

The distribution of alien vascular plants on Marion and Prince Edward Islands

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Thirty-eight species of vascular plants have been recorded on Marion and Prince Edward Islands, of which 13 are alien. On Marion Island 4 of the 13 aliens are classed as transient aliens, one as a persistent alien and 8 as naturalized aliens. Four of the naturalized aliens show a restricted distribution and four are spread widely over the island. Only one alien species occurs on Prince Edward Island and is considered to be naturalized.

It appears that 8 of the alien species on Marion Island were introduced by sealers during the last century. Five species have been introduced at the meteorological station since 1948. Four of the aliens have disappeared from the island since 1966. Only two of the alien species compete aggressively with the natural vegetation.

The vascular flora of Marion and Prince Edward Islands (46° 50' S, 37° 40' E) consists of 38 species, 13 of which are considered aliens (Huntley, 1971). A detailed survey of the distribution and general ecology of the alien vascular plants on Marion Island was carried out during the period November 1973 - June 1975. Some information on the introduced plant species on Prince Edward Island was obtained during a short visit to this island in May 1974. The data collected during the surveys of the two islands are presented in this paper for comparison with earlier observations on the distribution of the alien vascular species on these islands.

The activities of man on the islands

In 1802, thirty years after the discovery of Marion and Prince Edward Islands by the French sailor Marion Dufresne, several sealers' camps had been established on both islands (Marsh, 1948).

During the 19th and early 20th century the sealers occupied temporary settlements on the islands. Roberts (1958) mentions visits by sealing expeditions from South Africa, England, Norway and the United States. Three shipwrecks are recorded from Prince Edward Island: the *Richard Dart* (1849), *Maria* (1857) and the *Sea Bird* (1912). In 1908 the Norwegian sealer *Solglimt* was wrecked at Ship's Cove on Marion Island (Marsh, 1948). After the shipwreck of the *Sea Bird*, ships seem to have avoided the islands. Only in 1930 did the Cape Town-based sealer *Kildalkey* land a party on Marion Island. Unfavourable weather curtailed the expedition and forced the *Kildalkey* to return prematurely to Cape Town. Since then no further

Agt en dertig vaatplante, waaronder 13 uitheemse soorte, is op Marion- en Prins Edwardeiland gevind. Van die 13 vreemdsoortiges op Marioneiland is vier as tydelike, een as blywende en agt as genaturaliseerde indringers geklassifiseer. Vier van die genaturaliseerde indringers toon beperkte verspreiding, terwyl vier wydverspreid op die eiland voorkom. Slegs een uitheemse soort kom op Prins Edwardeiland voor en word as genaturaliseerde indringer beskou.

Agt van die vreemdsoortige plante op Marioneiland is waarskynlik in die vorige eeu deur robbejagters ingevoer. Vyf soorte is sedert 1948 by die weerstasie gevestig. Sedert 1966 het vier vreemdsoortige plante van die eiland verdwyn. Slegs twee van die uitheemse soorte ding sterk met die natuurlike plantegroei mee.

attempt has been made to resume the sealing industry on the islands.

Although the sealers must have had a devastating influence on the populations of fur seal (*Arctocephalus tropicalis* Gray) and elephant seal (*Mirounga leonina* L.) on the islands, their effect on the terrestrial ecosystem was relatively small. No domestic stock was introduced and the only mammal herbivores inadvertently brought to the islands were mice. These are now found in great numbers on Marion Island, but have not been observed on Prince Edward Island. The petrel and shearwater populations on Marion Island are extensively exploited by cats (Anderson & Condry, 1974).

Marion and Prince Edward Islands were annexed by South Africa on 29 December 1947 and 4 January 1948 respectively (Marsh, 1948). A meteorological station was established at Transvaal Cove on Marion Island in January 1948 and has been occupied continuously since then. Sheep and (domestic) chickens were introduced in 1950, but were not able to establish themselves on the island and a new supply was imported annually (La Grange, 1954) until 1969. The last sheep was seen in April 1973 (V.R. Smith, personal communication). Willows and pines were planted near the station, some of them in soil imported from South Africa (La Grange, 1954). Soil was also imported for a small greenhouse that was built. None of the trees and shrubs have survived, but invertebrates may have been introduced with the soil. The greenhouse is not in use at present.

