast at Diaz Cove, Undine South Harbour, Holmestrand, Wilson Harbour and

* Formerly the war-time Naval expedition "Operation Tabarin" and now re-named British Antarctic Survey.

Johan Harbour. Thus, not only was it possible to revisit almost all the areas from which plant collections had been made in the past, but also to extend the survey to new localities. It may be noted in passing that many of the place-names used in the older botanical literature are no longer officially accepted and will not be found in the *Gazetteer of the British Antarctic Territory, South Georgia and the South Sandwich Islands*. A list of them, together with their current equivalents, will be found in Greene (*a*, in prep.).

Amongst the collections from South Georgia were 256 specimens of vascular plants (216 phanerogams, 40 vascular cryptogams), all of which were submitted to the Royal Botanic Gardens, Kew, for confirmatory determination. This work was mainly undertaken by Mr. D. Philcox, who was at that time preparing his paper "Recent Records for the Flora of South Georgia" (Philcox, 1962): some material was referred to specialists with an intimate knowledge of individual taxa from the Southern Hemisphere (see p. 34).

Tables IV and V list all the species of vascular plants positively identified from the S. W. Greene (1960–61) collection and indicate the number of specimens of each taxon deposited in the ten herbaria to which the collection has been distributed. The most complete set of specimens is at Kew, and the number of specimens deposited there indicates the maximum number of collections for each species. Fourteen specimens were not fully determinable and these have been deposited either at Kew or in the British

TABLE IV

THE NATIVE VASCULAR PLANTS OF SOUTH GEORGIA, FROM THE S. W. GREENE (1960–61) COLLECTION, PRESENT IN WORLD HERBARIA

Herbarium	*Kew*	*British Antarctic Survey*	*Buenos Aires*	*Berlin*	*Cape Town*	*Christchurch*	*Harvard*	*Melbourne*	*Paris*	*Stockholm*
PHANEROGAMS										
Acaena adscendens ssp. *georgiae-australis*	13	5	4	4	4	4	5	4	4	5
Acaena tenera	14	4	3	4	3	3	3	4	3	3
Alopecurus antarcticus	3	3	3	3	3	3	3	3	3	3
Callitriche antarctica	9	3	3	2	2	2	3	3	3	3
Colobanthus crassifolius	6	3	2	2	1	1	2	2	1	1
Colobanthus subulatus	7	4	3	3	3	3	3	3	3	3
Deschampsia antarctica	12	9	6	6	6	6	6	6	6	6
Festuca erecta	10	6	6	5	6	6	6	5	5	6
Galium antarcticum	7	3	2	2	2	2	2	2	2	2
Juncus inconspicuus	2	1	1	—	1	1	1	1	—	1
Juncus scheuchzerioides	14	13	2	4	3	3	3	3	4	3
Montia fontana ssp. *fontana*	7	6	3	3	3	3	3	3	3	3
Phleum alpinum	9	5	5	5	5	5	5	5	5	5
Poa flabellata	7	3	3	3	3	2	3	3	2	2
Ranunculus biternatus	7	3	3	3	3	3	3	2	3	3
Rostkovia magellanica	9	5	5	5	5	5	5	5	5	4
Uncinia smithii	8	4	4	4	4	3	4	3	4	4
VASCULAR CRYPTOGAMS										
Blechnum penna-marina	1	1	1	1	1	1	1	1	1	1
Custopteris fragilis	4	2	2	2	1	1	2	1	2	2
Grammitis kerguelensis	7	3	1	2	2	2	2	2	2	2
Hymenophyllum falklandicum	12	5	4	5	5	5	4	5	5	5
Lycopodium magellanicum	4	4	4	3	3	3	4	3	3	3
Ophioglossum opacum	6	1	1	1	1	1	1	1	1	1
Polystichum mohrioides var. *plicatum*	6	3	3	3	3	3	3	3	3	3

The figures indicate the number of specimens present in each herbarium.
For full titles of the herbaria see p. 14.

TABLE V

THE ALIEN VASCULAR PLANTS OF SOUTH GEORGIA, FROM THE S. W. GREENE (1960–61) COLLECTION, PRESENT IN WORLD HERBARIA

Herbarium	*Kew*	*British Antarctic Survey*	*Buenos Aires*	*Berlin*	*Cape Town*	*Christchurch*	*Harvard*	*Melbourne*	*Paris*	*Stockholm*
PHANEROGAMS										
Achillea millefolium	1	1	—	—	—	1	—	1	1	—
Agropyron repens	1	1	1	1	1	—	1	—	—	1
Agrostis tenuis	5	4	4	4	4	4	4	4	4	4
Avena fatua	1	1	—	—	1	1	—	—	—	—
Capsella bursa-pastoris	3	1	1	1	—	—	1	—	1	1
Carum carvi	1	—	—	—	—	—	—	—	—	—
Cerastium holosteoides	5	4	4	3	3	4	4	3	4	3
Deschampsia caespitosa	3	2	2	3	2	2	3	2	2	3
Festuca rubra ssp. *rubra*	2	1	1	1	1	1	1	2	2	1
Lolium temulentum	1	—	—	—	—	—	—	—	—	—
Phleum pratense	1	1	—	1	—	—	—	—	1	—
Pisum sativum	1	—	—	—	—	—	—	—	—	—
Poa annua	9	7	7	7	7	7	6	7	7	7
Poa pratensis	6	3	3	3	3	3	3	3	3	4
Ranunculus repens	3	2	1	2	2	1	2	2	1	1
Rumex acetosella	2	1	2	1	2	2	1	2	1	1
Rumex crispus	1	1	—	—	—	—	—	—	—	—
Senecio vulgaris	1	—	—	—	—	—	—	—	—	—
Solanum tuberosum	1	—	—	—	—	—	—	—	—	—
Stellaria graminea	1	1	—	—	1	—	—	1	1	—
Stellaria media	1	—	—	—	—	—	—	—	—	—
Taraxacum officinale	3	3	2	2	2	2	2	2	2	2
Thlaspi arvense	1	—	—	—	—	—	—	—	—	—
Trifolium repens	2	2	1	1	—	1	1	—	—	1
Urtica urens	1	—	—	—	—	—	—	—	—	—

The figures indicate the number of specimens present in each herbarium.
For full titles of the herbaria see p. 14.

Antarctic Survey herbarium: all are regarded as transient aliens. A full determination list of all the vascular plants, itemizing the collecting numbers, will be given elsewhere (Greene, *a*, in prep.).

A comparison of the species listed in Tables II–V inclusive, shows that during the 1960–61 expedition South Georgian material was obtained of 15 vascular plant species not previously collected on the island; a 16th species, *Capsella bursa-pastoris*, had been collected by C. A. Larsen (see p. 17) but the record remained unpublished. Only two of these new plants, *Blechnum penna-marina* and *Alopecurus antarcticus*, are regarded as native species, the remainder being classed as transient aliens. Of the species previously collected on South Georgia only two, *Alopecurus geniculatus* and *Veronica persica*, were not seen, the latter species being another unpublished Larsen record. The status of all the vascular species known from South Georgia is further discussed below.

C. THE COLLECTIONS AND OTHER REPORTS

1. *The collections*

Although it has been impossible to trace every vascular plant specimen obtained on South Georgia, it is thought a substantial number of the collections have been located. Few of the published papers indicate clearly the number of specimens collected and mention is rarely made either of the location of the original set or of any duplicates distributed. Reference has already been made (Tables II and III) to specimens which have been examined to verify the published record. Unrecorded specimens from other

expeditions were found while tracing the historic collections, and thus substantially more South Georgian material exists in herbaria than is indicated in the literature.

To simplify reference, contractions are used for the herbaria holding South Georgian material and the people known to have collected on the island, and these are listed below:

Contractions	*Herbaria*
Berlin	Botanisches Museum, Berlin
British Antarctic Survey	British Antarctic Survey Herbarium, Department of Botany, The University, Birmingham
British Museum	British Museum (Natural History), London
Brooklyn	Brooklyn Botanic Garden, New York
Buenos Aires	Department of Botany, Faculty of Exact and Natural Sciences, University of Buenos Aires
Cape Town	Bolus Herbarium, University of Cape Town
Christchurch	Botany Division, Department of Scientific and Industrial Research, Christchurch, New Zealand
Gothenburg	Göteborgs Botaniska Trädgard
Göttingen	Systematisch-Geobotanisches Institut, Universität, Göttingen
Hamburg	Staatsinstitut für allgemeine Botanik und Botanischer Garten, Hamburg
Harvard	Gray Herbarium, Harvard University, Cambridge, Massachusetts
Kew	The Herbarium and Library, Royal Botanic Gardens, Kew
Lund	Botanical Museum and Herbarium, Lund
Melbourne	National Herbarium of Victoria, Melbourne
Munich	Botanische Staatssammlung, München
New York	The New York Botanical Garden, New York
Oslo	Botanisk Museum, Oslo
Paris	Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris
Stockholm	Naturhistoriska Riksmuseum, Stockholm
Trondheim	Museum of the Royal Norwegian Society for Science and Letters, Trondheim
Uppsala	Institute of Systematic Botany, University of Uppsala
Washington	United States National Museum (Smithsonian Institution), Washington
Vienna	Naturhistorisches Museum, Wien
Zürich	Botanischer Garten und Museum der Universität, Zürich

Collectors

Br.	Berggren, A.	O.	Olstad, O.
Bg.	Bergström, D.	R.	Rustad, D.
B.	Bonner, W. N.	Sa.	H.M.S. *Sappho* Expedition
CK.	Cameron, A. and P. Kennett	S.	Skottsberg, C.
D.	'Discovery' Investigations	Sl.	Sladen, W. J. L.
F.	Forster, J. R. and G. Forster	Sm.	Smith, J.
G.	Greene, S. W.	St.	Stammwitz, P.
Hg.	Holdgate, M. W.	T.	Tröim, T.
H.	Hooley, T.	U.	Unknown
J.	Johnsen, S.	W.	Will, H.
L.	Larsen, C. A.	Wi.	Wilcken, —*
M.	Mosthaff, E.	Wk.	Wilkins, G. H.
My.	Murphy, R. C.		

The herbaria which received duplicates from the 1960–61 expedition's collections have already been listed (Tables IV and V). Tables VI and VII show the location of all other material known at present

* Initials unknown.

TABLE VI

THE SPECIMENS OF SOUTH GEORGIAN NATIVE VASCULAR PLANTS PRESENT IN WORLD HERBARIA

Herbarium	*British Antarctic Survey*	*British Museum*	*Brooklyn*	*Gothenburg*	*Göttingen*	*Hamburg*	*Kew*	*Munich*	*New York*	*Oslo*	*Stockholm*	*Trondheim*	*Uppsala*	*Vienna*	*Washington*	*Zürich*
PHANEROGAMS																
Acaena adscendens ssp. *georgiae-australis*	Sm.3 — — — —	B.4 Sl.2 Wk.1 St.1 F.1	My.4	Br.1	W.1	W.1	Sm.3 B.1 W.1 Sa.2	W.2	My.2	L.2 O.1 J.1	S.1 M.2 Bg.1	U.1	S.1	— —	—	W.1
Acaena tenera	Sm.1 — — — —	B.6 Sl.2 Wk.2 St.1 —	—	—	W.1	W.1	Sm.3 — W.1 —	W.1	—	— O.1 —	S.2 M.2 —	—	S.1	— —	—	W.1
Alopecurus antarcticus	— — — — —	— — — — —	—	—	—	—	— — — —	—	—	— — —	— — —	—	—	— —	—	—
Callitriche antarctica	Sm.1 — — — —	B.3 Sl.5 — — —	My.2	—	—	W.1	Sm.7 B.1 W.1 —	—	My.1	L.4 — R.1	S.2 — —	T.1	—	— —	—	—
Colobanthus crassifolius	Sm.1 Sl.1 B.1 Hg.1 —	B.3 Sl.2 — — —	—	—	—	—	Sm.2 B.1 W.1 —	W.2	—	— — —	S.3 M.1 —	—	—	— —	—	—
Colobanthus subulatus	Sm.1 — B.1 — CK.1	B.1 Sl.1 — — —	—	—	Wi.1	W.1	Sm.3 B.2 W.1 —	W.1	—	— — —	S.3 — —	T.1	S.1	— —	—	W.1
Deschampsia antarctica	Sm.4 Sl.1 B.1 Hg.1 CK.1	B.11 Sl.2 — — —	My.1	—	U.1	—	Sm.3 B.1 W.1 —	—	My.1	L.4 — —	S.3 M.1 —	—	—	— —	—	—
Festuca erecta	— — — — —	B.7 Sl.1 — St.3 O.1	—	Br.1	—	—	Sm.1 B.1 W.1 Sa.1	W.2	—	L.3 O.2 —	S.3 M.1 Bg.1	U.1	S.1	S.1 W.1	—	—
Galium antarcticum	Sm.1 — B.1 — —	B.4 Sl.1 — — —	—	—	—	—	Sm.4 B.2 — —	—	—	L.1 — —	S.2 — —	—	S.1	— —	—	—
Juncus inconspicuus	— — — — —	B.1 — — — D.1	—	—	—	—	Sm.1 — — —	—	—	— — —	— — —	—	S.1	— —	—	—
Juncus scheuchzerioides	Sm.3 Sl.1 B.2 — —	B.9 Sl.1 — St.1 —	—	—	—	—	Sm.3 B.1 W.1 Sa.1	—	—	— — —	S.3 M.1 —	T.1	—	— —	—	—
Montia fontana ssp. *fontana*	Sm.1 — — — —	B.1(+5) Sl.(2) — — —	—	—	—	—	Sm.1(+2) B.1 — Sa.(1)	—	—	— — —	S.(1) — —	—	—	— —	—	—
Phleum alpinum	Sm.1 — — — —	B.7 Sl.2 — — H.1	—	—	—	—	Sm.1 — W.1 Sa.1	W.1	—	L.3 O.1 —	S.3 M.1 Bg.1	U.1	—	— —	—	—
Poa flabellata	Sm.2 Sl.1 — Hg.1 —	B.2 Sl.1 — — —	My.3	Br.1	—	—	Sm.3 B.2 W.1 Sa.1	W.2	My.3	L.3 O.1 —	S.2 M.2 Bg.1	U.2	Sm.1	— —	Br.1	—
Ranunculus biternatus	Sm.1 — — — —	B.6 Sl.2 — — —	My.1	—	—	W.2	Sm.7 B.2 W.1 Sa.1	W.2	My.1	L.3 — —	S.2 M.1 —	—	S.1	— —	—	W.1
Rostkovia magellanica	Sm.2 Sl.1 — — —	B.11 Sl.1 — — L.1	—	—	—	—	Sm.2 B.3 W.1 —	W.1	—	L.4 O.1 —	S.2 M.2 L.1	—	S.1	— —	—	W.1
Uncinia smithii	— — — — —	— — — — —	—	—	—	—	Sm.1 — — —	—	—	— — —	— — —	—	—	— —	—	—
VASCULAR CRYPTOGAMS																
Blechnum penna-marina	— — — — —	— — — — —	—	—	—	—	— — — —	—	—	— — —	— — —	—	—	— —	—	—
Cystopteris fragilis	Sm.1 — — — —	B.2 — — — —	—	—	—	W.1	Sm.2 B.2 — —	W.1	—	— — —	— — —	—	—	— —	—	—
Grammitis kerguelensis	— — — — —	B.1 — — — —	—	—	—	—	Sm.(1) B.1 — —	—	—	— — —	— — —	—	—	— —	—	—
Hymenophyllum falklandicum	Sm.1 — — — —	B.2 Sl.2 — — —	—	—	—	W.3	Sm.4 B.2 — —	—	—	— — —	S.4 M.2 —	—	—	— —	—	—
Lycopodium magellanicum	Sm.1 — — — —	B.2 — — — —	—	—	—	—	Sm.1 B.1 — —	—	—	— — —	— — —	—	S.2	— —	—	—
Ophioglossum opacum	Sm.1 — — — —	B.3 — — — —	—	—	—	—	Sm.1 B.1 — —	—	—	— — —	— — —	—	—	— —	—	—
Polystichum mohrioides var. *plicatum*	Sm.1 — — — —	B.3 Sl.2 — St.1 —	My.1	—	—	M.1	Sm.1 B.1 — —	M.1	My.1	L.1 — U.1	S.1 — —	T.1	—	— —	—	—

The letters signify the name of the collector and the figures indicate the number of specimens seen.
The figures in brackets indicate specimens known to exist but not available for examination.
For full titles of the herbaria and names of collectors see p. 14.
Specimens from the S. W. Greene (1960–61) collection are not included.

[face page 14

and indicate, with the name of the collector, the number of specimens of each species. In many cases, however, owing to the existence of duplicate collections, the number of different collections available for a taxon is less than the total number of specimens recorded; an indication of the extent of this duplication is given in the following list. The collections are arranged in alphabetical order of the collectors, and information on the origins and importance of the material is also included. In many cases, the specimens of vascular plants form part of larger collections composed mainly of bryophytes and lichens.

Berggren, A. (1927) collection. This unpublished collection consists of 4 specimens in Gothenburg and one duplicate specimen in Washington. All the material was collected at Leith Harbour in January 1927.

Bergström, D. (1921) collection. A small unpublished collection of 4 specimens at Stockholm made by Seaman D. Bergström in January 1921; it is part of the herbarium of Selim Birger.

Bonner, W. N. (1955–61) collection. This important collection contains 114 specimens in the British Museum, a further 27 in Kew (12 of which duplicate material at the British Museum) and an additional 7 specimens in the British Antarctic Survey herbarium, none of which duplicates any of the other specimens. Bonner's collection contains material from many previously unworked localities and, as well as providing new distribution data, it has added two new aliens (Philcox, 1962) to the island's check list (Table III). For further details about this collection see Greene and Groves (1963).

Cameron, A. and P. Kennett (1961–62) collection. This unpublished collection, made by two members of the British Antarctic Survey, is housed in the British Antarctic Survey herbarium. It contains two specimens collected at Gold Harbour in November 1961.

'Discovery' Investigations (1927) collection. The single unpublished specimen in the British Museum was collected on South Georgia during February 1927. It lacks a collector's name.

Forster, J. R. and G. Forster (1775) collection. So far as is known, the specimen of *Acaena adscendens* ssp. *georgiae-australis* labelled "*Ancistrum decumbens*, Insula Georgiae australis, Oceani Atlantici, J. R. and G. Forster" preserved in the British Museum is all that has survived from the first known collecting expedition on South Georgia. It was obtained in Possession Bay during Cook's landing on 17 January 1775.

No Forster specimen has been seen of the *Dactylis glomerata* reported from Possession Bay (Forster, 1777), but the identity of some specimens collected on "The New Year's Isles" strongly suggests that the South Georgian plant was *Poa flabellata*. It should be noted that Cook's original name is now applied to Isla Año Nuevo, one of the group of five small islands lying less than 10 km. off the north coast of Isla de los Estados (= Staten Island): however, it is not known on which of the islands the specimens were collected.

One of these specimens in Munich bears the following data:

Dactylis glomerata
Forster Herb. Neujahrs-Insel, Staatenland.
Forster Ex. herb. Schwaegrichen, Dedit Hiendlmayr.

Another specimen at Kiel is labelled:

Dactylis caespitosa
Wild. Sp. pl. p. 407, n. 3. Hab in Novi Anni insulis
Terrae Statuum proximis 2¼ Herb. Forst. 86, 2, b.

A second label on this sheet bears the name *Dactylis glomerata* in writing similar to that on the *D. caespitosa* label.

Both these gatherings are of the plant now known as *Poa flabellata* (Lam.) Hook.f. There is also a Forster specimen referable to *Poa flabellata* in the British Museum. This specimen lacks a locality, but on the back of the sheet is written "J. R. Forster's Herb."; on the front of the sheet, at the foot are four pencilled names: *Dactylis caespitosa, Poa Forsteri* Steud., *Poa flabellata* Hook.f., *Festuca flabellata* Lam. Mr. E. W. Groves (personal communication) considers it possible that this specimen was obtained at Lambert's

TABLE VII

THE SPECIMENS OF SOUTH GEORGIAN ALIEN VASCULAR PLANTS PRESENT IN WORLD HERBARIA

Herbarium	*British Antarctic Survey*			*British Museum*		*Gothenburg*	*Kew*		*Oslo*	*Stockholm*	*Trondheim*
Achillea millefolium	—	—	—	—	B.1	—	—	—	—	—	—
Agropyron repens	—	—	—	—	—	—	—	—	—	—	—
Agrostis tenuis	Sl.1	—	—	Sl.2	—	—	Sm.1	?—	—	—	—
Alopecurus geniculatus	Sl.1	—	—	Sl.1	—	—	—	—	—	—	—
Avena fatua	—	—	—	—	—	—	—	—	—	—	—
Capsella bursa-pastoris	—	—	—	—	—	—	—	—	L.1	—	—
Carum carvi	—	—	—	—	—	—	—	—	—	—	—
Cerastium holosteoides	Sl.1	Sm.1	—	Sl.2	B.6	—	Sm.2	—	—	—	—
Deschampsia caespitosa	—	—	—	—	—	—	—	—	—	—	—
Festuca rubra ssp. *rubra*	—	—	—	—	—	—	—	—	—	—	—
Lolium temulentum	—	—	—	—	—	—	—	—	—	—	—
Phleum pratense	—	—	—	—	—	—	—	—	—	—	—
Pisum sativum	—	—	—	Sl.1	—	—	—	—	—	—	—
Poa annua	Sl.2	Sm.1	—	Sl.5	B.3	Br.1	Sm.5	—	—	S.3	—
Poa pratensis	Sl.2	Sm.1	—	Sl.3	B.2	—	Sm.2	—	—	—	U.1
Ranunculus repens	—	—	B.1	Sl.2	B.2	—	Sm.1	—	—	—	—
Rumex acetosella	—	—	—	Sl.1	—	—	Sm.1	B.1	—	—	U.1
Rumex crispus	—	—	—	Sl.1	—	—	Sm.1	—	—	—	—
Senecio vulgaris	—	—	—	—	—	—	—	—	—	—	—
Solanum tuberosum	—	—	—	—	—	—	—	—	—	—	—
Stellaria graminea	—	—	—	—	—	—	—	—	—	—	—
Stellaria media	—	—	—	—	—	—	—	—	—	—	—
Taraxacum officinale	—	—	—	Sl.2	B.5	—	Sm.1	—	—	—	—
Thlaspi arvense	—	—	—	—	—	—	—	—	—	—	—
Trifolium repens	—	—	—	—	B.1	—	—	—	—	—	—
Urtica urens	—	—	—	—	—	—	—	—	—	—	—
Veronica persica	—	—	—	—	—	—	—	—	L.1	—	—

The letters signify the name of the collector and the figures indicate the number of specimens seen.
? following an entry signifies a doubtful determination (see p. 28).
For full titles of the herbaria and names of collectors see p. 14.
Specimens from the S. W. Greene (1960–61) collection are not included.

sale and is part of the type material of G. Forster's *Dactylis cespitosa* (Forster, 1789), since Britten (1885) quoted Hemsley as saying that the British Museum received ". . . an authenticated set of all published plants at least". Britten (loc. cit.) has provided interesting biographical information on the Forsters; he discussed the distribution of their herbarium, as did Merrill (1954).

Holdgate, M. W. (1961–62) collection. This unpublished collection, in the British Antarctic Survey herbarium, was made by the Survey's Senior Biologist and contains 3 specimens collected in the Bay of Isles and at Leith Harbour during March 1962.

Hooley, T. (1944) collection. This single unpublished specimen in the British Museum was collected on South Georgia in 1944 and is part of the collection made by the British Naval Expedition "Operation Tabarin".

Johnsen, S. (1911) collection. There is one unpublished specimen in Oslo collected at Grytviken in January 1911 by Siguid Johnsen.

Larsen, C. A. (1909–10) collection. This unpublished collection consists of 30 specimens in Oslo and two additional duplicate specimens, one in Stockholm and one in the British Museum. The material, which was collected between 20 December 1909 and 20 October 1910, unfortunately lacks precise localities. The collection added two alien plants not then known from the island, *Capsella bursa-pastoris* and *Veronica persica*: the latter has not been seen since on South Georgia. Larsen was the first manager of the Whaling Station established at Grytviken in 1904. Prior to this date he had gained fame from many successful southern expeditions, on one of which he discovered, on Seymour Island, what were believed to be the first fossils ever seen in Antarctica. He was captain of the *Antarctic* during the Swedish South Polar Expedition of 1901–03.

Mosthaff, E. (1883) collection. The 16 specimens collected by Mosthaff between January and July 1883, now in Stockholm, were obtained on the German International Polar-Year Expedition to Royal Bay during 1882–83. One further specimen in Munich, which is not a duplicate of any of the Stockholm material, is a duplicate of another specimen at Hamburg. Together with the collections of H. Will, these specimens laid the foundation for the first comprehensive check list of the South Georgian vascular flora (Engler, 1886, and Prantl, 1890).

Murphy, R. C. (1912–13) collection. This collection comprises 12 specimens in Brooklyn and a further 9 specimens in the New York Botanical Garden, most of the latter being duplicates of the Brooklyn set. All the material was collected by R. Cushman Murphy, the American Ornithologist, between December 1912 and March 1913, mainly at the Bay of Isles, but some was obtained at Cumberland and Possession Bays. Taylor (1914), who reported on the collection, incorrectly referred Murphy No. 1861 to *Festuca erecta*; it is *Deschampsia antarctica*.

Olstad, O. (1928) collection. This collection consists of 7 specimens in Oslo, together with one additional duplicate specimen in the British Museum. The plants were collected in February 1928, during the visit of the *Norvegia* (Norwegian Antarctic Expedition) to South Georgia, from Prince Olav Harbour, Godthul and "Hystadhullet", all previously unsampled areas. "Hystadhullet" is an unofficial place-name which, according to Professor O. Holtedahl (personal communication) "has been used by the whalers for a locality in Cobblers Cove". Dr. O. Olstad was a zoologist who accompanied the *Norvegia* expedition; included in his account of the feeding habits of rats and reindeer on South Georgia is a report by J. Lid on one of the present specimens—fragments of *Acaena* taken from the stomach of a reindeer (Lid *in* Olstad, 1930).

Rustad, D. (1928) collection. The single unpublished specimen in Oslo was collected at Husvik Harbour in February 1928, the collector being a biologist on the *Norvegia* expedition.

H.M.S. Sappho (1906) collection. This collection of 8 plants is preserved at Kew. According to Roberts (1958), H.M.S. *Sappho*, under the command of M. H. Hodges, visited South Georgia in February 1906. Amongst the manuscript plant lists at Kew is one signed by Otto Stapf itemizing the "Plants coll. in

South Georgia during a visit of H.M.S. 'Sappho'; comm. by the Colonial Office through the Imperial Institute. Rec'd. 5.4.1906".* Although small, the collection is important as the report of the genus *Lilaeopsis* from South Georgia (Hill, 1927) is based on one of these specimens (see p. 28). One specimen in the collection, referred by the present author to *Acaena adscendens* ssp. *georgiae-australis* was identified by E. Grondona in 1959 as *A. magellanica* (Lam.) Vahl (see p. 44).

Skottsberg, C. (1902–09) collections. C. Skottsberg first collected on South Georgia in 1902 when a member of the Swedish South Polar Expedition of 1901–03, and later in 1909 during the Swedish Expedition to Patagonia and Fuegia, 1907–09.

In his check list, Skottsberg (1905) refers to specimens collected on the former expedition. The first set of this material was deposited at Stockholm (Skottsberg, personal communication) and 39 of the 40 specimens in this herbarium have been seen. Another specimen which is not a duplicate is at Uppsala and one additional specimen which duplicates material at Stockholm is at Vienna. According to O. Nilsson (personal communication) there is at Lund a specimen of *Montia* from this collection, which is not a duplicate of the Stockholm material.

Skottsberg published no list of the plants collected on South Georgia during his second visit, but in his paper on the island's vegetation (Skottsberg, 1912) he again gave a full check list of the native vascular flora and referred to the one specimen, obtained on this visit, which was a new record for the island (Table II). The first set of this collection, of which 9 specimens have been seen, was deposited at Uppsala (Skottsberg, personal communication). Both the specimens of *Lycopodium magellanicum* in this herbarium (one collected 1902, the other 1909) were determined in 1936 by H. Roivainen as *L. magellanicum* f. *skottsbergii* Herter (see p. 37).

Sladen, W. J. L. (1949–51) collection. This collection contains 49 specimens of vascular plants in the British Museum and a further 12 specimens in the British Antarctic Survey herbarium, all the latter being duplicates of material in the British Museum. Sladen, a doctor and keen amateur botanist, was the first member of the Falkland Islands Dependencies Survey to collect plants and make notes on the flora of South Georgia (see p. 19). He worked mainly in the vicinity of the whaling stations in Cumberland and Stromness Bays and provided the first evidence of the rich alien flora of these habitats. Philcox (1962) has published some of the results from his collection which added 9 alien species (Table III) to the check list of the island's flora. According to O. Nilsson (personal communication) there is material of *Anagallis alternifolia* attached to one of Sladen's specimens of *Montia* in the British Museum. The specimen is numbered J.B. 10/15 and is considered further below (see p. 28).

Smith, J. (1956–58) collection. The most complete set of vascular plants from the Smith collection comprises 70 specimens at Kew. Of the further 30 specimens in the British Antarctic Survey herbarium all, except two, are duplicates of material at Kew, while one additional specimen at Uppsala also duplicates a Kew specimen. From the Kew collection determination sheet (No. H2525/58) it is evident that the collection originally contained 93 specimens of vascular plants, but some of the material has been abandoned as it was sterile (Philcox, personal communication).

The late J. Smith, who as a member of the Falkland Islands Dependencies Survey carried out glaciological research on South Georgia during the International Geophysical Year (1957–58), was keenly interested in botany. His collection and field notes (see p. 20) are of great importance not only because they added three new plants to the island's check list, one being a species new to science (Philcox, 1961, 1962), but also because they provided much new data on the distribution of plants on South Georgia. As well as collecting from various stations on the north-east coast, Smith made the first known plant collections from the south-west coast.

Stammwitz, P. (1913–14) collection. This small unpublished collection consists of 7 specimens from various localities on the north-east coast of South Georgia and is housed in the British Museum. It was made during December 1913 and January 1914 by P. Stammwitz, a zoologist on the Museum's

* This list was published in 1920 in the *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands*, p. 130.

staff, who accompanied G. E. H. Barrett-Hamilton when the latter went to South Georgia to investigate the state of the whaling industry and the biology of whales (E. W. Groves, personal communication).

Tröim, T. (1929–33) collection. A small unpublished collection of 4 specimens housed in Trondheim. It was made by T. Tröim in Cumberland Bay between January 1929 and March 1933.

Wilcken, — (1883) collection.* There is one unpublished specimen at Göttingen collected on South Georgia in 1883.

Wilkins, G. H. (1922) collection. A small unpublished collection of 3 specimens, mentioned by Wilkins (*in* Wild, 1923), which is housed in the British Museum. The specimens were obtained during the visit of the Shackleton-Rowett Antarctic Expedition to South Georgia in January 1922; although they lack precise collecting details, they have notes on the abundance and distribution of the species. G. H. Wilkins, who was naturalist to the expedition, remarked in his report on the biological work that "The naturalist was able to collect specimens of plants referable to sixteen species, but many of them were marine algae": later he noted "At South Georgia . . . a considerable collection was made" (Wilkins, loc. cit.). It is possible that some vascular plants of this collection have not yet been traced.

Will, H. (1882–83) collection. This collection consists of 45 specimens of which there are 15 in Munich, 12 in Kew, 10 in Hamburg,† 5 in Zürich, 2 in Göttingen, and one in Vienna. The collecting data on the specimen labels are more comprehensive on the material in Munich and Hamburg than in the other herbaria. The Zürich and Göttingen specimens are nearly all duplicates of material in Munich. Both the specimen in Vienna and all the material in Kew are labelled "Herbarium E. Engler" and some of these specimens are duplicates from the Hamburg and Munich collections. The material was collected by Dr. H. Will between November 1882 and March 1883 during the German International Polar-Year Expedition to Royal Bay, and taken together with the Mosthaff collection laid the foundation for the first comprehensive check list of the South Georgian vascular flora (Engler, 1886; Prantl, 1890).

