Conservation of Islands in the Southern Ocean
A review of the protected areas of Insulanantarctica
CONSERVATION OF ISLANDS IN THE SOUTHERN OCEAN:

A review of the protected areas of Insulantarctica

by

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This is a discussion document prepared for IUCN's Commission on National Parks and Protected Areas.

February 1985
PREFACE

This review of the protected areas of Insulantarctica makes an important contribution to the global protected areas monitoring programme of IUCN's Commission on National Parks and Protected Areas (CNPPA). The programme had its beginnings in 1959 when a resolution of the United Nations charged IUCN with the task of establishing and maintaining a world listing of national parks and protected areas. Since 1979 CNPPA has assembled protected area information on a systematic and scientific basis, using as a conceptual framework a system of biogeographic realms and provinces of the world. Several world lists have been published and more recently directories of protected areas have been produced according to realms. With the establishment of the IUCN Protected Areas Data Unit (PADU) in 1981, the collection, processing and dissemination of information on protected areas has become more sophisticated and efficient.

Monitoring of protected areas involves more than simply listing information. An important phase of the programme is the use of the information collected to assess the extent to which management objectives for protected areas are being attained. This evaluation is an essential tool in identifying priorities for future action and guiding IUCN's efforts at improving the extent and quality of protection for the world's living resources.

This review, by incorporating both a directory of essential information on protected areas and a preliminary evaluation of their management, goes much of the way towards satisfying the objectives of the protected area monitoring programme in Insulantarctica.

The information contained here also represents a substantial and timely contribution to IUCN's programme on island conservation. The conservation needs of the world's oceanic islands are widely recognised as being important and urgent, and they will receive special attention within IUCN's future programme. Already, through the co-operative efforts of IUCN and the International Council for Bird Preservation (ICBP), progress has been made in establishing an island data bank and identifying the most serious conservation problems.

Preparation of this document has been a worthy achievement and I commend its findings to those involved in all aspects of protected area management in the Southern Ocean. I also welcome the opportunities it presents for constructive dialogue not only within the membership of IUCN but also between IUCN and the Antarctic Treaty Nations, and other bodies actively involved in the conservation of Antarctica and the Southern Ocean, such as the Scientific Committee on Antarctic Research (SCAR).

H K Eidsvik
Chairman
IUCN Commission on National Parks and Protected Areas
FOREWORD

IUCN's mission in the conservation of living resources is elaborated in the World Conservation Strategy which has the three-fold goal of maintaining ecological processes and life-support systems, preserving genetic diversity, and ensuring the sustainable utilisation of species and ecosystems. A requirement for successfully attaining this goal is the establishment and effective management of a network of protected areas which is fully representative of the world's ecological diversity. Promoting action to achieve this global objective for protected areas is a principal function of IUCN's Commission on National Parks and Protected Areas.

Information is the life blood of protected area management. The central purpose of this report is to provide, according to a systematic format, a directory of essential scientific and administrative information on protected areas in Insulantarctica, thereby filling a significant gap in the recording of protected areas of the world. Such information, once integrated and processed with equivalent information for other global realms, at IUCN's Protected Areas Data Unit at Cambridge, U.K., will be invaluable for IUCN in establishing its priorities for action in extending and improving the management of the world's protected areas, consistent with the imperative of the World Conservation Strategy.

A secondary purpose of this report is to provide a preliminary evaluation of the degree to which management objectives are being met in protected areas on islands of the Southern Ocean, thus enabling a comparison among different management strategies, and promoting a mutually beneficial interchange of ideas and experiences among managers, aimed at finding solutions to common problems and improving management generally. This will also improve IUCN's capability for effective support, through, for example, technical, professional or financial assistance, where this is desirable.

This report is noteworthy as the first of IUCN's protected area directories which covers an island realm. Gathering the necessary information has not been an easy task and remains incomplete. The southern islands are scattered throughout a vast area of the globe, and have a complex political, governmental and legal arrangement which includes for some of the islands administration under the Antarctic Treaty. Information has been obtained through the resources of IUCN's network of members, and through official governmental channels as far as possible. The document is intended principally to assist protected area managers. However, it will be widely useful, and of particular interest and value to officials of government agencies which administer the islands. It is not a compendium of scientific information nor an exhaustive inventory of natural resources of the southern islands.
Rather, it is restricted to a compilation of that information essential for understanding and assessing protected areas on these islands. The assembling and analysis of information has been conducted on a professional and impartial basis. To achieve the widest possible coverage of islands in the Southern Ocean, some islands have been included which do not have formal protected area status. However, some form of nature protection exists for all islands considered.

I thank all those who have contributed to preparation of the report. I believe that it makes significant progress towards achieving its intended purposes, and am confident that it will be widely and well-received. Further data for filling any important gaps in the information, and comments or constructive criticism are welcomed. These should be addressed to me.

P H C Lucas
CNPPA Vice Chairman - Antarctic Realm
Director-General
Department of Lands and Survey
Wellington
New Zealand
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Shy albatross (Diomedea cauta) nesting in herbfield and tussock grassland of Disappointment Island, Auckland Islands Nature Reserve, illustrating a pristine subantarctic island environment. (Photo: NZ Department of Lands and Survey).
SECTION I

INTRODUCTION

Island ecosystems - opportunities and constraints for protected areas

The character of island ecosystems has been extensively documented elsewhere (e.g. Holdgate and Wace 1961; Wace 1982) and is not discussed in detail here. It is sufficient to note that island environments are very distinctive and markedly different from those of continental areas. Islands reflect the overwhelming influence of their oceanic surroundings (especially in their climatic regime) and are characterised by limitations of space, restricted habitats, impoverished floras and faunas compared to continental areas of similar ecological diversity, and a high degree of species endemism stemming from their geographical and ecological isolation.

These distinguishing insular characteristics also underlie the intrinsic values of islands as protected areas. Paramount among these values is the uniqueness of floras and fauna due to the presence of endemic, relict and/or specialised species. Their isolation means that islands are ideally suited as refugia for threatened plants and animals and as reservoirs for the preservation of genetic resources. Islands also offer much scope for the study, understanding and appreciation of intact and holistic natural ecosystems.

Notwithstanding the opportunities which these special island qualities provide for protected area management, there are also formidable constraints imposed on management. Indigenous island biota, having evolved in isolation from mainland biota, are often specialised and consequently highly vulnerable to external disturbance, especially human-induced impacts.

"If isolation and accessibility have hitherto been the great conserving forces in man's relations with wild nature, oceanic islands are the best examples we have of the catastrophic effects of the removal of these powerful constraints." (Wace 1982, p.4)

Modified conditions induced by burning of vegetation, cultivation and stocking with introduced domestic animals almost inevitably results in the rapid establishment and spread of alien biota at the expense of indigenous species. One of the greatest threats to island biota is the accidental or deliberate introduction of alien plants and animals, especially mammals. Indigenous island biota usually lacks mammalian herbivores and carnivores and their introduction may have a devastating impact. Extinction of species, therefore, is particularly common on islands.
Conservation of Islands in the Southern Ocean

Conservation needs of the world's southern islands

Several authors have addressed the subject of conservation in the Southern Ocean (eg Carrick 1960, 1964; Holdgate and Wace 1961; Holdgate 1970; Roberts 1977) and have highlighted the importance of protecting southern islands from the disruptive influences of man.

The vast majority of the world's oceanic islands bear the imprint of human influences. Most temperate and subtropical islands have been settled by man for a considerable period of time and few have escaped disruption, as evidenced in the Pacific Ocean (eg Fosberg 1963; Nicholson and Douglas 1970) and the Indian Ocean (eg Stoddart 1967; Snow 1970). Many southern temperate and subantarctic islands also exhibit marked human impacts (eg Holdgate and Wace 1961; Holdgate 1970). Generally, however, islands of the Southern Ocean* have not been permanently inhabited, periods of exploitation have been short and they have often escaped the severe effects experienced on the more northern oceanic islands. Several southern island groups have not been modified by man at all — indeed they are among the few remaining terrestrial areas of the world unaffected by man — and hence are of great importance.

The value of southern islands for scientific purposes has been long-recognised, beginning with scientific exploration in the mid-19th century. Scientific interest in Antarctica and the Southern Ocean was greatly increased following the activities of the International Geophysical Year in 1957. Today, meteorological and scientific bases are established on several islands, and many are visited regularly by scientific expeditions.

Following an exploitation phase in the 19th century, the importance of conserving wildlife and island habitats in the Southern Ocean became readily apparent, and legal protection of islands had its beginnings in the early decades of this century.

Experience reveals that the natural environments of these southern oceanic islands are easily disturbed and destroyed but virtually impossible to rehabilitate or replace. Protected area managers have an awesome responsibility to secure island protected areas against the deleterious influences of man. In recent years, the expansion of commercial interests in fishing, mineral (especially oil) exploration and tourism, and increased scientific activity, have been inexorably eroding the isolation of the southern islands and pose problems for their effective management as protected areas.

The need to review the conservation status of islands and their protected areas in the Southern Ocean is urgent. The World Conservation Strategy (IUCN 1980) which establishes guiding principles for survival of the

*Here we adopt the use of this term by Holdgate (1967) as referring to the area between the Antarctic continent and the Subtropical Convergence.
biosphere, identifies the southern oceanic islands among the world's priority regions for the establishment of protected areas.

Through its Commission on National Parks and Protected Areas (CNPPA), IUCN has initiated a global protected area monitoring programme aimed at the establishment and effective management of a world-wide system of ecologically representative protected areas (McNeely and Miller 1983). This report is the first step in documenting protected areas among the world's southern islands. The report also contributes to the database in IUCN's island conservation programme which is aimed at identifying priorities for conservation action among the world's oceanic islands. This programme is co-ordinated by IUCN's Commission on Ecology and Conservation Monitoring Centre in co-operation with the International Council for Bird Preservation (ICBP).

Reviewing protected areas of Insulantarctica - scope, objectives and methods

This report deals with those islands which are included within the biogeographic province of Insulantarctica (Figure 1). Insulantarctica is one of four provinces constituting the Antarctic Realm within a global biogeographic classification system devised for IUCN by Udvardy (1975).

Udvardy's broad conceptual framework has a number of limitations (Appendix I contains our proposed redefinition of Insulantarctica) but it does provide a useful and widely-recognised biogeographic grouping for considering protected areas of the island territories of the Southern Ocean.

Udvardy included the islands flanking Tierra del Fuego in Insulantarctica, but did not specify them. In view of the large number of very small islands off the south and west coasts of Tierra del Fuego we thought it impractical to cover these islands here. However, the southern islands of New Zealand are considered in this report. Udvardy (pers comm) included all of these, along with the mainland of New Zealand, in the province of Neozealandia, but, because of their ecological and conservation affinities with the world's other southern islands, we believe they are more logically a part of Insulantarctica.