The sites of the sealers' camps and of the meteorological station are shown on the distribution maps (Figs. 1 - 4).

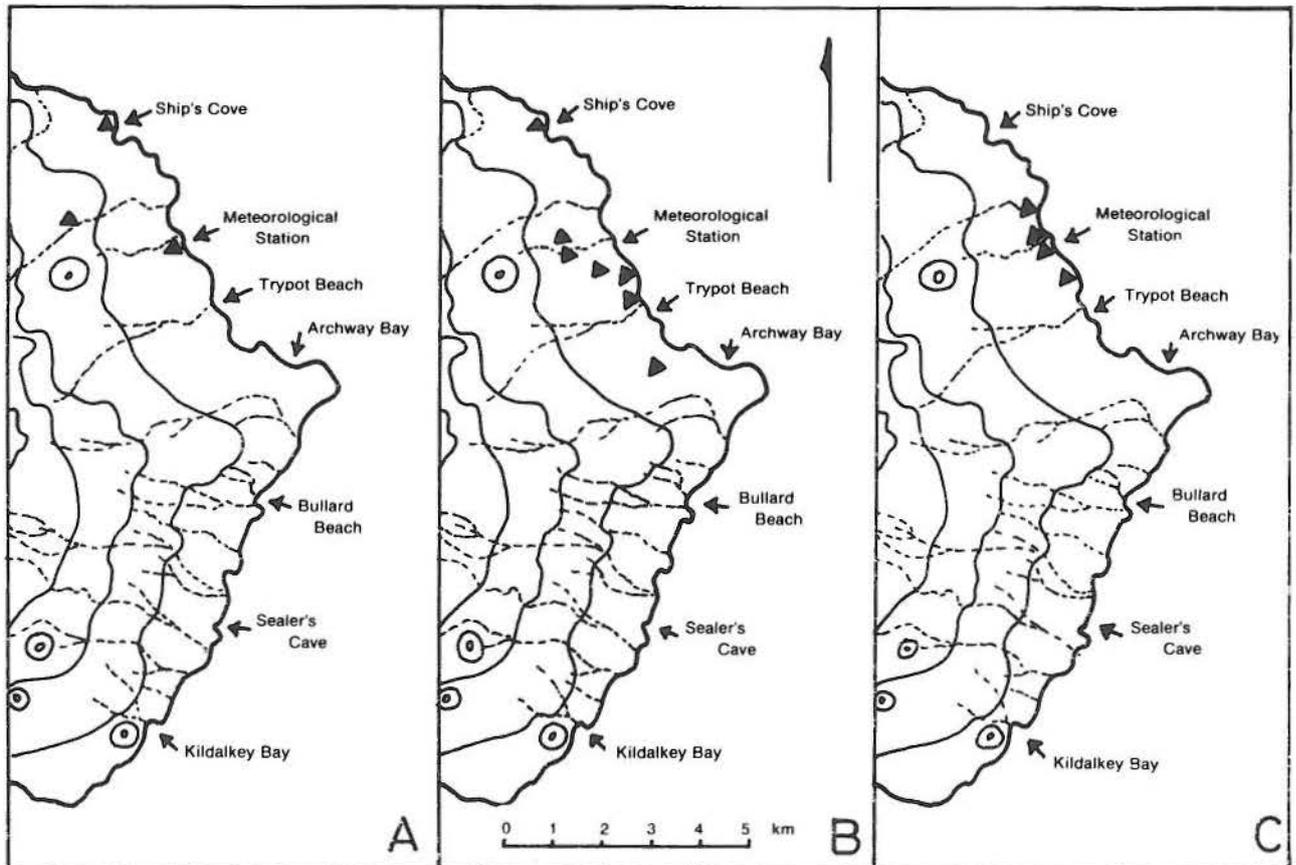


Fig. 1. Distribution of *Festuca rubra* (A), *Poa pratensis* (B) and *Sagina apetala* (C) on Marion Island. (▲ plant colony, → site of human settlement, — altitude lines at 100 m intervals, --- stream).