The following specimens require special notice: of the material at Kew, the specimen of *Colobanthus crassifolius* was determined as the var. *brevifolius* Engl. by Engler (see p. 41), while Buchenau determined the *Juncus* as *J. novae zelandiae* Hook.f. All the Munich material of *Acaena* was determined by Bitter, and includes *A. adscendens* Vahl ssp. *georgiae-australis* Bitter var. *majuscula* Bitter (see p. 43): *A. adscendens* ssp. *georgiae-australis* var. *minuscula* Bitter (see p. 43): and *A. tenera* Alboff ssp. *epilis* Bitter (see p. 45). Bitter's type specimen of ssp. *georgiae-australis* is at Göttingen. The specimen of *Acaena adscendens* ssp. *georgiae-australis* in Zürich was determined as *A. magellanica* (Lam.) Vahl by E. Grondona in 1957.

Unknown collectors. An unpublished miscellany of 7 specimens in Trondheim, one at Oslo, and one other at Göttingen. Some of the Trondheim material lacks adequate collecting data, but the majority of the specimens were obtained during February and March 1927. This collection is important since it contains the earliest known South Georgian material of *Poa pratensis* and *Rumex acetosella*, both collected at Grytviken in March 1927. The specimen at Oslo also lacks full collecting details. The material at Göttingen was collected in 1883.

2. *Unpublished reports*

Apart from the publications and collections mentioned in the last section, the only additional original data on the South Georgian vascular flora are four items in the botanical library associated with the British Antarctic Survey herbarium. These are unpublished reports and field notebooks compiled by the Falkland Islands Government biologist and two members of the Falkland Islands Dependencies Survey.

a. *The botany of South Georgia*, by W. J. L. Sladen. Ref. No. F.I.D.S. B/112/50.

This five-page report was prepared in October 1949 to supplement the collecting data on the labels

* Initials unknown.

† It is understood that a few additional specimens from this herbarium were transferred to the Herbarium of Moscow University but no details are available.

of the specimens which Sladen deposited in the British Museum. As well as listing the specimens collected, it contains notes on their distribution and abundance in parts of Cumberland and Stromness Bays. There is a copy of this report in the Botany Department of the British Museum.

b. *Some notes on the higher plants of South Georgia*, by W. N. Bonner.
Bonner prepared this twenty-page report during 1956, and in it provides useful information on the plant communities together with autecological data on many of the species. Distribution notes on many of the vascular plants are also included.

c. *Notes on the phanerogam vegetation of South Georgia*, by J. Smith. Ref. No. F.I.D.S. B/31/58.
This is an eleven-page draft of a manuscript prepared in 1958 which Smith intended as the first of a number of papers dealing with the South Georgian flora. It contains autecological data on the island's native vascular plants, as well as an account of the plant communities. There is a copy of this report at the Royal Botanic Gardens, Kew.

d. *The field notebooks of J. Smith.*
These three notebooks, totalling almost 100 pages, contain all the botanical data from J. Smith's original field books which were compiled between January 1957 and April 1958. They include the field observations from which his manuscript "Notes on the phanerogam vegetation of South Georgia" was prepared, and a mass of detailed information on the distribution and performance of the island's flora.

IV. THE PLANT COMMUNITIES

ALTHOUGH no programme of ecological investigation was undertaken during the 1960–61 botanical expedition, the observations made provided sufficient information for an introductory report on the vegetation and necessitate modifications to Skottsberg's account.

Skottsberg (1912) described the vegetation of South Georgia under the following five headings:

i. The *Poa flabellata* association
ii. The vegetation of the rocky shore
iii. The inland tundra
iv. The swamps
v. The fresh-water vegetation

Nevertheless he inclined to the view that there were only two major plant groups on the island: "The inland tundra is rather uniform and shows little variation on different kinds of soil—it must be remembered that the rock in itself offers little variation. The swampy spots do not break the general impression given by the tundra. Only the *Poa* association deserves to be treated separately."

The communities formed by the South Georgian vascular plants are here grouped as follows:

Tussock Formation	*Poa flabellata* association
Grass Heath Formation	*Acaena—Tortula* association
	Acaena—Festuca association
	Festuca—Acaena association
Marsh and Bog Formation	*Juncus—Deschampsia* association
	Rostkovia magellanica association

To these must be added the cryptogamic communities of rocks and screes, a composite group of communities consisting of bryophytes and lichens with vascular plants playing only a subordinate part and rarely exerting more than a local influence.

A. TUSSOCK FORMATION

1. *Poa flabellata association*

Poa flabellata, the only tussock-forming grass on South Georgia, is confined to coastal areas where it forms a distinctive zone of vegetation all around the shore, reaching an altitude of 750 ft. (*c.* 225 m.)

or more on coastal cliffs. Tussocks may be 1·5–3·5 ft. (*c.* 0·5–1·0 m.) in diameter and reach 3·5–5·0 ft. (*c.* 1·0–1·5 m.) in height, each consisting of a stool bearing a dense crown of leaves (Plate Ia). Owing to the spreading of the mature leaves and the pendant position of those that are withering, individual plants cast a deep shade; consequently, when growing in close association, more or less pure communities are built up as no other native vascular plant is sufficiently robust to act as dominant or co-dominant to *Poa flabellata.*

Tussock communities have two distinct facies according to the density of the plants which is mainly determined by the instability of the substrate and movements of animals. The maximum development of the *Poa flabellata* formation is "closed" tussock, the characteristic appearance of which (Plate Ib) is due to the crowding together of the plants and the meagre development of stools. The commonest facies, however, is "open" tussock which is widespread in regions above the tidal zone: it has a lower density of plants and well formed stools (Plate Ia and c).

Tussock with a "closed" facies covers extensive areas on Bird Island and at the north-western end of South Georgia in the vicinity of Elsehul, but is poorly developed or absent in and around Cumberland and Stromness Bays. Pure stands are best developed on horizontal to moderately sloping ground away from penguin or elephant seal colonies, but rarely persist over wide areas because of breaks in the canopy caused by such minor topographical factors as drainage channels. In the areas of "open" tussock formed by these agencies, sufficient light reaches the ground between individual plants of *Poa flabellata* to permit the growth of other species. Here, *Callitriche antarctica*, *Deschampsia antarctica* and *Acaena adscendens* are frequent, the first two species being especially characteristic of damper areas, e.g. beside pools or streams where *Montia fontana* is sometimes encountered. Bryophytes are common and such species as *Polytrichum strictum*, *P. alpinum* and *Dicranum aciphyllum* often form deep peat deposits. Seal and penguin colonies are usually established in tussock wherever there is low-lying ground behind the foreshore. Constant movement of these animals not only suppresses the development of plants between tussock stools but, in extreme cases, may result in the death of *Poa flabellata.* Under these circumstances the tops of the stools are reduced to slippery "leathery" mounds, while the surface of the peat between the stools is converted into a sludge of wet mud and dung, conditions under which no terrestrial plants can survive. On the steep tussock-covered hillsides of Bird Island, colonies of the black-browed and grey-headed albatrosses (*Diomedea melanophys* and *D. chrysostoma* respectively) are common and result in the local development of "open" tussock. Because of the better drainage and the comparative inactivity of the albatrosses, sludge is not formed and manuring results in an increased lushness of the tussock. Although a number of colonies with varying bird densities were examined, no species appeared to be especially characteristic of or restricted to these sites, but around abandoned nests *Callitriche antarctica* often forms extensive swards which are colonized by *Acaena adscendens* and the moss *Tortula robusta** as well as young plants of *Poa flabellata.*

No pteridophytes were observed as associates in the *Poa flabellata* formation, but mosses and lichens are common in open undisturbed areas. In some localities, as on Bird Island, the growth rate of the mosses appears to exceed that of *P. flabellata* so that extensive bryophyte banks are formed which spread out over the surface of the tussock (Plate Ib and d). In the vicinity of Husvik, where the tussock has been cleared by the grazing of domestic animals, it has been largely replaced by similar bryophyte banks; here regeneration of the *Poa flabellata* association appears to be extremely slow.

B. Grass Heath Formation

This formation is not only the richest in species but is also the climax vegetation over much of the north-east coast of South Georgia. The best examples were seen in Cumberland and Stromness Bays (Plate IIIa), the formation in its most mature state being unknown on Bird Island and the south-west coast. Skottsberg (1912) called it a "Grassy tundra" or a "Tundra-meadow" and aptly referred to it as ". . . giving a peculiar South Georgian stamp to the land". He remarked "According to different exposure and different mechanical composition of the substrate there are all transitions between a tundra rich in grasses and the moss and lichen carpet, where phanerogams are of small or almost no importance."

The formation attains its maximum condition in north-facing situations and is best developed on horizontal or moderately sloping, well drained, stable surfaces behind the coastal tussock fringe; it is

* For comments on the identity of this species see Greene, 1964*a*.

unable to compete successfully with the *Poa flabellata* association. It comprises a mosaic of intergrading communities in which three seral stages may be recognized: an *Acaena—Tortula* pioneer community; an "open" *Acaena—Festuca* stage; and a "closed" *Festuca—Acaena* climax heath. The moss and lichen communities and the *Rostkovia magellanica* "swamp" vegetation, included by Skottsberg in this formation, are here treated separately.

1. *Acaena—Tortula association*

Some form of the *Acaena—Tortula* association normally represents the first stage in the conversion of bare scree or morainic slopes to grass heath. Species of the genus *Acaena* have creeping, somewhat woody, stems which branch freely and produce short erect leafy shoots. In *A. adscendens*, the larger and more vigorous of the two South Georgian species, the rhizomes and branches intermingle to form a loose network of stems which is in intimate contact with the substrate (Plates IIa and IIIb), so that the species is well adapted to act as a colonizer of unstable ground. Striking examples of this ability are to be seen all over the island, a particularly good case being on the steep slopes of Brown Mountain overlooking King Edward Cove.

Almost invariably, on scree and morainic slopes, the moss *Tortula robusta* is associated with *Acaena adscendens*. It is only very rarely that *A. adscendens* becomes established without the moss, and in these cases it appears to be incapable of forming a sward. *T. robusta* is a turf-forming species and it is probable that on dry screes and moraines some humus production from decomposing *Tortula* turfs is necessary before *Acaena* can successfully colonize the ground. In addition to providing a suitable substrate for the *Acaena* fruits to lodge in, these turfs probably ensure sufficient water and adequate temperature for seed germination. Scattered individuals of other phanerogams, e.g. *Deschampsia antarctica*, *Festuca erecta* and *Phleum alpinum*, may be encountered in the *Acaena—Tortula* association; as the number of *Festuca erecta* plants increases, this association grades into the next stage in the establishment of grass heath.

2. *Acaena—Festuca association*

Unlike *Acaena adscendens*, the grass *Festuca erecta* forms dense erect tufts 7–10 in. (*c.* 18–25 cm.) tall. *F. erecta* seems to be intolerant of continuous instability of the substrate and only appears in the *Acaena—Tortula* association near the foot of screes where the slope has levelled out. Thus, areas of an "open" *Acaena—Festuca* community are established, their size depending on local topography (Plates IIb and IIIc). The only other phanerogamic species commonly present in this "open" association at low altitudes, e.g. 50–550 ft. (*c.* 15–170 m.), are individuals of *Deschampsia antarctica*, *Phleum alpinum* and *Rostkovia magellanica*. *Galium antarcticum* and *Polystichum mohrioides* are occasionally encountered on the down-slope of large stable boulders.

At higher altitudes, e.g. 550–750 ft. (*c.* 170–225 m.), and on exposed hillsides the relative frequencies of the grasses tend to alter, with *Phleum alpinum* and *Deschampsia antarctica* becoming more abundant than *Festuca erecta*. Under these conditions *Acaena tenera* is often a conspicuous constituent of the *Acaena* carpet and in exposed situations, particularly at the upper limit of phanerogamic communities, may become more abundant than *A. adscendens*. Since these exposed or high-level communities only develop in the presence of surface water, stunted plants of *Rostkovia magellanica* are often a conspicuous element. For example, on the wind-swept, terraced slopes between Moltke Harbour and Sacramento Bight, successful development of the *Acaena—Festuca* heath is confined to sheltered moist hollows in the lee of the terraces where *R. magellanica* is abundant.

3. *Festuca—Acaena association*

On well-drained, almost or fully stabilized ground, the density of *Festuca erecta* plants increases to form the climax state of the grass heath, the best examples of which were seen in Cumberland and Stromness Bays, e.g. the northern part of Bore Valley, Sphagnum Valley and Hestesletten.

In contrast to the "open" heath, where the individuals of *Festuca erecta* are approximately 8–12 in. (*c.* 20–30 cm.) apart, in the "closed" heath the plants of this species are more or less contiguous producing a rather tufted sward (Plates IIc and IIId). *Acaena adscendens* and *Tortula robusta* still survive as important elements, but *Phleum alpinum* and *Rostkovia magellanica* have diminished in frequency, while *Deschampsia antarctica* and *Acaena tenera* were only rarely observed. *Galium antarcticum* and *Uncinia smithii*, although

showing some restriction in distribution and with a distinct preference for sheltered, north-facing slopes, are also regarded as characteristic species of the "closed" heath. Casuals noted in the southern valley at Husvik were *Blechnum penna-marina*, *Alopecurus antarcticus* and *Cerastium holosteoides*.

The "open" and "closed" states of the grass heath are rich in bryophytes and fruticose lichens, but apart from infrequent plants of *Polystichum mohrioides* and the casual occurrence of *Blechnum penna-marina* just mentioned, pteridophytes are absent. The mosses are mainly robust acrocarps with a tall turf growth form, pleurocarpous species being surprisingly rare.

As elsewhere, the decaying remains of the bryophytes provide an abundance of humus which accumulates to form an irregular, hummocky surface between the tufts of *F. erecta*. Particularly on sloping ground the hollows between the hummocks may become connected to form shallow water runnels, and it is in these wetter areas that *Rostkovia magellanica* and *Deschampsia antarctica* flourish. On Hestesletten, an extensive area of "open" *Acaena—Festuca* heath, ridging in the underlying morainic surface has produced a regular pattern of alternating wetter *Rostkovia—Deschampsia* hollows and drier *Acaena—Festuca*-covered ridges. Where some of these runnels are converted into more permanent water courses as a result of changes in drainage patterns, local seepage communities are formed.

C. Marsh and Bog Formation

1. *Juncus—Deschampsia association*

In summer, water from the melting ice and snow fields combines with the high precipitation to produce extensive areas where free-water courses over the surface of the ground. The resulting marshy areas include seepage slopes, the banks of small streams and water runnels.

The most characteristic plant of wet stream-sides and seepage areas is *Juncus scheuchzerioides*, its robust non-flowering form often being abundant (Plate IId). *Deschampsia antarctica* is rarely absent from these habitats, and other common associates are *Rostkovia magellanica* and *Acaena adscendens*; on hillsides or wet scree slopes one of these species often becomes, locally, the dominant element. Other widespread species of wet ground are *Callitriche antarctica* and *Ranunculus biternatus*, while *Montia fontana* and *Ophioglossum opacum* are casuals with a distinct preference for north-facing sites. In seepage areas on the north-facing slopes of the southern valley at Husvik, *Alopecurus antarcticus*, *Cerastium holosteoides* and *Blechnum penna-marina* were noteworthy casuals, while *Poa annua* and *Poa pratensis* occupied the same position in parts of Stromness and Prince Olav Harbours.

On horizontal areas, more or less continuously flushed with water, the amount of *Deschampsia antarctica* in the community may increase at the expense of the other species of flowering plants until it becomes the sole phanerogamic constituent. This type of *Deschampsia* community (Plate IIe) is widespread on the north-east coast, but it is particularly characteristic of Bird Island and the vicinity of Elsehul. On Bird Island, in the south-facing corrie between Gazella Peak and Roché Peak, such horizontal areas are abundant and appear to originate from solifluction effects in wet, unstable peat amongst *Poa flabellata* (Plate IIIe). Their surfaces often show irregular stripes and polygons and they support pure, dense, non-flowering swards of *D. antarctica*. The lack of a phanerogamic associate is striking, but it should be noted that a bryophyte understorey is normally present. *Rostkovia magellanica* is very local on Bird Island but is present in small quantities in one or two of the terraces.

It seems probable, at least on Bird Island, that these *Deschampsia* meadows develop directly on bare peat surfaces in freshly formed areas of terraces or, following changes in drainage patterns, by colonizing bryophyte carpets which formerly lined the bottoms and sides of water runnels. On bare peat, *Callitriche antarctica* is a regular primary colonizer and it forms low mats along with small plants of *Deschampsia antarctica*. In a number of places young plants of *D. antarctica* were growing in *Callitriche* mats, the latter probably disappearing as the density of the *Deschampsia* shoots increased.

Small waterfalls are abundant on South Georgia and deep bryophyte banks, rich in species, may be built up in the splash zone of their sides. Some fully aquatic bryophytes were observed attached to rocks and boulders, in streams and submerged in lakes, but no fully aquatic vascular plants are known from the island.

2. *Rostkovia magellanica association*

Rostkovia magellanica, like *Poa flabellata*, forms relatively pure communities with only a few phanerogamic associates. *Rostkovia* bog is best developed on valley floors, on gently sloping ground or in small

hollows where drainage is impeded and the water table approaches the surface; under such conditions peat deposits are built up which, in places, exceed 6·5–8·0 ft. (*c.* 2–2·5 m.) in depth. Free water is rare and pool formation is local. The most extensive areas were seen in Sphagnum Valley, the southern valley at Husvik, Olsen Valley and the Stromness valley; particularly large areas are also known to surround the Hamberg Lakes at the west side of Hestesletten.

R. magellanica is a low-growing rush with long creeping rhizomes which produces erect leafy shoots at intervals of approximately 2–3 in. (*c.* 5–8 cm.). Although the rhizomes intertwine, the density of the erect shoots rarely becomes so high as to form a closed sward (Plate IIf); nevertheless the brownish colour of areas of *Rostkovia* bog is easily distinguished at a distance. *Acaena adscendens* is the only constant phanerogamic associate of the drier areas of *Rostkovia* bog where it forms irregular areas of varying size. Scattered plants of *Festuca erecta*, *Phleum alpinum* and less commonly *Acaena tenera* are usually present, and *Poa annua* was seen in drier areas of bog in a few places around Cumberland Bay. In wetter parts of the bog, e.g. along the edges of drainage channels, *Phleum alpinum* and *Festuca erecta* are replaced by *Juncus scheuchzerioides*; *Deschampsia antarctica* and, more rarely, *Ranunculus biternatus* may also be present.

The surface layer of the *Rostkovia* bog is composed mainly of mosses which, because of their varied growth forms, give rise to a low uneven surface; like the phanerogams, different species occupy the wetter and drier areas. *Acrocladium austrostramineum* and *Drepanocladus uncinatus* are the commonest mosses in wetter sites, *Tortula robusta* being more characteristic of drier regions. These three species can form extensive, more or less pure swards, but more commonly they have other species intermixed, common associates being *Polytrichum strictum*, *Dicranum aciphyllum* and species of *Aneura*; *Conostomum australe* was noted as a casual in Sphagnum Valley.

The only other bryophyte species of the *Rostkovia* association meriting special notice is *Sphagnum fimbriatum*. It is known from four localities, in each of which it forms numerous, circular to oval carpets amongst *R. magellanica* (Plate IIIf). Most of the carpets are dome shaped in profile and except at their margins are without bryophyte associates. The presence of *S. fimbriatum*, however, causes little change in the distribution pattern of the vascular plants unless, perhaps, to produce a slight decrease in the density of *Rostkovia* shoots within the carpet. *Acaena adscendens* and more rarely *Deschampsia antarctica*, *Festuca erecta* and *Phleum alpinum* were all observed growing within the *Sphagnum* carpet.

In each locality, under large carpets, *S. fimbriatum* has built up considerable deposits of its own peat, the usual depth being between 10–20 in. (*c.* 25–50 cm.), but in Sphagnum Valley depths up to 40 in. (*c.* 1 m.) were obtained.

D. Cryptogamic Communities of Rock and Scree

At the present time not a great deal can be said about the cryptogamic scree communities which precede the establishment of the *Acaena—Tortula* association, since ecological study is dependent upon a satisfactory elucidation of the taxa involved. On the north-east coast no phanerogam-dominated communities were observed above 750–1,000 ft. (*c.* 225–300 m.), the existing plant cover being mainly bryophytic. In this upland zone two distinct habitats may be recognized: rock faces and ledges, as well as partially stable scree slopes and glacial detritus.

The bryophyte communities of upland rock ledges are rich in number of species even in close proximity to glaciers, e.g. the rocks on the eastern side of the Hodges Glacier snout. The species comprising the communities vary greatly from area to area; some show preferences for north-facing slopes, but communities in these situations are by no means invariably richer and better developed than those on south-facing slopes. The cover ranges from a patchy distribution of isolated cushions on otherwise bare rocks faces to small swards formed in sheltered crevices or ledges. Characteristic genera of rock faces include *Andreaea*, *Blindia* and *Dicranoweissia*, while in crevices and on ledges species of *Bartramia*, *Brachythecium*, *Dicranum*, *Distichium*, *Drepanocladus*, *Pohlia*, *Polytrichum*, *Rhacomitrium* and others constantly occur.

Vascular plants are rarely absent from these upland crevice and ledge communities, but since they occur as scattered individuals they exert only a local influence. *Acaena tenera*, *Deschampsia antarctica* and *Phleum alpinum*, together with *Hymenophyllum falklandicum*, are seen regularly up to 1,250 ft. (*c.* 375 m.). The maximum altitude attained by these species is unknown, but one of the main limiting factors is probably the absence of suitable habitats.

At the summit of scree slopes, on glacial outwash plains and on moraines, bryophyte tufts are usually very scattered, but on stable surfaces in the presence of a good water supply extensive swards may be formed. These swards contain many of the bryophytes as well as individuals of the phanerogams already noted from upland rock-ledge communities; in addition, *Rostkovia magellanica* and less commonly *Ranunculus biternatus* are seen up to 1,000 ft. (*c.* 300 m.), and *Acaena adscendens*, *Colobanthus crassifolius* and *Poa annua* are also occasionally present.

The bryophyte component of lowland rock ledges, partially stable scree and glacial detritus appears to be very similar to that just described from upland regions. Both bryophytes and vascular plants can be seen as close to glacier snouts as stability of the substrate will allow, *Acaena tenera*, *Deschampsia antarctica* and *Phleum alpinum* being regularly encountered. At the head of the Stromness valley and on Hestesletten, but at some distance from the glacier snouts, *Lycopodium magellanicum* was a noteworthy element in these cryptogamic communities.

Lowland rock-ledge communities often have ferns present, in addition to the phanerogams noted from upland ledges; north-facing lowland ledges around Cumberland and Stromness Bays appear to be the headquarters of most of the South Georgian pteridophytes. *Cystopteris fragilis*, *Hymenophyllum falklandicum* and *Polystichum mohrioides* are the commonest species, but *Grammitis kerguelensis* may be locally abundant, as in the northern part of Bore Valley. *P. mohrioides* was equally characteristic of the junction line of scree and rock face, here and elsewhere, where it may form almost pure swards up to 3·5 ft. (*c.* 1 m.) or more in length. Pteridophytes are rare or absent from rock ledges on sea cliffs; the two species of *Colobanthus*, particularly *C. subulatus*, and *Poa flabellata* are the characteristic vascular plants, while of the bryophytes, *Orthotrichum crassifolium* and *Willia grimmioides* were seen only in such situations.

E. Comparison with Other Islands

From the foregoing it is evident that the facies of the South Georgian vegetation is provided a by small number of herbaceous phanerogams, trees and shrubs being unknown from the island. Most species occur in a wide range of habitats, and individual communities are characterized more by differing proportions of the same few species than by a number of individual species showing strong habitat preferences, an exception being *Poa flabellata*. The best developed communities, as well as the greatest number of associations, occur on the north-east coast in the vicinity of Cumberland and Stromness Bays in a coastal zone extending from 0–750 ft. (–1,000 ft.) [*c.* 0–225 m. (–300 m.)]. Above this limit, the vegetation is formed by cryptogamic communities of mosses and lichens with vascular plants only occurring as scattered individuals and exerting a purely local influence.

When the vegetation of South Georgia is compared with that of the other oceanic islands in the South Atlantic and South Indian Oceans, the New Zealand Shelf islands and the Antarctic mainland, it is seen that the South Georgian vegetation is best classed as sub-Antarctic (Greene, 1964*b*). The vegetation of the Antarctic zone, i.e. all land south of 60° together with the South Sandwich Islands and Bouvetøya (Fig. 2), is wholly cryptogamic in facies with only two native flowering plants—*Colobanthus crassifolius* and *Deschampsia antarctica*, although some of the aliens which occur on South Georgia have been reported (Greene and Greene, 1963). In contrast, the sub-Antarctic zone (i.e. South Georgia, Prince Edward Islands, Îles Crozet, Îles de Kerguelen, Heard Island and Macquarie Island), has a vegetation of herbaceous angiosperms with a noteworthy absence of woody species; there is no development of the dwarf-shrub-dominated oceanic heath so characteristic of the Falkland Islands and elsewhere in the southern cold temperate zone (Wace, 1960). Sub-Antarctic vegetation is further distinguished by the absence of fern bush and cushion bogs, two formations which occur widely in the cold temperate zone.

V. STATUS AND DISTRIBUTION OF SPECIES

A. Check List of Native and Alien Species

The present check list of the South Georgian vascular flora (Tables VIII and IX) has been compiled from three sources: first, the species which have been reported in the literature (summarized in Tables II and

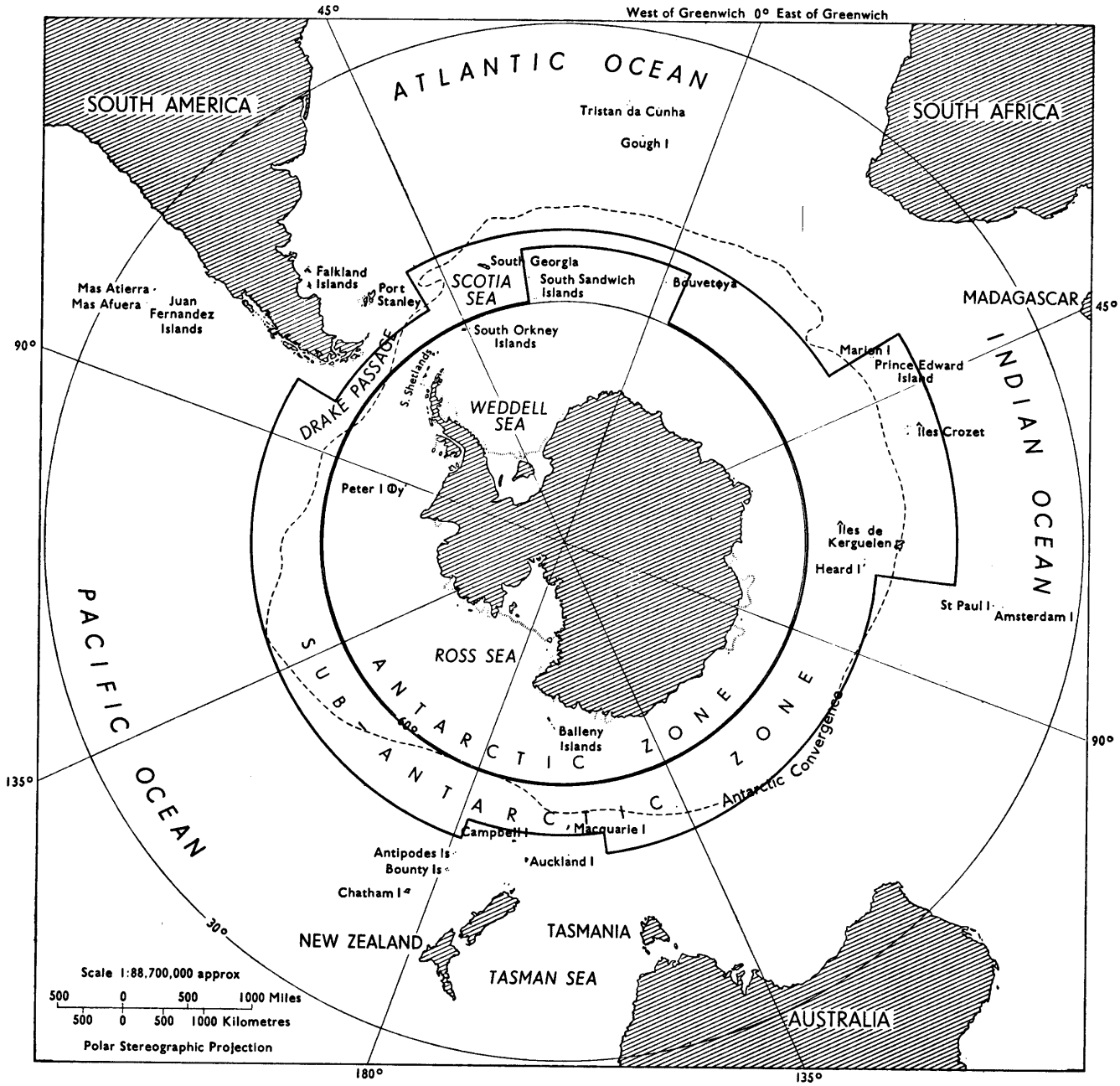


FIGURE 2
Antarctic and sub-Antarctic botanical zones (from Greene, 1964*b*).

III), second, the additional species noted during the 1960–61 Botanical Expedition (included in Tables IV and V), and third, one unpublished record of *Veronica persica* based on a specimen preserved in Oslo.

To date 51 species of vascular plants have been positively identified from South Georgia. Of these species, 24 are accepted as native to the island and 5 are classed as naturalized aliens (Table VIII); the remaining 22 species (Table IX) are all regarded as transient aliens. In addition, there exists in the S. W. Greene (1960–61) collection material of at least a further 13 species none of which is fully determinable at present, some specimens being sterile while others bear only immature fruits. All the indeterminable species are classed as transient aliens.*

It is often extremely difficult to evaluate the status of a species in a given area. By considering the

* Dr. R. E. Longton (personal communication) noted 6 additional aliens during 1963-64.

species known from South Georgia in relation to their present-day austral distribution and their performance on the island, each may be assigned to one of the following classes:

a. Native Species, i.e. those which have arrived by natural agents of dispersal.
b. Alien Species, i.e. those which have been introduced by man, either deliberately or accidentally.

Alien species are further subdivided into

i. Naturalized Aliens, i.e. those which have been long established in one or more places on the island.
ii. Transient Aliens, i.e. those which survive locally in temporary artificial habitats provided by man's continual intervention.

The transient aliens form a large group of plants which occur in the vicinity of human habitation, usually in such impermanent sites as bare ground by the side of paths and around buildings. Some of the species included in Table IX are common in these situations, but others, e.g. *Agropyron repens*, have only been seen in the vicinity of heated pipes. These latter species, as well as most of the other transient aliens will probably vanish if their present habitats revert to natural vegetation. This is thought to be the explanation for the complete absence of transient aliens at Prince Olav Harbour, which was noted during a visit in February 1961; this station was abandoned during the early 1930's (Table I).

It should be noted, however, that some species at present classed as transient aliens may, in time, become established on South Georgia. It was observed at Husvik and Grytviken, during the 1960–61 expedition, that *Agrostis tenuis* and *Deschampsia caespitosa* not only occurred in temporary habitats, but had also spread into *Rostkovia* bogs and *Festuca* grassland in the neighbourhood of these stations, thus demonstrating the ability to survive in competition with the natural vegetation. If these and other species survive and spread after the permanent closure of the whaling stations, they should then be regarded as naturalized species.

At present only five alien species are accepted as fully naturalized on South Georgia.* Of these, *Cerastium holosteoides*, *Ranunculus repens* and *Taraxacum officinale* are most commonly seen in the vicinity of present or former habitation. *R. repens* is the most restricted in its distribution and seems to be extending its range mainly by vegetative means; the other two appear to be spreading by seed. Some idea of the rate of spread of one of the species, *Taraxacum officinale*, is given by the following observations: in 1948, two clumps of *T. officinale* by the Grytviken Radio Hut on the south shore of King Edward Cove were the only plants in that area (W. J. L. Sladen, personal communication), but by March 1961 the species had spread through the whaling station to King Edward Point on the north side of the cove, and also along the shingle of the storm beach on the south shore as far as the Horse Head, distances of half a mile and one mile respectively. *C. holosteoides* has not only become established in natural vegetation at Husvik, but according to W. N. Bonner (personal communication) is widely distributed in the neighbourhood of Ocean Harbour, having spread to about 650 ft. (*c.* 200 m.) in the pass connecting that harbour with Cumberland East Bay. J. Smith (field notebooks) noted the plant on the low lying ground between the snouts of the Geikie and Lyell Glaciers at the western end of Cumberland West Bay.