Insulantarctica, thus, encompasses some twenty-two major islands or island groups (Figure 2), listed below according to the order in which they are considered in this report.

Heard Island
MacDonald Islands
Macquarie Island
Ile Amsterdam
Ile Saint-Paul
Iles Crozet
Iles Kerguelen
Figure 1
Biogeographical Provinces of the Antarctic Biogeographical Realm (after Udvardy 1975).
Introduction

The objectives of this report are:

(i) To provide a directory of information on the major physical and biological features of the southern islands, and details of administration and management of their protected areas.

(ii) To identify the conservation status of the islands and evaluate the adequacy of the extent and management of protected areas.

(iii) To identify significant conservation problems and establish priorities for future action.

The directory follows a standard format recommended for the information storage and retrieval system at the Protected Areas Data Unit of IUCN's Conservation Monitoring Centre, based in Cambridge, U.K. This includes a description of physical features, flora and fauna, protected area administrative details, management policies and management problems. This is followed by a critical assessment of management based on criteria established by IUCN for evaluating management effectiveness in protected areas (Deschler 1982). Maps of each island group are included.

We have not sought to provide an encyclopaedic coverage of the natural resources and features of the islands. Instead, the directory is intended as a sourcebook for protected area management, to assist in understanding and evaluating island protection. A listing of major reference material is provided for those requiring further information.

Information gathering for such a widely dispersed and international assemblage of island territories has been a demanding research challenge. We have relied heavily on information provided by the membership network of IUCN, and have obtained material from published literature, unpublished reports, and from correspondence with individuals or agencies involved in research and conservation on the southern islands.
The southern hemisphere south of latitude 30° S, showing the positions of the islands, and Subtropical and Antarctic Convergences.
Our own direct experience in the management of New Zealand's outlying island reserves has also been beneficial. As far as possible information has also been sought from official government sources, but regrettably in the limited time available to us this task remains incomplete. We readily acknowledge this deficiency but hope that, by responding constructively to this discussion document, governments will fill any important remaining gaps in the documentation and correct any errors. We are confident that this report will be helpful to governments with island management responsibilities and will lay the foundation for development by IUCN of effective policies and an active programme for conservation of the oceanic islands of the Southern Ocean.
SECTION II

RESOURCE AND PROTECTED AREA INFORMATION

Royal penguin (*Eudyptes schlegeli*) colony of Nugget Point, Macquarie Island. (Photo: NZ Department of Lands and Survey).
Heard Island

HEARD ISLAND

GENERAL INFORMATION

COUNTRY Australia

GEOGRAPHICAL LOCATION 53°06'S, 73°30'E, in the southern Indian Ocean, on the Kerguelen Plateau.

AREA Approximately 38 000 ha

MAXIMUM ALTITUDE 2745 m (Mawson Peak, of Big Ben)

PHYSICAL FEATURES Heard Island is 42 km by 25 km, with the main body of the island roughly circular. Topography is dominated by the Big Ben massif, with the volcanically active Mawson Peak. A mountainous headland, Laurens Peninsula, extends to the north-west. There are numerous outlying islets, rocks and reefs.

The island is volcanic, of basaltic composition. Over 90% of its area is glaciated, with ice up to 150 m deep. There is little soil development.

The island has a cool maritime climate: strong westerly winds prevail, mean annual temperature 1°C, with rainfall of 1400 mm/yr. The Antarctic Convergence lies about 180 km to the north in summer.

FLORA AND VEGETATION Eight species of vascular plant occur (five herbs, three grasses), with moss and lichen species.

Principal vegetation communities are tussock, herbfield, and feldmark. Short tussock grass (Poa cookii), with cushions of the herb Colobanthus kerguelensis are present in central areas, with Kerguelen cabbage (Pringlea antiscorbutica) and Azorella selago cushions in established moraines and valleys up to 200 m. Dwarf shrub (Acaena magellanica) occurs in sheltered areas. Above 200 m, mosses and lichens dominate ice-free regions.

There are no trees.

Kelp (principally Macrocystis antarctica) is abundant along the coastline.

FAUNA Large populations of southern elephant seal (Mirounga leonina) occur. Leopard seal (Hydrurga leptonyx) are common but non-breeding. Antarctic fur seal (Arctocephalus gazella) are recolonising the island.
20 species of bird breed on Heard Island. Gentoo penguin (*Pygoscelis papua*) and macaroni penguin (*Eudyptes chrysolophus*) are abundant, with chinstrap penguin (*Pygoscelis antarctica*), rockhopper penguin (*Eudyptes chrysolophus chrysolophus*), and king penguin (*Aptenodytes patagonicus*) also breeding. Royal penguin (*Eudyptes schlegeli*) occur but do not breed. Other main breeding bird species are: southern giant petrel (*Macronectes giganteus*), fulmar prion (*Pachyptila crassirostris*), Wilson's storm petrel (*Oceanites oceanicus*), South Georgian diving petrel (*Pelecanoides georgicus*), common diving petrel (*Pelecanoides urinatrix*), southern skua (*Catharacta lomnbergii*), southern black-backed gull (*Larus dominicanus*), Antarctic tern (*Sterna vittata*), Antarctic prion (*Pachyptila desolata*), and lesser sheathbill (*Chionis minor*).

Wandering albatross (*Diomedea exulans*) were reported breeding in small numbers, for the first time, in 1980.

Subspecies of blue-eyed shag (*Phalacrocorax atriceps nivalis*) and lesser sheathbill (*Chionis minor nasicornis*) are endemic to Heard Island and the MacDonald Islands.

Most bird populations are reported as stable, with those of king penguin and black-browed albatross (*Diomedea melanophris*) increasing.

Over 50 species of terrestrial arthropod are found, principally of the taxa Collembola, Coleoptera, Diptera, and Lepidoptera. These display a relatively low level of endemism, many in common with Iles Kerguelen.

**HISTORICAL FEATURES** Discovery of Heard Island is attributed to the British captain, Peter Kemp, in 1833, but the sighting was not published. It was visited by the American captain Heard of the 'Oriental' in 1853. The first landing was in 1855. Sealing gangs occupied the island continuously for the next 20 years, thereafter sporadically until 1929. Elephant seal, fur seal, and penguin (particularly king penguin) were exploited.

Heard Island was annexed to Australia from Britain in 1947. However, sovereignty claims by Britain and the United States, based on the discoverer of the island, are unresolved.

A research station was operated from 1947 to 1954 by Australian National Antarctic Research Expeditions, who later shifted activities to bases on the Antarctic mainland. The island is now visited infrequently.

**HABITATION** There is no permanent habitation.

**PROTECTED AREA INFORMATION**

**MANAGEMENT CLASSIFICATION** There is no specific classification. The island is not formally protected by statute.
Conservation of Islands in the Southern Ocean

DATE ESTABLISHED Not applicable (Australian control was formalised in 1953).

AREA Not applicable (although entire island area of 38,000 ha is managed by Australia).

LAND TENURE Crown land (Australian External Territory).

LEGAL PROTECTION Under the Heard and MacDonald Islands Act 1953, the island was designated part of an Australian External Territory. Laws of the Australian Capital Territory (ACT) apply, and the Governor-General is empowered to enact ordinances for the Territory.

Several general conservation acts exist for the ACT, but no ordinances specifically deal with Heard Island. The protection of Migratory Birds Ordinance 1980, protects Wilson's storm petrel (Oceanites oceanicus) and great skua (Stercorarius skua) (referred to here as southern skua, Catharacta lombergi), which breed on the island.

A management and nature conservation ordinance for Heard Island and the MacDonald Islands is being prepared by the Department of Science and Technology.

Heard Island is within the boundaries of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) (1980) regulating commercial exploitation of marine animals.

ADMINISTRATION Under the Heard and MacDonald Islands Act 1953, the Australian Minister of the Interior was initially responsible for administration of Heard Island (and MacDonald Islands), subsequently the Minister for Science and Technology, advised by the Antarctic Division.

Contact address: The Secretary
Department of Science and Technology
P O Box 65
Belconnen
ACT 2616
AUSTRALIA

MANAGEMENT POLICY There are no management plans, although guidelines for visits have been produced by the Department of Science and Technology. The guidelines deal with administrative, safety, and environmental protection measures. Under these, it is prohibited to: interfere with fauna or flora; introduce any animal, plant, parasite, or disease; collect samples, except for bona fide scientific reasons; use motorised vehicles; light fires; erect permanent structures; or carry or use firearms.

Detailed management policies are currently being developed in conjunction with a new management and nature conservation ordinance by the Antarctic Division of the Department of Science and Technology.
Heard Island

Management follows the Agreed Measures for the Conservation of Antarctic Fauna and Flora where appropriate, and these form the basis of the new ordinance.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN There are no known alien animals or plants on the island. Sheep (Ovis aries) were introduced with the first Australian National Antarctic Research Expedition (1947), but did not become established.

Antarctic fur seal (Arctocephalus gazella), southern elephant seal (Mirounga leonina), and king penguin (Aptenodytes patagonicus) were heavily exploited in the 19th century, but populations are now increasing.

SCIENTIFIC RESEARCH The island was visited by several scientific expeditions in the 1800s and early 1900s. Frequent ANAREs (1947–54, 1963, 1969, 1971, 1980, 1983) have carried out much research. Involvement of the Scientific Committee on Antarctic Research (SCAR) has prompted investigations on seabird and seal populations. An active, although spasmodic, research programme is conducted. Several private expeditions in recent years have included scientists.

ASSESSMENT OF PRESENT CONSERVATION STATUS Populations of seals and penguins on the island are recovering from heavy exploitation in the 19th and early 20th centuries.

The immediate area around the ANARE station has been slightly modified, but most of Heard Island is unaffected by man. No alien plants or animals are present.

Geographical isolation has, in the past, been the main factor in conservation of the island. Legal protection appears an immediate requirement. Keage (1982) discusses in detail, various options for future nature conservation, and recommends inclusion of Heard and the MacDonald Islands under the Australian Antarctic Treaty (Environmental Protection) Act 1980, and adoption of the Agreed Measures for the Conservation of Antarctic Fauna and Flora.

Completion in the near future of a detailed official management plan which is being prepared by the Antarctic Division appears desirable. This concerns protection of fauna and flora, regulation of human activities, and prevention of introductions of alien species.

SELECTED REFERENCES

1 Budd, G M. 1972: Breeding of the fur seal at McDonald Islands, and further population growth at Heard Island. Mammalia 36: 423-7.
2 Dowries, M C; Ealey, E H M; Gwynn, A M; Young, P S. 1959: The birds of Heard Island. ANARE publications 51: 135 p.
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MACDONALD ISLANDS

GENERAL INFORMATION

COUNTRY Australia

GEOGRAPHICAL LOCATION 53°03'S, 72°36'E, on the Kerguelen Plateau, about 40 km west of Heard Island.