The alien vascular flora

Walton & Smith (1973) classified the alien species of vascular plants on South Georgia in three categories: transient, persistent and naturalized aliens. The latter group was divided into species with a restricted distribution and those with a widespread distribution on the island. Their classification has been followed here.

Herbarium specimens from the herbarium of the Institute for Environmental Sciences, U.O.F.S., Bloemfontein, have been abbreviated as IVO, and those from the National Herbarium, Pretoria, as PRE.

Transient aliens

Avena sativa L. This species was recorded in 1965-66 from the meteorological station (Huntley, 1971).

Holcus lanatus L. The first collection of this species was made in 1953 by J.J. van der Merwe (17, PRE). In April 1965 a small group of *Holcus* was found in a ditch near the meteorological office (B.J. Huntley 457, IVO).

Hypochoeris radicata L. A single plant was found by J.J. van der Merwe in 1953 (19, PRE). In 1965-66 another plant of this species was collected near the chicken-runs at the meteorological station (Huntley, 1971).

Plantago lanceolata L. Only one specimen was found in 1965-66, near the chicken-run at the meteorological station (Huntley, 1971).

All four of the above species were observed flowering (Huntley, 1971). During the 1973-75 survey

none of these species was recorded and presumably they have not survived on the island.

Persistent aliens

Rumex acetosella L. This species was recorded in 1965-66 from Sealer's Cave and from the meteorological station (Huntley, 1971). At the latter locality a few plants were seen near the chicken-run (B.J. Huntley 459, IVO) and a large colony occupied a well-drained peaty slope on the margin of Gentoo Lake (E.M. van Zinderen Bakker Jr. 995, IVO). The colony of *Rumex acetosella* at Gentoo Lake was inspected several times during 1973-75. Seed was produced in abundance, but seedlings were observed only in the ca. 20 m² area occupied by this species. The chicken-run population has not survived. It is possible that the colony at Sealer's Cave was overlooked since the weather was bad and some parts of the steep coastal slopes in this area could not be searched thoroughly.

Naturalized aliens

Eight of the species of alien vascular plants must be considered naturalized. Four of these are widespread while the others show a restricted distribution.

NATURALIZED ALIENS WITH A RESTRICTED DISTRIBUTION

Agropyron repens (L.) P. Beauv. In April 1965 fertile material of this grass was collected at Ship's Cove by E.M. van Zinderen Bakker Jr. (460, IVO). Huntley recorded this species from the same site in February