The remaining two naturalized species, *Poa annua* and *Poa pratensis*, are not only common around the whaling stations in temporary and natural habitats, but they are widely distributed over the island and may be expected in a variety of situations. *P. annua* seems the wider ranging and has been seen up to 1,000 ft. (*c.* 300 m.) on moraines and screes; in contrast, *P. pratensis* appears to be confined to moist ground near sea-level.

Of the native species some, e.g. *Poa flabellata*, are very widespread and may be expected to occur in all suitable habitats on the island, while others, e.g. *Uncinia smithii*, are restricted in their distribution. These restricted species are not only predominantly or completely confined to natural situations, but they show no tendency to increase their frequency in temporary artificial habitats.

The discussion, so far, has concerned the performance of species on South Georgia. When the distribution in austral regions of the species regarded as native to South Georgia is considered, it is found that five-sixths of them are present in southern South America and approximately one-third also occur on most or all of the other sub-Antarctic Islands (Greene and Greene, 1963). Since the spread of these species is not restricted to the path of man's colonization, it can be concluded that South Georgia lies

* A further three, *Agrostis tenuis*, *Deschampsia caespitosa* and *Rumex acetosella* can also now be accepted as naturalized following new information obtained during 1963-64 by Dr. R. E. Longton (personal communication).

within their natural area of distribution. In contrast, all the species classed as transient and naturalized aliens show a diversity of distribution patterns in austral regions and elsewhere which has led to the belief that their arrival has been due solely to transport by man. It may be concluded that the dispersal ability of a species is one of the most important features to consider when assessing its status in the flora of an isolated island.

B. Erroneous Records

In addition to the species listed in Tables VIII and IX, a few other vascular plant species have been reported from South Georgia. Hill (1927) in his monograph of the genus *Lilaeopsis* referred a specimen from the H.M.S. *Sappho* collection to *L. macloviana* (Gandog.) A. W. Hill, and commented "It is not certain whether the specimens from . . . South Georgia are rightly referred to *L. macloviana* . . . The South Georgian specimens bear neither flowers nor fruits and are tentatively included under *L. macloviana* on account of their geographical distribution." Elsewhere in the same paper Hill remarked "A few specimens cannot be named, as, unfortunately, they bear neither fruits nor flowers; one from South Georgia may represent a distinct species allied to *L. macloviana* . . ." From the foregoing, as well as from remarks in a later paper (Hill, 1929), it is clear that Hill had no doubts about referring the *Sappho* specimen to the genus *Lilaeopsis*, but was unsure of its specific relationships within the genus.

The specimen in the Kew herbarium bears the following data: "*Crantzia lineata* Nutt? Isle of South Georgia; Coll. during the recent visit of H.M.S. 'Sappho'; recd. from the Col. Off. 5.4.06.* ?*L. macloviana* (Gandoger) A. W. Hill." The specimen consists of a number of sterile stems bearing alternating, sheathing, septate leaves and, in the opinion of the present author, is only sterile material of *Juncus scheuchzerioides* Gaudich. Philcox has also expressed doubts about the validity of Hill's identification (Greene and Greene, 1963). The nature of the leaf sheaths and the arrangement of the leaves is quite different from that of fruiting specimens of *L. macloviana* and related species of this genus, which clearly show the ". . . tufted character with rosettes of 'leaves', . . . and long, creeping rhizomes, which bear single 'leaves' on small leafy shoots and inflorescences at the nodes whence also the roots are produced" (Hill, 1927). In a section of a leaf from the *Sappho* specimen the epidermis was strongly thickened, as in *Juncus scheuchzerioides*, and the upper epidermis lacked the projecting vertical plates which form the ridges seen on a "leaf" of a fruiting specimen of *L. macloviana*, sectioned for comparison. Nothing comparable in growth form to a *Lilaeopsis* was seen during the 1960–61 expedition, and the occurrence of the genus on South Georgia rests on the identification of the single specimen at Kew. Matthews (1931) mentions on p. 17 of his book that "*Crantzia lineata* grows actually in the water" but has said (personal communication) that his statement was based on the *Sappho* specimen. Until undoubted fruiting material of a *Lilaeopsis* is collected on South Georgia, the genus must be excluded from the island's flora.

One other reported species, *Agrostis stolonifera* L., must be deleted from the check list. This species was first reported by Philcox (1962) who based his record on three specimens. Two were collected by W. J. L. Sladen in 1949, one being quoted as from "wet places from Leith Harbour to Husvik", and the other from the "cemetery, Grytviken"; the third specimen was collected by J. Smith in March 1957 from "Grytviken". Both of Sladen's specimens are in the British Museum, but a duplicate of the "Leith Harbour to Husvik" collection is in the British Antarctic Survey herbarium: they were identified by Professor C. Skottsberg as *A. stolonifera*. Smith's specimen at Kew was identified by Mr. J. K. O'Byrne.

During the 1960–61 expedition, material of *Agrostis tenuis* was collected from the localities where Sladen and Smith obtained their specimens as well as elsewhere on South Georgia, but no plants of *A. stolonifera* were seen. When Sladen's specimens were critically examined it was found that they were similar to the material referred to *A. tenuis*. During July 1963, Dr. A. Melderis of the British Museum kindly examined the Sladen material in the Museum's collection and confirmed (personal communication) that it was *A. tenuis*. He also examined the Smith specimen and reported (personal communication) that the material was too immature and inadequate for certain determination. He commented, however, that the specimen had characters which indicated a close relationship to *A. tenuis* and that it could be a form of that species although it also showed resemblances to the related *A. gigantea*. Since no other specimens from South Georgia have been referred to *A. stolonifera* this species has now been excluded from the island's check list. The Smith specimen has been given as A. ?*tenuis* in the relevant tables.

* In the *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands* (see footnote, on p. 18), this specimen was referred to as "*Crantzia*, sp., very similar to *C. lineata*, Nutt., from the Falkland Islands".

TABLE VIII

CHECK LIST OF THE NATIVE AND NATURALIZED VASCULAR PLANTS KNOWN FROM SOUTH GEORGIA

PTERIDOPHYTA

LYCOPODINEAE

LYCOPODIACEAE
Lycopodium magellanicum Sw.

FILICINEAE

HYMENOPHYLLACEAE
Hymenophyllum falklandicum Baker

POLYPODIACEAE
Blechnum penna-marina (Poir) Kuhn
Cystopteris fragilis (L.) Bernh.
Polystichum mohrioides (Bory) C. Presl. var. *plicatum* (Poepp.) C. Chr.
Grammitis kerguelensis Tard.

OPHIOGLOSSACEAE
Ophioglossum opacum Carmichael

SPERMATOPHYTA-ANGIOSPERMAE
DICOTYLEDONES

RANALES

RANUNCULACEAE
**Ranunculus repens* L.
Ranunculus biternatus Sm.

CENTROSPERMAE

CARYOPHYLLACEAE
**Cerastium holosteoides* Fr.
Colobanthus crassifolius (D'Urv.) Hook.f.
Colobanthus subulatus (D'Urv.) Hook.f.

PORTULACACEAE
Montia fontana L. ssp. *fontana*

ROSALES

ROSACEAE
Acaena adscendens Vahl ssp. *georgiae-australis* Bitter
Acaena tenera Alboff

MYRTALES

CALLITRICHACEAE
Callitriche antarctica Engelm.

RUBIALES

RUBIACEAE
Galium antarcticum Hook.f.

ASTERALES

COMPOSITAE
**Taraxacum officinale* Weber

MONOCOTYLEDONES

LILIIFLORAE

JUNCACEAE
Juncus scheuchzerioides Gaudich.
Juncus inconspicuus (D'Urv.) Hook.f.
Rostkovia magellanica (Lam.) Hook.f.

CYPERALES

CYPERACEAE
Uncinia smithii Philcox

GLUMIFLORAE

GRAMINEAE
Festuca erecta D'Urv.
Poa flabellata (Lam.) Hook.f.
**Poa annua* L.
**Poa pratensis* L.
Deschampsia antarctica Desv.
Phleum alpinum L.
Alopecurus antarcticus Vahl.

* indicates a naturalized species. See also footnote on p. 27.

TABLE IX

CHECK LIST OF THE TRANSIENT ALIEN VASCULAR PLANTS KNOWN FROM SOUTH GEORGIA†

ANGIOSPERMAE
DICOTYLEDONES

RHOEADALES

CRUCIFERAE
Thlaspi arvense L.
Capsella bursa-pastoris (L.) Medic.

CENTROSPERMAE

CARYOPHYLLACEAE
Stellaria media (L.) Vill.
Stellaria graminea L.

LEGUMINOSAE

PAPILIONACEAE
Trifolium repens L.
Pisum sativum L.

UMBELLALES

UMBELLIFERAE
Carum carvi L.

POLYGONALES

POLYGONACEAE
**Rumex acetosella* L.
Rumex crispus L.

URTICALES

URTICACEAE
Urtica urens L.

TUBIFLORAE

SOLANCEAE
Solanum tuberosum L.

SCROPHULARIACEAE
Veronica persica Poir.

ASTERALES

COMPOSITAE
Senecio vulgaris L.
Achillea millefolium L.

MONOCOTYLEDONES

GLUMIFLORAE

GRAMINEAE
Festuca rubra L. ssp. *rubra*
Lolium temulentum L.
Agropyron repens (L.) Beauv.
Avena fatua L.
**Deschampsia caespitosa* (L.) Beauv.
**Agrostis tenuis* Sibth.
Phleum pratense L.
Alopecurus geniculatus L.

† See footnote on p. 26.
* Now accepted as naturalized. See footnote on p. 27.

One other specimen mentioned earlier (p. 18) requires further comment. It is attached to a Sladen specimen of *Montia* from the Grytviken area, collected in March 1949, but was not available for examination by the present author. According to O. Nilsson (personal communication) ". . . on this sheet there is also a small piece of *Anagallis alternifolia*: but Dr. Skottsberg who has seen this collection thinks that it is from the Falkland Islands, and some mistake has been made, but of course he can't be sure, when the *Montia* and the *Anagallis* resemble each other so very much." Skottsberg identified some of Sladen's collection of Falkland Island material in the British Museum as *Anagallis alternifolia* (e.g. Sladen, JB 102/11, collected at Fitzroy, 25 April 1949), so that an error is conceivable, although it should be noted that Sladen was a careful worker. As no other specimen of *A. alternifolia* is known from South Georgia, the species has been excluded from the check list until its presence on the island is confirmed.

So far as is known, the check list includes all taxa which have been reliably reported from South Georgia. However, the distribution data quoted in papers discussing the floras of other sub-Antarctic islands (e.g. Taylor, 1955; and Lourteig and Cour, 1963) indicate the presence of species on South Georgia which were either unrecorded at the time of publication or are still unknown.

C. Mapping the Distribution of Species

1. *The South Georgian grid*

When considering in detail plant distribution in such a botanically under-surveyed area as South Georgia, it is important to ensure that inequalities in survey do not obscure differences in distribution patterns between species. This difficulty can be overcome by the use of a grid superimposed on the map of the island, in individual squares of which only the presence or absence of a species is recorded for units of uniform size.

A small square, with sides 5 km. long, was selected for use as the summer snow-free ground is broken up by glaciers and fjords into small areas (Map 1). Map 2 shows the grid superimposed on the first edition of the 1:200,000 map of South Georgia; squares considered to have had a reasonable preliminary floristic survey are indicated. Individual squares, and localities within them, may be cited in the usual way by reference to the intersection of north–south and east–west co-ordinates at their south-west corners, eastings being cited before northings. Further details are given on the 1:200,000 map in the end pocket. Maps 1-31 are to be found at the end of this report.

The species distribution maps have been compiled from three sources: published papers, collecting data from herbarium specimens, and expedition field notes. Records from the first two sources have, in many cases, proved disappointing as localities have been cited too imprecisely to be mapped (e.g. Forster's specimen of *Acaena adscendens* from Possession Bay). Fortunately much of the ground covered by earlier workers has been revisited in recent years and extensive use has been made of the unpublished field notes of former members of the Falkland Islands Dependencies Survey, in particular those of W. J. L. Sladen and J. Smith (p. 19). For more accessible regions of the world, the publication of the present incomplete species distribution maps would be considered premature; but, in view of the infrequency of botanical work on South Georgia, they serve a useful purpose in drawing together the existing scattered records in such a way as to form a basis for future floristic survey. It should be noted that, so far, the amount of recording in the field with the grid has been limited. The results obtained in this way by Dr. R. E. Longton during 1963-64 have been incorporated into the species distribution maps.

2. *Distribution of native species*

Maps have been prepared for all the native species to show their distribution within South Georgia. The data are still too fragmentary to draw any detailed conclusions about the performance of individual taxa, but it appears that at least two types of distribution may be involved. One class comprises "widespread" species—e.g. *Acaena adscendens* (Map 16), *Deschampsia antarctica* (Map 29) and *Poa flabellata* (Map 26)—which are present not only in almost every square where there has been a reasonable preliminary floristic survey but in others besides; the second class comprises species with a "restricted" distribution, examples being *Alopecurus antarcticus* (Map 31), *Lycopodium magellanicum* (Map 3) and *Uncinia smithii* (Map 24). Plants of the last class seem to be confined to the vicinity of Cumberland and Stromness Bays. It is probable that future work will show that species of the "widespread" class occur

all round South Georgia, but that members of the "restricted" class are confined to areas with a comparatively less severe climate as in the lee of the Allardyce Range.

Owing to the taxonomic uncertainties concerning the relationships of austral floras, no attempt has been made to map the distribution of the native species on a world basis. Instead, the aim has been to demonstrate the relationships of the South Georgian vascular flora with those of southern South America, the Falkland Islands and the remainder of the Scotia Ridge-Antarctic Peninsula sector of the Antarctic and also with those of the remaining sub-Antarctic Islands. Distribution data for these areas have been taken from the following sources: Greene and Greene, 1963 (Antarctic and sub-Antarctic zones); Skottsberg, 1913 (Falkland Islands); Skottsberg, 1916 (southern South America); this information is given after the description of each species.

3. *Distribution of alien species*

Species distribution maps have also been prepared for the five naturalized species, but since their world distribution is believed to be due, in part at least, to fortuitous introductions by man, no austral distribution has been provided. Some comments have already been made (p. 27) on the performance of these five species on South Georgia. The maps show their distribution on the island, and Table X summarizes all known records for those localities where a species has been recorded on at least two occasions. Unfortunately the data in Table X are too incomplete to deduce accurately the period over which these species have been established on the island. It seems clear, however, that in the Grytviken area most of the species have been well established, at least since 1949, and *Poa annua* has probably been present continuously from 1902. The recent spread of *Taraxacum officinale* at Grytviken has already

TABLE X

ALL KNOWN RECORDS, WITH DATES, FOR THE SOUTH GEORGIAN NATURALIZED VASCULAR PLANTS IN THE LOCALITIES SHOWN

Locality	*Grytviken*	*King Edward Point*	*Husvik*	*Stromness*	*Leith Harbour*	*Holmestrand*
Cerastium holosteoides	Sl. Mar. 1949 B. Dec. 1956 Sm. Jan. 1957 B. Feb. 1957 G. Jan. 1961 B. Feb. 1961 G. Mar. 1961		Sl. Mar. 1949 G. Jan. 1961 G. Mar. 1961	G. Mar. 1961		
Poa annua	S. May 1902 Sl. Mar. 1949 Sl. Apr. 1951 Sm. Jan. 1957 Sm. Jan. 1958 G. Mar. 1961		Sl. Mar. 1949 G. Jan. 1961	*G. Mar. 1961*	Br. Jan. 1927 Sm. Jan. 1958 *G. Mar. 1961*	Sm. Sept. 1957 G. Mar. 1961
Poa pratensis	U. Mar. 1927 B. Feb. 1957 Sm. Mar. 1957 G. Jan. 1961 G. Mar. 1961	B. Dec. 1956 Sm. Jan. 1957 *G. Jan. 1961*	G. Mar. 1961	Sl. Mar. 1949 G. Mar. 1961	Sl. Mar. 1949 *G. Mar. 1961*	G. Mar. 1961
Ranunculus repens	Sm. Feb. 1957 B. Feb. 1961 G. Apr. 1961		G. Mar. 1961		Sl. Mar. 1949	
Taraxacum officinale	Sl. Mar. 1949 B. Dec. 1956 Sm. Jan. 1957 G. Mar. 1961	*G. Mar. 1961*	Sl. Mar. 1949 G. Mar. 1961		B. Jan. 1957 G. Mar. 1961	

The letters signify the name of the collector (see p. 14).
Entries in italics indicate field records.

been mentioned (p. 27), and it is possible that the spread of *Cerastium holosteoides* to the pass inland from Ocean Harbour (see p. 27) has been from an original introduction there while the whaling station was operating (Table I). Some or all of these naturalized species will undoubtedly spread still further, and future survey may reveal newly formed, and even long established, populations in additional localities.

It has not been considered necessary to prepare species distribution maps for the transient aliens, as their permanent survival on South Georgia is in doubt. Instead, all the available data for these plants have been summarized in Table XI. From a comparison of Tables I and XI it is seen that these transient

TABLE XI

ALL KNOWN RECORDS, WITH DATES, FOR THE SOUTH GEORGIAN TRANSIENT ALIEN VASCULAR PLANTS

Locality	*Grytviken*	*King Edward Point*	*Husvik*	*Stromness*	*Leith Harbour*
Achillea millefolium	B. Feb. 1957 G. Mar. 1961	—	*G. Mar. 1961*	—	—
Agropyron repens	G. Mar. 1961	—	—	—	—
Agrostis tenuis	Sl. Mar. 1949 ?Sm. Mar. 1957 G. Mar. 1961	G. Mar. 1961	?Sl. Mar. 1949 G. Jan. 1961 G. Mar. 1961	?Sl. Mar. 1949 G. Mar. 1961	*G. Mar. 1961*
Alopecurus geniculatus	—	—	Sl. Mar. 1949	—	—
Avena fatua	G. Mar. 1961	—	—	—	—
Capsella bursa-pastoris	?L. Jan. 1910 G. Mar. 1961	G. Mar. 1961	G. Mar. 1961	—	—
Carum carvi	—	—	G. Mar. 1961	—	—
Deschampsia caespitosa	G. Mar. 1961	—	G. Mar. 1961	G. Mar. 1961	—
Festuca rubra ssp. *rubra*	—	—	G. Mar. 1961	G. Mar. 1961	—
Lolium temulentum	—	—	—	—	G. Mar. 1961
Phleum pratense	—	—	G. Mar. 1961	—	—
Pisum sativum	G. Mar. 1961	—	—	—	Sl. Mar. 1949
Rumex acetosella	U. Mar. 1927 Sl. Mar. 1949 Sm. Feb. 1958	—	B. Feb. 1959 G. Mar. 1961	G. Mar. 1961	—
Rumex crispus	Sm. Feb. 1958 G. Mar. 1961	—	Sl. Mar. 1949	—	—
Senecio vulgaris	—	—	G. Mar. 1961	—	—
Solanum tuberosum	—	—	—	G. Mar. 1961	—
Stellaria graminea	—	—	G. Mar. 1961	—	—
Stellaria media	—	G. Mar. 1961	—	—	—
Thlaspi arvense	—	—	G. Mar. 1961	—	—
Trifolium repens	B. Feb. 1957 G. Mar. 1961	—	G. Mar. 1961	—	—
Urtica urens	G. Mar. 1961	—	—	—	—
Veronica persica	?L. Mar. 1910	—	—	—	—

The letters signify the name of the collector (see p. 14).
Entries in italics indicate field records.
? before a record indicates a doubtful locality, except for the Smith specimen of *Agrostis tenuis* which is a doubtful determination (see p. 28).

aliens have been reported only from the vicinity of human habitation. Some species, e.g. *Rumex acetosella* at Grytviken, have been recorded from a locality over a considerable period of time, whereas other species, e.g. *Urtica urens*, are only known from a single record. In the case of *Capsella bursa-pastoris* and *Veronica persica*, Larsen unfortunately did not specify his collecting locality, but since he was manager at the Grytviken whaling station it is possible that the species were collected in this area. Similarly, the specimen of *Agrostis tenuis* collected by Sladen is imprecisely localized; according to his field notes it was collected during a walk from Stromness to Husvik and hence could not have been collected at Leith as implied on the specimen label (see p. 28).

Table XI also shows that except for *Agrostis tenuis*, *Capsella bursa-pastoris*, *Deschampsia caespitosa* and *Rumex acetosella*, all the species are restricted to one or, less frequently, two localities, i.e. they have

not spread to all the available localities with temporary man-made habitats. The same is also true of the performance of almost all the species at each whaling station since, apart from the four species already noticed, the transient aliens survive as single, usually small populations. At Grytviken, for instance, only solitary sites are known for *Achillea millefolium* and *Trifolium repens*, as it is known with certainty that the collections made in 1961 were from the same populations as those sampled in 1957 (Bonner, personal communication); the same is almost certainly true of *Rumex crispus*. As all the whaling stations are almost or completely closed down (Table I), periodic survey of these localities in the future will enable the status of the transient aliens to be more fully assessed.

VI. SYSTEMATICS

A. Notes on the Descriptions

Apart from a few isolated examples, descriptions have not previously been published for the vascular plants as they occur on South Georgia. The descriptions given in the next section are based on a study of plants in the field, on an examination of a range of herbarium specimens and on preliminary observations on plants raised from South Georgian seed.

Descriptions for all the native species and the five naturalized aliens are given and are set out after the manner of Clapham, Tutin and Warburg (1962) in their *Flora of the British Isles*. For example, the normal size-ranges are quoted for each character with extremes given in brackets, in all cases length being cited before breadth; important diagnostic characters are italicized; an asterisk before the name of a species indicates that it has been introduced. Where possible, the figures for the normal size-range of a character are based on at least ten measurements from each of ten samples from different localities on South Georgia. To facilitate identifications by non-botanists, comparative notes are given after every description and some photographs and drawings are included. A dichotomous key to all the species described is provided and a glossary of some of the descriptive terms will be found on p. 53.

Few changes have been made in nomenclature, pending the necessary systematic revisions of taxa throughout their austral ranges. For example, the South Georgian form of *Acaena adscendens* has been retained as ssp. *georgiae-australis* Bitter, although the likelihood of its being distinct from all other forms of the species throughout the remainder of its geographical range is regarded as doubtful by many botanists. Reference has already been made (p. 12) to the part played by Mr. D. Philcox in naming the S. W. Greene (1960–61) collection. Messrs.W. D. Clayton and J. K. O'Byrne of Kew and Dr. A. Melderis of the British Museum (Natural History) assisted with some of the grasses, while Mr. C. Jermy of the British Museum (Natural History) helped with *Lycopodium* and *Ophioglossum*. Professor L. Constance of the University of California identified the species of *Carum*. Other specialists who helped were Mme. Tardieu-Blot of Paris (with *Grammitis*), Dr. H. D. Schotsman of Paris (with *Callitriche*), and Dr. D. M. Moore of Leicester (with *Colobanthus* and *Montia*). The naming and present treatment of these taxa owes much to information gained in this way.

The only synonyms which have been quoted are the names used by earlier authors in papers concerning the South Georgian flora. As no attempt has been made to examine the type material of these taxa the word *sensu* has been included with the citation. The only synonyms omitted are the field names used by Skottsberg in his preliminary report (Skottsberg, 1902*a* and *b*) as he corrected these in his check list (Skottsberg, 1905). Local names have been noted where these exist; for the remainder of the species English names, in use elsewhere, have been applied and in a few cases English names have been coined.

B. Artificial Key to Species

PTERIDOPHYTA

1. Leaves sessile, numerous, crowded, small (< 0·5 cm. long) in relation to stem (Plate IVa) ***Lycopodium magellanicum*** (p. 36)
   Leaves petioled, few, large ([1–] 2–10 [–20] cm. long) in relation to stem 2
2. Leaves simple, not divided 3
   Leaves divided into segments 4

3. Leaves narrow (< 0·5 cm. broad), strap-like, with sporangia on underside of upper half of leaf (Plate IVa and b) .. .. ***Grammitis kerguelensis*** (p. 38)
   Leaves broad (1–2 cm. broad), ovate to oblong with sporangia confined to stalked spikes (Plate IVc) .. .. ***Ophioglossum opacum*** (p. 39)
4. Leaves irregularly pinnate, delicate in texture, translucent (Plate IVa) ***Hymenophyllum falklandicum*** (p. 37)
   Leaves regularly pinnate, rather leathery in texture, opaque 5
5. Leaves bipinnate, at least at base (Place IVa) .. .. .. ***Cystopteris fragilis*** (p. 37)
   Leaves simply pinnate 6
6. Pinnae crowded, overlapping, with variously lobed margins (Plate IVa) ***Polystichum mohrioides*** (p. 38)
   Pinnae more widely spaced, not overlapping, margins not lobed (Plate IVa) ***Blechnum penna-marina*** (p. 37)

SPERMATOPHYTA—ANGIOSPERMAE

1. Leaves broad in proportion to length, the principal leaf veins forming an irregular network 2
   Leaves long and narrow in proportion to length, grass-like, the principal leaf veins parallel 12

DICOTYLEDONES

2. Leaves pinnate, flowers in globular heads 3
   Leaves not pinnate, flowers not in globular heads 4
3. Leaflets on fully developed leaves wedge-shaped at base (Fig. 5) ***Acaena adscendens*** (p. 43)
   Leaflets on fully developed leaves truncate to cordate at base (Fig. 5) ***Acaena tenera*** (p. 44)
4. Leaves in 4's, arranged in often widely-spaced whorls, stems square in section (Fig. 7) ***Galium antarcticum*** (p. 46)
   Leaves not arranged in whorls, stems round in section 5
5. Leaves entire, in opposite pairs 6
   Leaves normally coarsely toothed or lobed, not in opposite pairs 10
6. Leaves and stems hairy .. .. ***Cerastium holosteoides*** (p. 40)
   Leaves and stems smooth 7
7. Leaves widest below midleaf, tapering to narrow points, crowded, plants forming often dense cushions 8
   Leaves widest above midleaf, tapering to broad bluntly pointed or rounded apices, normally ± widely spaced, plants straggling or forming spreading mats 9
8. Peduncles long, the fruit being elevated above the surface of the cushions, apical leaves spreading, star-like .. .. ***Colobanthus crassifolius*** (p. 40)
   Peduncles shorter, the fruit being at or just below the surface of the cushion, apical leaves ± erect, not spreading .. .. ***Colobanthus subulatus*** (p. 41)
9. Leaves narrowing below midleaf, but expanding again at insertion (Fig. 3). Flowers hermaphrodite with white petals .. .. ***Montia fontana*** (p. 41)
   Leaves narrowing below midleaf but not expanding again at insertion (Fig. 3). Flowers unisexual lacking petals .. .. ***Callitriche antarctica*** (p. 45)
10. Plants giving a white milky latex on crushing, lower leaves entire to coarsely toothed, flowers arranged in dense heads .. .. .. ***Taraxacum officinale*** (p. 47)
    Plants without a white milky latex, lower leaves deeply lobed or compound, flowers not arranged in heads 11
11. Plants slender, creeping, smooth, all leaves stalked and fleshy, sepals smooth, reflexed, in length equal to petals .. .. ***Ranunculus biternatus*** (p. 39)
    Plants robust, erect, hairy, leaves not fleshy, the upper sessile, the lower stalked, sepals hairy, not reflexed, shorter than petals.. .. .. .. ***Ranunculus repens*** (p. 39)

MONOCOTYLEDONES

12. Flowers solitary or in groups of 1–3 13
Flowers numerous, arranged in compact or spreading inflorescences 15
13. Leaves brownish, "C" shaped in section with 2 internal cavities (Fig. 8), lacking transverse septa, flowers large > 0·5 cm. long, solitary .. ***Rostkovia magellanica*** (p. 48)
Leaves green, oval or circular in section, with 1 internal cavity (Fig. 8) and frequent transverse septa, flowers small < 0·5 cm. long, 1–3 together 14
14. Flowers normally in groups of 2 or 3, pedunculate .. ***Juncus scheuchzerioides*** (p. 47)
Flowers solitary, sessile .. .. ***Juncus inconspicuus*** (p. 48)
15. Flowers arranged in dense ± cylindrical spikes 16
Flowers not arranged in dense spikes 19
16. Spikes slender, < 0·5 cm. diameter, most flowers with a conspicuous hooked bristle (Plate Vc) .. .. ***Uncinia smithii*** (p. 49)
Spikes more robust, > 0·5 cm. diameter, flowers lacking a hooked bristle 17
17. Plants tussock-forming, spike usually > 5 cm. long, spikelets appearing smooth with short hairs confined to the margins of the glumes (Plate Vd) .. ***Poa flabellata*** (p. 50)
Plants not tussock-forming, spike usually < 3 cm. long, spikelets appearing softly hairy or bristly due to abundant soft or stiff hairs on the surface of the glumes 18
18. Spikelets bristly with stiff spreading hairs particularly along back of glumes, awns 2 per spikelet, each arising from the apex of a glume, leaves green to greenish-purple with conspicuously inflated leaf sheaths on flowering stems (Plate Vd) ***Phleum alpinum*** (p. 52)
Spikelets softly hairy with abundant silky hairs on back of glumes, awn 1 per spikelet arising from the back of the lemma, leaves greenish-blue, lacking inflated leaf sheaths on flowering stems (Plate Vd) .. .. ***Alopecurus antarcticus*** (p. 53)
19. Panicle branches erect, closely appressed to the inflorescence axis (Plate Vd), plants densely tufted .. .. ***Festuca erecta*** (p. 49)
Panicle branches ascending to widely spreading, plants not tufted 20
20. Spikelets silvery green, with conspicuous awns .. .. ***Deschampsia antarctica*** (p. 51)
Spikelets dull green, awns absent 21
21. Lowest panicle branches arising 2–5 together at node (Plate VIb), rootstock creeping ***Poa pratensis*** (p. 51)
Lowest panicle branches arising 1–2 together at node (Plate VIa), rootstock not creeping ***Poa annua*** (p. 50)

C. Pteridophyta

LYCOPODIACEAE

Lycopodium magellanicum Sw. Magellanic Clubmoss

Rhizomes elongate, creeping, giving rise to erect shoots which bear at their apices a group of leafy prostrate or ascending branches. ***Branches*** *small* 1–2×0·3–0·5 cm. ± *cylindrical, densely covered by short* (3–4 mm.) *narrow, linear-lanceolate, sessile, leaves.* ***Strobili*** (0·7–) 1–1·8×0·3–0·5 cm. ± *cylindrical, sessile, erect at the apices of leafy branches,* the bracts with hyaline irregularly toothed margins, yellow in colour with the apices of the bracts reflexed when mature, Plate IVa.

Native. On bare, well drained, stable, stony ground. Altitude 0–100 (–500) ft. [0–30 (–150) m.]. Often locally abundant in open communities on younger parts of moraines. South Georgia, Map 3; Falkland Islands; Fuegia, west and Andean Patagonia; Prince Edward Islands, Îles Crozet, Îles de Kerguelen.

Notes. Since the short leafy branches are normally pressed closely to the surface of the ground with only the cones standing erect, *L. magellanicum* is an inconspicuous species and does not usually attract attention. However, it is more conspicuous at maturity when the yellow cones contrast with the green

vegetative branches. It is more likely to be passed over as a bryophyte than to be mistaken for any of the other vascular plants.

There appears to be much confusion about the correct name of the present species. Two specimens in Uppsala, collected by Skottsberg on South Georgia, one in 1902 and the other in 1909, have been named by Roivainen as *L. magellanicum* f. *skottsbergii* Herter. However, Roivainen (1936) expressed doubts about the justification for treating the South Georgian forms as a separate taxon and pointed to the need for experimental studies. According to C. Jermy (personal communication) the epithet *skottsbergii* was not validly published by Herter till 1940, when he used it for a plant from Juan Fernandez which he named *L. scariosum* var. *gayanum* f. *skottsbergii* Hert., at the same time calling Skottsberg's South Georgian plants *L. magellanicum* var. *pusillum* Hert. Then, in 1949, in his *Index Lycopodiorum*, Herter raised both these taxa to the rank of species, now calling the Juan Fernandez plant *L. skottsbergii* (Hert.) Hert., and the South Georgian plants *L. urani* Hert. nom. nov. It seems better to retain the South Georgian plants as *L. magellanicum* Sw., pending a full revision of the taxon.