AREA Approximately 260 ha

MAXIMUM ALTITUDE 230 m

PHYSICAL FEATURES The group comprises MacDonald Island, with several small rocky islets (notably Flat Island and Meyer Rock).

MacDonald Island consists of two sections joined by a narrow isthmus: a northern, sloping plateau, and a southern steep-sided hill, both bounded by steep cliffs.

The islands are composed of basaltic lava and tuffaceous material, resulting from eruptions of volcanic vents near sea level. There is little soil.

Climate is probably very similar to that of Heard Island: persistent, strong westerly winds, mean annual temperature about 1°C, and annual rainfall of around 1400 mm.

FLORA AND VEGETATION Five vascular plant species have been recorded.

Tussock grass (Poa cookii) is common on eastern slopes, and lower parts of the plateau. Cushions of Azorella selago cover higher areas, with Kerguelen cabbage (Pringlea antiscorbutica), and dwarf shrub (Acaena magellanica).

FAUNA Fauna is similar to Heard Island.

Macaroni penguin (Eudyptes chrysolophus) are very abundant. Southern giant petrel (Macronectes giganteus), Cape pigeon (Daption capense), Wilson's storm petrel (Oceanites oceanicus), South Georgian diving petrel (Pelecanoides georgicus), lesser shearwater (Chionis minor nasicornis), southern skua (Catharacta lonnbergi), and blue-eyed shag (Phalacrocorax atriceps nivalis) are common.

The subspecies of lesser shearwater and blue-eyed shag are endemic to Heard and MacDonald Islands.

Southern elephant seal (Mirounga leonina) and Antarctic fur seal (Arctocephalus gazella) breed, while leopard seal (Hydrurga leptonyx) occur. Fur seal from the MacDonald Islands have probably recolonised Heard Island after severe exploitation of the latter populations in the 1800s.
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HISTORICAL FEATURES The islands were discovered in 1854 by Captain MacDonald of the British sealing vessel Samarang. Some exploitation of seals and penguins occurred in the 1800s. The Australian Government assumed sovereignty in 1947. The first recorded landing was in 1971 for less than 1 hour. Subsequently, a 4 day visit took place in 1980.

HABITATION Uninhabited.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION There is no specific classification. The islands are not formally protected by statute.

DATE ESTABLISHED Not applicable (Australian Government assumed sovereignty and control in 1947, formalised 1953).

AREA Not applicable (entire island area of about 260 ha is managed by Australia).

LAND TENURE Crown land, as an Australian External Territory.

LEGAL PROTECTION The MacDonald Islands are part of an Australian External Territory, and laws of the Australian Capital Territory (ACT) apply. In addition, the Governor-General is empowered to institute ordinances. Only one set is specifically relevant to the MacDonald Islands (and Heard Island), the Protection of Migratory Birds Ordinance 1980, under which Wilson's storm petrel (Oceanites oceanicus) and southern skua (Catharacta lomnbergi in this report) are protected.

A management and nature conservation ordinance for the MacDonald Islands and Heard Island is currently being prepared by the Department of Science and Technology.

The islands are within the boundaries of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) governing exploitation of animals.

ADMINISTRATION The Australian Minister of Science and Technology is responsible for the islands, advised by the Antarctic Division of the Department of Science and Technology.

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Department of Science and Technology
P O Box 65
Belconnen
ACT 2616
AUSTRALIA
Macdonald Islands

MANAGEMENT POLICY There is no formal conservation policy or management plan. Guidelines for visits by expeditions to the islands (and Heard Island) have been prepared by the Department of Science and Technology. These include measures to prevent: interference with fauna and flora; introductions of animal, plant, parasite, or disease; collection of samples except by bona fide scientists; use of motorised vehicles; lighting of fires; erection of permanent structures; use of firearms.

Detailed management policies are being developed at present by the Antarctic Division of the Department of Science and Technology. These policies are being developed in conjunction with the management and nature conservation ordinance, based on the Agreed Measures for the Conservation of Antarctic Fauna and Flora.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Sealing and whaling operations occurred in the Heard - MacDonald Islands area in the 1800s and early 1900s, but these were centred on Heard Island.

The MacDonald Islands are unmodified by man. There are no alien plants or animals.

SCIENTIFIC RESEARCH Research has been very limited in the past, landings on the islands having been made only in 1971 and 1980.

Current research consists of some mapping and photographic work by Australian National Antarctic Research Expeditions (ANARE) in conjunction with research at Heard Island.

ASSESSMENT OF PRESENT CONSERVATION STATUS The MacDonald Islands are in a natural state, and conservation prospects are good. However, as for Heard Island, reliance largely upon geographical isolation may not be sufficient in the future.

Keage (1982) discusses fully the conservation and management needs of Heard and MacDonald Islands, and recommends that the islands be protected under the Australian Antarctic Treaty (Environmental Protection) Act 1980, formalising adoption of the Agreed Measures for the Conservation of Antarctic Fauna and Flora. Such action, together with preparation of comprehensive management plans, would ensure adequate legal protection of the islands.

SELECTED REFERENCES


Conservation of Islands in the Southern Ocean

MACQUARIE ISLAND

GENERAL INFORMATION

COUNTRY Australia

GEOGRAPHICAL LOCATION 54°37'S, 158°54'E, in the South Pacific Ocean, 1500 km south-east of Tasmania.

AREA 12 785 ha

MAXIMUM ALTITUDE 433 m (Mt Hamilton)

PHYSICAL FEATURES Macquarie Island is 34 km long (north-south), and up to 5 km wide. It has a rocky shoreline, backed by steep cliffs, with an undulating plateau at 200-300 m. There is a wide coastal platform in the north-west. Several stacks and offlying islets occur, most notably Bishop and Clerk islets to the south-west, and Judge and Clerk islets to the north-east.

The island is of volcanic origin, a horst block, subsequently eroded. It is composed of igneous rocks of Miocene/Pliocene age. There has been glacial activity in the past, but there is now no permanent ice. Several lakes are present. Soils are gravelly loams on the plateau, with acid peat soils elsewhere.

The island has a cold temperate climate: small seasonal and diurnal variation in temperature (annual mean 4.4°C), 85-90% humidity, strong westerly winds, heavy cloud, and average rainfall of 900 mm/yr. The Antarctic Convergence lies 200-250 km to the south.

FLORA AND VEGETATION There are no trees, but the island is extensively vegetated. 40 vascular, 50 moss, 30 liverwort, and 55 lichen species occur.

Tussock Braggland of Poa foliosa and Poa hamiltoni dominates well-drained upland flat areas. Herb fields of Pleurophyllum hookeri and Macquarie cabbage (Stilbocarpus polaris) occur on moderately exposed flat and slope regions with a high water table. Wetter areas are occupied by the rush Juncus scheuchzeroides, and sedges Scirpus aucklandicus and Carex trifida. Feldmark vegetation is characteristic of exposed uplands above 200 m, dominated by the low-growing cushion herb Azorella selago with moss Rhacomitrium crispulum. In the north-west, areas of peat bog occur, dominated by Brentelia and Sphagnum moss species, with cushions of Colobanthus muscoides.

Three endemic vascular species are found: grasses Poa hamiltoni, Deschampsia penicillata, and Puccinellia macquariensis.
Conservation of Islands in the Southern Ocean

There is a high degree of endemism among lichens.

Four species of introduced plant are well established, but only the grass Poa annua is common.

Kelp of the genera Macrocystis and Durvillea are abundant in coastal waters.

**PAUNA** Birds are abundant on the island, with 21 breeding species. King penguin (Aptenodytes patagonicus), gentoo penguin (Pygoscelis papua), rockhopper penguin (Eudyptes chrysolophus chrysolophus), and royal penguin (Eudyptes schlegeli) are common, with black-browed albatross (Diomedea melanophris), grey-headed albatross (Diomedea chrysoptera), and light-mantled sooty albatross (Phoebetria palpebrata). Numerous species of petrel occur, notably giant petrel (Macronectes halli, M. giganteus), blue petrel (Halobaena caerulea), white-headed petrel (Pterodroma lessonii), grey-backed storm petrel (Garrodia nereis), and fairy prion (Pachyptila turtur). Wandering albatross (Diomedea exulans), sooty shearwater (Puffinus griseus), king shag (Phalacrocorax albiventer purpurascens), southern skua (Catharacta lonnbergi), and Antarctic tern (Sterna vittata) also breed. Redpoll (Acanthis flammea) and starling (Sturnus vulgaris) are self-introduced from New Zealand.

Macquarie Island is the only known breeding ground of royal penguin. They occur also on Heard Island, but do not breed.

Southern elephant seal (Mirounga leonina), New Zealand fur seal (Arctocephalus forsteri) and Amsterdam Island fur seal (Arctocephalus tropicalis) breed. Several hundred leopard seal (Hydrurga leptonyx) may visit the island annually.

Animals introduced by man include grey ducks (Anas superciliosa), mallards (Anas platyrhynchos), wekas (Gallirallus australis), cats (Felis catus), rats (Rattus rattus), mice (Mus musculus), and rabbits (Oryctolagus cuniculus).

The invertebrate fauna comprises several hundred species. Arthropod species number 119, principally spiders and insects.

**HISTORICAL FEATURES** Macquarie Island was discovered by the English sealer Hasselburgh in 1810, and was inhabited periodically by bands of sealers throughout the 1800s. The island was included in the 1825 proclamation of Van Dieman's Land (Tasmania). Several scientific expeditions visited the island during the 19th and early 20th centuries. It was declared a sanctuary in 1933. A meteorological and research station was established in 1948 (Australian National Antarctic Research Expedition (ANARE) base) which is maintained to the present.
HABITATION There are no permanent residents.

The ANARE station and six small field huts are maintained, manned by about 20 (1981) overwintering personnel.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Macquarie Island Nature Reserve:

IUCN categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tr>
<td>I</td>
<td>(Scientific/Strict Nature Reserve)</td>
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<tr>
<td>IX</td>
<td>(Biosphere Reserve)</td>
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</tbody>
</table>

DATE ESTABLISHED

- 1933 - declared Nature Sanctuary
- 1972 - declared State Reserve
- 1977 - declared Biosphere Reserve
- 1978 - classified Nature Reserve

AREA Entire island (12,785 ha), including offshore islets, to low water mark.

LAND TENURE Crown land.

LEGAL PROTECTION Macquarie Island was initially protected as a sanctuary under the Animals and Birds Protection Act 1928. It was subsequently designated a State Reserve under the Tasmanian National Parks and Wildlife Act in 1970, (gazetted 1972) and declared a Nature Reserve under the same act in 1978. All wildlife and natural features are protected. Entry to the reserve is by permit. Alteration of regulations, or revocation of part of the reserve area, requires the assent of both Houses of Parliament, and security of reserve status is consequently high.