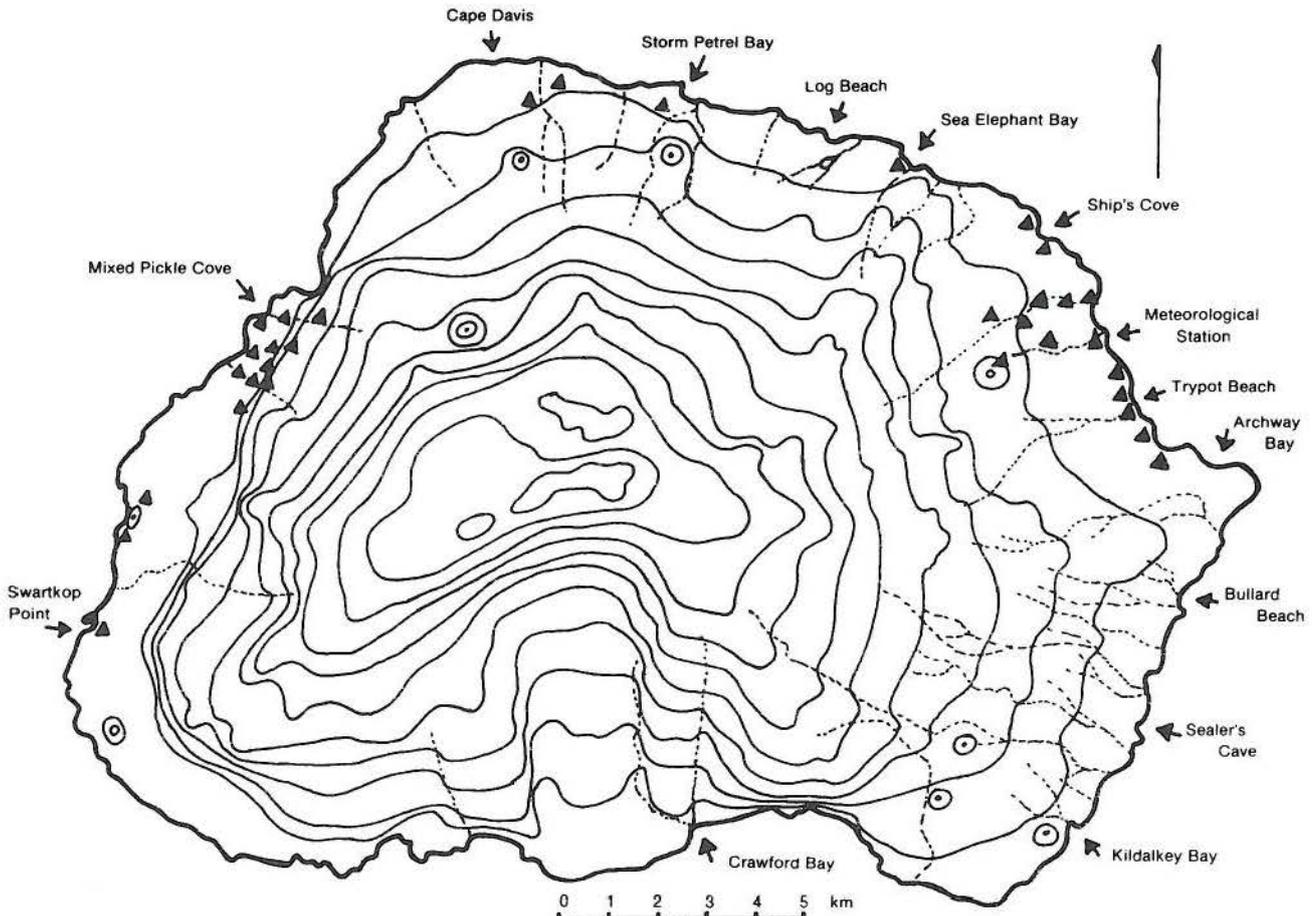


Fig. 2. Distribution of *Cerastium fontanum* on Marion Island. (▲ *Cerastium fontanum*, → site of human settlement, — altitude lines at 100 m intervals, --- stream).

1966, where it formed a small stand near the remains of the sealer's camp (B.J. Huntley 2066, IVO). *Agropyron repens* was also reported from the meteorological station (Huntley, 1971), but this record is based on misidentification of the collected material (B.J. Huntley 2074, IVO), which belongs to *Agrostis bergiana* Trin. var. *bergiana*, an indigenous or naturalized alien species on Marion Island not mentioned by Huntley (1971).

In January 1975 the species was recorded again on a well drained, sheltered slope at Ship's Cove, where vegetative shoots were found occupying approximately 20 per cent of the aerial cover of a ca. 200 m² stand. *Acaena magellanica* (Lam.) Vahl. and *Blechnum penna-marina* (Poir.) Kuhn surrounded this stand, in which *Festuca rubra* L., another alien, formed the dominant component. By May of 1975 *Agropyron repens* dominated the vegetation of this stand and formed numerous inflorescences. Although seed had been formed, this grass seems to spread exclusively by rhizomes.

Alopecurus australis Nees. A single population of this species was observed in December 1965 at the site of the old sealers' encampment at Mixed Pickle Cove (B.J. Huntley 974, IVO). In February 1975 this colony was recorded again. Inflorescences were observed, but it could not be established if seed had been formed. Spreading seems to occur by vegetative means only.

Festuca rubra L. A small patch of this grass was

discovered in 1966 at the site of the sealers' camp at Ship's Cove (B.J. Huntley 2067, IVO). In 1973-75 three populations of this species were found. The colony at Ship's Cove covers a ca. 200 m² area of well drained, sheltered slope and is mixed with *Agropyron repens*. Just north of Van den Boogaard River, at an altitude of 150 m, a dense sward of *Festuca* was found, forming a roughly circular patch of 50 m² and a separate small stand of ca. 5 m². A small population occurs on a steep coastal cliff near the meteorological station. In February seed was formed in abundance at all localities, but *Festuca* seems to spread into the surrounding vegetation largely by vegetative means. The distribution of this species is shown in Fig. 1a.