HYMENOPHYLLACEAE

Hymenophyllum falklandicum Baker — Filmy-fern

H. peltatum Desv. sensu Prantl, 1890 and Skottsberg, 1905.

Rhizomes elongate and wiry, creeping, producing many erect leaves which form densely crowded tufts owing to intertwining of the stems. ***Leaves*** variable in size, 2–5 × 0·5–1·0 cm. including a petiole of variable length, *blade pinnate.* ***Pinnae*** *delicate and translucent, simple or divided into two lobes,* each pinna, or its lobes, being ± elongate and *conspicuously toothed on its margin, with a single, prominent, central vein.* ***Sori*** marginal, at or near the apices of the leaves. ***Indusium*** consisting *of two flap-like valves with entire margins,* forming a ± cup-like structure, brown at maturity, Plate IVa.

Native. In crevices of north- or south-facing rocks. Altitude 0–750 (–1,250) ft. [*c.* 0–225 (–375) m.]. Locally frequent. South Georgia, Map 4; Falkland Islands; Fuegia, west Patagonia.

Notes. There is never any difficulty in recognizing this small fern because of the "filmy" nature of its dark green, translucent leaves. When poorly developed, however, the very compact tufts of the plant can easily be mistaken for a bryophyte.

POLYPODIACEAE

Blechnum penna-marina (Poir) Kuhn — Small-fern (of Falkland Islands)

Rhizomes short, creeping, producing *a rosette-like group of spreading or erect dimorphic leaves.* ***Sterile leaves*** 10–15 × 0·8–1·2 cm., normally spreading, the petiole about equalling the length of the blade, the latter narrowly oblong, *simply pinnate.* ***Pinnae*** numerous, ± *widely spaced, oblong, flat or with their margins narrowly recurved.* ***Fertile leaves*** erect, normally longer than the sterile, with the margins of their pinnae more broadly revolute, so that the pinnae appear narrower than those on the sterile leaves. ***Sori*** *elongate,* on under surface of pinnae, *running the full length on either side of the midrib,* when mature sporangia apparently cover the whole undersurface of the pinna. ***Indusium*** *single, linear,* Plate IVa.

Native. On screes, in rock crevices, in seepage areas and in *Festuca* grassland. Altitude 0–100 ft. (*c.*0–30 m.). Frequent on north-facing slopes in the southern valley at Husvik, South Georgia, Map 5; Falkland Islands; Fuegia, west and Andean Patagonia; Prince Edward Islands, Îles Crozet, Îles de Kerguelen, Macquarie Island.

Notes. *B. penna-marina* is easily identified as it is the only fern on South Georgia that has dimorphic leaves. Even when sterile, the simply pinnate leaves will enable it to be readily recognized.

Cystopteris fragilis (L.) Bernh. — Brittle Bladder-fern

Rhizomes short, bearing at their apices a crown of erect or spreading leaves. ***Leaves*** 10–15 cm. long, *normally bipinnate,* petiole brown at base and shorter or as long as the blade, the latter 6–9 × 3–5 cm.,

lanceolate. ***Pinnae*** longest at or below the middle of the blade, ± *lanceolate in outline, the pinnules being variously toothed from dentate to deeply pinnatifid.* ***Sori*** *circular,* on underside of pinnules, *normally arranged in a single row on either side of the midrib.* ***Indusium*** *basal,* delicate, ovate-lanceolate in outline, Plate IVa.

Native. In rock crevices, and at junction of scree and rock faces, north-facing. Altitude 100–750 (–1,250) ft. [*c.* 30–225 (–375) m.]. Locally frequent. South Georgia, Map 6; Falkland Islands; Fuegia, west and Andean Patagonia; Îles de Kerguelen.

Notes. The individual pinnae, particularly the lower ones, are usually separated a little from each other and this character, together with the bipinnation, gives a "feathery" appearance to the leaves. Since plants of this species often grow close together, *C. fragilis* forms clumps of a very characteristic appearance which do not resemble any of the other South Georgian pteridophytes. Plants in cultivation do not differ from those seen in the field.

Polystichum mohrioides (Bory) C. Presl. var. **plicatum** (Poepp.) C. Chr. Shield-fern

Aspidium mohrioides Bory sensu Prantl, 1890; *Polystichum* (*Aspidium*) *andinum* Phil. sensu Skottsberg, 1905; *Polystichum andinum* Phil. sensu Christ, 1905.

Rhizomes short, bearing at their apices a crown of ± erect leaves. ***Leaves*** 12–20 cm. long including a petiole of 5–7 cm., the latter usually abundantly clothed with dark-coloured scales, the blades, 8–12 × (1·5–) 2–3 cm. *simply pinnate,* ± parallel sided for most of their length, having the rachis clothed with scales along the underside. ***Pinnae*** *crowded and overlapping, variously lobed towards their apices but bearing* ± *distinct, toothed pinnules towards their bases.* ***Sori*** *circular,* on underside of the upper pinnae, when mature coalescing to cover the surface with densely packed brownish sporangia. ***Indusium*** persistent, *peltate, orbicular,* Plate IVa.

Native. At junction of scree and rock faces, occasionally on ± stable screes, north facing. Altitude (0–) 250–1,000 (–1,250) ft. [*c.* (0–) 75–300 (–375) m.]. Common to abundant, sometimes forming dense stands. South Georgia, Map 7; Fuegia, Andean Patagonia.

Notes. A distinctive plant which is easily identified by the crowded, overlapping, arrangement of the pinnae, which are rather rigid and have a somewhat leathery texture.

Grammitis kerguelensis Tard. Strap Fern

G. billardieri Willd. sensu Philcox, 1962.

Rhizomes ascending, wiry, giving rise to abundant, closely set, erect leaves, which form low dense tufts, 2–3 cm. high. ***Leaves*** *simple,* 1–2 × *c.* 0·3 cm., *narrow at base and widening a little towards the apex,* glabrous, central nerve weak and inconspicuous, laterals absent. ***Sori*** *naked,* on under surface of upper half of leaf, coalescing when mature, to give a more or less continuous cover of sporangia over the surface, Plate IVa and b.

Native. In sheltered rock crevices, rarely at junction of scree and rock face, north-facing. Altitude (0–) 250–1,000 (–1,250) ft. [*c.* (0–) 75–300 (–375) m.]. Occasional. South Georgia, Map 8; Prince Edward Islands, Îles Crozet, Îles de Kerguelen.

Notes. The narrow, non-pinnate, strap-like leaves of this species are quite unlike those of any other South Georgian fern except *Ophioglossum opacum,* with which it is unlikely to be confused. However, *G. kerguelensis* forms dense tufts in rock crevices which, without care, could easily be passed over as bryophytes. It often occurs with *Hymenophyllum* and on one occasion it was seen not forming tufts, but growing scattered amongst *H. falklandicum.*

G. kerguelensis was first described from Kerguelen material by Tardieu-Blot (1962) who has confirmed the determination of the South Georgian plants.

OPHIOGLOSSACEAE

Ophioglossum opacum Carmichael — Adder's Tongue

Rhizomes short, swollen, and *normally producing only one leaf per season.* ***Leaves*** *fleshy*, with a slender basal portion sheathing the stalk of the fertile spike, about equalling the length of the upper portion which is *expanded into a non-pinnate blade.* ***Blade*** 2–4 × 1–2 cm., ovate to oblong, concave and tapering to a blunt point, *borne ± at right angles to the sheathing basal portion.* ***Sporangia*** *borne in a spike*, the latter when mature having the form of a flattened cylinder. ***Spike*** 0·5–1 cm. long, elevated on a slender stalk some 2–4 cm. above the level of the sterile blade, Plate IVc.

Native. In seepage areas, by stream banks, rarely on moist moraines, north-facing. Altitude 0–350 ft. (*c.* 0–110 m.). Locally frequent. South Georgia, Map 9.

Notes. *O. opacum* is at once distinct from all other South Georgian ferns both by the form of its leaf and by the arrangement of the sporangia in a stalked spike and not on the underside of the leaf. The plants usually occur singly or in small groups and while the non-pinnate sterile blade is somewhat reminiscent of the leaves of *Grammitis kerguelensis*, the appearance of the present plant, as well as its habitat, is totally different.

Plants from the Falkland Islands and central Chile are referred to *Ophioglossum crotalophoroides* Walter. According to C. Jermy (personal communication) the South Georgian plants are very similar to this taxon, but they agree more closely with *O. opacum* Carmichael from Tristan da Cunha and St. Helena in having usually only one leaf coming from the bulbous rhizome at any one time.

D. SPERMATOPHYTA—ANGIOSPERMAE

1. Dicotyledones

RANUNCULACEAE

***Ranunculus repens** L. — Creeping Buttercup

A robust perennial, stoloniferous herb, rooting at the nodes. ***Flowering stems*** 20–40 cm. long, erect, leafy, hairy. ***Lower leaves*** variable in size, 10–15 cm., *petioled, with the blade usually divided into 3 leaflets*, each of which is variously subdivided into toothed segments, leaflets stalked, the central stalk much exceeding those of the laterals so that its leaflet projects beyond the others. ***Upper leaves*** *smaller, sessile, with narrower segments, all leaves somewhat hairy* or glabrous. ***Flowers*** 1·5–2 cm. diameter, *terminating the branches of irregular cymes, pedicels hairy*, furrowed, hermaphrodite, actinomorphic. ***Sepals*** 5, *hairy, not reflexed.* ***Petals*** 5, *exceeding the sepals*, obovate, sub-erect to spreading, often widely spaced, golden yellow, shining. ***Stamens*** numerous. ***Ovary*** superior, apocarpous, carpels smooth. ***Fruit*** a globular head of smooth achenes, each with a short curved beak, *receptacle hairy.*

Introduced. In seepage areas and on bare ground around present and former whaling stations. Altitude 0–50 ft. (*c.* 0–15 m.). Rare. South Georgia, Map 10.

Notes. *R. repens*, the familiar creeping buttercup of the Northern Hemisphere, is readily distinguished by its yellow petals from all other members of the South Georgian flora except *R. biternatus*; the differences between the two plants are pointed out in the notes under that species.

Ranunculus biternatus Sm. — Antarctic Buttercup

A small perennial, stoloniferous herb, with prostrate far-creeping leafy stems. ***Leaves*** arranged in groups at the nodes, very variable in size, petioles 1–5 cm., blades 0·5–1·5 (–2) × 0·5–1 cm., *glabrous and somewhat fleshy, regularly biternate or divided into a variable number of acute, stalked, toothed lobes*, the central lobe projecting beyond the laterals because of its longer stalk. ***Flowers*** 0·6–1 cm. diameter, solitary or in pairs, borne on a glabrous pedicel 0·5—2 cm. long, hermaphrodite, actinomorphic. ***Sepals*** 4–5 (–6) ovate, *glabrous, reflexed*, green to yellow-green, with scarious, hyaline to purplish border. ***Petals*** *similar in length and number to sepals*, narrow spathulate, with claw about half the length of the petal, widely

spaced and spreading, *yellow*. ***Stamens*** numerous. ***Ovary*** superior, apocarpous, carpels smooth with papillose stigmas. ***Fruit*** a globular head of smooth achenes, yellow to purplish when mature, each achene inflated with a short curved beak, *receptacle smooth.*

Native. In seepage areas and by stream banks, rarely on wet rocks. Altitude 0–500 (–1,000) ft. [*c.* 0–150 (–300) m.]. Locally frequent. South Georgia, Map 11; Falkland Islands; Fuegia, west and Andean Patagonia; Prince Edward Islands, Îles Crozet, Îles de Kerguelen, Macquarie Island.

Notes. Owing to the presence of yellow petals, the distinctive lobing of the leaves and the creeping habit of the plants, *R. biternatus* is unlikely to prove difficult to recognize. *R. repens* is the only other plant which is at all similar, and that plant may be readily distinguished by its more robust size, the normally hairy non-fleshy leaves, and the larger flowers with non-reflexed hairy sepals, etc. Plants in cultivation differ little from those in the field.

The identity of specimens of *R. biternatus* at Kew and Stockholm has been confirmed by A. Lourteig; they have been cited in her revision of the Ranunculaceae of southern South America (Lourteig, 1952).

CARYOPHYLLACEAE

***Cerastium holosteoides** Fr. Mouse-ear Chickweed

A perennial herb, with decumbent to erect, leafy, flowering and non-flowering shoots, forming loose straggling clumps. ***Flowering shoots*** variable in size, 8–15 (–25) cm. long, *conspicuously hairy.* ***Leaves*** 1–2×0·4–0·6 cm., arranged *in opposite, usually widely spaced pairs*, entire, sessile, elliptical to oblong, the apex broadly acute to ± rounded, *dark greyish-green and densely covered with short, white hairs.* ***Flowers*** in dichasial bracteate cymes, the lower bracts leaf-like, the upper smaller and with narrow scarious margins, borne on short pedicels, hermaphrodite, actinomorphic. ***Sepals*** 5, *c.* 5 mm. long, ovate-lanceolate, *hairy*, with scarious glabrous margins, *persistent.* ***Petals*** 5, *white, equalling or shortly exceeding the sepals, bifid one-quarter to one-half of length.* ***Stamens*** 10. ***Ovary*** superior, 1-celled, with 5 (–6) styles. ***Fruit*** a capsule, when mature *c.* 1 cm. long, *as much as twice the length of the sepals, narrowly cylindrical, straight to weakly curved, scarious, shining*, dehiscing by 10 short apical teeth.

Introduced. Between rocks and on loose scree, in seepage areas, on storm beaches, rarely in *Festuca* grassland, also on bare ground around the whaling stations. Altitude 0–650 ft. (*c.* 0–200 m.). Locally frequent. South Georgia, Map 12.

Notes. The straggling, densely hairy shoots of *C. holosteoides*, with their wide-spaced pairs of opposite leaves, conspicuous white flowers with deeply cleft petals, and elongated cylindrical papery fruits are unmistakable and quite unlike any of the other native or naturalized South Georgian plants.

Colobanthus crassifolius (D'Urv.) Hook.f. Antarctic Pearlwort

A perennial herb forming low, *loosely compacted cushions* 3–4 cm. high×3–8 cm. diameter ***Leafy shoots*** 1·5–3 cm. long, erect or spreading, sparingly branched, arising as a group from the apex of the central stem, *the terminal leaves generally spreading to give a ± star-like appearance to the apices of individual shoots.* ***Leaves*** 3–5×1 mm., sessile, in opposite decussate pairs, close-set, *spreading or weakly recurved*, from a loose, sheathing, hyaline base, which is fused with the opposite member of the pair, the blades narrowly triangular to linear, gradually tapering to a blunt or shortly cuspidate point, *not, or weakly, channelled on the upper surface*, margins entire with a narrow hyaline border, glabrous. ***Flowers*** *c.* 2 mm. diameter, borne singly at the apices of short peduncles from below the terminal leaves on the main shoots or lateral branches, hermaphrodite, actinomorphic. ***Sepals*** 4–5, *c.* 2 mm. long, *all ± equal triangular to ovate, gradually tapering to rounded apices*, green, the margins hyaline or purplish, *persistent.* ***Petals*** absent. ***Stamens*** 4–5, alternating with the sepals. ***Ovary*** superior, 1-celled with 4–5 short spreading styles. ***Fruit*** a capsule, slightly shorter than the sepals, opening by 4–5 valves, the latter often recurving with age, *elevated by an elongated peduncle, c. 0·5–1·5 cm. above the leaves.*

Native. On gravelly or stony ground of young moraines and stream sides, less commonly in seepage areas. Altitude 0–550 (–1,000) ft. [*c.* 0–170 (–300) m.]. Common. South Georgia, Map 13; South Orkney

Islands southwards to Marguerite Bay, Antarctic Peninsula; Falkland Islands; Fuegia, west Andean and east Patagonia; Macquarie Island.

Notes. The low, moss-like cushions of *C. crassifolius* are distinct from all other South Georgian plants except the closely related *C. subulatus*. When vegetative the two species may best be distinguished by the arrangement of the leaves, particularly those at the apices of the shoots: differences also exist in the relative compactness of the cushions. The two species are most easily separated when in fruit, for the seed capsule, surrounded by its sepals, may be either lifted clear of the surface of the cushions, as in the present species, or be at or below its surface, as in *C. subulatus*. Further differences occur in the shape of the sepals.

C. crassifolius, like the next species, shows little variation in the field apart from a slight increase in vigour in sheltered habitats. In cultivation, however, its size is at least doubled. Plants from more southerly latitudes differ in having more tightly compacted cushions and shorter fruiting pedicels, often with the capsules not, or only barely, clear of the top of the cushion. Engler (1886) recognized a var. *brevifolius* Engl. from South Georgia, in addition to the normal form. This variety was at first accepted by Skottsberg (1905), but later rejected (Skottsberg, 1912). A specimen in the Will collection at Kew and a Mosthaff specimen at Stockholm, named by Engler, do not differ significantly from the normal South Georgian form.

Colobanthus subulatus (D'Urv.) Hook.f. Sessile Pearlwort

A perennial herb forming low, *usually tightly compacted cushions* 3–6 cm. high ×4–8 cm. diameter. ***Leafy shoots*** 1·5–5 cm. long, mostly erect or some spreading, variously branched, *the terminal leaves ± erect and not giving a star-like appearance to the apices of individual shoots.* ***Leaves*** 3–5×1 mm. sessile in opposite decussate pairs, close-set, stiff, *imbricate, erect to little spreading*, from a loose, sheathing, hyaline base, which is fused with opposite member of a pair, the blades narrowly triangular to linear, gradually tapering to a distinctly cuspidate point, *usually conspicuously channelled on the upper surface*, margins entire with a yellowish or hyaline shining border, glabrous. ***Flowers*** *c.* 2 mm. diameter, borne singly at the apices of the short peduncles from below the terminal leaves on lateral branches, hermaphrodite, actinomorphic. ***Sepals*** 4 (–5), 1·5–2 mm. long, *2 slightly shorter than others, triangular to narrowly ovate, gradually tapering to a cuspidate point*, green with yellowish or hyaline shining margins, channelled on the inner surface, *persistent*. ***Petals*** absent. ***Stamens*** 4 (–5) alternating with the sepals. ***Ovary*** superior, 1-celled with 4 (–5) short erect styles. ***Fruit*** a capsule, slightly shorter than the sepals, opening by 4 (–5) valves, *the peduncle not or only slightly longer than in flower, at or just below the apices of the terminal leaves.*

Native. Mainly on wet, rock faces, rarely on moraines. Altitude 0–550 (–900) ft. [*c.* 0–170 (–275) m.]. Common in coastal areas, less so further inland. South Georgia, Map 14; Falkland Islands; Fuegia, west Patagonia.

Notes. *C. subulatus* is only likely to be confused with *C. crassifolius* and the differences between the two species have been pointed out under that plant. Plants in cultivation differ little from those in the field.

PORTULACACEAE

Montia fontana L. ssp. **fontana** Water Blinks

M. fontana L. sensu Engler, 1886; *M. rivularis* Gmel. var. *lamprosperma* Cham. sensu Skottsberg, 1905; *M. rivularis* Gmel. sensu Skottsberg, 1912.

Annual herb with decumbent to erect leafy shoots, loosely tufted. ***Shoots*** 2–5 (–10) cm. long, usually freely branched, *solid in section of internode.* ***Leaves*** 6–10 (–20)×2–3 (–4) mm. *in opposite, decussate pairs, the upper erect to spreading, normally equalling or exceeding the length of the internodes, the lower recurved, spathulate to obovate, narrowing below and then expanding at the extreme base into a sheathing portion* which is fused with opposite member of a pair, bluntly pointed at apex, entire, glabrous, rather fleshy, *central vein pink-tinged particularly so in leaf base, lateral veins ascending.* ***Flowers*** 2–3 mm.

diameter, *1–3 in terminal cymes*, but often appearing lateral due to later growth of shoot, hermaphrodite, actinomorphic. ***Sepals*** 2, broadly ovate, rounded at apex with a narrow hyaline margin, persistent. ***Petals*** 5, *white*. ***Stamens*** 3, attached to petals. ***Ovary*** superior, l-celled, style simple, pedicel shorter than leaves, erect in flower, in fruit recurving at first, later erect. ***Fruit*** *a small globose capsule, in length slightly exceeding the sepals*, elevated on a short pedicel. ***Seeds*** when ripe, black, *smooth and shiny, lacking tubercles*, Figs. 3 and 4.

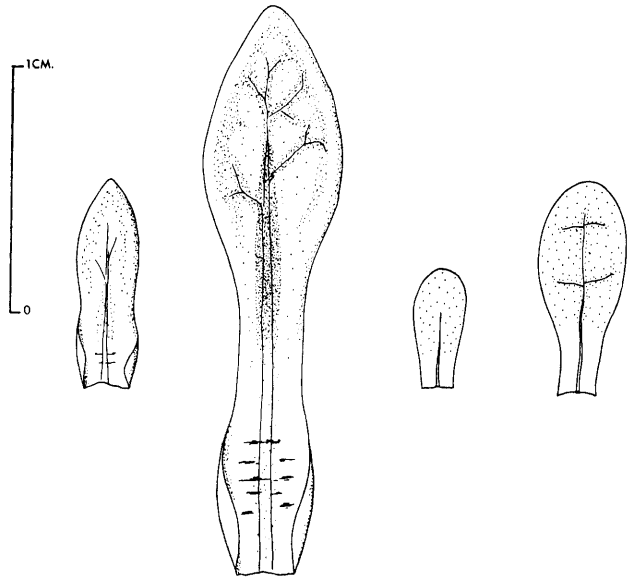


FIGURE 3
Immature (small) and mature (large) leaves of *Montia fontana* (left-hand pair) and *Callitriche antarctica* (right-hand pair).

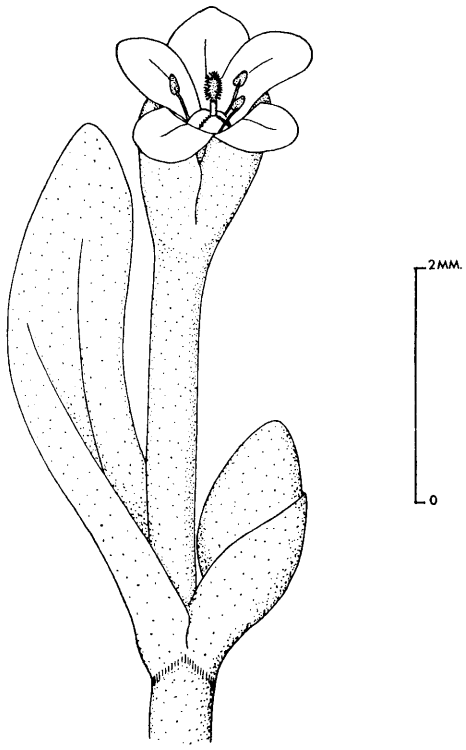


FIGURE 4
Flowering shoot of *Montia fontana*.

Native. In seepage areas, by stream sides, on wet rocks and around pools in tussock, north-facing. Altitude 0–250 (–550) ft. [*c.* 0–75 (–170) m.]. Frequent. South Georgia, Map 15; Îles Crozet, Macquarie Island.

Notes. *M. fontana* is likely to be confused only with *Callitriche antarctica*. Plants in flower or fruit may be readily separated but, without care, the long stalked stamens of *C. antarctica* might be confused with the fruits of *M. fontana*. When vegetative, the differences in shape and venation of the leaves are reliable distinguishing characters, as is the distinctive pinkish tinge of the veins of living *M. fontana*, a colour which is absent from the veins of *C. antarctica*.

M. fontana is very variable in habit and size, and a range of forms may be obtained connecting the more compact plants of drier habitats to the more attentuated forms of aquatic habitats. Plants in cultivation differ little from aquatic forms in the field. O. Nilsson of Lund (personal communication) is of the opinion that the South Georgian plants should not be referred to *M. fontana* L., and that they have their closest affinities with certain South American species. However, Moore (1963) has referred all South Georgian material to *M. fontana* L. ssp. *fontana*.

ROSACEAE

Acaena adscendens Vahl. ssp. **georgiae-australis** Bitter — Greater Burnet, Kaningras

Sanguisorba officinale sensu Forster, 1776; *Ancistrum decumbens* sensu Forster, 1789; *A. adscendens* Vahl sensu Engler, 1886 and Skottsberg, 1905; *A. adscendens* var. *austro-georgiae* Bitter sensu Skottsberg, 1912.

Perennial prostrate herbs, forming extensive carpets as a result of intertwining of the elongated woody rhizomes. ***Leafy shoots*** 10–25 cm. long (including peduncles), decumbent to ascending, often abundantly branched, rather woody at base. ***Leaves*** 5–10×(1–) 1·5–2·5 (–3) cm., *imparipinnate, with 4–6 pairs of leaflets*, the lower leaflets smaller and more widely spaced than the upper, *the largest* (0·5–) 1–1·5 (–2) cm. long, *elliptical to obovate, obtuse at apex, cuneate at base, the margins crenate to dentate, usually shallowly so, glabrous or with occasional hairs on upper surface, the lower surface and rachis pilose with silky hairs, pale glaucous green in colour, the upper surface of the teeth infrequently edged with red.* ***Stipules*** sheathing below, fused to the petiole but with a free leaf-like apex. ***Flowers*** *numerous in globose heads*, hermaphrodite, actinomorphic. ***Heads*** (0·5–) 1–1·5 cm. diameter when in flower and then without evident spines, solitary on erect or weakly curving terminal peduncles, (2–) 8–12 (–16) cm. long. ***Epicalyx*** absent. ***Sepals*** 3–5 mm. long, (3–) 4 fused below, oblong, obtuse or subacute, pilose on back, *green to reddish purple, persistent.* ***Petals*** absent. ***Stamens*** (3–) 4, exceeding the sepals. ***Ovary*** superior, 1-celled, enclosed by the calyx, stigma feathery. ***Fruiting heads*** enlarged, individual fruits surrounded by the *hardened bases of the sepals which lack conspicuous swollen groups of shining cells on their surfaces*, each armed with 4 spines, the latter 5–8 mm. long, each barbed at the tip, Fig. 5.

Native. On mobile to stable screes and moraines, in *Festuca* grassland, and amongst tussock, in seepage areas, in bog and on wet rocks. Altitude 0–750 ft. (*c.* 0–225 m.). Abundant. South Georgia, Map 16. ? Endemic.

Notes. Owing to the presence of pinnate leaves and stalked globular flowering heads, *A. adscendens* is very distinct and is only likely to be confused with *A. tenera*, the differences being summarized under that plant. When the fruits are mature they become detached from the heads (or the head as a whole detaches) and adhere to clothing, feathers, etc., proving difficult to remove owing to the barbed spines.

Bitter (1911) created the new subspecies *georgiae-australis* Bitter for the South Georgian form of *A. adscendens*, and he further subdivided the subspecies into two new varieties—var. *majuscula* Bitter and var. *minuscula* Bitter. From an examination of the South Georgian material in Munich, collected by Will and determined by Bitter as *A. adscendens* Vahl ssp. *georgiae-australis* Bitter var. *majuscula* Bitter and var. *minuscula* Bitter, it is clear that Bitter's varieties are nothing more than large and small plants respectively of the normal South Georgian form of *A. adscendens*. For this reason the varieties have been omitted from the present work, although Philcox (1962) has referred recent collections from South Georgia

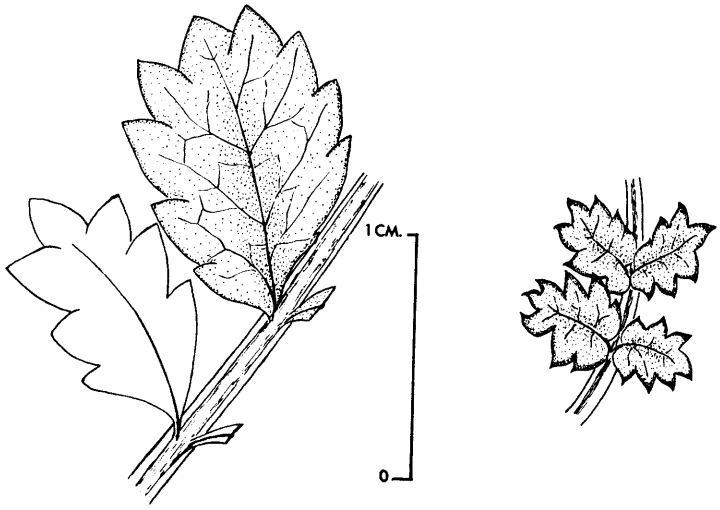


FIGURE 5
Mature leaflets of *Acaena adscendens* (on left) and *Acaena tenera* (on right).

to both varieties. From an examination of the specimens cited by Philcox, it is clear that his use of the var. *majuscula* corresponds to the form here referred to ssp. *georgiae-australis*, while the var. *minuscula*, as understood by Philcox, comprises the plants referred to *Acaena tenera* in the present work.

The Will material of *A. adscendens* in Zürich has also been determined by Bitter as *A. adscendens* Vahl ssp. *georgiae-australis* Bitter, and Will's specimens in Munich and Zürich are cited by Bitter in his monograph of the genus *Acaena* (Bitter, 1911). Bitter's herbarium at Göttingen contains 3 leaves used to illustrate Fig. 39 on p. 181 of this monograph and, although no collecting data is given with the leaves, they must be part of the material at Munich or Zürich. Two South Georgian specimens of *A. adscendens*, one at Zürich, leg. Will and one from the H.M.S. *Sappho* collection at Kew, were identified in 1957 and 1959 respectively as *A. magellanica* (Lam.) Vahl by E. Grondona of Belcarce, Argentina, who is of the opinion (personal communication) that the two taxa are synonymous.

Field experience has shown that *A. adscendens* is extremely variable and that it occupies a wide range of habitats. It is quite likely that the South Georgian plants will prove to be indistinguishable from material of *A. adscendens* from other parts of its range, as has already been suggested by Taylor (1914), but until the results of a thorough revision of the species are available for evaluation it seems best to propose no changes in nomenclature. Plants in cultivation differ little from those seen in the field.

Acaena tenera Alboff — Lesser Burnet

A. laevigata Ait. sensu Engler, 1886.

Similar in general structure to *A. adscendens* but smaller in all its parts and differing as follows: ***Leaves*** (2–) 3–5 (–6) × 0·8–1·2 cm., *the largest leaflets* 4–5 (–6) mm. long, *broadly elliptical to ± circular, truncate to cordate at base, the margins sharply and deeply incised, glabrous on both surfaces or with occasional hairs below, dark green above, the teeth normally edged with red on their upper surfaces.* ***Flowering heads*** 4–5 mm. diameter, elevated on a peduncle 4–8 cm. long. ***Fruiting heads*** with the *hardened bases of the sepals covered by conspicuous swollen groups of shining cells*, each group comprised of irregular moniliform units, spines 1·5–2 mm. long, Fig. 5.

Native. On screes near junction with rock faces and on moraines, more rarely on rocks and in open *Festuca* grassland. Altitude 0–1,000 (–1,250) ft. [*c.* 0–300 (–375) m.]. Common. South Georgia, Map 17; Fuegia, Andean Patagonia.

Notes. When vegetative, *A. tenera* may be most easily distinguished from typical plants of *A. adscendens* by the nature of the mature leaflets. The fruiting heads of the two species not only differ strikingly

in size, but the presence of irregular groups of shining cells on the sides of the fruit of *A. tenera* give it a distinctive appearance, which is quite unlike the smooth-sided fruits of *A. adscendens*.

Bitter (1911) referred the South Georgian plants to ssp. *epilis* Bitter and a typical South Georgian specimen in Munich, collected by Will, has been so determined by him. E. Grondona of Belcarce, Argentina, is of the opinion (personal communication) that *A. tenera* Alboff and *A. microcephala* Schlechtd. are synonymous.

A. tenera, unlike *A. adscendens*, is not very variable but occasional plants occur with a leaflet structure intermediate between the two species, the commonest having the broad base and red-tipped teeth of *A. tenera* but with the bluish-green colour and hairiness of *A. adscendens*. The general size of leaflet and plant of these intermediate individuals is smaller than typical *A. adscendens* and larger than normal *A. tenera*, and while some are fertile no material with fruiting heads has been seen. The status of these intermediate plants is, as yet, unknown. Plants of *A. tenera* in cultivation differ little from the typical form seen in the field.