ADMINISTRATION The island is administered by the Tasmanian National Parks and Wildlife Service, with the co-operation of the Antarctic Division of the Australian Department of Science and Technology.

Contact address: National Parks and Wildlife Service
PO Box 210
Sandy Bay
Hobart
Tasmania 7005
AUSTRALIA

MANAGEMENT POLICY Access to the island is generally limited to those engaged in official research or management programmes. Limited tourism, through visits of cruise vessels, has occurred in the past, and is still permitted. However, due to certain quarantine regulations, no visits have been made since 1982.
Conservation of Islands in the Southern Ocean

Considerable modification of native fauna and flora has occurred, and efforts are being made to reverse some trends. An active programme of rabbit (*Oryctolagus cuniculus*) eradication through the introduction of myxomatosis (with regular introduction of rabbit flea (*Spilopsyllus cuniculi*)) has been conducted since the 1970s, with flea release dating from 1972, and virus introduction in 1978. Control of cats (*Felis catus*) through shooting and trapping also occurs. Cat and weka (*Gallirallus australis*) eradication programmes are planned.

There are two management zones: the isthmus, where development is concentrated; and the remainder of the reserve, where disturbance is minimised. Strict enclosure zones may be established.

The officer-in-charge of the ANARE base is generally appointed an honorary ranger under the National Parks and Wildlife Act.

A detailed management plan is currently being prepared.

**MANAGEMENT PROBLEMS AND THE IMPACT OF MAN**  
Macquarie Island was used as a sealing base from 1810 to 1919. A large population of fur seal was completely exterminated, although recolonisation by New Zealand fur seal (*Arctocephalus forsteri*) and Amsterdam Island fur seal (*Arctocephalus tropicalis*) is taking place. Southern elephant seal (*Mirounga leonina*) and seabirds (in particular king penguin (*Aptenodytes patagonicus*)) were also heavily exploited. Populations of wandering albatross (*Diomedea exulans*) were reduced to very low levels.

Sealing operations led to introductions of rabbits, black rats (*Rattus rattus*), mice (*Mus musculus*), cats, dogs and wekas. Grazing by rabbits has substantially modified tussock grassland and herbfield vegetation. Reduction of vegetation cover has contributed to erosion of peaty soils. Predation by cats, rats and wekas is also responsible for the decline of populations of small birds. New Zealand red-crowned parakeet (*Cyanoramphus novaezelandiae erythrotis*) and Pacific banded rail (*Rallus philipensis macquariensis*) became extinct around 1900, and this has been attributed to the impact of man and introduced animals. Control programmes on rabbits and cats are currently proving effective.

Sheep (*Ovis aries*) and goats (*Capra hircus*) were imported in 1947 by personnel of the meteorological station, but were destroyed soon after.

**SCIENTIFIC RESEARCH** An active research programme is conducted on Macquarie Island, under the auspices of the Antarctic Division of the Department of Science and Technology. The ANARE base has been continually manned since its construction, staff averaging 15 to 20.
Base facilities include biological, physics, and meteorological laboratories, and enable a wide range of research to be undertaken by ANARE, university, and government scientists. Present research fields include meteorology, geology, seismology, upper atmospheric physics, geomorphology, botany, and biology. Recent research has focussed on seabird and mammal ecology, causes of erosion, and effects of introduced animals on the native vegetation and wildlife. Approximate annual expenditure by all institutions with personnel on the island is A$1.5 million (1980).

ASSESSMENT OF PRESENT CONSERVATION STATUS  Man has had considerable impact on Macquarie Island. Marine mammals and seabirds have been heavily exploited in the past, and introductions of animals have caused depletion of bird populations, modified vegetation, and contributed to erosion of the land. Control programmes are proving effective against rabbits and cats, and in areas where these have been excluded vegetation has tended to recover. However, introduced mammals are well established, and eradication is unlikely to be achieved, although current efforts will probably serve to permit rare and endangered bird and plant species to increase.

Protection under the Tasmanian National Parks and Wildlife Act 1970 is good, with a high level of security. Macquarie is the only island in the Southern Ocean region to have been declared a Biosphere Reserve under the UNESCO Man and the Biosphere Programme. These reserves are intended to preserve genetic diversity by protection of typical examples of particular ecosystems, and to act as research, education and training areas to enable study of man's interaction with the environment.

Commercial development in the vicinity of the island does not at this time appear likely. Fishing occurs to the south of New Zealand, but not in the relatively deep waters around Macquarie Island.

Access to the island is difficult due to its isolation and is controlled by the Antarctic Division and the Tasmanian National Parks and Wildlife Service. This enables thorough organisation and supervision of expeditions to the island. Tourism has occurred, with visits to the island of cruise vessels such as the 'Lindblad Explorer'. These, however, were curtailed in 1982 due to quarantine regulations.

Completion at an early date of the management plan for Macquarie Island would be desirable.

SELECTED REFERENCES

1 Brothers, N P; Eberhard, I E; Copson, G R; Skira, I J. 1982: Control of rabbits on Macquarie Island by myxomatosis. Australian wildlife research 9: 477-85.
Conservation of Islands in the Southern Ocean


ILE AMSTERDAM

GENERAL INFORMATION

COUNTRY France

GEOGRAPHICAL LOCATION 37°50'S, 77°32'E, in the southern Indian Ocean, 1300 km north-east of Iles Kerguelen.

AREA 5500 ha.

MAXIMUM ALTITUDE 911 m (Mont de la Dives)

PHYSICAL FEATURES The island is oval, 10 km by 7 km. Steep coastal cliffs occur, especially on the western side, sloping to a central crater. The crater floor forms a large plateau at an altitude of about 600 m. Highest points on the island are the remnants of the crater wall. Numerous craters and vents occur on the plateau and flanks of the central cone. There is no present volcanic activity. A sloping lava flow on the north-eastern side of the island affords access, and is the site of a small weather station.

Climate is oceanic and mild; mean annual temperature of 13°C, rainfall of 1100 mm/yr, persistent westerly winds, and high humidity. The island lies to the north of the Subtropical Convergence.

FLORA AND VEGETATION Lowland slopes to 250 m are dominated by meadows of tussock grass Poa novarae. Dense grasslands of sedges Scirpus nodosus, and to a lesser extent Spartina arundinacea, occur to about 600 m. Above this, vegetation comprises feldmark of dwarf shrub (Acaena magellanica), sphagnum bogs, and mosses.

Phylica arboresa trees up to 7 m high, and ferns, were formerly widespread but now occur only in sheltered areas free from grazing.

One Endangered (IUCN classification) plant species is present, the fern Hymenophyllum aeruginosum.

Alien plants are widespread. In recent years there has been a marked increase in abundance of thistle (Cirsium arvense) up to an altitude of 500 m.
Ile Amsterdam

**FAUNA** At least nine bird species are known to breed on Ile Amsterdam: Moseley's rockhopper penguin (*Eudyptes chrysocome moseleyi*), yellow-nosed albatross (*Diomedea chlororhynchos*), sooty albatross (*Phoebetria fusca*), the rare endemic Amsterdam Island albatross (*Diomedea amsterdamsis*), soft-plumaged petrel (*Pterodroma mollis*), broad-billed prion (*Pachyptila vittata macgillivrayi*), southern skua (*Catharacta lonnbergi*), Antarctic tern (*Sterna vittata*) and the introduced Kerguelen pintail (*Anas eatoni*). A species of waxbill (*Estrilda astrild*) has recently become established on the island.

The breeding population of yellow-nosed albatross (37,000 pairs) comprises more than one-half of the world population of the species.

Amsterdam Island fur seal (*Arctocephalus tropicalis*) breed on the island (population of about 20,000 adults in 1981/82) and are rapidly increasing in numbers, and southern elephant seal (*Mirounga leonina*) occur.

Introduced mammals are widespread; cattle (*Bos taurus*), Norwegian rats (*Rattus norvegicus*), mice (*Mus musculus*), and cats (*Felis catus*).

**HISTORICAL FEATURES** Ile Amsterdam was discovered by Sebastian del Cano (on one of Magellan's ships) in 1522, but was not landed on until 1696. It was visited sporadically by explorers, sealers, scientists and crayfishermen in the 1700s and 1800s, and claimed by France in 1843. Cattle farming was attempted in 1871. A French meteorological station was established in 1949-50.

**HABITATION** There are no permanent residents.

The base of La Roche Godon is manned by 35 men on average, relieved annually.

**PROTECTED AREA INFORMATION**

**MANAGEMENT CLASSIFICATION** The island forms part of a 'Parc national antarctique français'.

Management details are not fully known, but probably approximate IUCN category IV (Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary).

**DATE ESTABLISHED** 1938.

**AREA** Entire island (5500 ha)
Conservation of Islands in the Southern Ocean

**LAND TENURE** State-owned territory, part of Territoire des Terres Australes et Antarctiques Françaises (TAAF).

**LEGAL PROTECTION** A decree of 1924 established a 'Parc national de refuge dans les possessions australes françaises', which was replaced by a more comprehensive decree in 1938. This 1938 National Park Act protects marine mammals (in particular fur seal and elephant seal) and some bird species (e.g. rockhopper penguin) on the island.

Antarctic and Subantarctic Lands Act (decree 1966) cover activities of French personnel on the island.

A statute relating to general nature protection in France (law 76-629, 1976) covering protection of the environment, preservation of animal and plant species, maintenance of biological equilibrium and protection of natural resources, applies also to the TAAF.

Exploitation of whales in the 200 mile Exclusive Economic Zone around the island is now prohibited.

**ADMINISTRATION** TAAF is administered from Paris, as four districts. The District of Amsterdam and Saint-Paul is the responsibility of the District Head, based at La Roche Godon.

The Comité de l'Environnement (Committee for the Environment), established in 1982, advises the Head of the Territory on matters relating to environmental and wildlife protection, protected areas, and management problems.

Contact address: administrateur supérieur
Terres Australes et Antarctiques Françaises
34 Rue des Renaudes
75017, Paris
FRANCE

**MANAGEMENT POLICY** Specific details of policy are not known. Guidelines for conduct of personnel on the island, and visitors, have been prepared by TAAF. Personnel are periodically informed of environmental issues and conservation regulations.

A programme to reduce numbers of cattle is planned for 1985.