Poa pratensis L. The earliest collections of this species were made in 1965-66 from Ship's Cove and the meteorological station (Huntley, 1971). During the 1973-75 survey colonies of this grass were found at seven localities (Fig. 1b). *Poa pratensis* forms dense stands on well drained sites. At most localities the colonies occupy areas of 10-30 m². The colony at Ship's Cove, however, covers 200 m² while the Prion Valley population forms a patch of only 0.2 m². *Poa pratensis* colonies occur in *Acaena magellanica* vegetation or sometimes in *Acaena* - *Poa cookii* Hook. f. or *Blechnum penna-marina* vegetation.

At all sites numerous inflorescences were formed and seed was set. Seedlings were not observed, however, and this species also seems to spread by vegetative means rather than by seeds.

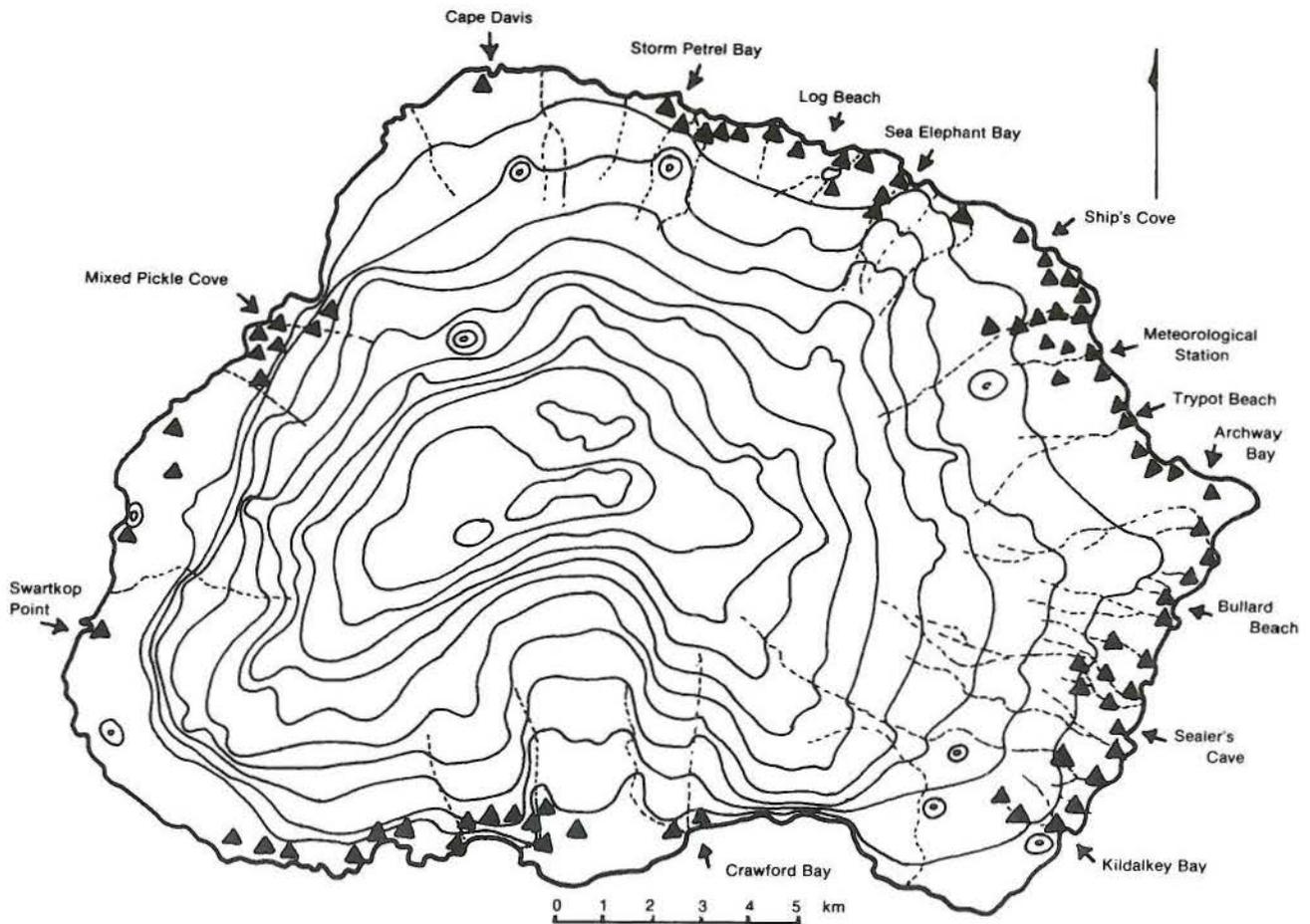


Fig. 3. Distribution of *Poa annua* on Marion Island. (▲ *Poa annua*, → site of human settlement, — altitude lines at 100 m intervals, -- stream).

NATURALIZED ALIENS WITH A WIDESPREAD DISTRIBUTION

Cerastium fontanum Baumg. The occurrence of a *Cerastium* species on Marion Island was first mentioned by Moseley (1874) but this genus is not present in the list of species collected by Moseley (Oliver, 1874). In 1965-66 *Cerastium fontanum* was recorded from six localities: meteorological station, Ship's Cove, Sea Elephant Bay, Mixed Pickle Cove, Kaalkoppie and Bullard Beach (Huntley, 1971).

During the 1973-75 survey this species was found at over 30 sites (Fig. 2). *Cerastium* generally occurs in small groups or as single individuals on well drained sites in *Poa cookii* tussock grassland and in open *Cotula plumosa* Hook. f. - *Poa cookii* vegetation in areas along the coast, influenced by animals. Inland it occurs in *Acaena magellanica-Brachythecium rutabulum* (Hedw.) B.S.G. stands and is sometimes found in open *Azorella selago* Hook. f. fjældmark vegetation up to 250 m above sea level.