CALLITRICHACEAE

Callitriche antarctica Engelm. Antarctic Starwort

C. verna L. forma *longistaminea* Engl. sensu Engler, 1886.

Small perennial herb with decumbent to erect leafy shoots, forming low mats or loose aggregations of straggling stems. ***Shoots*** 3–8 (–15) cm. long, variously branched, stems slender, *in section of internode solid (land form) or with 2 longitudinally running air canals (aquatic form)*. ***Leaves*** 2–4 (–7) × 1–2 (–3) mm., *in opposite decussate pairs, the upper normally recurved and usually less than half the length of the internode in all but the compact terrestrial forms, broadly elliptical to obovate, gradually narrowing to a pale green or hyaline base*, which is shortly fused with the opposite member of a pair, at apex bluntly pointed to rounded, entire, glabrous, *the central vein green, not pink-tinged, lateral branches spreading*. ***Flowers*** *solitary (rarely in pairs), axillary, sessile, ebracteate, unisexual, perianth absent*. ***Male flowers*** a solitary stamen, the slender hyaline filament up to 1 cm. long, ripe anther yellow. ***Female flowers*** a 4-celled ovary, with 2 long simple, erect to recurved persistent styles. ***Fruit*** *c.* 1–2 mm. diameter, *sessile, 4-lobed, each lobe rounded, often with traces of narrow marginal wings, lateral grooves barely to weakly developed*, Figs. 3 and 6.

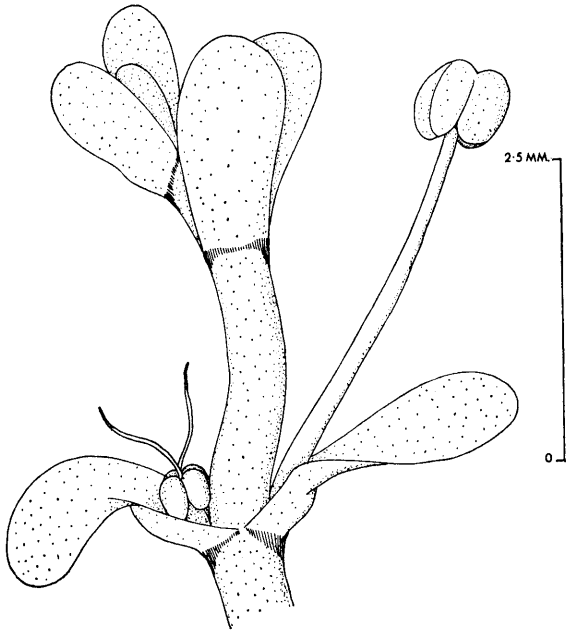


FIGURE 6
Flowering shoot of *Callitriche antarctica*.

Native. In seepage areas, by stream sides, and around pools in tussock, less commonly on wet rocks. Altitude 0–250 ft. (*c.* 0–75 m.). Common. South Georgia, Map 18; Falkland Islands; Fuegia, west and Andean Patagonia; Prince Edward Islands, Îles Crozet, Îles de Kerguelen, Heard Island, Macquarie Island.

Notes. *C. antarctica* is likely to be confused only with *Montia fontana*, and the differences between the taxa have been pointed out under that plant. Much variation occurs in the appearance of the present species, mainly because of the wetness of the habitat, and a complete series may be found connecting the compact terrestrial form with the attenuated aquatic state.

Recently Schotsman (1961) has discussed the characters of *C. antarctica* in parts of its austral range and has confirmed the identity of the South Georgian plants.

RUBIACEAE

Galium antarcticum Hook.f. Antarctic Bedstraw

A small perennial herb with slender decumbent or erect leafy shoots, forming loose tufts. ***Shoots*** 4–8 cm. long, mostly sparingly branched, *stems square in section.* ***Leaves*** (including leaf-like stipules) 3–5 × 1–2 mm., *in whorls of 4, all the members of each whorl being ± similar in length*, narrowly elliptical to obovate, rounded at apex, entire, ± sessile, glabrous, spreading to recurved. ***Flowers*** 2–3 mm. in diameter, 1–2 (–3) at the apex of the shoot or axillary from the side of the stem, hermaphrodite, actinomorphic. ***Sepals*** absent. ***Petals*** 3 (–4), tube short with spreading lobes, *white to creamy white.* ***Stamens*** epipetalous, similar in number and alternating with the petals. ***Ovary*** inferior, 2-celled, styles fused, capitate. ***Fruit*** *c.* 2 mm. in diameter, of two 1-seeded mericarps, glabrous, *borne on short thick pedicels*, Fig. 7.

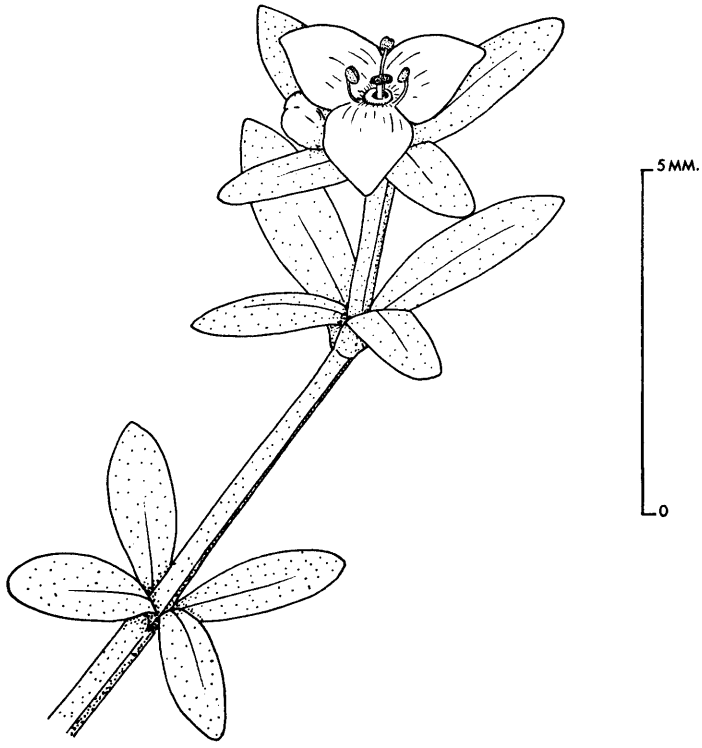


FIGURE 7
Flowering shoot of *Galium antarcticum.*

Native. Amongst *Festuca* grassland, rarely on scree. Altitude 0–550 ft. (*c.* 0–170 m.). Locally frequent. South Georgia, Map 19; Falkland Islands; Fuegia, Andean Patagonia; Îles Crozet, Îles de Kerguelen.

Notes. *G. antarcticum* is unique amongst the South Georgian vascular plants in having a square stem with leaves arranged in whorls. It is relatively inconspicuous in the vegetative state, but the presence of the small creamy white flowers render it more noticeable.

COMPOSITAE

***Taraxacum officinale** Weber, sensu lato — Dandelion

Perennial herb with erect shoots, *giving a white milky latex on crushing.* ***Leaves*** 12–25×2–8 cm., widest at or above mid-leaf and tapering below into a short petiole, *almost entire to deeply divided into variously toothed, runcinate segments*, glabrous. ***Flowers*** small, *arranged in capitula c.* 3–4 cm. in diameter, the latter solitary at the apex of unbranched scapes 8–20 cm. long. ***Capitulum*** surrounded by a calyx-like involucre of bracts, the outer lanceolate, more than three times as long as broad, spreading to reflexed, the inner erect, linear, about twice the length of the outer, lacking appendages near the tip. ***Florets*** *all ligulate, hermaphrodite, yellow.* ***Pappus*** *of simple, rough, white, hairs.* ***Fruit*** an achene *c.* 4 mm. long, brownish green, muricate above with a conical point prolonged into a slender beak, *c.* 1 cm. long, the beak expanded at apex into a disk to which the pappus is attached.

Introduced. On storm beaches and on bare ground around present and former whaling stations. Altitude 0–50 ft. (*c.* 0–15 m.). Occasional. South Georgia, Map 20.

Notes. *T. officinale*, the common dandelion of the Northern Hemisphere, may be readily identified by the characteristic, irregularly dissected leaves and the yellow "composite" flower head, white and feathery in fruit.

2. Monocotyledones

JUNCACEAE

Juncus scheuchzerioides Gaudich. — Greater Rush

J. Novae Zealandiae Hook.f. sensu Engler, 1886.

Perennial, ± tufted herb, with short erect or ascending leafy stems. ***Leaves*** sheathing at base, with linear-subulate blades, blade 3–10×0·1–0·2 cm., very variable in size, *in section circular to oval with a single internal cavity filled with a variable amount of pith and periodically interrupted by transverse septa.* ***Flowering shoots*** 5–12 cm. long. ***Flowers*** 2–3 mm. long, hermaphrodite, *in a ± compact terminal (1–) 2–3 flowered inflorescence, borne on a peduncle 1–3 cm. long*, subtended by bracts less than, or 1–1·5 times the length of the perianth. ***Perianth segments*** 6, ovate-lanceolate, tapering to narrow apices, *greenish.* ***Stamens*** 6. ***Ovary*** superior with trifid stigma. ***Fruit*** a capsule, when mature *trigonous*, brown, *in length (to base of style) not, or only slightly, exceeding perianth*, Fig. 8 and Plate Va.

Native. In seepage areas, by streams and in bogs. Altitude 0–250 (–500) ft. [*c.* 0–75 (–150) m.]. Frequent. South Georgia, Map 21; Falkland Islands; Fuegia, Andean Patagonia; Macquarie Island.

Notes. *J. scheuchzerioides* is unlikely to be confused with any other species except *J. inconspicuus*, the differences being enumerated under that plant. When vegetative, the septate leaves, oval to circular in section with a single pith-filled cavity, will distinguish both species of rushes from *Rostkovia magellanica* as well as from all known South Georgian grasses and the sedge.

J. scheuchzerioides is extremely variable in size. In addition to the forms included in the above description, there exist on South Georgia sterile forms which are commonly larger than the fertile plants, having leafy shoots up to 25 cm. long and leaf blades 6–15×0·2–0·3 cm. These forms may be abundant beside streams and in seepage areas and occur with the fertile plants, but their relationships are unknown; herbarium material of these forms has been identified as *Juncus* sp.

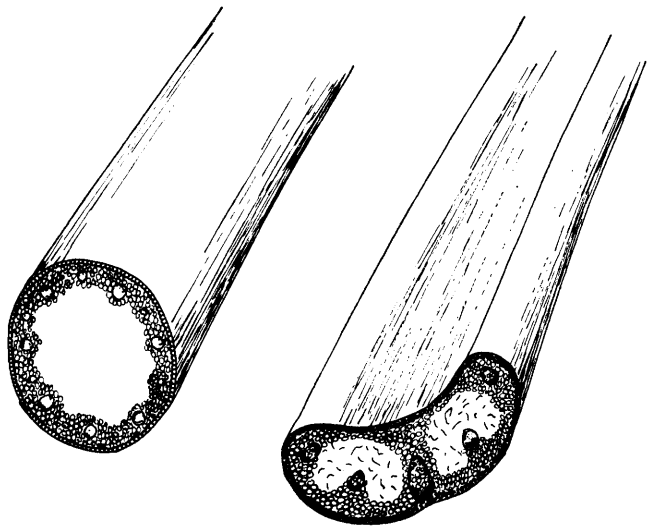


FIGURE 8
Leaf sections (at mid-length of blade) of *Juncus scheuchzerioides* (left) and *Rostkovia magellanica* (right).

Skottsberg (1905) referred to another species of *Juncus* on South Georgia as "Juncus sp. . . . Dubiosus restat." The plant was not referred to in his later publication on the South Georgian flora (Skottsberg, 1912), but his specimen in Stockholm was determined by him in 1953 as *J. scheuchzerioides* Gaud. f. *depauperata*; the plant appears to be nothing more than a small form of *J. scheuchzerioides*.

Juncus inconspicuus (D'Urv.) Hook.f. Lesser Rush

Similar to *J. scheuchzerioides* but normally smaller in all its parts. ***Flowering shoots*** 1–2 cm. long. ***Leaf blades*** 0·5–1·5 cm. long, in section similar to *J. scheuchzerioides*. ***Inflorescence*** *1 (–2) flowered, sessile or almost so.* ***Perianth segments*** *ovate, acute to obtuse, the inner with broad hyaline margins.* ***Fruit*** when mature *obovate*, brown, *its length (to base of style) much exceeding the perianth.*

Native. In seepage areas and by streams. Altitude 150–250 ft. (*c.* 45–75 m.). Rare. South Georgia, Map 22; ? Falkland Islands; Fuegia, ? west Patagonia.

Notes. The normally sessile 1 (–2) flowered inflorescence of the present plant contrasts with the peduncled 2–3 flowered inflorescence of *J. scheuchzerioides*, and further differences are to be found in the shape of the perianth members and the fruits. Although plants of *J. inconspicuus* show little variability in these characters, 1–2 flowered shoots may be encountered attached to plants of *J. scheuchzerioides* bearing 2–3 flowered inflorescences; also plants of *J. scheuchzerioides* may, rarely, have the inner perianth members with hyaline margins. Accordingly, the status of the present species must remain doubtful until its relationship with the forms of *J. scheuchzerioides* has been fully elucidated.

Rostkovia magellanica (Lam.) Hook.f. Brown Rush

Perennial herb with creeping underground stems which periodically produce erect, ± tufted, leafy shoots. ***Leaves*** ± erect, with sheathing base and *linear, channelled blades, smooth*, blade, 8–15 × 0·1 cm., in colour brown to greenish-brown, *in section* ± *bi-convex, with two internal cavities loosely filled with pith.* ***Ligule*** < 1 mm., papery, formed of 2 rounded overlapping flaps, each distinct to base at centre. ***Flowering shoots*** 10–18 cm. long (to top of longest bract) variable in size, with the upper leaves at least overtopping the long bract. ***Flowers*** 6–8 mm. long, hermaphrodite, *solitary, borne terminally on a long peduncle from the*

apex of the erect shoot, subtended by 2 unequal leaf-like bracts, lower bract about equalling the length of the flower, the upper much exceeding it, 2·0–3·5 cm. long, broad at base subulate above. ***Perianth segments*** 6, ovate-lanceolate, ± *scarious with reddish brown centre and narrow pale margins*, persistent. ***Stamens*** 6. ***Ovary*** superior, with an elongate style and trifid stigma. ***Fruit*** a capsule, *when mature globular, black to reddish-brown, shining*, reaching or just exceeding the top of the perianth, the base of the style usually remaining as a short beak, indehiscent, Fig. 8 and Plate Vb.

Native. In bogs, seepage areas, stream banks and in moist areas of *Festuca* grassland. Altitude 0–750 (–1,000) ft. [*c.* 0–225 (–300) m.]. Abundant. South Georgia, Map 23; Falkland Islands; Fuegia, west and Andean Patagonia.

Notes. When flowering or fruiting, *Rostkovia magellanica* is not likely to be mistaken for any other species except, perhaps, a species of *Juncus*, but the solitary large brownish flowers are strikingly distinct from the smaller, greener, 1–3 flowered heads of *Juncus*. When vegetative, the two genera may be readily separated by the nature of the leaf section and the presence or absence of transverse septa in the leaf blade. Individual leaves of *R. magellanica* bear a distinct resemblance to the leaves of *Festuca erecta*, but the presence of minute hairs on the upper surface of the *Festuca* leaves as well as their arrangement and colour, combined with the different growth form of that species, will enable the vegetative plants of the two species to be separated with confidence.

CYPERACEAE

Uncinia smithii Philcox — Smith's Sedge

Perennial herb, with creeping rhizomes which periodically give rise to erect leafy shoots. ***Leaves*** *arranged in 3 distinct rows, with their blades recurved*, blades 8–12×0·1–0·2 cm. linear, *channelled or keeled, with fine ridges on upper surface, margins and back of midrib scabrid above*, bases sheathing, with a short ligule at junction of base and blade. ***Inflorescence*** *a simple spike*, 1–2×0·2–0·3 cm., *narrowly cylindrical*, elevated on a straight or curved peduncle 6–10 cm. long (excluding spike), normally overtopped by the leaves, androgynous. ***Flowers*** *unisexual, the male forming a group at the apex of spike, the female comprising most of its length.* ***Male glumes*** 4–5 mm. long, oblong, at apex rounded and often laciniate, green to brown at centre with scarious margins. ***Stamens*** 3. ***Female glumes*** 4–5 mm. long, broadly ovate, amplexicaul at base, tapering to an acute or rounded apex, green to brown at centre with moderately broad, scarious, entire, margins. ***Stigmas*** 3. ***Fruit*** 4–5 mm. long, when mature surrounded by an inflated utricle which slightly exceeds the top of the glume, narrowly elliptical in outline and shortly beaked, biconvex in section, *scabrid above particularly on margins.* ***Rhachilla*** *exceeding beak of utricle* by 3–5 mm., *hooked at apex, smooth*, Plate Vc.

Native. In *Festuca* grassland. Altitude 0–550 (–1,250) ft. [*c.* 0–170 (–375) m.]. Locally frequent. South Georgia, Map 24; Endemic.

Notes. The stems, because of their recurved leaves arranged in 3 rows, are quite unlike those of any other species known from South Georgia and enable *U. smithii* to be easily identified in the vegetative state. When fertile, the spike-like inflorescences, with prominent hooked appendages protruding from the fruits are unmistakable. The species was first collected between the Harker and Hamberg Glaciers on 10 February 1957 by Jeremy Smith, in whose honour it was named (Philcox, 1961). The holotype is preserved at Kew.

GRAMINEAE

Festuca erecta D'Urv. — Tufted Fescue. "Land tussac" of the Falkland Islands

An erect, densely tufted perennial herb, *with the erect leafy shoots inserted ± on opposite sides of the erect stems giving a conspicuously flattened appearance to the culms.* ***Leaf blades*** 8–12×0·1 cm. linear-setaceous, *the upper surface minutely hairy, and usually strongly channelled particularly on the sterile shoots, less so on flowering shoots, borne stiffly erect.* ***Ligule*** very short in the centre but raised into a

conspicuous rounded flap at either side, papery. ***Flowering shoots*** 18–25 cm. long, erect, with a terminal branched inflorescence. ***Panicle*** 6–10 × *c.* 1 cm., *the branches remaining erect and appressed, being arranged* ± *along one side of the inflorescence axis.* ***Spikelets*** 8–10 mm. long, of 3–5 hermaphrodite florets, flattened, *purplish green to purplish at maturity.* ***Glumes*** a little shorter than spikelet, *unequal to subequal*, ovate-lanceolate, acute, keeled, normally both 3-nerved, lower rarely 2-nerved, upper rarely 4-nerved, margins membranous and shortly ciliate at apex, keel scabrid on back, the glume surfaces often finely so. ***Lemma*** ovate-lanceolate, acute, *emarginate at apex, tapering into a short scabrid terminal awn*, 5-nerved, margins membranous and shortly ciliate, scabrid on back. ***Palea*** ± equalling length of lemma, ovate-lanceolate, membranous, 2-nerved, emarginate at apex, scabrid on back. ***Lodicules*** 2, minute, lobed. ***Stamens*** 3. ***Ovary*** smooth with 2 feathery stigmas, Plate Vd.

Native. On stable, well drained moraines, rarely on screes and in bogs. Altitude 0–500 (–1,250) ft. [*c.* 0–150 (–375) m.]. Abundant. South Georgia, Map 25; Falkland Islands; Fuegia; Îles de Kerguelen, Macquarie Island.

Notes. This grass, by virtue of its tufted habit and inflorescence with erect appressed branches bearing flattened spikelets, cannot be confused with any other species known from the island. The setaceous leaf blades are more reminiscent of *Rostkovia magellanica* than of any of the other grasses, and characters that will separate vegetative plants of the two species are pointed out in the notes under that plant. Plants in cultivation are more luxuriant than any seen in the field, having leaf blades up to 15–22 cm. long.

Poa flabellata (Lam.) Hook.f. Tussock or Tussac Grass

Dactylis glomerata sensu Forster, 1776, 1777, and Sparrman *in* Rutter, 1953.

A robust erect growing herb forming dense tufts, *the shoots aggregating to form a low stool which is crowned by spreading leaves*, well grown tufts 1 m. or more in diameter. ***Leaf blades*** 30–50 × 1–1·5 cm., linear, channelled, minutely scabrid on upper surface, usually recurved at apex. ***Ligule*** long and irregularly torn, papery. ***Flowering shoots*** variable in size averaging 1 m. in length, erect, with a terminal inflorescence. ***Panicle*** 5–10 × 1 cm., *spike-like, the branches standing erect and appressed to the inflorescence axis so that the whole has an ovoid or cylindrical, usually rather lobed, appearance.* ***Spikelets*** 7–9 mm. long, usually of 3–4 hermaphrodite florets, flattened, yellowish green, tinged with purple. ***Glumes*** *unequal*, the upper a little longer than the lower, ovate-lanceolate, the upper 1–3 nerved, the lower 1-nerved, mucronate, membranous, smooth with shortly ciliate margins. ***Lemma*** ovate-lanceolate, *tapering gradually to* ± *abruptly contracted, at apex produced into a short terminal awn*, keeled, 3–5 nerved, the margins membranous and shortly ciliate, scabrid on back, particularly on the nerves. ***Palea*** variable in length but shorter than lemma, oblong and broadest above middle, membranous, 2-nerved, emarginate at apex with 2 prominent points, a nerve running into each, margins shortly ciliate, scabrid on back of nerves and with a longitudinally running central groove. ***Lodicules*** 2, minute, lobed. ***Stamens*** 3. ***Ovary*** smooth with 2 feathery stigmas, Plate Vd.

Native. On dry or wet peat, scree or rock surfaces in coastal regions, rarely extending far inland. Altitude 0–500 ft. (*c.* 0–150 m.). Abundant. South Georgia, Map 26; Falkland Islands; Fuegia, west Patagonia.

Notes. *Poa flabellata*, by nature of its growth form and size, as well as the shape and size of its spike, is unlikely to be confused with any other species known from South Georgia; the spike-like panicle is totally different from the spreading inflorescences of the remaining two species of the genus.

***Poa annua** L. Annual Poa

An annual or short-lived perennial herb with slender, erect, leafy shoots forming loose to compact tufts, *lacking distinct creeping rhizomes*; shoots spreading to erect, sometimes with a creeping base. ***Leaf blades*** (2–) 3–4 (–7) × 0·2–0·3 cm., variable in length, linear, flat or slightly keeled, *often with distinct transverse undulations near the hooded apex*, erect to spreading. ***Ligule*** 2–3 mm. long, membranous. ***Flowering shoots***

5–15 (–25) cm. long, variable in height, *bearing a terminal freely branched inflorescence.* ***Panicle*** 2–4 (–8) cm. *the branches arising 1–2 (–3) together, spreading at maturity.* ***Spikelets*** 3–5 mm. long, composed of 3–5 hermaphrodite florets, flattened, green, tinged with purple at maturity. ***Glumes*** unequal, ovate-lanceolate to elliptical, keeled, the lower 1 (–2) nerved, the upper 3-nerved, margins hyaline, entire, back of central nerve scabrid. ***Lemma*** broadly ovate to oblong, rounded or bluntly pointed at apex, keeled, 5-nerved, margin entire, hyaline below, becoming broader and minutely and irregularly lobed or toothed at apex, *nerves smooth, or keel with short straight hairs from base to about mid-length, smooth above.* ***Palea*** slightly shorter than lemma, narrowly oblong, hyaline, 2-nerved, irregularly lobed or toothed at apex, with longitudinally running central groove, finely hairy on backs of nerves. ***Lodicules*** 2, minute, lanceolate. ***Stamens*** 3. ***Ovary*** smooth with 2 feathery stigmas, Plate VIa.

Introduced. On moraines, on storm beaches, and on bare stony ground around the whaling stations, less commonly on screes, by stream sides in bogs and seepage areas. Altitude 0–250 (–1,000) ft. [*c.* 0–75 (–300) m.]. Locally frequent. South Georgia, Map 27.

Notes. Owing to its small size and branched panicle *P. annua* will not be confused with *P. flabellata*; the differences between *P. annua* and *P. pratensis* are enumerated under that plant. For a comparison with *Deschampsia antarctica* see notes under that plant.

***Poa pratensis** L. Meadow Grass

Similar in vegetative form and panicle type to *Poa annua* but differing in the following characters: perennial *with distinct creeping rhizomes,* forming ± compact tufts; erect flowering shoots, 30–50 cm. long. ***Leaf blades*** (4–) 8–15 (–25) × 0·3–0·4 cm., very variable in length, *normally lacking transverse undulations near the hooded apex.* ***Ligule*** *short,* 1 (–2) mm. ***Panicle*** (2–) 5–10 (–13) cm. long, *branches erect to ascending, arising 2–5 together at a node.* ***Glumes*** unequal, acute, both 3-nerved. ***Lemma*** acute, scabrid near apex, *hairy on keel and backs of marginal nerves from mid-length or just above, the hairs getting longer and more crinkled towards the base.* ***Lodicules*** lobed, Plate VIb.

Introduced. In seepage areas, and on bare ground around whaling stations, rarely around pools amongst tussock. Altitude 0–50 ft. (*c.* 0–15 m.). Locally frequent. South Georgia, Map 28.

Notes. *P. pratensis* is likely to be confused only with *P. annua.* When flowering, the two species are most easily separated by a comparison of the number of branches arising together at the lowest nodes of the inflorescence, but important differences also exist in the nature of the hairs on the backs of the lemmas. Vegetative plants are most easily identified by examining the bases of the erect shoots for the presence or absence of creeping underground stems, but characters of leaf blade and ligule may also be used. For a comparison with *Deschampsia antarctica* see the notes under that plant.

Deschampsia antarctica Desv. Antarctic Hair-grass

Aira antarctica Hook. sensu Engler, 1886, and Skottsberg, 1912; *D. antarctica* (Hook.) Desv. sensu Skottsberg, 1905; *D. elegantula* (Steud.) Parodi sensu Greene and Greene, 1963.

A perennial herb with erect vegetative shoots forming low dense mats which at times coalesce to form a sward. ***Leaf blades*** 3–8 × 0·1–0·2 cm., linear, *flattened or compressed, with conspicuous longitudinal grooves on their upper surfaces.* ***Ligule*** 3–7 mm. *long and pointed, papery.* ***Flowering shoots*** 8–20 cm. long or longer, very variable in size, erect, *with a terminal, freely branched, inflorescence.* ***Panicle*** 5–10 cm. long, *the branches spreading with maturity.* ***Spikelets*** 4–6 mm. long (excluding awn), compressed, of 2 rarely 1, hermaphrodite florets, the upper slightly smaller than the lower, *silvery green becoming purple-tinged at maturity.* ***Glumes*** subequal, ovate-lanceolate, keeled, the lower 1-nerved, the upper 3-nerved, with broad membranous margins which are finely toothed above, minutely scabrid on back, particularly on nerves. ***Rhachilla*** *with a group of silky hairs at the base of each floret, produced above the upper floret into a slender*

appendage which bears two opposite rows of silky hairs. ***Lemma*** broadly oblong, irregularly toothed at apex, indistinctly 4–5 nerved, rounded on back and minutely scabrid above, *bearing from the middle, or below, a scabrid awn, the latter straight or weakly curved and about twice the length of the lemma.* ***Palea*** slightly shorter than lemma, narrowly oblong, 2-nerved, irregularly toothed at apex, finely hairy on backs of the nerves. ***Lodicules*** 2, minute, lanceolate. ***Stamens*** 3. ***Ovary*** smooth, with 2 feathery stigmas, Plate VIc.

Native. On screes and moraines, in seepage areas, by streams, on storm beaches and in rock crevices, less commonly in bogs and amongst tussock. Altitude 0–1,250 ft. (*c.* 0–375 m.). Abundant. South Georgia, Map 29; South Sandwich Islands southwards to Marguerite Bay, Antarctic Peninsula; Falkland Islands; Fuegia, Andean Patagonia; Îles Crozet, Îles de Kerguelen, Heard Island.

Notes. The branched spreading inflorescences of this species readily distinguish it from all other known native grasses. It is only likely to be confused with *Poa annua* or *Poa pratensis* and it may readily be separated from both by the presence of the awns and the longer panicle branches. When vegetative, the long narrow pointed ligule and the narrow compressed leaf prevent confusion with the flat-leaved, shorter liguled, species of *Poa.*

D. antarctica, which Skottsberg (1954) reported as being cleistogamous, is extremely variable, its robustness apparently depending upon the degree of exposure of the habitat. Material from the South Sandwich Islands, South Orkney Islands, South Shetland Islands and the Antarctic Peninsula differs from South Georgian plants in being more stunted with short unexpanded or only slightly spreading inflorescences and dwarfed shoots. However, plants in cultivation, raised from South Georgian seed, are more luxuriant than anything seen in the field, having leaf blades up to 13–17 cm. ×2 mm., and the ligule 7–10 mm. long. While flowering freely in most habitats in South Georgia, a robust form occurs very commonly in seepage areas and by streams and it appears to be habitually sterile.

Phleum alpinum L. Alpine Cat's-tail

P. commutatum Gaud. sensu Hubbard, 1954.

A rather stout perennial herb, with creeping stems and ± erect vegetative shoots. ***Leaf blades*** 5–9 ×0·3–0·6 cm., very variable, linear-lanceolate, *flattened and often with a purplish tinge.* ***Ligule*** *short and rounded, papery.* ***Flowering shoots*** 10–18 cm. long or longer, variable in height, usually creeping at first, later erect, *the leaf blades being shorter than on the vegetative shoots and with conspicuously inflated leaf sheaths,* bearing a terminal inflorescence. ***Panicle*** 1·5–3·0 ×0·5–1·0 cm., *spike-like, shortly ovoid to broadly cylindrical.* ***Spikelets*** 5–8 mm. long (including awn), of 1 hermaphrodite floret, *strongly compressed and with a distinct purplish tinge.* ***Glumes*** subequal, oblong, keeled, 1–3 nerved, *rounded at apex and produced into a straight or curved awn which is about half the length of the glume,* margins membranous to purplish, *on back densely covered with minute hairs which on the keel are long and stiffly spreading, forming a conspicuous fringe almost to the base of the scabrid awn.* ***Lemma*** half to two-thirds the length of the glume, ± oblong, keeled, 3-nerved, membranous, at apex truncate and bluntly toothed, on back minutely hairy on nerves, the hairs being most conspicuous on the keel. ***Palea*** shorter than lemma, ovate-lanceolate, 1–3 nerved, membranous, rounded at extreme apex, hairy like the lemma. ***Lodicules*** 2, minute, lobed. ***Stamens*** 3. ***Ovary*** smooth, with 2 feathery stigmas, Plate Vd.

Native. On screes and moraines, in *Festuca* grassland, and in rock crevices, rarely in bogs and by streams. Altitude 0–750 (–1,250) ft. [*c.* 0–225 (–375) m.]. Very common. South Georgia, Map 30; Fuegia, Andean Patagonia.

Notes. This grass has a unique appearance due to the presence of broad leaves with conspicuously inflated sheaths on the flowering stems. The stout, normally cylindrical inflorescence, which on close examination is "bristly" because of the abundance of rigid hairs on the surfaces of the glumes, is also distinctive. It is only likely to be confused with *Alopecurus antarcticus*, but the two species may be readily distinguished by characters of the leaves and spikelets.

Alopecurus antarcticus Vahl. Antarctic Foxtail

A tall slender perennial herb, with creeping stems which give rise to erect shoots. ***Leaf blades*** 12–18 × 0·3–0·4 cm., variable in length, linear, *spreading, flattened or channelled, with a distinct greenish-blue colour.* ***Ligule*** *prominent, rounded, often torn, papery.* ***Flowering shoots*** 30–50 cm. long, variable in height, erect, bearing a terminal inflorescence. ***Panicle*** 1·5–2·5 × 0·8–1·0 cm., *spike-like, ovoid or ± conical.* ***Spikelets*** *c.* 5 mm. long, crowded, of 1 hermaphrodite floret, *strongly compressed and with a silver-purple tinge.* ***Glumes*** subequal, *equalling or slightly exceeding the lemma,* ovate-lanceolate, keeled, 3-nerved, *on back densely clothed with silky hairs, particularly on the keels.* ***Lemma*** broadly ovate, strongly keeled, 5-nerved, membranous with margins fused below for about a quarter of their length, *with a short awn arising from about mid length of back of keel, awn a little longer than lemma and protruding for a short distance above the apices of the glumes,* on back scabrid above and sparsely covered with silky hairs near the margins. ***Palea*** 0. ***Lodicules*** 0. ***Stamens*** 3. ***Ovary*** smooth with 2 feathery stigmas, Plate Vd.

Native. In seepage areas and by stream sides. Altitude 0–250 ft. (*c.* 0–75 m.). Locally frequent. South Georgia, Map 31; Falkland Islands; Fuegia, Andean and east Patagonia.