**MANAGEMENT PROBLEMS AND THE IMPACT OF MAN** Amsterdam Island fur seal (*Arctocephalus tropicalis*) were heavily exploited in the 1800s, but populations are now recovering. However, southern elephant seal (*Mirounga leonina*) no longer breed on the island.
Vegetation on the island has been considerably modified by grazing of introduced mammals, in particular cattle (*Bos taurus*), which are still present, but also sheep (*Ovis aries*), goats (*Capra hircus*), and pigs (*Sus scrofa*), which were formerly present. Cattle are widely distributed, and their grazing has destroyed large areas of tree *Phylica arborea* and ferns. General reduction of vegetation cover has contributed to spread of alien vegetation, caused soil erosion, and reduced suitable habitat for some bird species. Vegetation has also been frequently destroyed by fire, the last one in 1973 burning for many months, and affecting colonies of birds.

Introduction of rats (*Rattus norvegicus*), cats (*Felis catus*) and to a lesser extent mice (*Mus musculus*) has severely affected populations of small seabirds, which are known to have been abundant in the past as evidenced by large numbers of subfossil bones. Few petrel species now occur on the island, most surviving only in small numbers. Great-winged petrel (*Pterodroma macroptera*), white-faced storm petrel (*Pelagodroma marina*), and common diving petrel (*Pelecanoides urinatrix*) are among species formerly recorded on the island.

Rockhopper penguin (*Eudyptes chrysocome moseleyi*) and southern skua (*Catharacta lonnbergi*) were regularly shot by station personnel up to 1975.

The crayfish industry around Ile Amsterdam and Ile Saint-Paul (100 km to the south) is thought to be over-exploiting the resource. Up to 500 tonnes are taken annually.

**SCIENTIFIC RESEARCH** Research in TAAF is controlled by a scientific council in Paris, chaired by the Head of the Territory. The council operates in conjunction with the Direction Générale de la Recherche Scientifique et Technique (General Directorate for Scientific and Technical Research), and the Comité National Français des Recherches Antarctiques (French National Committee on Antarctic Research). Research is centred on Iles Kerguelen and Iles Crozet, but limited studies are conducted on Ile Amsterdam (geophysical observations, some work on crayfish physiology).

**ASSESSMENT OF PRESENT CONSERVATION STATUS** The native fauna and flora of Ile Amsterdam have been greatly affected by human actions over the last 200 years. The extent of modification of the island’s environment by man and introduced animals is extensive. Some animals are recovering under protection (eg Amsterdam Island fur seal), but most bird species continue to be threatened. There is urgent need for measures to protect the population of Amsterdam Island albatross (*Diomedea amsterdamensis*). The presence of albatrosses on the island was known since the 1950s, but they were only recognised as a distinct species in the 1982. They number 25-30 breeding pairs, and nesting habitat is vulnerable to trampling and grazing by cattle.
Conservation of Islands in the Southern Ocean

The distribution of *Phyllica arborea* has been considerably reduced due to fire and grazing by cattle. A preliminary programme of replanting was conducted from 1975 to 1980.

Control measures to limit number and distribution of introduced mammals (cattle, cats, rats in particular) should be considered as these could substantially reduce the deleterious impact on native flora and fauna, and permit some restoration of the island environment towards its original state. A cull of 1000 cattle is planned for 1985-1986. Control of cats was attempted in the 1950s, but discontinued when it was alleged that rodents were simultaneously increasing. Control programmes against cats and rats would need to be introduced together and be long-term. Both mammals are well-established on Ile Amsterdam, and eradication may not be feasible, but even limited control programmes of shooting, trapping, and poisoning would probably reduce numbers sufficiently to permit increases in bird populations.

The recognition of Amsterdam Island albatross in 1982 and the presence of an undescribed species of procellariid highlight the need for a comprehensive biological survey of Ile Amsterdam, and more intensive ecological studies, especially on the effects of alien animals on the native biota.

Consideration is being given by the TAAF administration to designation of the Plateau des Tourbières as a Site of Special Scientific Interest (equivalent to such areas created under the Antarctic Treaty) to protect the colony of Amsterdam Island albatrosses. Details of this are not known.

The crayfish resource around the island is thought to be over-exploited. However, some finfish species, especially notothenid cods, appear to be abundant and may support a fishery. Development of fisheries would probably have little direct effect on the island and biota. Ile Amsterdam has no harbour and few practical sites for onshore facilities. Mortality of birds in trawl nets would be the main concern, as populations of some seabird species are already small. Other commercial interest in the island (eg tourism) is low.

SELECTED REFERENCES

Ile Amsterdam


Conservation of Islands in the Southern Ocean

ILE SAINT-PAUL

GENERAL INFORMATION

COUNTRY France

GEOGRAPHICAL LOCATION 38°43'S, 77°31'E, in the southern Indian Ocean, 1250 km north-east of Iles Kerguelen.

AREA 700 ha

MAXIMUM ALTITUDE 272 m

PHYSICAL FEATURES The triangular shaped island is the summit of a volcano. Steep, 200 m high cliffs occur on the eastern side, 30 m cliffs on the other sides, sloping to a large crater rim at 200-250 m. The eastern side of the crater has exploded or eroded away, resulting in a wide bay with a 1-2.5 m sill at its entrance. Active thermal springs occur at two points around the crater.

There are several offlying islets, rocks, and stacks, most notably Roche Quille.

Climate is oceanic, and mild: mean annual temperature 13°C, rainfall 1100 mm/yr, strong westerly winds prevail, humid. The island is just north of the Subtropical Convergence.

FLORA AND VEGETATION Dry, lowland slopes are covered with meadows of high tussock grass Poa novarae and the grass Spartina arundinacea. Vegetation of wetter coastal and inland areas is dominated by dense growths of sedges, principally Scirpus nodosus.

Ile Saint-Paul lacks woody vegetation. The small tree Phylica arborea common on Ile Amsterdam is absent.

FAUNA Five bird species breed on Ile Saint-Paul: Moseley's rockhopper penguin (Eudyptes chrysocome moseleyi), yellow-nosed albatross (Diomedea chlororhynchos), sooty albatross (Phoebetria fusca), flesh-footed shearwater (Puffinus carneipes), little shearwater (Puffinus assimilis), broad-billed prion (Pachyptila vittata macgillivrayi), white-bellied storm petrel (Fregetta grallaria) and Antarctic tern (Sterna vittata). Additional species have been recorded from Roche Quille, including fairy prion (Pachyptila turtur), and sooty tern (Sterna fuscata).

Amsterdam Island fur seal (Arctocephalus tropicalis) breed, and southern elephant seal (Mirounga leonina) occur.
Conservation of Islands in the Southern Ocean.

Introduced mammals are widespread: rabbits (Oryctolagus cuniculus), Norwegian rat (Rattus norvegicus), and mice (Mus musculus).

The invertebrate fauna is not well-documented, but reportedly consists largely of introduced species.

HISTORICAL FEATURES The island was probably discovered in the 1600s by a Dutchman, Harwick Claez. It was visited sporadically by explorers, fishermen and sealers in the 18th and 19th centuries. Several shipwrecks have occurred. Following annexation by France in 1843, the island was the centre of a fishing industry from 1843 to 1914. A crayfishing operation commenced in 1927, and a settlement of about 120 people was established, but abandoned in 1932. Fishing recommenced in 1937–38, and since 1948 has operated entirely from large refrigerated vessels.

HABITATION The island is uninhabited. The area is visited frequently by fishermen from Reunion.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION The island is part of a 'Parc national antarctique français'.

This approximates IUCN category IV (Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary).

DATE ESTABLISHED 1938

AREA Entire island (700 ha)

LAND TENURE State-owned, part of Territoire des Terres Australes et Antarctiques Françaises (TAAF).

LEGAL PROTECTION A decree of 1924 established a 'Parc national de refuge dans les possessions australes françaises', which was replaced by a more comprehensive decree in 1938. This 1938 National Park Act protects marine mammals (in particular fur seal and elephant seal) and some bird species (eg rockhopper penguin) on île Saint-Paul.

Antarctic and Subantarctic Lands Act (decree 1966) cover activities of French personnel on the island.

A statute relating to general nature protection in France (law 76–629, 1976) covering protection of the environment, preservation of animal and plant species, maintenance of biological equilibrium and protection of natural resources, applies also to TAAF.

Exploitation of whales in the 200 mile Exclusive Economic Zone around the island is prohibited.
ADMINISTRATION The District of Amsterdam and Saint-Paul is administered by the District Head, based at La Roche Godon, Ile Amsterdam. The District Head is responsible to the Territory Head (TAAF), in Paris.

The Comité de l'Environnement (Committee for the Environment), established in 1982, advises the Head of the Territory on matters relating to environmental and wildlife protection, protected areas, and management problems.

Contact address:

Administrateur Supérieur
Terres Australes et Antarctiques Françaises
34 Rue des Renaudes
75017, Paris
FRANCE

MANAGEMENT POLICY Details of management policy are unknown, although TAAF have prepared guidelines for personnel visiting the French islands.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Populations of Amsterdam Island fur seal (Arctocephalus tropicalis) and southern elephant seal (Mirounga leonina) were heavily exploited, to the extent of near extermination by the mid-1800s. Elephant seal no longer breed on the island, and the population of fur seal is estimated at only about 350 animals (1970/71). Rockhopper penguin (Eudyptes chrysocome moseleyi) and albatross were also killed in large numbers for food, oil, and bait. Bird stocks are slowly recovering.

Introduced mammals have had considerable impact on vegetation and birdlife on the island. Pigs (Sus scrofa) and goats (Capra hircus) were abundant in the mid-1800s, but had disappeared by 1874. Several goats were re-introduced in 1981, and may have had some effects on flesh-footed shearwater (Puffinus carneipes) through trampling of burrows, before their extermination in 1982. Cats (Felis catus), black rats (Rattus rattus), mice (Mus musculus) and rabbits (Oryctolagus cuniculus) also became established in the 19th century. Rats and cats are thought responsible for severe depletion of bird populations on the island, especially small burrowing petrel species such as broad-billed prion (Pachyptila vittata mascigilllaryi). An estimated 9 species of seabird have become extinct on the island since its discovery. Cats died out in the early 1900s, but rats and mice are still abundant. Rabbit grazing in the past resulted in severe depletion of vegetation cover, leading to considerable erosion. However, rabbits have inexplicably declined in recent decades, and regeneration of vegetation has occurred.

Alien plants are widespread.

Fires have also occurred frequently in the past, large areas of the island having been burnt on several occasions.
Conservation of Islands in the Southern Ocean

Scientific Research Research in the area of TAAF is controlled by a scientific council chaired by the Head of the Territory, in conjunction with the Direction Générale de la Recherche Scientifique et Technique (General Directorate for Scientific and Technical Research) and the Comité National Français des Recherches Antarctiques (French National Committee on Antarctic Research).

Ile Saint-Paul is visited infrequently by scientific expeditions, and very little research is conducted on the island.