Cerastium fontanum produced flowers and seed in abundance at all sites and seedlings were frequently observed. It seems that this species is able to spread easily by means of seed. Although groups of up to 0,5 m² of this species are found in sheltered sites, it does not appear to compete strongly with the natural vegetation.

Poa annua L. This species was first collected on Marion Island by Dike in 1948 (Greene & Greene, 1963). In 1965-66 *Poa annua* was widely spread over

the island and thirteen localities are given by Huntley (1971). During the 1973-75 survey the grass was observed at more than 80 sites on Marion Island (Fig. 3), often forming dense swards in areas where the original vegetation had been destroyed by animals. It does not colonize barren areas where the influence of animals is absent, however, and appears to require a certain amount of manuring. Single plants or small groups of plants are often found in stands of *Poa cookii* tussock grassland and in *Acaena adscendens* vegetation. *Poa annua* is also frequently found together with *Callitriche antarctica* Engelm. ex Hegelmeyer in regenerating seal wallows.

Huntley (1971) recorded *Poa annua* as the only alien species on Prince Edward Island in 1966. In May 1974 it was found in abundance in the Cave Bay area, often forming extensive mats at sites influenced by penguins and seals. On account of bad weather only the eastern part of the island was visited and no data are available on the occurrence of *Poa annua* on the western side of Prince Edward Island.

Flowers and seed were present throughout the summer. When growing in dense swards *Poa annua* is apparently perennial (cf. Walton & Smith, 1973). In some areas numerous seedlings were observed and this species spreads easily by means of seed.

Sagina apetala Ard. This species was collected by Huntley in 1965 at the meteorological station, where it was restricted to a small area around the buildings (B.J. Huntley 1076, IVO). During the 1973-75 survey