Notes. By colour alone, this grass may be distinguished from all the known South Georgian species, and its ovoid to conical inflorescence is only likely to be confused with the more cylindrical inflorescence of *Phleum alpinum.* Owing to the abundance of silky hairs on the surface of the glumes, the spikelets of *A. antarcticus* are "softly" hairy in contrast to the "bristly" appearance of the inflorescences of *P. alpinum.* The arrangement of the awns is also different in both species.

E. Glossary

Achene — A small, dry, indehiscent, one-seeded fruit.

Actinomorphic — Radially symmetrical.

Alternate — (of leaves) See *leaf arrangement.*

Apocarpous — An ovary with the carpels free, not fused; see also *flower.*

Appressed — Pressed close to another organ, but not fused to it.

Awn — A stiff bristle-like projection from the lemma or glume of a grass.

Bract — A modified leaf associated with an inflorescence; *bracteate*—with bracts; *ebracteate*—lacking bracts.

Calyx — See *flower.*

Capitulum — A compact inflorescence formed of many sessile flowers aggregated at the apex of a peduncle.

Ciliate — Bearing a marginal fringe of fine hairs; see also *margin.*

Cordate — (of leaf base) Having basal lobes which project below the point of attachment of the blade.

Corolla — See *flower.*

Crenate — See *margin.*

Cuneate — (of leaf base) Wedge-shaped.

Cuspidate — (of an apex) Bearing a distinct point, the sides tapering gradually from below.

Decussate — See *leaf arrangement.*

Dehiscent — Opening to shed its seeds or spores: the opposite is *indehiscent.*

Dentate — See *margin.*

Ebracteate — See *bract.*

Entire — (of margin) Not lobed or toothed; see also *margin.*

Flower — The reproductive part of a plant, borne on a receptacle at the apex of a *pedicel* or *peduncle.* It is normally composed of 4 sets of parts:

i. an outer *calyx* of green sepals;
ii. an inner *corolla* of brightly coloured petals. (A separate calyx and corolla may be replaced by a sepaloid or petaloid *perianth*);

iii. one or more *stamens* each consisting of a filament and terminal anther (which produces pollen);
iv. a centrally placed *ovary*, composed of one or more separate or fused carpels (which produce seeds), bearing style(s) and stigma(s). One or more of these 4 sets of parts may be absent. In grasses (see *spikelet*) the flowers are very reduced in structure and in the Compositae and some Rosaceae (e.g. *Acaena*) many small flowers are arranged in heads.

Glabrous Lacking hairs.

Glaucous Pale bluish-green.

Glume See *spikelet*.

Imbricate Edges overlapping like the scales of a fish.

Imparipinnate See *pinnate*.

Incised (of leaves) With the margin deeply cut.

Indusium A membrane covering the *sorus* of a fern; sori lacking an indusium are described as naked.

Inflorescence A flowering branch or portion of the stem above the last stem leaves, with its branches, bracts and flowers.

Keeled Bearing a ridge on the back, but distinct from a channelled structure of U- or V-shaped section.

Laciniate Deeply and irregularly divided into narrow segments.

Leaf arrangement Leaves are *opposite*, when inserted on an axis, in pairs, at the same level, at the ends of a diameter; *decussate*, when opposite with successive pairs at right angles; *whorled*, when a ring of leaves arises at, or nearly at, the same level; *alternate*, when inserted singly at different levels.

Leaf insertion Leaves may be *stalked*, with a petiole, or *sessile*, when a petiole is absent and the leaf blade directly adjoins the stem.

Lemma See *spikelet*.

Ligulate Strap-shaped.

Ligule (of leaves) A small flap of tissue borne at the base of a leaf, or at the junction of a leaf blade and sheath.

Linear Long, narrow and $\pm$ parallel-sided.

Lobed See *margin*.

Lodicule See *spikelet*.

Margin The edge of a leaf or other structure as seen in face view. A margin may be *entire*, when not lobed or toothed, though it may be *ciliate*; *lobed*, when cut into comparatively large segments which do not reach the midrib; *toothed* when subdivided into comparatively small segments (= teeth), which are described as *dentate* if the teeth are pointed and directed outwards, *serrate* if the teeth are pointed and directed forwards, and *crenate* if the teeth are rounded instead of pointed.

Membranous Thin and delicate, flexible, not green; see *scarious*.

Node A point on an axis where one or more leaves or branches arise.

Obovate An egg-shaped (= ovate) outline, with the broadest point above the middle, not below it.

Opposite (of leaves) See *leaf arrangement*.

Ovary See *flower*.

Palea See *spikelet*.

Panicle A branched inflorescence.

Pedicel The stalk of a single flower in a compound inflorescence.

Peduncle The stalk of a solitary flower, or of an inflorescence.

Perianth See *flower*.

Pilose Hairy with rather long soft hairs.

Pinna The primary division of a pinnate leaf, itself often pinnate or *pinnatifid*; see also *pinnate, pinnule*.

Pinnate (of leaves) Divided into leaflets arranged in opposite pairs along a common axis, with (= *imparipinnate*) or without a terminal leaflet. The leaflets themselves may be pinnate, when the leaf is said to be *bipinnate*. When the leaf is pinnately lobed but not divided into separate leaflets it is described as *pinnatifid*.

Pinnule The primary division of a pinna in a bipinnate leaf; see *pinna, pinnate*.

Recurved Curved backwards; see *reflexed*.

Reflexed Bent sharply backwards; see *recurved*.

Rhachilla See *spikelet*.

Rhachis (of pinnate leaves) The leaf axis above the lowest pair of leaflets, i.e. the continuation from the petiole.

Rhizome An underground stem, persisting for more than one year; see *stolon*.

Runcinate (of leaf) Pinnately lobed, with the lobes directed toward the base.

Scabrid Rough.

Scarious Chaffy or papery, thin, not green, rather stiff and dry; see *membranous*.

Serrate See *margin*.

Sessile See *leaf insertion*.

Setaceous Bristle-like, very long and fine; see *subulate*.

Sorus A group of *sporangia*, often covered by an *indusium*.

Spathulate From a narrow strap-like base expanding above into a broader portion.

Spike An inflorescence with sessile, or nearly sessile flowers along an axis; also used of ferns for the arrangement of sessile sporangia along an axis, e.g. *Ophioglossum*.

Spikelet The ultimate unit of a grass or sedge inflorescence. In grasses the spikelet is usually composed of 2 *glumes* (an upper and lower), and 1 or more flowers, each enclosed in two bracts, the *lemma* and *palea*, the whole arranged on an axis, the *rhachilla*. Each flower consists of the *lodicules* (usually 2), representing the perianth; *stamens* (normally 3); a single *ovary* with 2 styles. In sedges the flower is further reduced and in *Uncinia* each spikelet consists of 1 unisexual flower which lacks a perianth and is borne in the axil of a glume (referred to as male or female glume): when mature the fruit is covered by an inflated sac—the *utricle*—with the *rhachilla* projecting through its apex.

Sporangium A structure containing spores.

Stamen See *flower*.

Stolon A prostrate stem of short duration, creeping on the surface of the ground, produced by a plant with a central rosette or an erect stem.

Strobilus A cone, consisting of a dense spike of closely imbricated bracts, e.g. *Lycopodium*.

Subulate Long and narrow, tapering from the base to a fine point, ± flattened, stouter than *setaceous*.

Ternate (of leaf) Divided into 3, ± equal leaflets; *biternate*, with the ternate primary divisions themselves ternate.

Toothed See *margin*.

Trigonous Triangular in cross-section, with blunt angles.

Truncate (of leaf) The lamina ending abruptly, as though cut off.

Whorled See *leaf arrangement*.

VII. ACKNOWLEDGEMENTS

IT is a pleasure to acknowledge the support given by Sir Vivian Fuchs to the 1960–61 Botanical Expedition to South Georgia and for providing facilities that have helped the working up of the Expedition's results. I am also indebted to my Head of Department, Professor J. Heslop-Harrison, for arranging my leave of absence.

I wish to thank the Directors of the following Institutes and Herbaria for the loan of specimens: British Museum (Natural History); Brooklyn Botanic Garden; Göteborgs Botaniska Trädgard;

Systematisch-Geobotanisches Institut, Universität Göttingen; Staatsinstitut für allgemeine Botanik, Hamburg; Royal Botanic Gardens, Kew; Botanisches Institut der Universität, Kiel; Botanische Staatssammlung, München; New York Botanical Garden; Botanisk Museum, Oslo; Naturhistoriska Riksmuseum, Stockholm; Museum of the Royal Norwegian Society for Science and Letters, Trondheim; University Institute of Systematic Botany, Uppsala; United States National Museum (Smithsonian Institution), Washington; Naturhistorisches Museum, Wien; Botanischer Garten und Museum der Universität Zürich.

I am much indebted to the many people mentioned in the text who helped in various ways, and I should also like to acknowledge the following assistance: the preparation of text-figures 3–8 by W. N. Bonner; the preparation of the Glossary by P. D. Brown; the typing of the text by Mrs. C. Barton and the preparation of the photographs by Miss A. J. Cox. Messrs. W. N. Bonner, P. D. Brown and E. W. Groves as well as Drs. M. W. Holdgate and D. M. Moore have read the manuscript and made many helpful suggestions. To all these people, as well as to my wife for constant assistance throughout the preparation of the manuscript, I am extremely grateful.

Acknowledgement is also made to Messrs. Butterworth and Co. (Publishers) Ltd. for permission to reproduce Fig. 2 and Plates 1c and IIId, to the Editor of the *Polar Record* for permission to reproduce Table I, and to the Directorate of Overseas Surveys for preparing the maps, especially those showing the species distribution.

VIII. REFERENCES

ANDERSSON, J. G. 1902. The Winter Expedition of the "Antarctic" to South Georgia. *Geogr. J.*, **20**, No. 4, 405–8.

———. 1905. (*In* NORDENSKJÖLD, N. O. *and* J. G. ANDERSSON. *Antarctica or Two Years Amongst the Ice of the South Pole*, 608 pp., London, Hurst and Blackett Ltd.)

BANNISTER, J. L. 1964. Whaling Stations in South Georgia. *Polar Rec.*, **12**, No. 77, 207-09.

BELLINGSHAUSEN, F. G. VON. (*In* DEBENHAM, F. 1945. *The Voyage of Capt. Bellingshausen to the Antarctic Seas, 1819–21*, Hakluyt Society, Ser. II, **91** (259 pp.) and **92** (474 pp.), London.)

BITTER, G. 1911. Die Gattung *Acaena*. Vorstudien zu einer Monographie. *Bibl. bot. Stuttgart*, Bd. **17**, Heft 74, 1–336.

BONNER, W. N. 1958. The Introduced Reindeer of South Georgia. *Falkland Islands Dependencies Survey Scientific Reports*, No. 22, 8 pp.

BRITTEN, J. 1885. The Forster Herbarium. *J. Bot. Lond.*, **23**, 360–68.

CARSE, V. D. 1958. South Georgia Survey, 1956–57. *Polar Rec.*, **9**, No. 58, 27–28.

CHRIST, H. 1905. Über die australen *Polystichum*-arten. *Ark. Bot.*, Bd. **4**, No. 12, 1–5.

CLAPHAM, A. R., TUTIN, T. G. *and* E. F. WARBURG. 1962. *Flora of the British Isles*, 2nd ed., 1269 pp., Cambridge, University Press.

COOK, J. (*In* BEAGLEHOLE, J. C. 1961. *The Journals of Captain James Cook on His Voyage of Discovery.* **2.** *The Voyage of the Resolution and Adventure, 1772–1775*, Hakluyt Society, No. 35 (Extra Series), 1021 pp., Cambridge.)

ENGLER, A. 1886. Die Phanerogamenflora von Süd-Georgien. Nach den Sammlungen von Dr. Will. *Bot. Jb.*, Bd. **7**, 281–85.

———. 1890. Die Phanerogamenflora in Süd-Georgien. Nach den Sammlungen von Dr. Will. *Die Internationale Polarforschung 1882–1883. Die Deutschen Expeditionen und ihre Ergebnisse*, Bd. **2**, Lief. 8, 166–72.

FORSTER, J. R. *and* G. FORSTER. 1776. *Characteres Generum Plantarum quas in Itinere ad Insulas Maris Australis, collegerunt, descripserunt, annis 1772–1775.* 153 pp., London, B. White, T. Cadell and P. Elmsly.

FORSTER, G. 1777. *A Voyage Round the World in His Britannic Majesty's Sloop "Resolution" Commanded by Captain James Cook, During the Years 1772, 3, 4, and 5.* **2**, 607 pp., London, B. White, J. Robson, P. Elmsly and G. Robinson.

———. 1789. Fasciculus Plantarum Magellanicarum. *Commentationes Societatis Regiae Scientiarum Gottingensis*, **9**, 13–45.

GOEBELER, E. 1890. Die deutschen Polar-Expeditionen 1882–3, II. Zur Geologie und Flora Süd-Georgiens. *Das Ausland, Wochenschrift für Erd-und Völkerkunde*, Bd. **63**, Nr. 30, 583–85.

GREENE, S. W. 1964*a*. Problems and Progress in Antarctic Bryology. (*In* CARRICK, R., HOLDGATE, M. *and* J. PRÉVOST, ed. *Biologie Antarctique, Proceedings of the first Symposium on Antarctic Biology*, Paris, 2–8 September 1962. Paris, Hermann, 173-79.)

———. 1964*b*. Plants of the Land. (*In* PRIESTLEY, R. E., ADIE, R. J. *and* G. DE Q. ROBIN, ed. *Antarctic Research.* London, Butterworth & Co. (Publishers) Ltd., 240–51.)

———. (*a*, in prep). The 1960–61 Botanical Expedition to South Georgia.

———. *and* D. M. GREENE. 1963. Check List of the Sub-Antarctic and Antarctic Vascular Flora. *Polar Rec.*, **11**, No. 73, 411–18.

———. *and* E. W. GROVES. 1963. The W. N. Bonner (1955–61) Collection of Plants from South Georgia. *British Antarctic Survey Bulletin*, No. 2, 93–96.

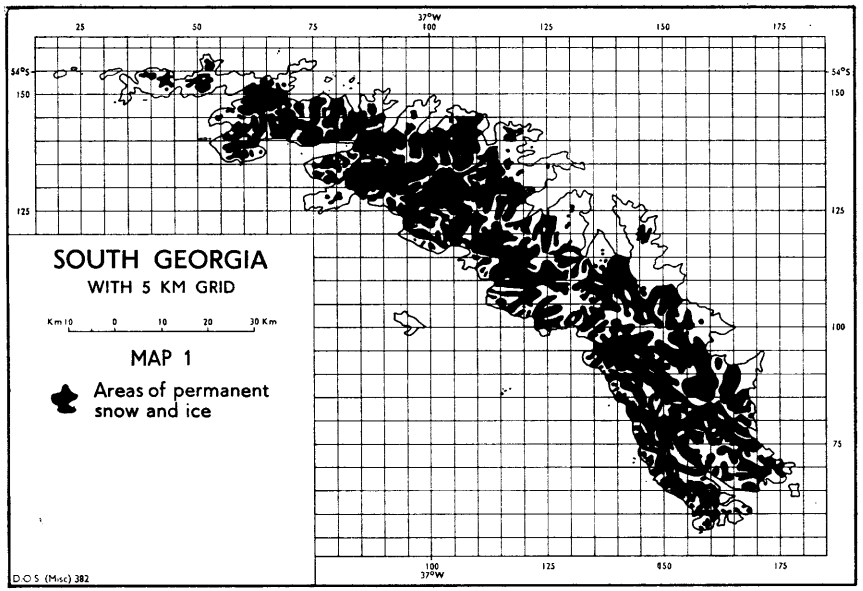
HEMSLEY, W. B. 1886. Vegetation of South Georgia. *Nature, Lond.*, **34**, No. 866, 106–7.
HILL, A. W. 1927. The Genus *Lilaeopsis:* a Study in Geographical Distribution. *J. Linn. Soc.* (*Bot.*), **47**, No. 317, 525–51.
———. 1929. Antarctica and Problems in Geographical Distribution. *Proc. 4th Int. bot. Congr., Ithaca, N.Y., 1926*, **2**, 1477–86.
HOLDGATE, M. W. *and* N. M. WACE. 1961. The Influence of Man on the Floras and Faunas of Southern Islands. *Polar Rec.*, **10**, No. 68, 475–93.
HOLTEDAHL, O. 1929. On the Geology and Physiography of Some Antarctic and Sub-Antarctic Islands, with Notes on the Character and Origin of Fjords and Strandflats of Some Northern Lands. *Sci. Res. Norweg. antarct. Exped.*, No. 3, 1–172 (50–82).
LID, J. (*In* OLSTAD, O. 1930. Rats and Reindeer in the Antarctic. *Sci. Res. Norweg. antarct. Exped.*, No. 4, 1–20.)
LOURTEIG, A. 1952. Ranunculáceas de Sudamérica Templada. *Darwiniana*, T. **9**, Nos. 3–4, 396–608.
———. *and* P. COUR. 1963. Essai sur la Distribution Géographique des plantes Vasculaires de l'Archipel de Kerguélen. *Comité National Français des Recherches Antarctiques*, No. 3, 63–70.
MATTHEWS, L. H. 1931. *South Georgia, The British Empire's Sub-Antarctic Outpost.* 163 pp., Bristol, John Wright and Sons Ltd., and London, Simpkin Marshall Ltd.
MERRILL, E. D. 1954. The Botany of Cook's Voyages and its Unsuspected Significance in Relation to Anthropology, Biogeography and History. *Chronica bot.*, **14**, Nos. 5–6, 161–383.
MOORE, D. M. 1963. The Subspecies of *Montia fontana* L. *Bot. Notiser*, **116**, Fasc. 1, 16–30.
MURPHY, R. C. 1936. *Oceanic Birds of South America.* **1**, 640 pp., New York, Macmillan Co.
———. 1948. *Logbook for Grace.* 290 pp., London, Robert Hale Ltd.
NEUMAYER, G. VON. 1891. Die Expedition nach dem Moltke-Hafen auf Süd-Georgien, deren Verlauf und Rückkehr. *Die Internationale Polarforschung 1882–1883. Die Deutschen Expeditionen und ihre Ergebnisse*, Bd. **1**, 91–144.
PEPPER, J. 1954. *The Meteorology of the Falkland Islands and Dependencies; 1944–1950.* 249 pp., London, The Crown Agents.
PHILCOX, D. 1961. An *Uncinia* from South Georgia. *Kew Bull.*, **15**, No. 2, 229.
———. 1962. Recent Records for the Flora of South Georgia. *Kew Bull.*, **16**, No. 2, 243–45.
PRANTL, K. 1890. Filices. *Die Internationale Polarforschung 1882–1883. Die Deutschen Expeditionen und ihre Ergebnisse*, Bd. **2**, Lief. 13, 328.
RANKIN, N. 1951. *Antarctic Isle, Wild Life in South Georgia.* 383 pp., London, Wm. Collins, Sons and Co. Ltd.
Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands. 1920. London, H.M. Stationery Office.
ROBERTS, B. 1958. Chronological List of Antarctic Expeditions. *Polar Rec.*, **9**, No. 59, 97–134; No. 60, 191–239.
ROIVAINEN, H. 1936. Beiträge zur Kenntnis der *Lycopodium*—Arten Feuerlands. *Ann.* (*bot.-zool.*) *Soc. zool.-bot. fenn. Vanamo*, (Botany), **6**, No. 8, 8–16.
SCHOTSMAN, H. D. 1961. Note sur le *Callitriche antarctica* Engelm. *Bull. Mus. Hist. nat., Paris*, 2e Série, **33**, No. 2, 224–27.
SKOTTSBERG, C. 1902*a*. Några ord om Sydgeorgiens Vegetation. *Bot. Notiser*, 216–24.
———. 1902*b*. The Geographical Distribution of Vegetation in South Georgia. *Geogr. J.*, **20**, No. 5, 498–502.
———. 1905. Die Gefässpflanzen Südgeorgiens. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. **4**, Lief. 3, 1–12.
———. 1907. Vegetationsbilder aus Feuerland, von den Falkland Inseln und von Südgeorgien. *Vegetationsbilder*, Bd. **4**, Heft 3–4, T. 13–24.
———. 1912. The Vegetation in South Georgia. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. **4**, Lief. 12, 1–36.
———. 1913. A Botanical Survey of the Falkland Islands. Botanische Ergebnisse der schwedischen Expedition nach Patagonien und dem Feuerlande, 1907–09. *K. svenska VetenskAkad. Handl.*, Bd. **50**, Häft 3, 1–129.
———. 1916. Die Vegetationsverhältnisse längs der Cordillera de los Andes S. von 41° S. Br. Botanische Ergebnisse der schwedischen Expedition nach Patagonien und dem Feuerlande 1907–09. *K. svenska VetenskAkad. Handl.*, Bd. **56**, Häft 5, 1–366.
———. 1954. Antarctic Flowering Plants. *Bot. Tidsskr.*, **51**, 330–38.
SPARRMAN, A. 1953. (*In* RUTTER, O. *A Voyage Round the World with Captain James Cook in H.M.S. Resolution by Anders Sparrman.* Translated by H. Beamish and A. Mackenzie-Grieve, 214 pp., London, Robert Hale Ltd.)
TARDIEU-BLOT, M. L. 1962. Sur les *Grammitis* des Îles Australes. *Adansonia*, Nouvelle Série, Tome **2**, Fasc. 1, 111–16.
TAYLOR, N. 1914. Plants Collected on the South Georgia Expedition. (*In* MURPHY, R. C., A report on the South Georgia Expedition. *Sci. Bull. Brooklyn Inst.*, **11**, No. 14, 43–102 (60–63).)
TAYLOR, B. W. 1955. The Flora, Vegetation and Soils of Macquarie Island. *A.N.A.R.E. Rep.*, Ser. B, **2**, 1–192.
TRENDALL, A. F. 1953. The Geology of South Georgia: I. *Falkland Islands Dependencies Survey Scientific Reports*, No. 7, 26 pp.
———. 1959. The Geology of South Georgia: II. *Falkland Islands Dependencies Survey Scientific Reports*, No. 19, 48 pp.
WACE, N. M. 1960. The Botany of the Southern Oceanic Islands. *Proc. roy. Soc.*, Ser. B, **152**, No. 949, 475–90.
WEDDELL, J. 1825. *A Voyage Towards the South Pole Performed in the Years 1822–24.* 276 pp., London, Longman, Hurst, Rees, Orme, Brown and Green.
WILKINS, G. H. 1923. (*In* WILD, F. *Shackleton's Last Voyage: The story of the "Quest" . . . From the official journal and private diary kept by Dr. A. H. Macklin*, Appendix 2. Natural History. 328–40, London, Cassell and Co.)
———. 1925. Gough Island. *J. Bot. Lond.*, **63**, 65–70.

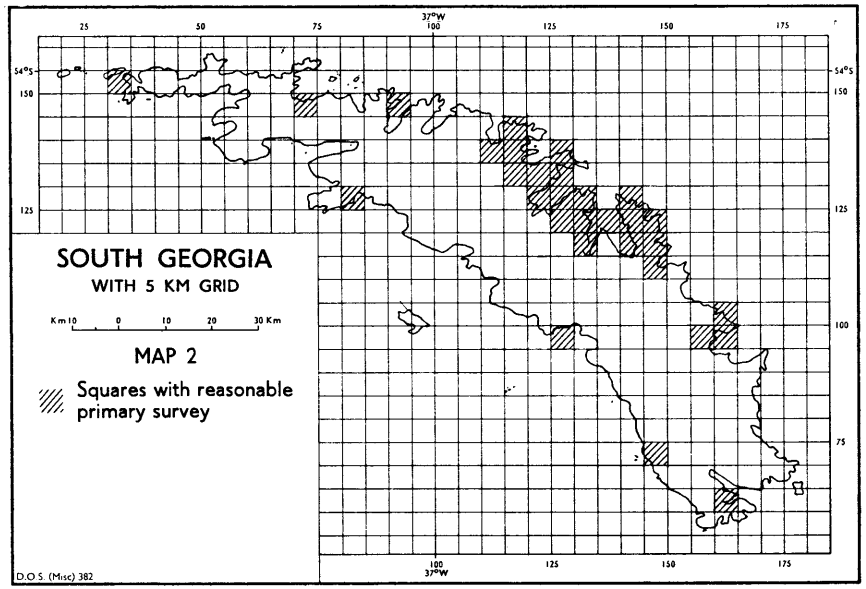
WILL, H. 1884. Das Exkursionsgebiet der deutschen Polarstation auf Süd-Georgien in geognostischer, floristischer, und faunistischer Beziehung. (*In* MOSTHAFF, E. *and* H. WILL: 'Die Insel Süd-Georgien. Mitteilungen von der deutschen Polarstation daselbst 1882–83'. *Dte. geogr. Bl*, Bd. **7**, Heft 2, 113–51 (116–44).)

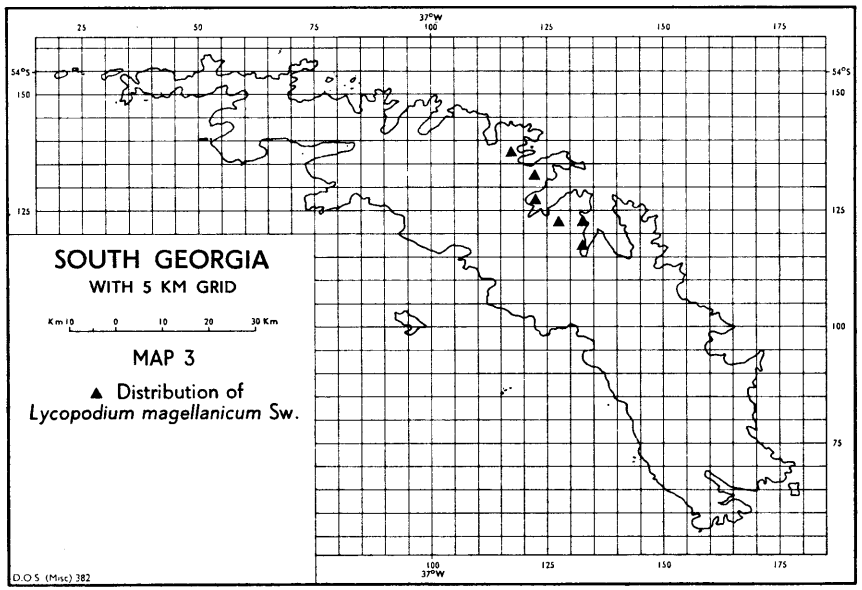
————. 1887. Die Vegetationsverhältnisse des Exkursionsgebietes der deutschen Polarstation auf Süd-Georgien. *Bot. Zbl.*, Bd. **29**, No. 8, 251–56; No. 9, 281–83.

————. 1890. Vegetations-Verhältnisse Süd-Georgiens. *Die Internationale Polarforschung 1882–1883. Die Deutschen Expeditionen und ihre Ergebnisse*, Bd. **2**, Lief. 9, 172–94.

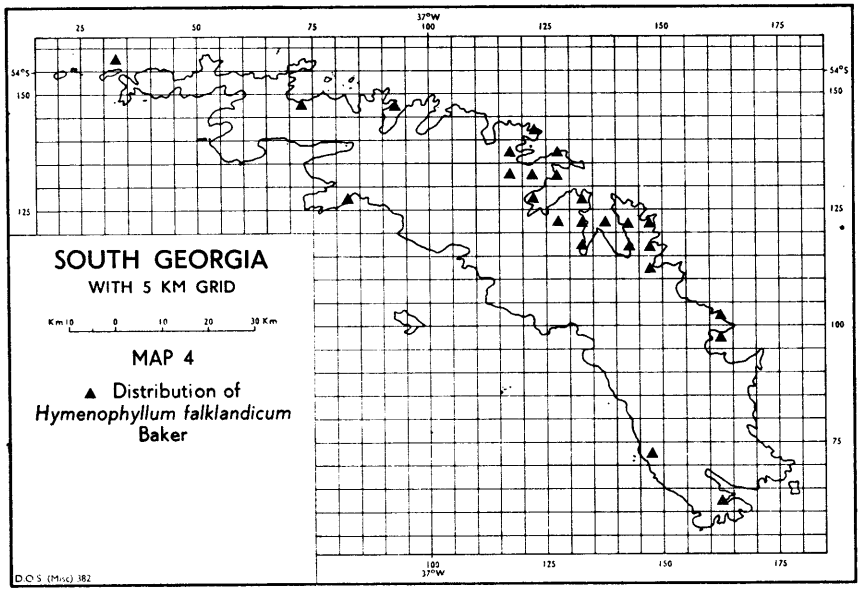
WILSON, J. I. 1912. The Coast of South Georgia. *Geogr. J.*, **39**, No. 1, 77–79.