Assessment of present conservation status The fauna of Ile Saint-Paul has been severely affected by man and introduced animals, to the extent that several species no longer occur, or breed, on the island. This island is considerably modified from its original state, but populations of native species are generally no longer in decline. Rabbits are currently not abundant, and the remaining bird species are not very vulnerable to predation by rats and mice.

Conservation legislation is probably adequate for effective management of the island. However, in view of the recent re-introduction of goats, measures need to be enforced to prevent further alien animals and plants establishing on the island, and further affecting remaining native species. In addition, monitoring of the fauna on Roche Quille would enable prompt action if rats gained access from the main island.

Roche Quille is currently being considered by the French authorities for designation as a Specially Protected Area, equivalent to such areas under the Antarctic Treaty.

Selected References


ILES CROZET

GENERAL INFORMATION

COUNTRY France

GEOGRAPHICAL LOCATION 46°00' - 46°30'S, 50°00' - 52°30'E, in the southern Indian Ocean, 2400 km south-east of South Africa.

AREA 50 000 ha.

MAXIMUM ALTITUDE 1090m (Pic Marion on Ile de l'Est)

PHYSICAL FEATURES Iles Crozet is an archipelago consisting of five main volcanic islands, in two groups: a western group of Ile aux Cochons, Ile des Pingouins, and Ilots des Apotres; and an eastern group comprising Ile de la Possession, and Ile de l'Est.

Ile aux Cochons is a volcanic cone, 9 km in diameter, 770 m high, with an area of 6600 ha, and with steep western slopes. It is the least eroded of the group, probably the last to erupt.

Ile des Pingouins, 53 km to the south of Ile aux Cochons, is 3 km long, 360 m high, with steep cliffs on the western side.

Ilots des Apotres comprises two islands, and 10 rocks. The principal island is Grande Ile, which is 3 km long, 289 m high, with steep western cliffs.

Ile de la Possession is the largest island in the archipelago (14 600 ha). It is roughly rectangular in shape, 30 km by 15 km. Topography is dominated by an inland chain of mountains, up to 934 m (Pic du Mascarin), with deep valleys to the north and east, and high cliffs to the west and south.

Ile de l'Est, 20 km east of Ile de la Possession is oval, 18 km by 10 km, with an area of 13 000 ha. It has numerous peaks, with deep valleys, the highest point being 1090 m (Pic Marion). Most of the coastline is bordered by high cliffs.

The group lies just to the south of the Antarctic Convergence. In general, climate is cool (mean annual temperature about 7°C), with high rainfall, and strong westerly winds. There are no glaciers, but some permanent ice on the peaks of Ile de la Possession and Ile de l'Est. There is evidence of past glaciation.
Conservation of Islands in the Southern Ocean

**FLORA AND VEGETATION** Vegetation of the three main islands is relatively uniform. On the coasts, the herbs *Crassula moschata* and *Cotula plumosa* are common. Tussock grassland of *Poa cookii*, with *Poa pratensis*, dominates to about 50 m. Grass *Agrostis magellanica* is important 50–100 m, with Kerguelen cabbage (*Pringlea antiscorbutica*), dwarf shrub (*Acaena magellanica*), and fern *Blechnum penna-marina*. Above 100 m, feldmark vegetation predominates, comprising cushion herbs *Azorella selago* with *Agrostis*. There are unvegetated areas of scoria in many places.

Vascular plants occur to 200–300 m, above which only sparse mosses and lichens are found.

**Giant kelp** (*Laminaria* spp.) is common in coastal waters.

Alien plants are widespread, in particular the grass *Agrostis stolonifera*, tussocks *Poa annua* and *Poa pratensis*, and herbs *Cerastium fontanum* and *Rumex acetosella*.

**FAUNA** The islands host more breeding seabird species than any other island group in the world. 36 species of bird breed in the group (18 on Ile aux Cochons, 24 on Ile de la Possession, 30 on Ile de l'Est), with the total number of birds estimated at 25 million. Among the most common birds are: king penguin (*Aptenodytes patagonicus*) (world's largest colonies), macaroni penguin (*Eudyptes chrysolophus*), rockhopper penguin (*Eudyptes chrysocome chrysocome*), wandering albatross (*Diomedea exulans*), sooty albatross (*Phoebetria fusca*), light-mantled sooty albatross (*Phoebetria palpebrata*), northern giant petrel (*Macronectes halli*) and southern giant petrel (*Macronectes giganteus*), lesser broad-billed prion (*Pachyptila salvini*), Kerguelen petrel (*Pterodroma brevirostris*), white-chinned petrel (*Procellaria aequinoctialis*), South Georgian diving petrel (*Pelecanoides georgicus*), southern skua (*Catharacta lonnbergi*), southern black-backed gull (*Larus dominicanus*), Crozet shag (*Phalacrocorax albiventer melanogenis*), Antarctic tern (*Sterna vittata*), Kerguelen tern (*Sterna virgata*), Kerguelen pintail (*Anas eatoni*), and endemic Crozet lesser sheathbill (*Chionis minor crozettensis*).

Several species are very abundant on the small offlying islands, but not on the main islands. Ile des Pingouins, for example, hosts large numbers of yellow-nosed albatross (*Diomedea chlororhynchos*), blue petrel (*Halobaena caerulea*), and fairy prion (*Pachyptila turtur*).

The invertebrate fauna is extensive, with numerous endemic insect species.
Southern elephant seal (Mirounga leonina), small numbers of Amsterdam Island fur seal (Arctocephalus tropicalis) and Antarctic fur seal (Arctocephalus gazella) breed, and leopard seal (Hydrurga leptonyx) occasionally occur.

Notothenid fishes and lithodid crabs are common in coastal waters.

Introduced mammals occur on several islands: cats (Felis catus), black rats (Rattus rattus), and mice (Mus musculus).

**HISTORICAL FEATURES** The islands were discovered in 1772 by Marion Dufresne. They were visited sporadically by sealers in the 19th century. Several shipwrecks occurred. A scientific station was established by the French on Ile de la Possession in 1962.

**HABITATION** There are no permanent residents.

The meteorological station, Alfred-Faure, on Ile de la Possession is manned continually, by 20 men on average, and relieved annually.

**PROTECTED AREA INFORMATION**

**MANAGEMENT CLASSIFICATION** The islands are part of a 'Parc national antarctique français', with the exception of Ile de la Possession and Ile de l'Est.

Details of management in these protected areas are not fully known, but probably approximate IUCN category IV (Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary).

**DATE ESTABLISHED** 1938.

**AREA** Approximately 22,500 ha.

**LAND TENURE** State-owned territory, part of Territoire des Terres Australes et Antarctiques Françaises (TAAF).

**LEGAL PROTECTION** A 'Parc national de refuge dans les possessions australes françaises' was established by decree in 1924.

A 1938 National Park Act (decree, 1938) replaced this, and designated the islands part of a 'Parc national antarctique français'. This protects marine mammals (in particular fur seal and elephant seal) and some bird species (eg rockhopper penguin).
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Antarctic and Subantarctic Lands Act (decree, 1966) regulates activities near breeding colonies of birds to minimise human disturbance.

A statute relating to general nature protection in France (law 76-629, 1976) also covers the TAAF and provides for protection of the environment, preservation of animal and plant species, maintenance of biological equilibrium and protection of natural resources.

Iles Crozet lie within the area covered by the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR). This governs exploitation of marine animals, but French regulation of local fisheries occurs.

Exploitation of whales in the 200 mile Exclusive Economic Zone around the islands is prohibited.

ADMINISTRATION TAAF is divided into four districts, administered from Paris by the Head of Territory assisted by an Advisory Council. Local responsibility for the District of Crozet is assumed by a District Head, based at Alfred-Paure.

The Comité de l’Environnement (Committee for the Environment), established in 1982, advises the Head of the Territory on matters relating to environmental and wildlife protection, protected areas, and management problems.

Contact address: Administrateur Superieur Terres Australes et Antarctiques Francaises 34 Rue des Renaudes 75017, Paris FRANCE

MANAGEMENT POLICY Details of management are unknown. However, the administration of TAAF has prepared guidelines for protecting the fauna of the islands. Killing or removal of animals is forbidden unless specifically permitted.

There is strict control on fishing within a 200 mile zone around the islands, and trawling is not permitted at present.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Southern elephant seal (Mirounga leonina) and Amsterdam Island fur seal (Arctocephalus tropicalis) were heavily exploited in the 1800s. Elephant seal have recovered and are common, but the latter species, together with very small numbers of Antarctic fur seal (Arctocephalus gazella), have only recently recolonised the Crozet group.
Alien mammals have been introduced to several islands; pigs (Sus scrofa), goats (Capra hircus), mice (Mus musculus), black rats (Rattus rattus), rabbits (Oryctolagus cuniculus), and cats (Felix catus).

On Ile aux Cochons, pigs which became established in the early 1800s caused considerable damage to tussock vegetation and penguin colonies, and were consequently exterminated in the late 19th century. Mice are currently abundant on the island and feed largely on seeds. Rabbits were introduced around 1850, number up to 2000 (1974 summer, less in winter), and are particularly abundant on the east coast, where they have a marked impact on vegetation, especially dwarf shrub (Acaena magellanica). Cats became established around 1887, and numbered about 100 animals in 1974. They prey heavily on birds (principally lesser broad-billed prion Pachyptila salvini) in summer, mice and rabbits in winter. There are no rats on the island.

On Ile de la Possession, rabbits and goats were both introduced in the 19th century, but did not survive. Cats were formerly present, and with black rats are thought responsible for devastation of populations of burrowing petrels, in particular storm petrels and lesser broad-billed prion. Rats and mice are the only mammals currently on Ile de la Possession.

On Ile de l'Est, rabbits were common in the past, but died out. There are no mammals on the island at present.

Salmonid fishes have also been introduced into the group. Brown trout (Salmo trutta) and brook char (Salvelinus fontinalis) eggs were liberated in 1969 and 1972 into streams on Ile de la Possession, and persist but are not well established. The fishes may have a localised impact on the native invertebrate fauna, as reported from Iles Kerguelen.

Alien plants are widespread on some of the islands, especially Ile de la Possession where about 50 alien vascular species are established, at least 12 being naturalised with widespread distributions.

**Scientific Research** Research in the TAAF is conducted under the auspices of a scientific council in Paris, chaired by the Head of the Territory. The council is assisted by the Direction Generale de la Recherche Scientifique et Technique (Général Directorate for Scientific and Technical Research) and the Comité National Français des Recherches Antarctiques (French National Committee on Antarctic Research).
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In recent years, the amount of research carried out in the Crozet group has increased. Emphasis is on biology and ecology of birds, and the effects of alien animals on the native biota. Estimates and censuses now exist for most bird species and in 1982 the small outlying islands were visited by ornithologists for the first time. Studies on marine mammals have been undertaken, with monitoring of recolonisation of the islands by fur seal.