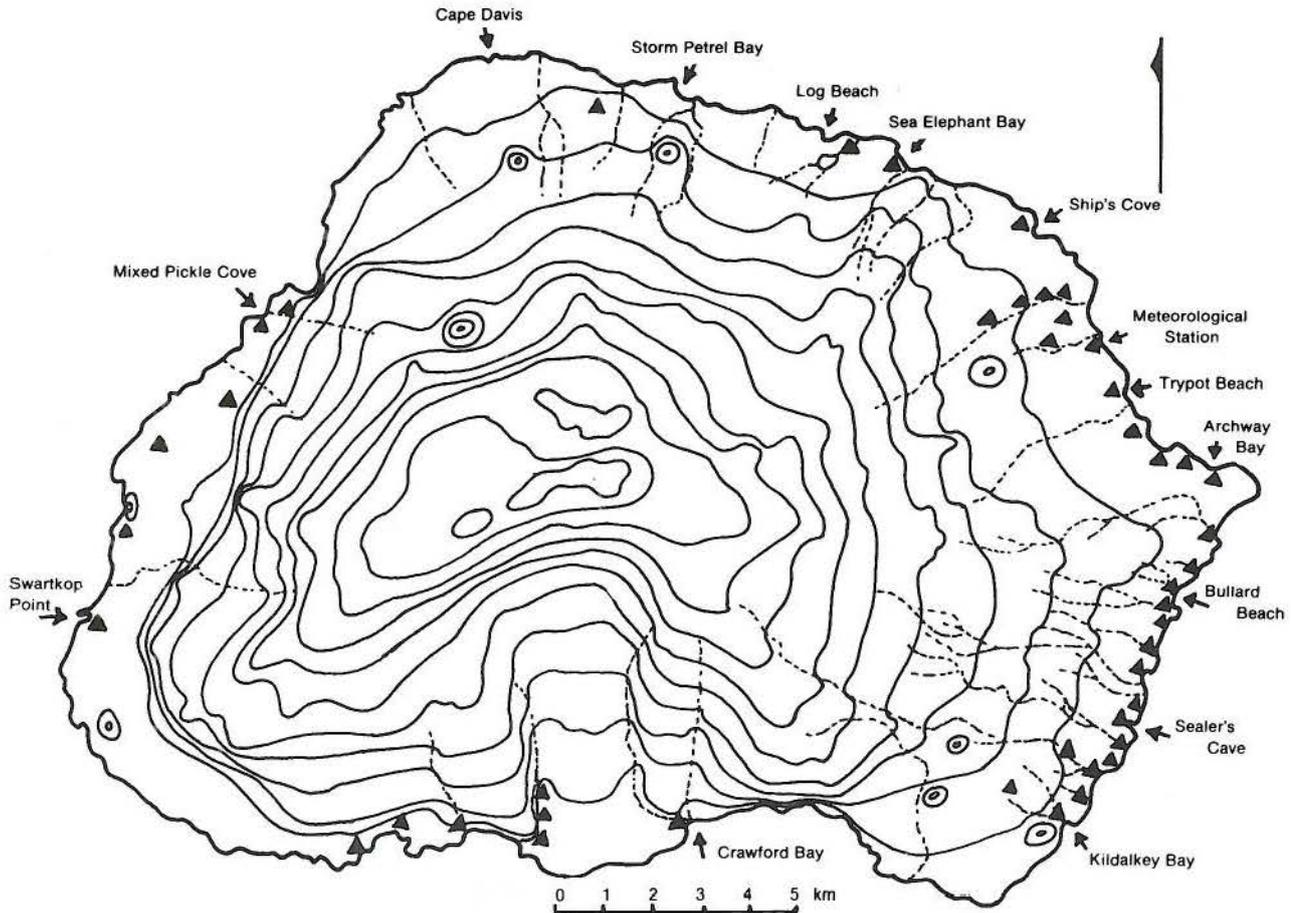


Fig. 4. Distribution of *Stellaria media* on Marion Island. (▲ *Stellaria media*, → site of human settlement, — altitude lines at 100 m intervals, --- stream).

Sagina was found abundantly in the area around the station, from ca. 100 m. south of Gentoo Lake up to Cabbage Point. A second population of 200 - 300 individuals was recorded at the mouth of Van den Boogaard River. In May 1975 a single plant was observed half way between the meteorological station and Trypot Beach. The distribution of *Sagina apetala* is shown in Fig. 1c.

This species is found on sites where the plant cover is broken by trampling by animals and humans. Abundant flowers and seed were produced during nearly the greater part of the summer and seedlings were observed. It appears that *Sagina* readily invades the natural vegetation by means of seed where trampling has occurred.

Stellaria media (L.) Vill. Moseley collected *Stellaria media* from Marion Island in 1873 (Oliver, 1874). According to Huntley this species was widespread on the island in 1965-66 and he recorded it at 12 localities (Huntley, 1971).