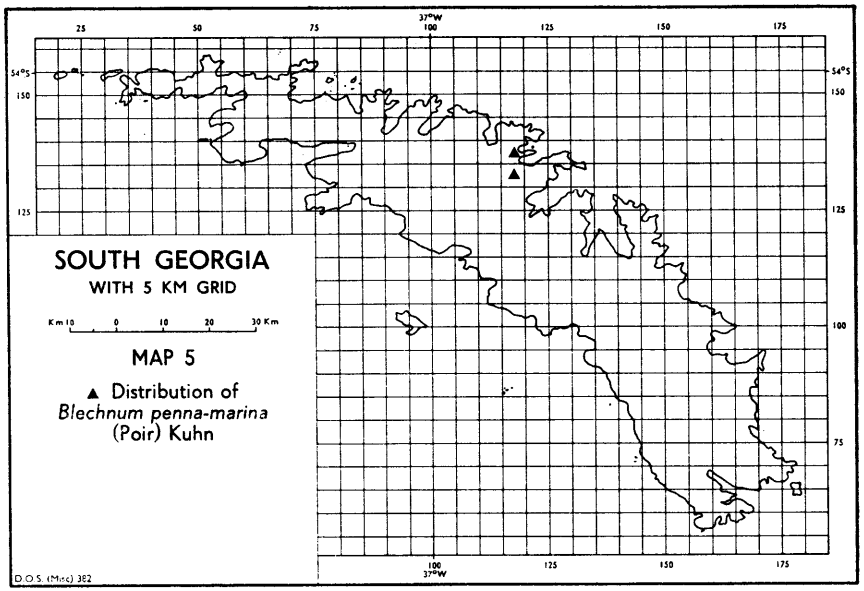

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 1
Areas of permanent snow and ice
D.O.S. (Misc) 382

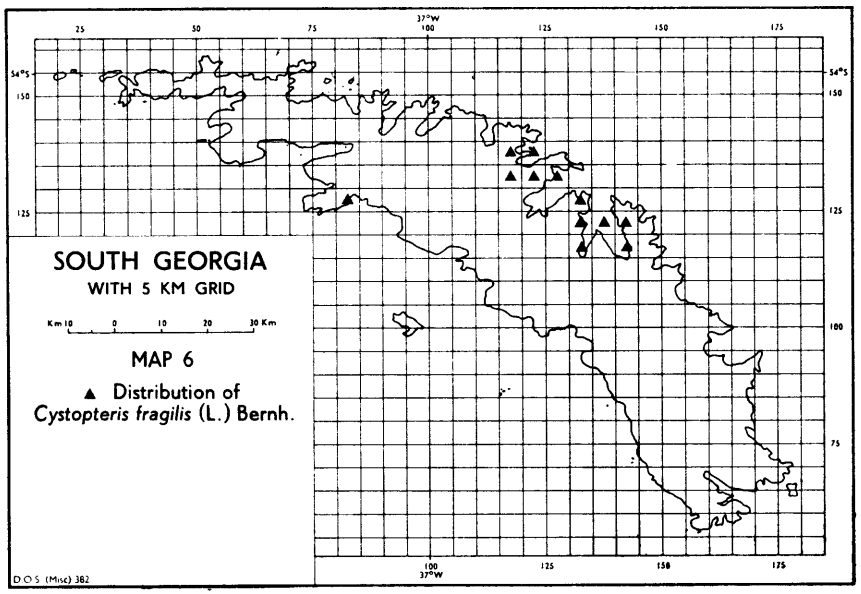

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 2
Squares with reasonable primary survey
D.O.S. (Misc) 382

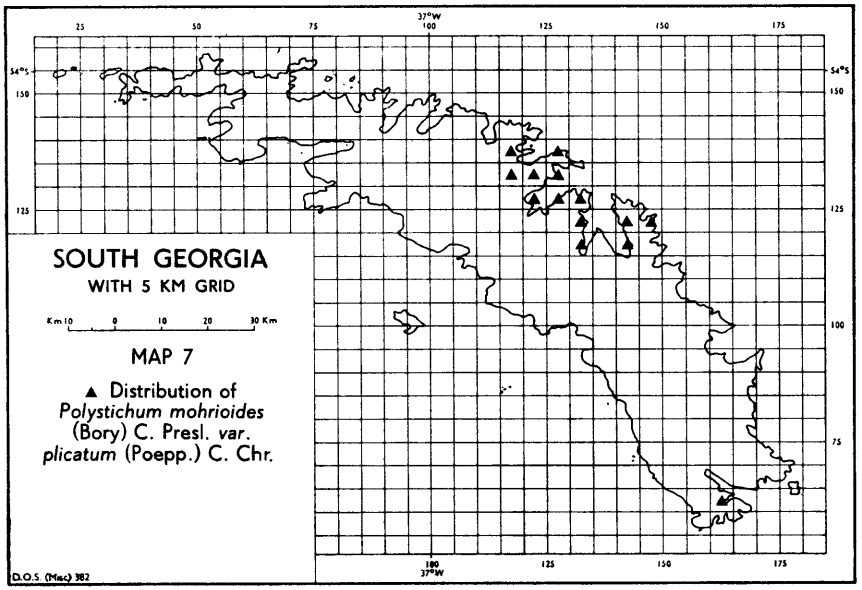

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 3
▲ Distribution of
Lycopodium magellanicum Sw.
D.O.S. (Misc) 382

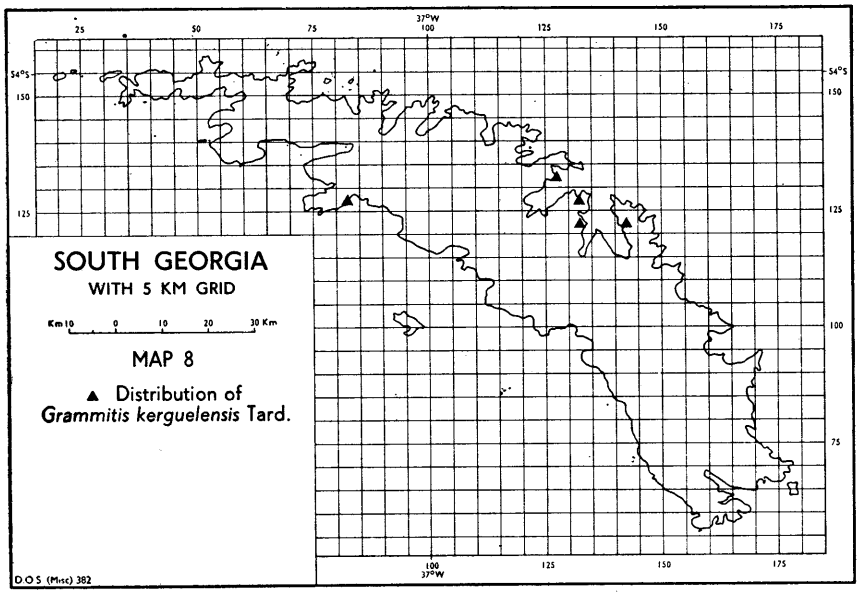
MAPS 1–3

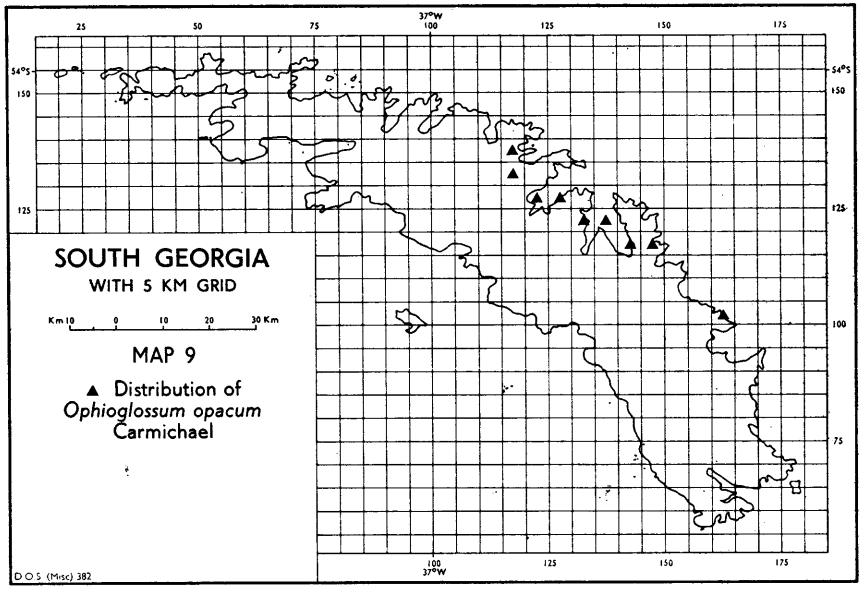

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 4
▲ Distribution of
Hymenophyllum falklandicum
Baker
D.O.S. (Misc) 382

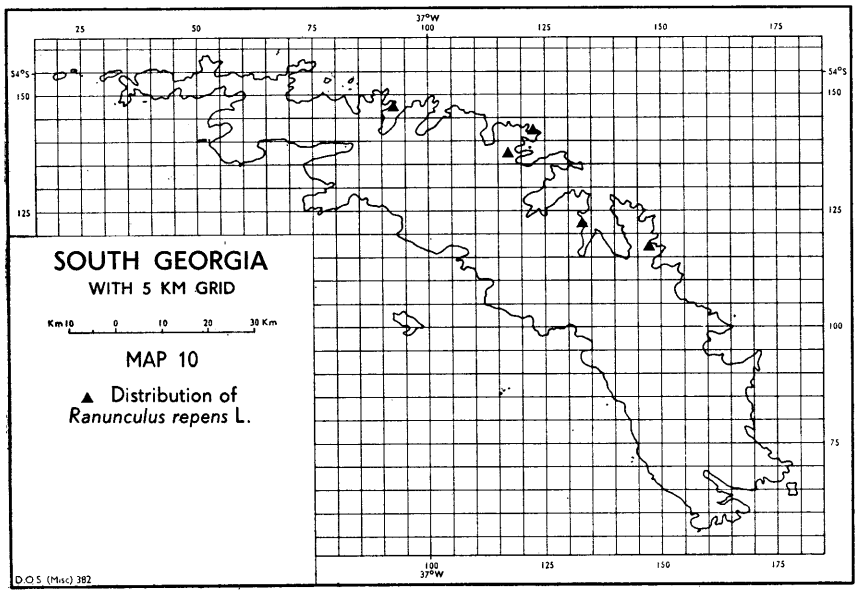

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 5
▲ Distribution of
Blechnum penna-marina
(Poir) Kuhn
D.O.S. (Misc) 382

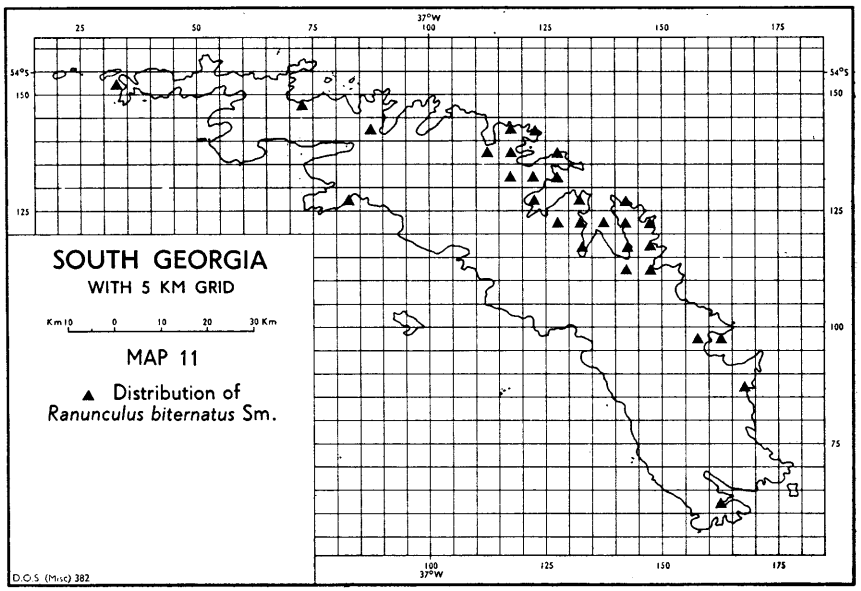

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 6
▲ Distribution of
Cystopteris fragilis (L.) Bernh.
D.O.S. (Misc) 382


SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 7
▲ Distribution of
Polystichum mohrioides
(Bory) C. Presl. var.
plicatum (Poepp.) C. Chr.
D.O.S. (Misc) 382

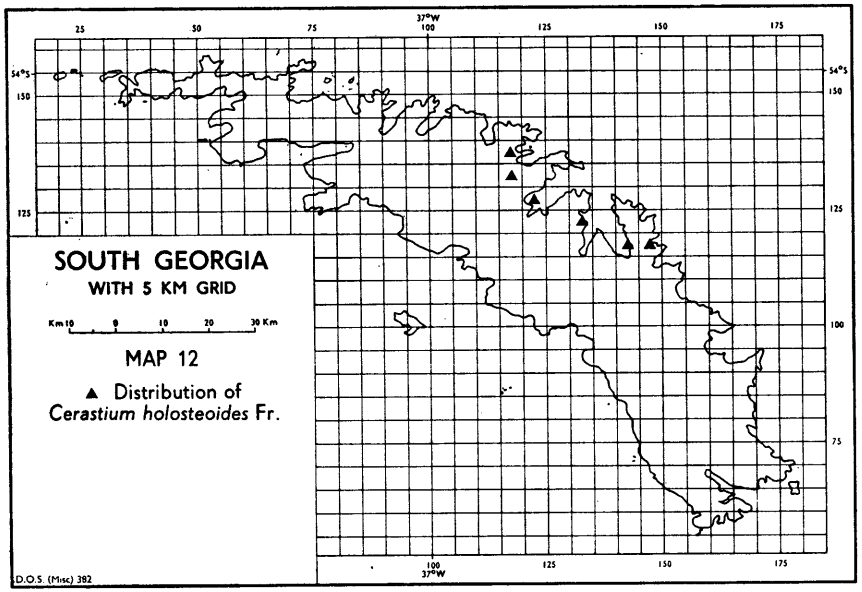

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 8
▲ Distribution of
Grammitis kerguelensis Tard.
D.O.S. (Misc) 382

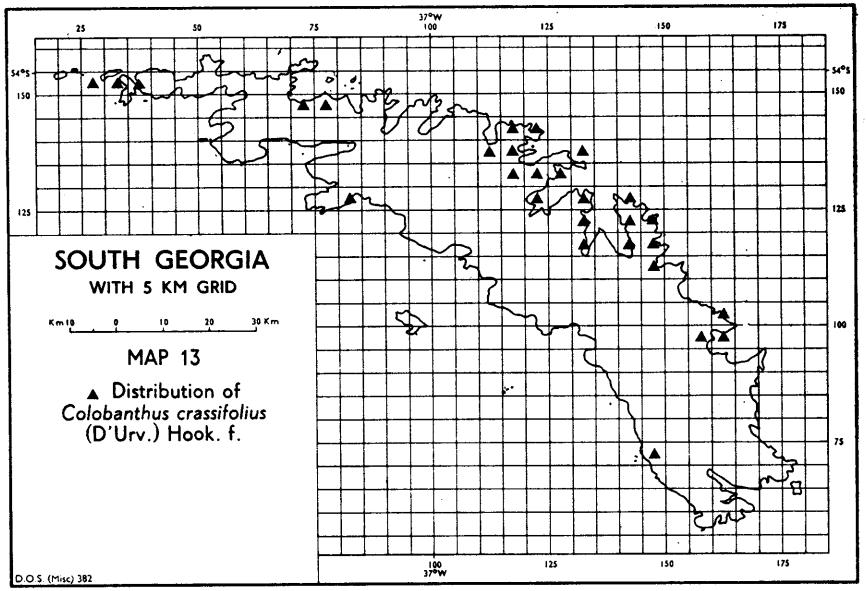

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 9
▲ Distribution of
Ophioglossum opacum
Carmichael
D.O.S. (Misc) 382

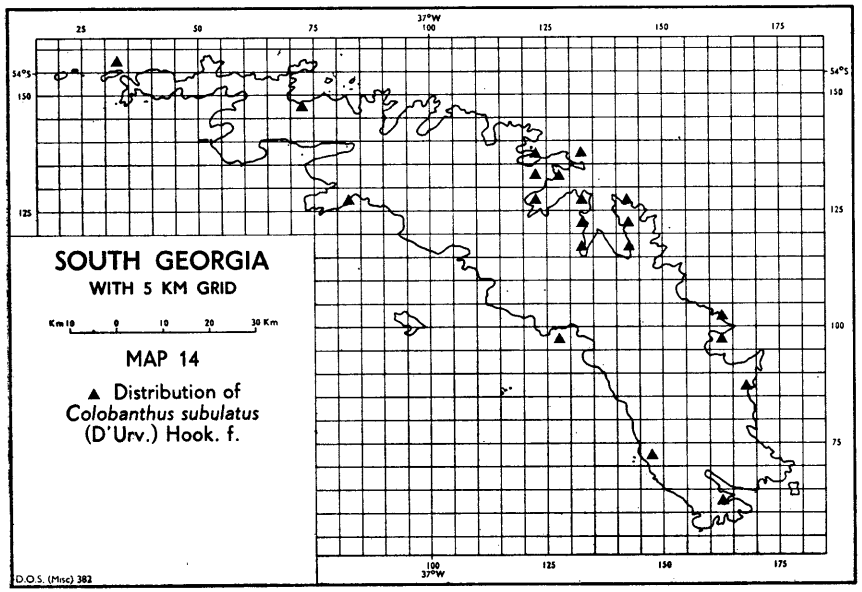

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 10
▲ Distribution of
Ranunculus repens L.
D.O.S. (Misc) 382

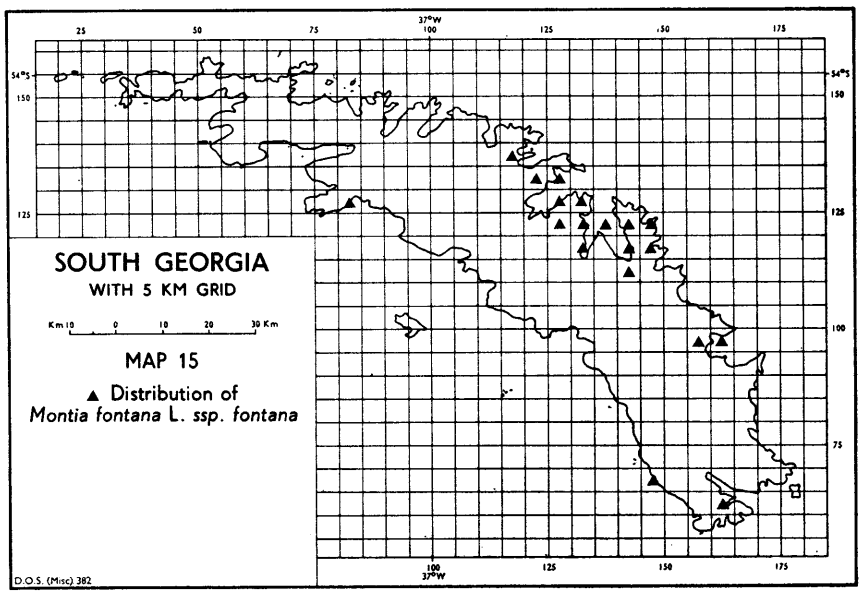

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 11
▲ Distribution of
Ranunculus biternatus Sm.
D.O.S. (Misc) 382

MAPS 8–11

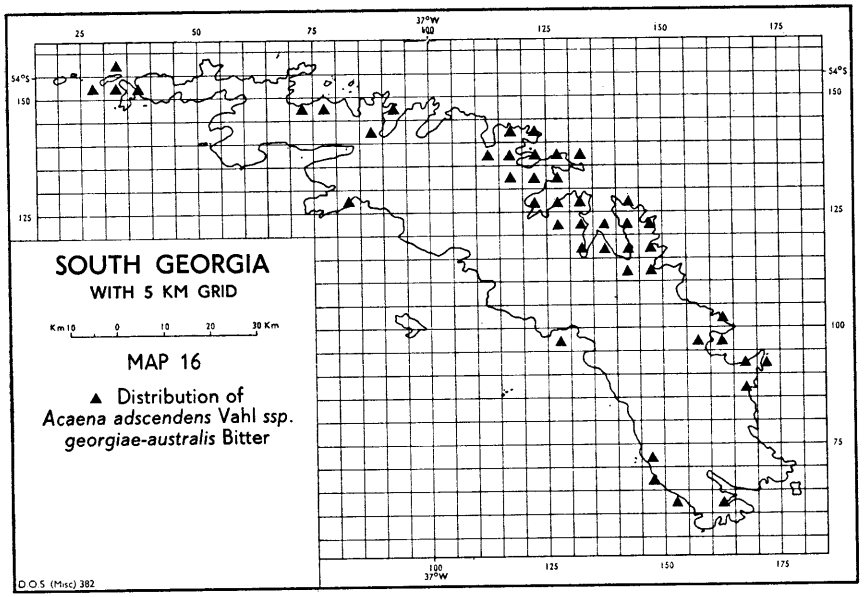

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 12
▲ Distribution of
Cerastium holosteoides Fr.
D.O.S. (Misc) 382

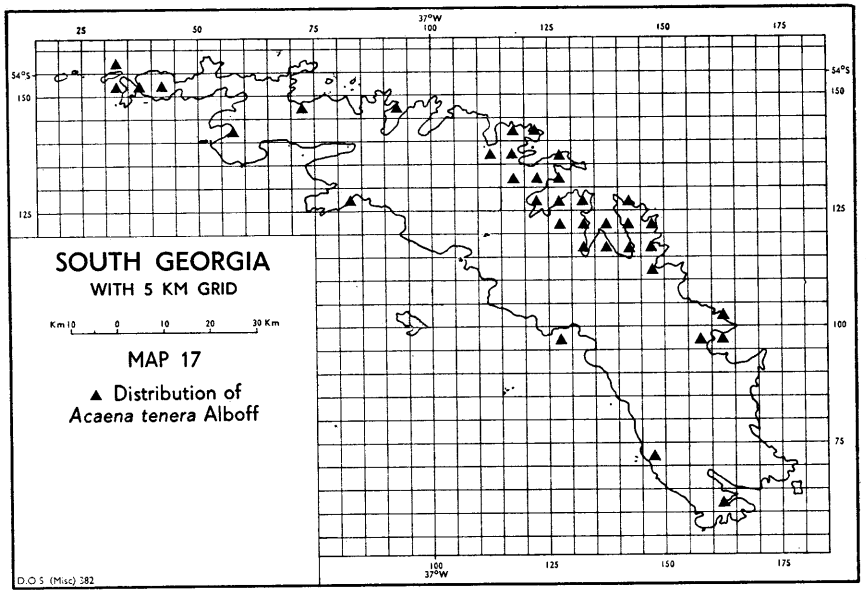

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 13
▲ Distribution of
Colobanthus crassifolius
(D'Urv.) Hook. f.
D.O.S. (Misc) 382

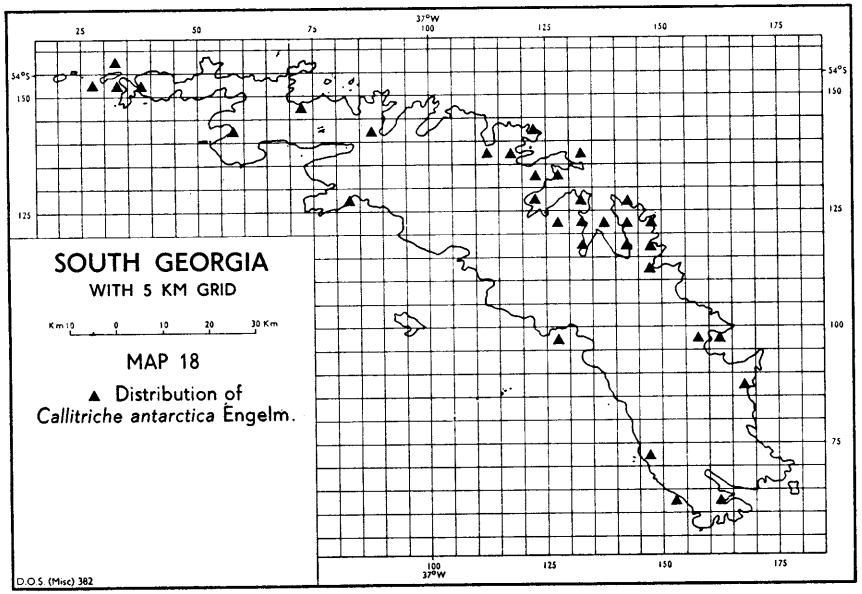

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 14
▲ Distribution of
Colobanthus subulatus
(D'Urv.) Hook. f.
D.O.S. (Misc) 382

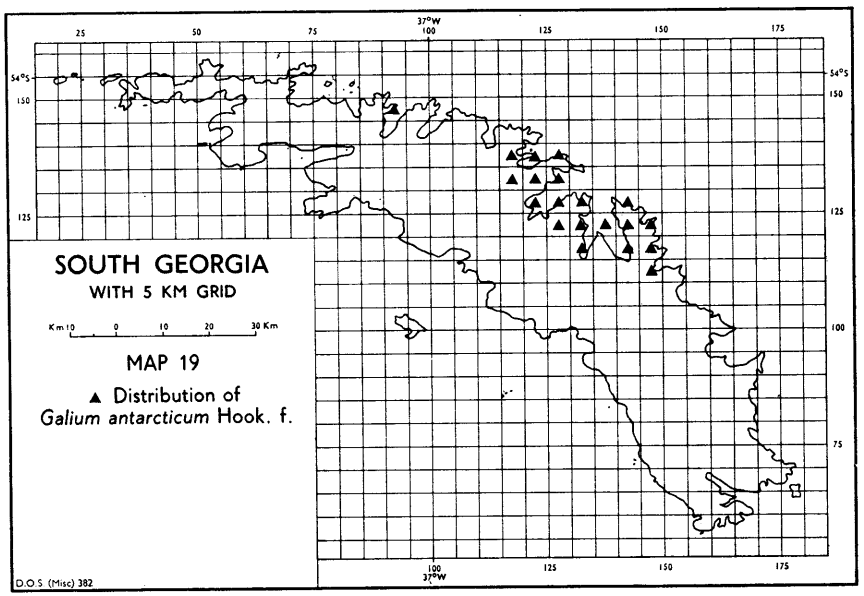

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 15
▲ Distribution of
Montia fontana L. ssp. fontana
D.O.S. (Misc) 382

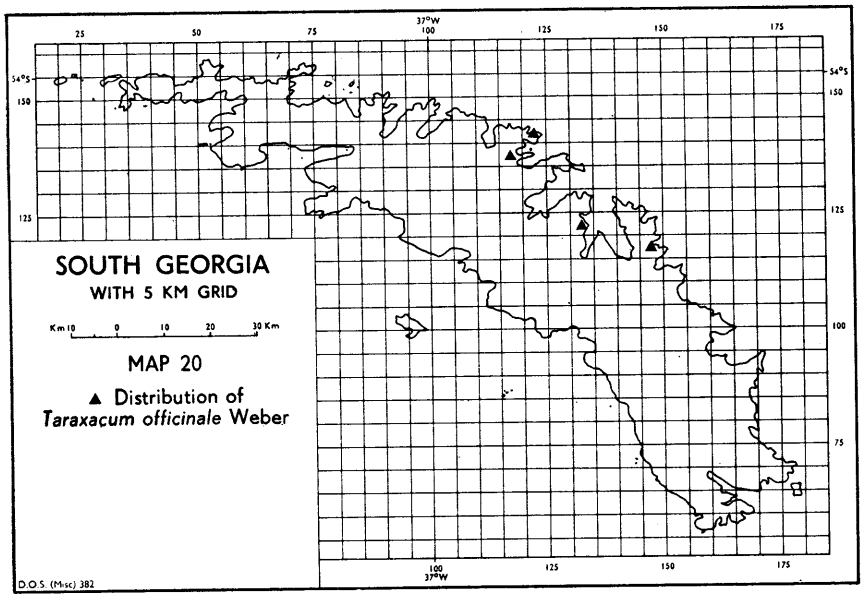
MAPS 12–15

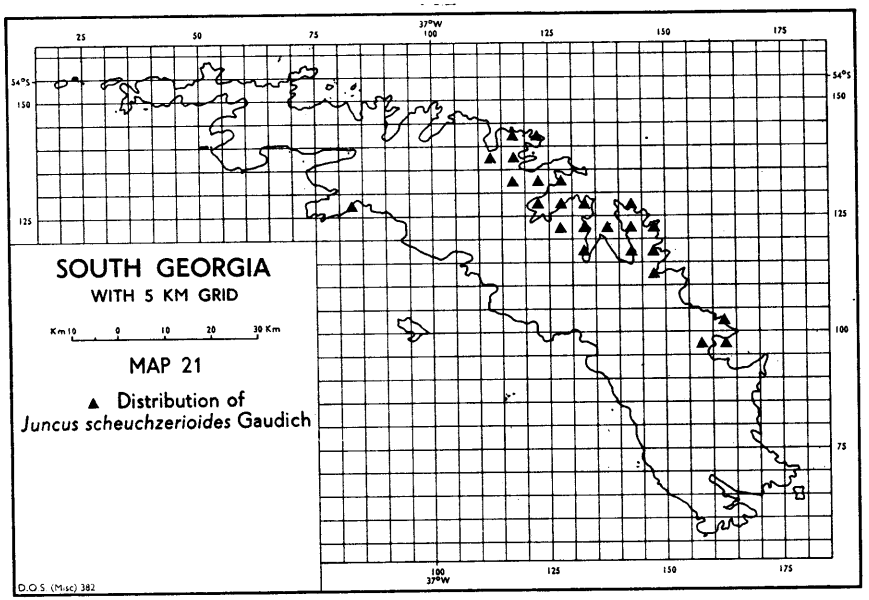

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 16
▲ Distribution of
Acaena adscendens Vahl ssp.
georgiae-australis Bitter
D.O.S (Misc) 382

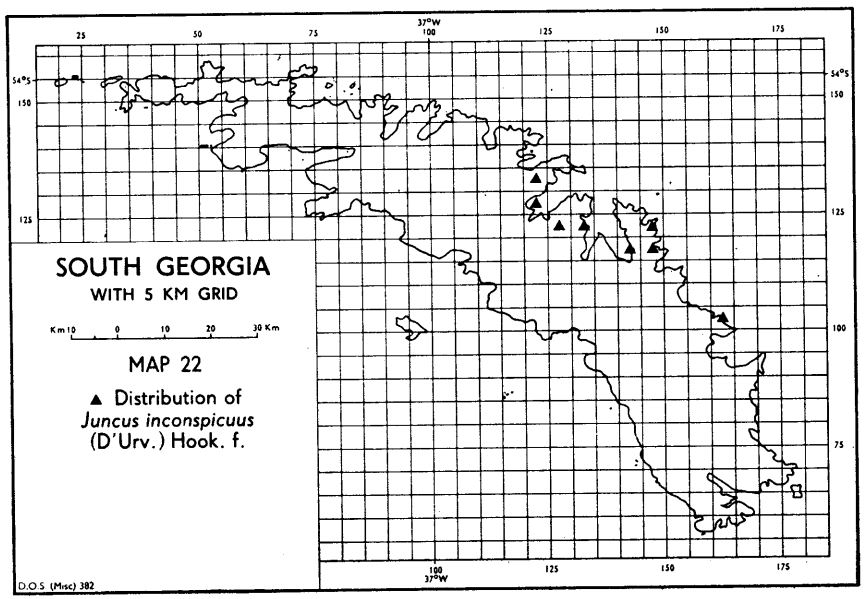

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 17
▲ Distribution of
Acaena tenera Alboff
D.O.S (Misc) 382

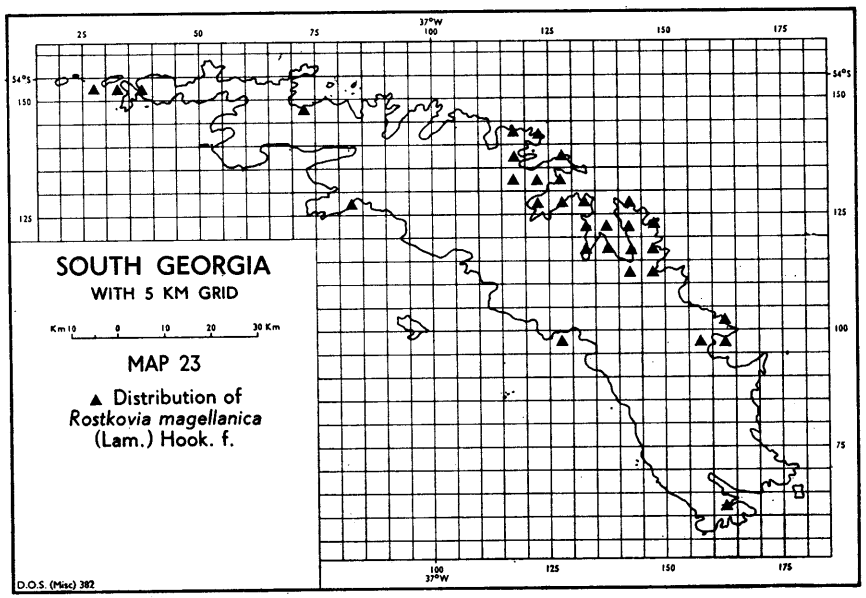

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 18
▲ Distribution of
Callitriche antarctica Engelm.
D.O.S (Misc) 382

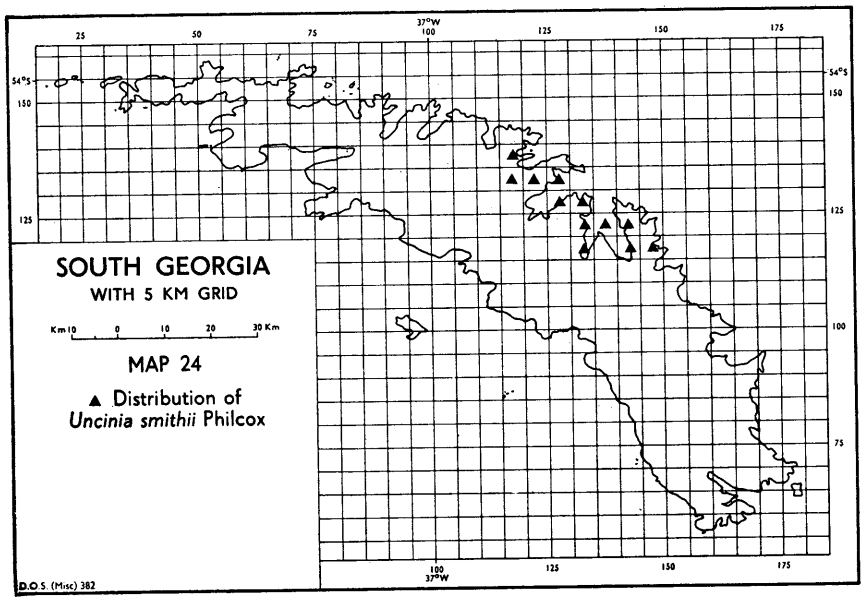

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 19
▲ Distribution of
Galium antarcticum Hook. f.
D.O.S (Misc) 382