**ASSESSMENT OF PRESENT CONSERVATION STATUS** Iles Crozet are considered to be of high biological value, with a very rich avifauna. The impact of man in the past has been variable. Marine mammals were heavily exploited in the 1800s, and fur seals have only recently recolonised the group. Some bird populations, in particular burrowing petrels, have been severely affected by predation from introduced mammals (rats, cats) and vegetation on some islands has also been modified. Nevertheless, several islands in the group are largely unmodified with intact native fauna and flora; islands such as Ilots des Apotres, Ile des Pingouins, and Ile de l'Est. The former two islands are covered under the 1938 National Park legislation, but Ile de l'Est is not. Protection equivalent to IUCN category I (Scientific/Strict Nature Reserve) seems warranted for these islands.

The authorities of TAAF are currently considering protection of Ilots des Apotres and Ile des Pingouins as Specially Protected Areas, and Ile aux Cochons, Ile de l'Est and the north-west coast of Ile de la Possession as Sites of Special Scientific Interest equivalent to such areas under the Antarctic Treaty.

Ile de la Possession is the only island with human occupation, but still retains some notable fauna and flora. In 1983 a road was constructed between the coastal landing area and the scientific base (at 140 m altitude) through a major king penguin (*Aptenodytes patagonicus*) colony. The need to improve facilities for base personnel is acknowledged, but it is important that the biological consequences of any development be taken into account.

The fauna and flora of the three main islands has been relatively well described and formulation of a management plan for guiding management in the future is strongly recommended.

Trawling is presently prohibited on the Crozet Islands shelf following over-fishing in the early 1970s. However, recent surveys have indicated that several fish species (in particular notothenid cods) and king crab (*Lithodes murrayi*) are abundant around the islands. The possibility of renewed development of a major fishery raises questions concerning the effects of fisheries on the birdlife of the islands. Trawling operations for demersal fishes would result in some bird mortality in the nets, but potting for crustaceans would have little direct effect. Concern has been expressed that such mortality in nets may be important for albatrosses.
Few data are available on the consequences of fisheries development for structure of the marine community and trophic relationships. In the absence of such information, care must be exercised with establishing fisheries, management needing to take into account the dependence on the adjacent marine environment of birds nesting on the islands.

SELECTED REFERENCES

Conservation of Islands in the Southern Ocean

ILES KERGUELEN

GENERAL INFORMATION

COUNTRY France

GEOGRAPHICAL LOCATION 48°27'-50°00'S, 60°27'-70°35'E, in the southern Indian Ocean, 1800 km south-west of Australia.

AREA Approximately 700 000 ha

MAXIMUM ALTITUDE 1850 m (Mont Ross)

PHYSICAL FEATURES Iles Kerguelen is an archipelago comprising one large island, Ile Kerguelen (Grande Terre) of 660 000 ha, with about 300 offlying islands, islets and rocks.

Ile Kerguelen is 120 km by 140 km, its rocky shoreline deeply dissected by inlets into a number of peninsulas. High mountains occur in the west, with extensive plateaux in the east, deep glacial valleys, and numerous rivers and lakes. A large ice cap, Calotte Glaciaire Cook, in the west, is 50 km by 20 km, the remains of an ice sheet which formerly covered the entire island. Numerous other glaciers occur.

The islands are of volcanic origin, with four eruptive phases. Rocks are mainly of basaltic composition, dating from the Miocene.

Climate is oceanic, characterised by low temperatures (mean annual about 4.5°C), rainfall in excess of 1100 mm/yr, strong westerly winds, heavy cloud cover, and 70-80% humidity. Indications are that the climate has become warmer this century, with retreating glaciers. The islands lie just south of the Antarctic Convergence.

FLORA AND VEGETATION The flora comprises 36 vascular species, with over 200 species of lichen, moss and bryophyte.

Vegetation varies considerably to 500 m, with a range of communities. Kerguelen cabbage (Pringlea antiscorbutica), endemic to the southern Indian Ocean, dominates steep, rocky cliffs and moist habitats in rabbit-free areas. Cushions of the herb Azorella selago occur on moist moraine slopes and exposed plateaus inland, where they form deep peaty areas. In regions where rabbits are abundant, dwarf shrub (Acaena magellanica) is common. Moors are dominated by Acaena and Azorella. Grasses Deschampsia antarctica and Agrostis magellanica occur along stream banks and in bog areas. Above the plateaus, open feldmark vegetation of grasses, ferns, mosses, and lichens can occur, but many high areas are devoid of vegetation.
Conservation of Islands in the Southern Ocean

There are only two endemic vascular species: herbs Ranunculus mo8eleyi and Lyallia kerguelensis.

A large number of species of algae occur around the coasts. Kelp, Durvillea utilia close inshore in rocky areas, giant kelp (Macrocystis pyrifera) in deeper coastal waters, are prominent.

FAUNA The islands host 30 breeding species of bird, common species including king penguin (Aptenodytes patagonicus), macaroni penguin (Eudyptes chrysolophus), and rockhopper penguin (Eudyptes chrysocome chrysocome), wandering albatross (Diomedea exulans), Cape pigeon (Daption capense), white-headed petrel (Pterodroma lessonii), Kerguelen petrel (Pterodroma brevirostris), blue petrel (Halobaena caerulea), and white-chinned petrel (Procellaria aequinoctialis), Wilson's storm petrel (Oceanites oceanicus), black-bellied storm petrel (Pterodroma trops), Antarctic prion (Pachyptila desolata), South Georgian diving petrel (Pelecanoides georgicus), common diving petrel (Pelecanoides urinatrix), Kerguelen shag (Phalacrocorax verrucosus), southern skua (Catharacta lonnbergi), southern black-backed gull (Larus dominicanus), Kerguelen tern (Sterna virgata) and Antarctic tern (Sterna vittata), Kerguelen pintail (Anas eatoni) which is endemic to the southern French islands, and endemic Kerguelen lesser sheathbill (Chionis minor minor). Also present are introduced mallard (Anas platyrhynchos).

Two species of marine mammal breed on the islands: southern elephant seal (Mirounga leonina) and Antarctic fur seal (Arctocephalus gazella).

Several species of salmonid fishes have been introduced into rivers, and have become established.

Introduced mammals include black rats (Rattus rattus), mice (Mus musculus), rabbits (Oryctolagus cuniculus), sheep (Ovis aries), mouflon (Ovis ammon musimon), reindeer (Rangifer tarandus), and cats (Felis catus).

There is a large number of invertebrate species, principally arthropods. Numerous endemic insects are associated with Kerguelen cabbage.

In nearshore coastal waters, several fish species are abundant, in particular notothentid cods.

HISTORICAL FEATURES Iles Kerguelen were discovered by Captain Yves Joseph de Kerguelen-Tremarec in 1772. They were explored by Captain James Cook in 1776, who named them after Kerguelen (with the alternative name of Islands of Desolation). Sealing, whaling, and several scientific expeditions visited the islands in the 19th century. In 1908 a sheep station and whaling station were established by Bossiere at Port Jeanne d'Arc which continued until 1932.
Iles Kerguelen

The islands were a dependency of Madagascar from 1924 to 1955, and then became part of 'Territoire des Terres Australes et Antarctiques Françaises' (TAAF). A scientific station was established at Port-aux-Français in 1949.

HABITATION There are no permanent residents.

Port-aux-Français, in the Golfe du Morbihan, is a permanent establishment. Staff number 90 on average (1980), and are relieved annually.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Areas of Iles Kerguelen are part of a 'Parc national antarctique français'.

This approximates IUCN category IV (Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary).

DATE ESTABLISHED 1938

AREA Approximately 8000 ha.

LAND TENURE State-owned territory, part of Territoire des Terres Australes et Antarctiques Françaises (TAAF).

LEGAL PROTECTION A decree of 1924 established a 'Parc national de refuge dans les possessions australes françaises', which was replaced by a more comprehensive decree in 1938 designating part of the islands a 'Parc national antarctique français'. This 1938 decree protects marine mammals (in particular fur seal and elephant seal) and some bird species (eg rockhopper penguin) on Iles Nuageuses, Iles Leygues, most of Ile de l'Ouest, and the northwestern coastline of Peninsule Loranchet.

Antarctic and Subantarctic Lands Act (decree 1966) limits human activities near breeding colonies of birds.

A 1976 law of general nature conservation in France applies also to the TAAF. This covers protection of the environment, preservation of animal and plant species, maintenance of biological equilibrium and protection of natural resources.

The area around Iles Kerguelen is within the boundaries of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), although French management of local fisheries occurs.

There is a ban on exploitation of whales within the 200 mile Exclusive Economic Zone around the islands.

ADMINISTRATION TAAF is administered in Paris, as four districts. The district of Kerguelen has its own district head based at Port-aux-Français, assisted by an advisory council.
Conservation of Islands in the Southern Ocean

The Comité de l’Environnement (Committee for the Environment), established in 1982, advises the Head of the Territory on matters relating to environmental and wildlife protection, protected areas, and management problems.

Contact address: Administrateur Superieur
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34 Rue des Renaudes
75017, Paris
FRANCE

MANAGEMENT POLICY No management policy is available.

The administration of TAAF has prohibited the taking of birds, with the exception of Kerguelen pintail. Personnel in TAAF are periodically informed of conservation regulations and requirements.

Fisheries within the 200 mile Economic Zone around the islands are regulated. Measures include a ban on fishing in inshore waters, closed seasons and areas where appropriate, minimum size of fish, need to hold a fishing licence, return of detailed catch records, and presence of observers at times.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Exploitation of marine mammals and seabirds occurred throughout much of the 19th century, and elephant seals (Mirounga leonina) were killed up until the 1960s. Stocks of Antarctic fur seal (Arctocephalus gazella) and elephant seal have only recently begun to recover.

Introduced mammals have had considerable impact on the islands’ native biota.

Rabbits (Oryctolagus cuniculus) were introduced in 1874 by a Transit of Venus expedition. Grazing has decimated Kerguelen cabbage (Pringlea antiscorbutica) to the extent that it now occurs only in rabbit-free or inaccessible areas on the main island. Azorella selago has also been greatly reduced by grazing. Less palatable Acaena magellanica has become dominant over large areas, in contrast to offlying islands without alien mammals, where Pringlea predominates. Grazing of Pringlea has caused the loss of much invertebrate fauna closely associated with it. Myxomatosis was introduced in 1955-56 but without a vector, and spread was slow, with marked rabbit resistance.

Feral populations of sheep (Ovis aries) 1908-32, 1949-present day (800 head in 1975); mouflon (Ovis ammon musimon) 1956-present day (about 50 head in 1968); reindeer (Rangifer tarandus) 1956-present day (2000 head in 1974); together with rabbits have devastated native vegetation, which has led to considerable erosion, and reduced nesting habitat for seabirds.
Mice (Mus musculus) and black rats (Rattus rattus) were introduced with sealers in the 1800s. Rats have had a considerable impact on populations of small petrels. Mice are thought to contribute to spread of alien plants, through transport of seeds.