In 1973-74 *Stellaria* was found at more than 40 sites (Fig. 4). Only at a few sheltered, well drained sites did big colonies (up to 5 m²) occur. *Stellaria* is generally found in small groups or as single individuals in *Poa cookii* tussock grassland, *Poa cookii*-*Cotula plumosa* vegetation and in *Acaena magellanica* stands. Flowers and seed were observed throughout the summer and seedlings were found at a number of sites. *Stellaria* does not compete aggressively with the natural vegetation.

Discussion

Thirteen alien vascular plant species have been recorded at Marion Island, of which four are classed as transient aliens, one as persistent alien and eight as naturalized aliens. Only one alien species, *Poa annua*, is known from Prince Edward Island and it is considered to be naturalized.

Two of the transient aliens, *Avena sativa* and *Plantago lanceolata*, were previously recorded only once, while *Holcus lanatus* and *Hypochoeris radicata* were observed twice. All records of the transient aliens were from the immediate vicinity of the meteorological station and these plants were presumably introduced with livestock, fodder or soil. The intensive survey of 1973-75 yielded no records of these species; it is felt that none has survived on the island.

Rumex acetosella has been recorded from two localities, 9 km apart. Since this species is apparently unable to spread into the surrounding vegetation it seems likely that this species was introduced independently at the two sites. The establishment of the *Rumex* colony near Gentoo Lake was possibly facilitated by the destruction of the *Poa cookii* tussock grassland in this area by sheep (Huntley, 1971).

Of the naturalized aliens with a restricted distribution, *Alopecurus australis* is only found at Mixed Pickle Cove and *Agropyron repens* at Ship's Cove. The last occupation of the Ship's Cove encampment was in 1912-13 (by survivors of the wrecked sealer *Sea Bird*) and the camp at Mixed Pickle Cove was

already deserted at that time (Marsh, 1948). Both species must therefore have been introduced more than 60 years ago.

The distribution patterns of *Festuca rubra* and *Poa pratensis* do not suggest a recent introduction at the meteorological station. *Festuca* was presumably introduced at Ship's Cove and *Poa pratensis* at the Trypot Beach area, the population of *Poa pratensis* at Ship's Cove possibly representing a second introduction. Both species have extended their distribution since 1965-66. The size of some of the newly discovered colonies, however, indicates an age of more than ten years and presumably the stand of *Festuca rubra* near the Van den Boogaard River, as well as some groups of *Poa pratensis*, were overlooked during the 1965-66 survey.

Cerastium fontanum, *Poa annua*, *Sagina apetala* and *Stellaria media* are considered to be naturalized aliens with a widespread distribution. The distribution pattern of *Sagina* indicates that it was introduced at the meteorological station. It has extended its distribution considerably since 1966 and competes aggressively with the natural vegetation. The other three species of this group were introduced by sealers during the nineteenth century. The distribution of *Cerastium*, especially, indicates a multiple introduction. It is likely that *Poa annua* and *Stellaria media* were also introduced at more than one place on Marion Island.

The widespread naturalized aliens all spread readily by seed. In contrast, all other alien species spread predominantly by vegetative means, except for *Rumex acetosella*, which seems to consolidate its colonies by seed, but does not encroach upon the surrounding vegetation.

The most important agent in the dispersal of the seed of the alien species on Marion and Prince Edward Island is almost certainly wind. Dispersal by water may also occur. No observations have been made implicating birds or other animals as a dispersal factor of the seed of the alien plants. Seed of a number of indigenous species is frequently found in the nests and the stomach contents of mice. (V.R. Smith, personal communication) and it is possible that these animals contribute to the dispersal of the alien plants.

Man has exerted only a small influence on the ecosystems of Marion and Prince Edward Islands in comparison with other sub-Antarctic islands. On Prince Edward Island, especially, human interference has been negligible. It is proposed that the introduction of foreign organisms to the islands be avoided in future. Those species of alien plants with a limited distri-

bution can be eradicated. It is unlikely, however, that the widespread naturalized aliens which are capable of spreading by means of seed can be eradicated from the islands.

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