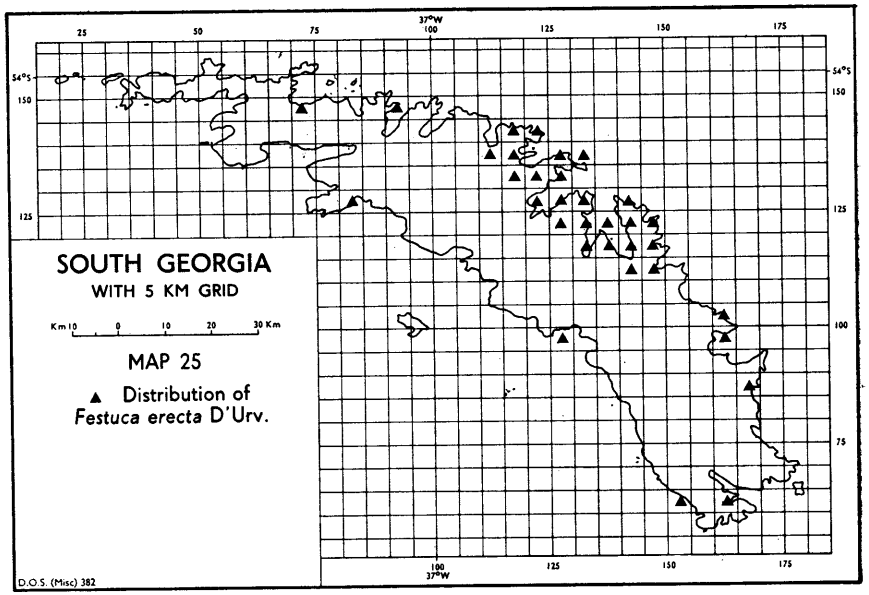

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 20
▲ Distribution of
Taraxacum officinale Weber
D.O.S. (Misc) 382

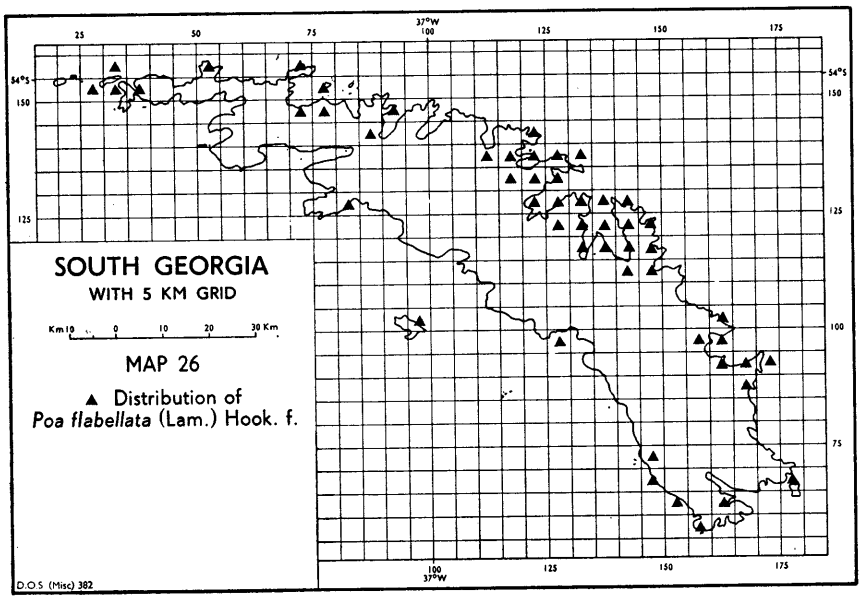

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 21
▲ Distribution of
Juncus scheuchzerioides Gaudich
D.O.S. (Misc) 382

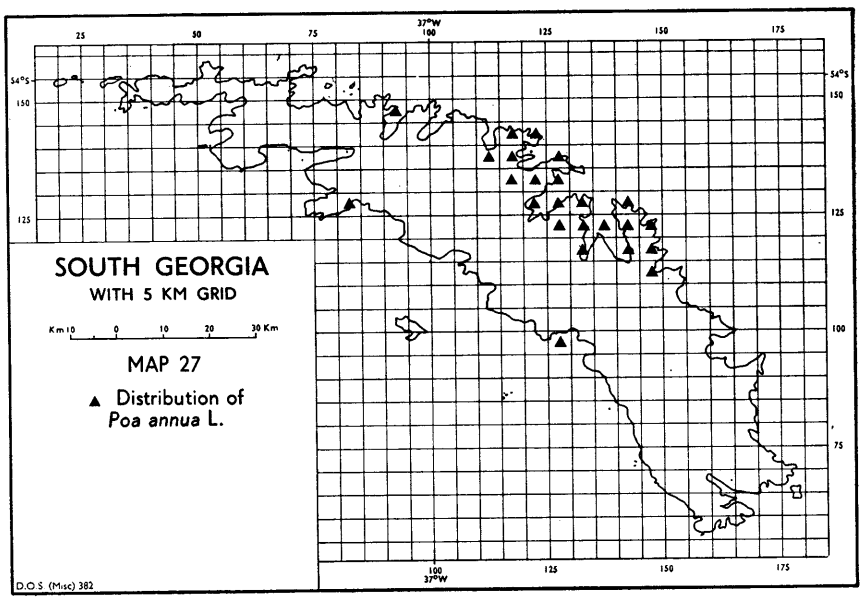

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 22
▲ Distribution of
Juncus inconspicuus
(D'Urv.) Hook. f.
D.O.S. (Misc) 382


SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 23
▲ Distribution of
Rostkovia magellanica
(Lam.) Hook. f.
D.O.S. (Misc) 382

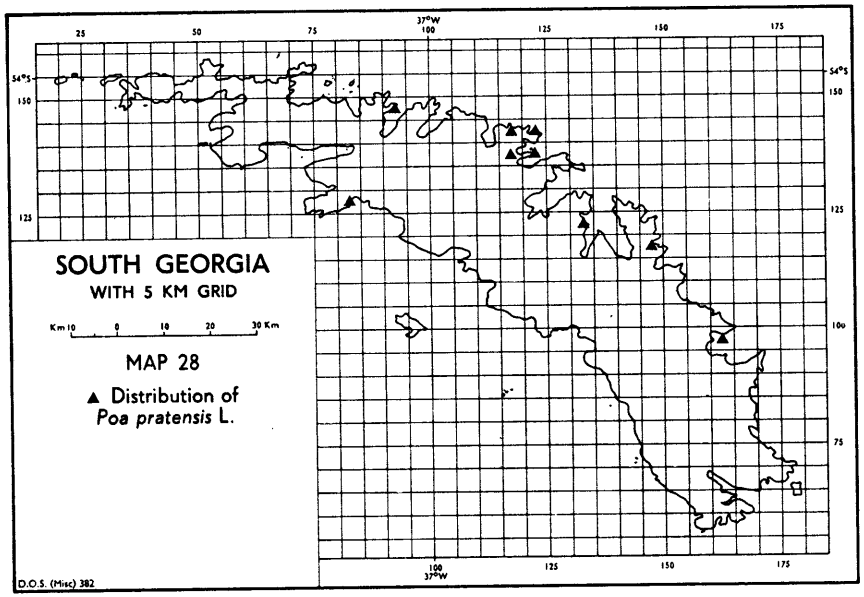

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 24
▲ Distribution of
Uncinia smithii Philcox
D.O.S. (Misc) 382

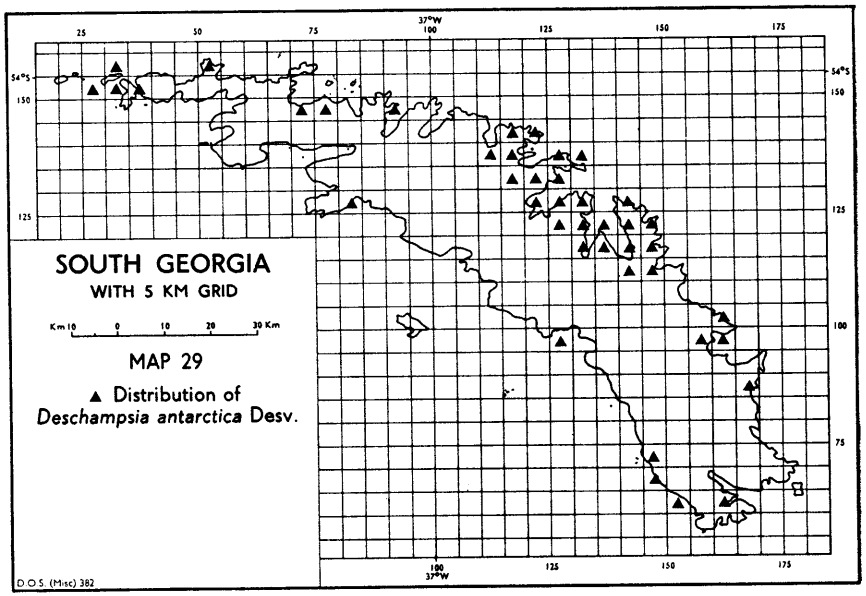

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 25
▲ Distribution of
Festuca erecta D'Urv.
D.O.S. (Misc) 382

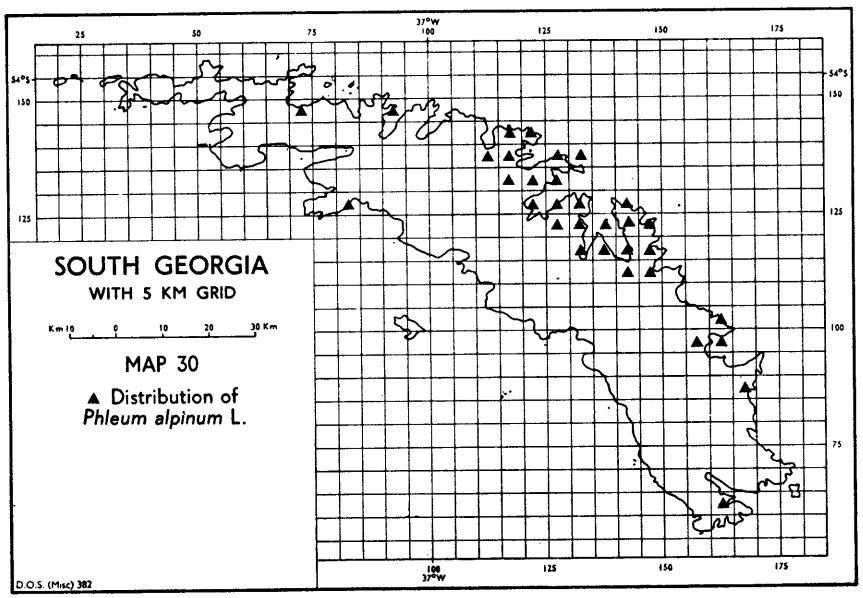

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 26
▲ Distribution of
Poa flabellata (Lam.) Hook. f.
D.O.S. (Misc) 382

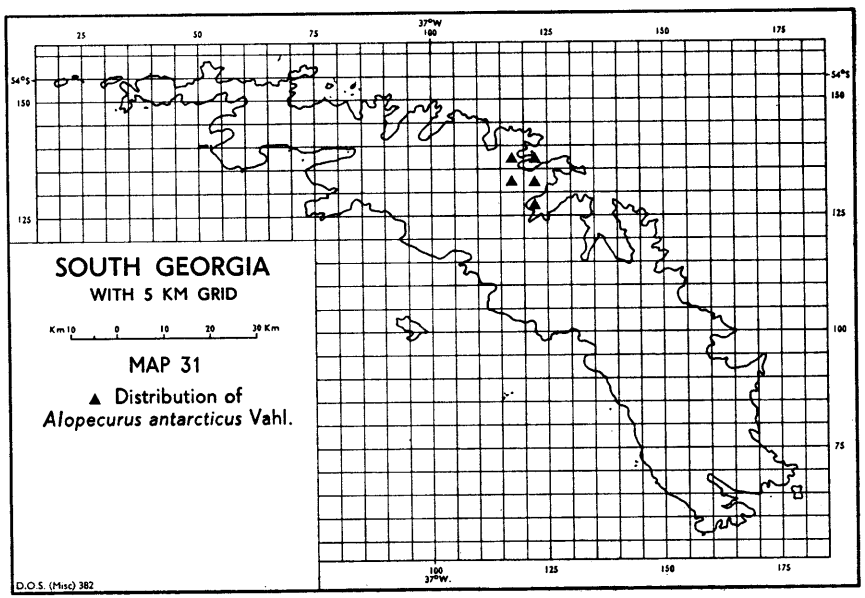

SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 27
▲ Distribution of
Poa annua L.
D.O.S. (Misc) 382

MAPS 24–27


SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 28
▲ Distribution of
Poa pratensis L.
D.O.S. (Misc) 382


SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 29
▲ Distribution of
Deschampsia antarctica Desv.
D.O.S. (Misc) 382


SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 30
▲ Distribution of
Phleum alpinum L.
D.O.S. (Misc) 382


SOUTH GEORGIA
WITH 5 KM GRID
Km 10 0 10 20 30 Km
MAP 31
▲ Distribution of
Alopecurus antarcticus Vahl.
D.O.S. (Misc) 382

MAPS 28–31

PLATE I

a. "Open" tussock community. Paul Beach, Ample Bay, Bay of Isles.

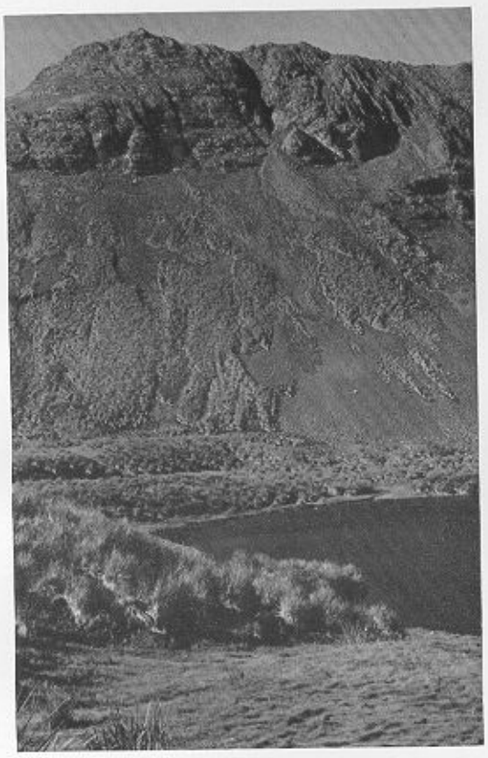
b. "Closed" tussock community, showing early development of bryophyte banks. South shore of Bird Island, east of Shoemaker Point.

c. Coastal shore and scree community of *Poa flabellata*. Tortula Cove, Maiviken, Cumberland West Bay. (From Greene, 1964b.)

d. Bryophyte bank (mainly *Dicranum aciphyllum*) developed on "closed" tussock, being colonized by lichens. South shore of Bird Island, east of Shoemaker Point.

a

b



c

d

PLATE II

a. Pure sward of *Acaena adscendens* with an understory of *Tortula robusta*. Paul Beach, Ample Bay, Bay of Isles.

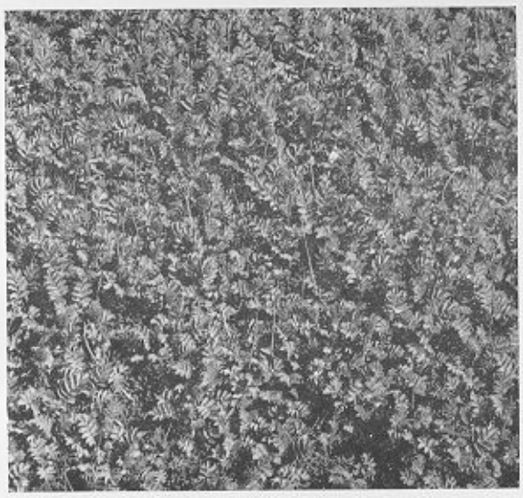
b. *Acaena adscendens* and *Festuca erecta* from an *Acaena-Festuca* association. Hestesletten, Cumberland East Bay.

c. *Festuca erecta* and *Acaena adscendens* from a *Festuca-Acaena* association. The northern valley at Husvik, Stromness Bay.

d. A marsh community of *Juncus scheuchzerioides* and *Ranunculus biternatus*. The northern part of Bore Valley, Cumberland West Bay.

e. Pure sward of non-flowering *Deschampsia antarctica* fringed by tussocks of *Poa flabellata*. Corrie north-east of Jordan Cove, Bird Island.

f. *Rostkovia magellanica* with *Sphagnum fimbriatum* understory. The Stromness valley, Stromness Bay.



a

b

c

d

e

f

PLATE III

a. Distribution of vegetation zones in the Stromness valley. Upper slopes (to right of buildings) with bare scree; lower slopes (right foreground) with grass heath, marsh developing locally by stream sides; valley bottom with marsh and bog; tussock formation confined to vicinity of shore. View eastwards towards Stromness whaling station, Stromness Bay.

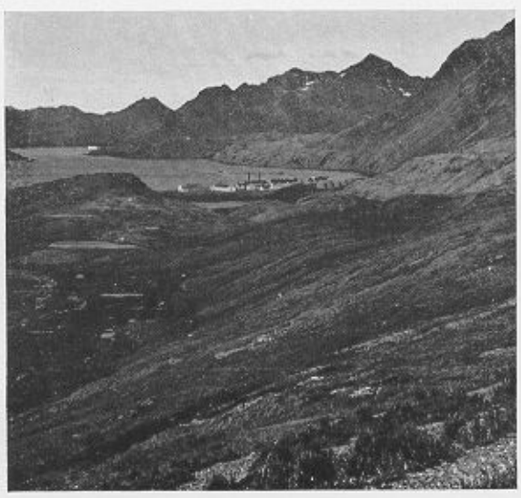
b. Sward of *Acaena adscendens* with invading *Poa flabellata* in foreground and *Festuca erecta* in left background. Paul Beach, Ample Bay, Bay of Isles.

c. *Acaena-Festuca* association on unstable scree. The northern part of Bore Valley, Cumberland West Bay.

d. Climax *Festuca erecta* grass heath. The northern valley at Husvik, Stromness Bay. (From Greene, 1964*b*.)

e. *Deschampsia* meadows surrounded by bryophyte banks (darker colour), developed on horizontal solifluction areas amongst *Poa flabellata* tussock. Nesting wandering albatross in background. Corrie north-east of Jordan Cove, Bird Island.

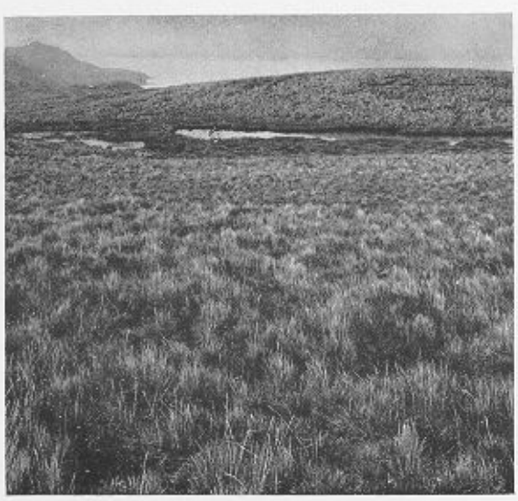
f. Oval carpet of *Sphagnum fimbriatum* in *Rostkovia magellanica* community. The Stromness valley, Stromness Bay.



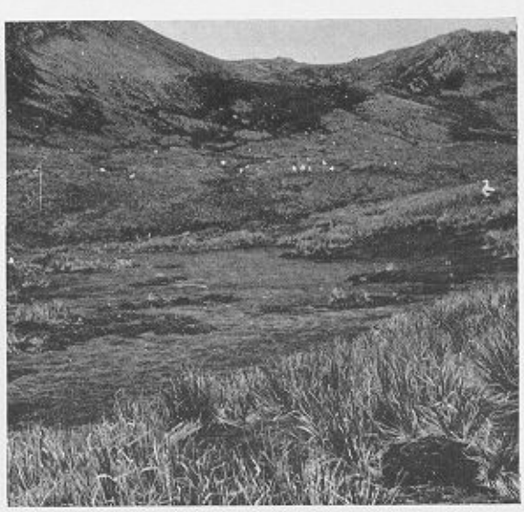
a

b

c



d



e

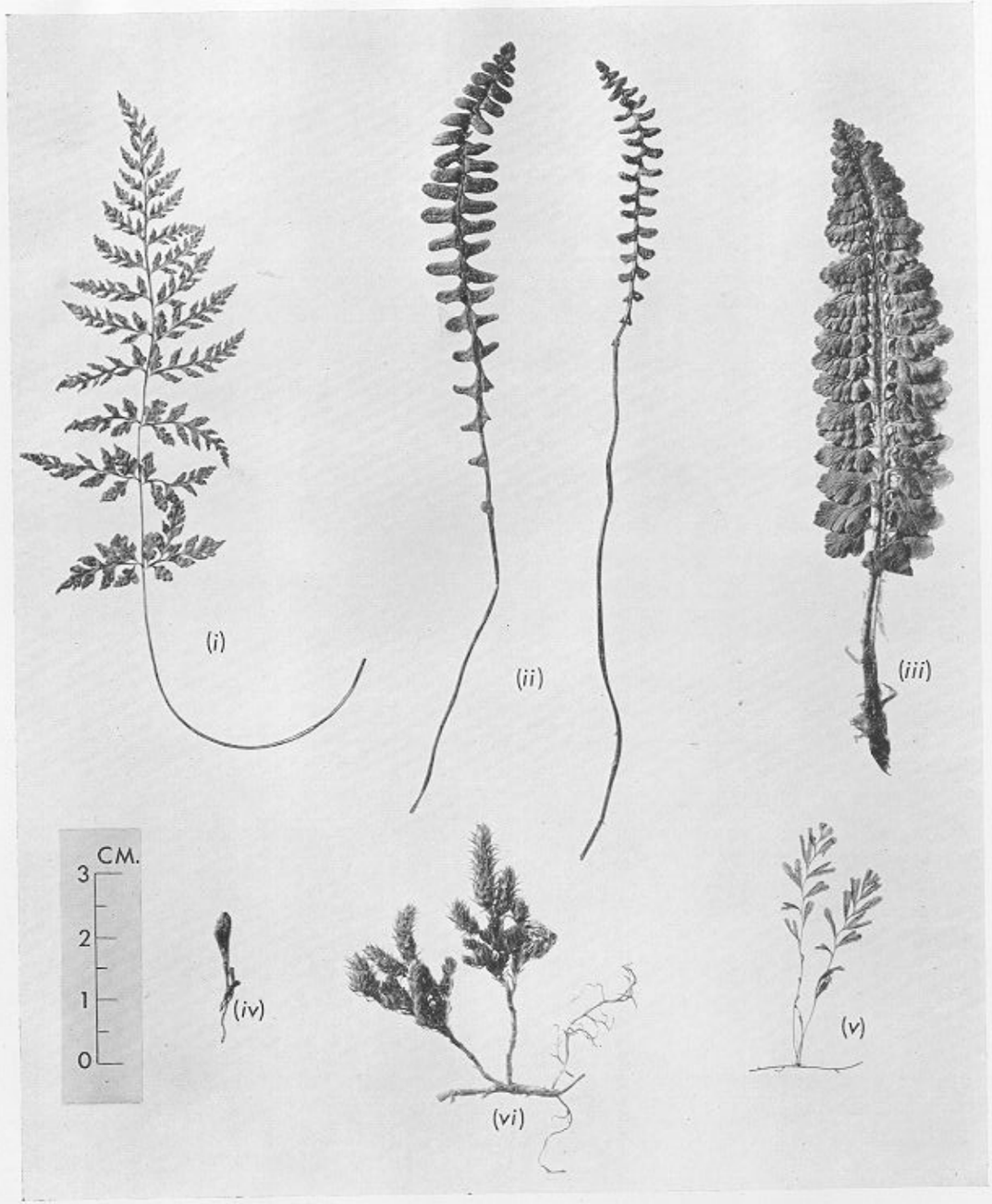
f

PLATE IV

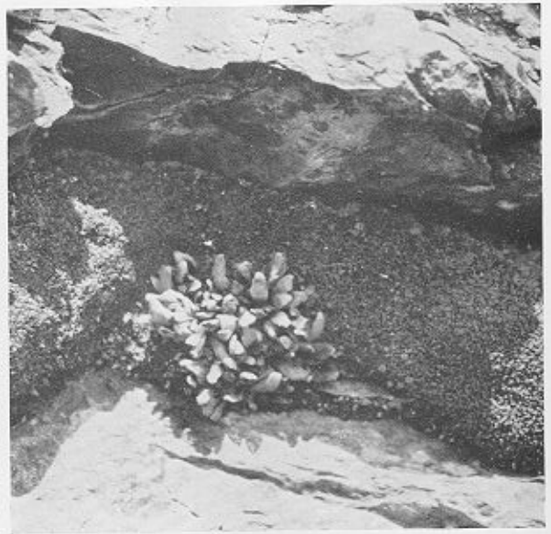
a. Leaves of: *i. Cystopteris fragilis*; *ii. Blechnum penna-marina*; *iii. Polystichum mohrioides*; *iv. Grammitis kerguelensis*; *v. Hymenophyllum falklandicum*; *vi.* leafy branches of *Lycopodium magellanicum*.

b. *Grammitis kerguelensis* with bryophytes on rock face. Spencer Peak, Bore Valley, Cumberland West Bay.

c. *Ophioglossum opacum* amongst *Phleum alpinum*. North-facing slopes of Brown Mountain, King Edward Cove, Cumberland East Bay. Scale object a penny (diameter = 3 cm.).



a



b

c

PLATE IV

PLATE V

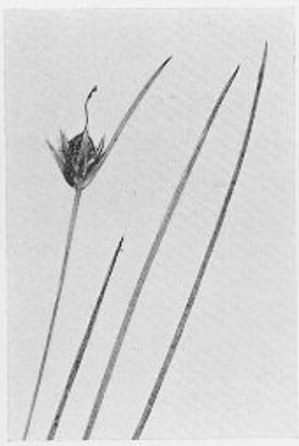
a. Inflorescence of *Juncus scheuchzerioides*.

b. Inflorescence of *Rostkovia magellanica*.

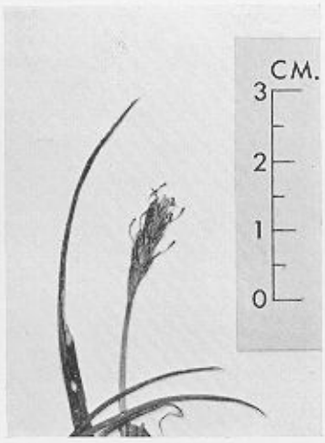
c. Inflorescence of *Uncinia smithii*.

d. Inflorescences of: *i. Phleum alpinum*; *ii. Poa flabellata*; *iii. Alopecurus antarcticus*; *iv. Festuca erecta*.

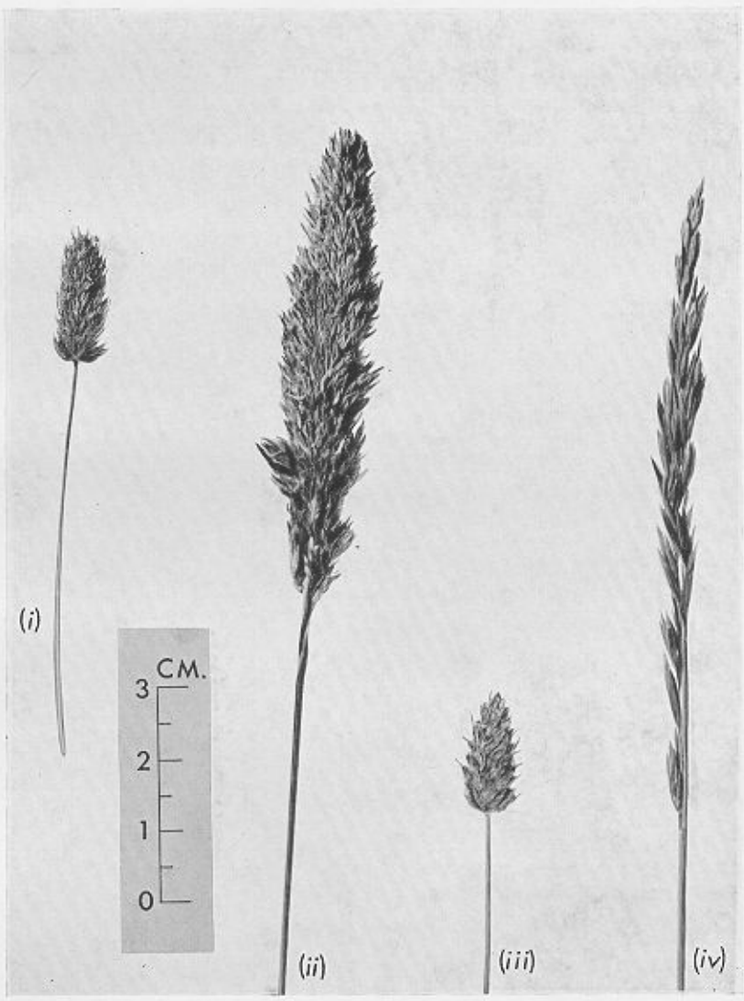
a



b



c

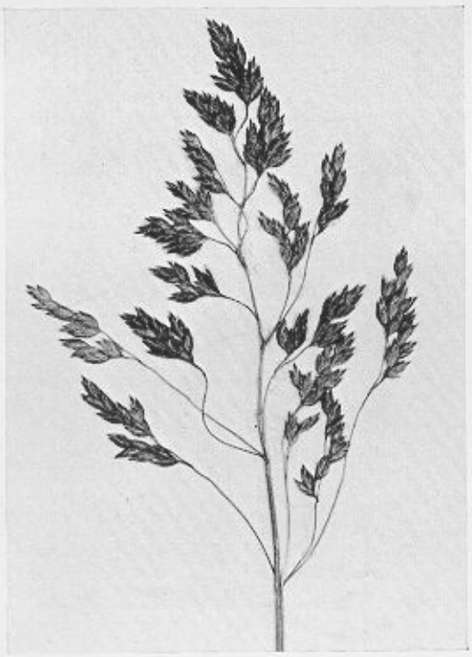


d

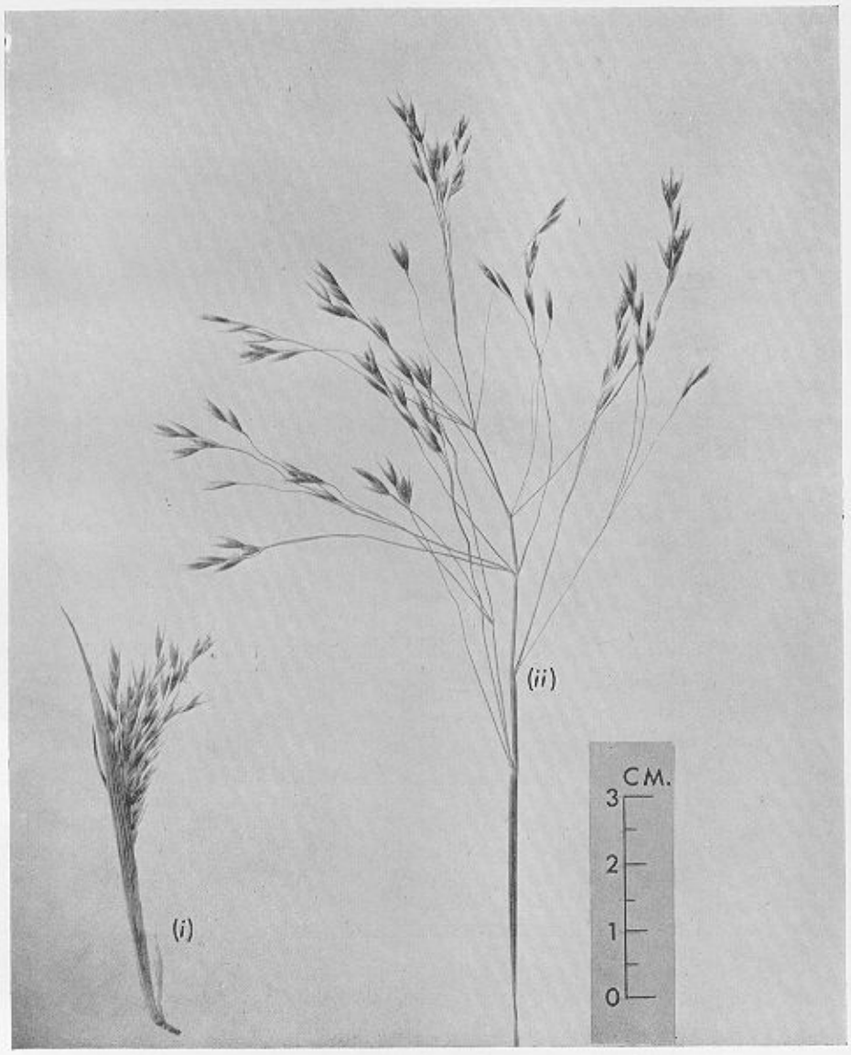
PLATE VI

a. Panicle of *Poa annua*. (Scale as in c.)
b. Panicle of *Poa pratensis*. (Scale as in c.)
c. Panicles of *Deschampsia antarctica*: *i*. unexpanded; *ii*. expanded.

a



b



c