Cats (Felis catus) were introduced in the early 19th century to control rodents. They died out, but were subsequently re-introduced in the 1950s. They are now having a severe effect on birds, especially petrels. It has been estimated that there are 3500 cats on Ile Kerguelen (1977) killing more than 1 million birds annually. Kerguelen tern (Sterna virgata) breed principally on Ile Kerguelen, and the population on the island is thought threatened by alien mammals. Cat control was attempted in 1972-75, with success, but the programme was discontinued.

Mink (Mustela lutreola) and dogs (Canis familiaris) failed to establish.

Horses (Equus caballus), pigs (Sus scrofa), cattle (Bos taurus), and formerly mules, are kept near the scientific station at Port-aux-Français.

Several salmonid species were intentionally introduced as game fish in the 1950s to 1970s: Brook char (Salvelinus fontinalis), brown trout (Salmo trutta), Atlantic salmon (Salmo salar), and coho salmon (Oncorhynchus kisutch) have become established, and have reportedly had a marked effect on the invertebrate fauna which previously was not subject to predation by fishes.

Alien plants are widespread over Ile Kerguelen. Importation of seeds either through livestock feed or inadvertently with animals, and introduction of plants for experimental purposes, have resulted in a large number of alien species. Reduction of native vegetation by grazing has aided the spread of several alien species such as Poa annua, Cerastium glomeratum, and Myosotis versicolor.

Scientific Research A considerable amount of research is conducted from the base at Port-aux-Français. Most is related to atmospheric and geophysical observations, but biological work is also undertaken, largely under contract to the French authorities, on seabirds, introduced mammals, salmonids, as well as oceanographic research on productivity and water mass movement. Since 1983, research on introduced mammals has increased under the sponsorship of TAAF, with the objective of conducting control programmes.
Conservation of Islands in the Southern Ocean

A local scientific council, chaired by the head of the Territory, in conjunction with the Direction Générale de la Recherche Scientifique et Technique (General Directorate for Scientific and Technical Research), co-ordinates research programmes. Research is conducted in association with the Comité National Français des Recherches Antarctiques (French National Committee on Antarctic Research), a member of the international Scientific Committee on Antarctic Research (SCAR).

ASSESSMENT OF PRESENT CONSERVATION STATUS Man has had a profound impact on the biota of Iles Kerguelen, through sealing activities and introduction of animals. Over much of Ile Kerguelen, modification of biota is very advanced, and populations of mammals well-established.

Rabbit and cat control programmes have occurred in the past, but these have been irregular and of short duration. These animals are well-established, but a programme of control would reduce pressures on vegetation and seabirds. Use of feline enteritis has been advocated for control of cats. Burrowing petrels and terns are the birds most at risk from predation and reduction of vegetation cover. Most other bird populations are regarded as stable.

There is urgent need for a full biological survey of Iles Kerguelen, in particular the offlying islands which are thought to be largely free of introduced mammals and to have intact native biota. Species which are rare on the main island are thought to be abundant on some of the offshore islands (e.g. Iles Nuageuses may be the site of large colonies of soft-plumaged petrel Pterodroma mollis, and the only colony of Antarctic fur seal Arctocephalus gazella). Identification of priority areas for conservation is of immediate concern. To this end, an increase in permanent scientific staff attached to TAAF would be beneficial, enabling more long-term investigations to be undertaken. An increase in logistic support for biological research is also necessary.

The French administration is reportedly concerned to protect the fauna and flora of the islands. A greater level of legal protection is needed for areas of the main island, and total protection of offlying island environments and biota would help ensure conservation of the diverse fauna of Iles Kerguelen.

Iles Nuageuses are being considered by the TAAF administration as a Specially Protected Area, comparable to such areas established in the Antarctic under the Antarctic Treaty.

Spread of alien mammals and plants to islands currently free of them must be avoided. Despite the impact on the indigenous biota, plant and animal introductions have continued until recently (e.g. introduction of conifers in 1976). Such introductions, if necessary, should be carefully regulated to minimise further detrimental effects on the environment.
It has been proposed in the past that an airfield be constructed to enable surveillance of fishing operations in the Kerguelen-Crozet region, and to act as an intermediate base for expeditions to the Antarctic. No proposals have been actioned, but an airfield would greatly increase the accessibility of the islands, and with it, risks to wildlife. Any development of tourism must be carefully controlled.

Fishing has occurred in the area around Iles Kerguelen since 1970, principally by Soviet vessels. Annual catches have ranged from 12 000 t to 229 000 t, the bulk of the catch consisting of two species, *Notothenia squamifrons* and *Champoscephalus gunnari*. These species are regarded as heavily exploited. Little is known of the interactive dynamics of seabird and marine communities. Exploitation of relatively large fishes may release more zooplankton and small fishes, on which seabirds and marine mammals feed, but conversely, catches of these animals (especially albatrosses and seals) in fish nets could be significant with a large fishery. Considerable numbers of seals are caught in the fishery around the islands. Careful management of fisheries is therefore necessary until quantitative information is available on the dependence of seabird and marine mammal populations on marine resources around their breeding islands. Current fisheries management measures of the French authorities should be adequate.

Vessel movements around the islands need to be monitored. In 1980 a Soviet tanker ran aground north of Ile Kerguelen. Little oil escaped, but this incident highlighted the difficulty of dealing with pollution in isolated areas, and the consequential vulnerability of island fauna.

SELECTED REFERENCES

Conservation of Islands in the Southern Ocean

Antipodes Islands

ANTIPODES ISLANDS

GENERAL INFORMATION

COUNTRY New Zealand

GEOGRAPHICAL LOCATION 49°41'S, 178°48'E in the South Pacific Ocean, 850 km south-east of the South Island of New Zealand.

AREA Approximately 2100 ha

MAXIMUM ALTITUDE 402 m (Mt Galloway)

PHYSICAL FEATURES The group comprises the main Antipodes Island, with several offlying islets and rocks (principally Bollons Island, Archway Island, Windward Island, Leeward Island).

Antipodes Island is roughly triangular in shape, 7 km by 5 km, with an area of 2025 ha. Steep coastal cliffs occur up to 150 m high. The central undulating plateau has several volcanic cones, dissected by deep gullies.

The islands are of volcanic origin, remnants of the upper portion of an extensive submerged volcanic pile. Composition is of basaltic lava with pyroclastic debris. Phosphate-rich peat soils occur.

There are few climatic data. Strong westerly winds prevail, with much cloud, high humidity, mean annual temperature probably about 8°C, rainfall 1000-1500 mm/year. The islands lie about 800 km south of the Subtropical Convergence.

FLORA AND VEGETATION Recorded flora comprises 46 species of flowering plant, 18 pteridophyte, 23 bryophyte, and 15 moss species.

Predominant vegetation in coastal areas is tussock grassland of Poa litorosa, up to 1.5 m high. Inland, the fern Polystichum vestitum is common. On higher sheltered slopes, and in gullies, Coprosma ciliata scrub occurs, with ferns Polystichum and Blechnum species, and the herb Stilbocarpa polaris. Scattered bogs of sedge Carex ternaria, with herbs Pleurophylum criniferum and Anisotome antipoda occur. In upper areas, mosses Lycopodium spp. and lichens Stereocaulon spp. are prominent.

Bull kelp (Durvillea antarctica) is common in coastal areas.
Endemic plants: herbs *Gentiana antipoda*, *Senecio antipodus*, a variety of *Stellaria decipiens*, and the shrub *Coprosma antipoda*.

The only woody plants on the island are four species of *Coprosma*.

The grass *Poa annua* is the sole alien plant species, and is not widespread.

**FAUNA** 25 species of bird breed. Erect-crested penguin (*Eudyptes sclateri*) and rockhopper penguin (*Eudyptes chrysocome chrysocome*) are very abundant, with wandering albatross (*Diomedea exulans*) and light-mantled sooty albatross (*Phoebetria palpebrata*), northern giant petrel (*Macronectes halli*), white-headed petrel (*Pterodroma lessonii*), grey petrel (*Procellaria cinerea*), white-chinned petrel (*Procellaria aequinoctialis*), and southern skua (*Catharacta lombergi*) common.

Four endemic birds are present: Antipodes Island snipe (*Coencorypha aucklandica meinertzhagenae*), Antipodes Island pipit (*Anthus novaezeelandiae steindachneri*), Antipodes Island parakeet (*Cyanoramphus unicolor*), Antipodes red-crowned parakeet (*Cyanoramphus novaezelandiae hochstetteri*).

Redpoll (*Carduelis flammea*), hedge sparrow (*Prunella modularis*), and starling (*Sturnus vulgaris*) are self-introduced and established.

**Mice** (*Mus musculus*) are the only introduced mammals established on the islands.

Numerous land invertebrates are found: 50 insect, 6 spider, 1 amphipod, and 4 mollusc species have been recorded, with a high degree of endemism.

Southern elephant seal (*Mirounga leonina*) are the only indigenous mammals breeding. New Zealand fur seal (*Arctocephalus forsteri*) also occur but do not breed.

Littoral and marine ecology is generally not well known. Several species of echinoderm, pycnogonid, amphipod, and mollusc occur.

**HISTORICAL FEATURES** The islands were discovered in 1800 by Captain Waterhouse of HMS *Reliance*. Sealing commenced four years later, and continued into the 1820s. The islands were designated New Zealand territory in 1870. A castaway depot was established in 1886 and maintained until 1927. Shipwrecks occurred in 1893 and 1908. Antipodes Island was leased for farming in 1895 but was never stocked. Frequent scientific expeditions have taken place.
Conservation of Islands in the Southern Ocean

HABITATION Uninhabited

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Antipodes Islands Nature Reserve.

IUCN category I (Scientific/Strict Nature Reserve).

DATE ESTABLISHED 1961 - declared Reserve for the Preservation of Fauna and Flora
1975 - foreshores added to reserve
1977 - designated Nature Reserve

AREA Entire island (2100 ha, although gazetted as 611 ha)

LAND TENURE Crown land

LEGAL PROTECTION The Reserves Act 1977 provides for protection of indigenous fauna and flora, the environment, and the preservation of community relationships. Entry to the reserve, and activities within it, are governed by permit. It is illegal to enter a nature reserve, take or kill animals and plants, introduce any fauna or flora, or erect structures without a permit.

Marine mammals are additionally protected under the Marine Mammals Protection Act 1978. New Zealand fur seal (Arctocephalus forsteri) and southern elephant seal (Mirounga leonina) were initially protected in the late 1880s.

Several other New Zealand statutes relate generally to management of fisheries, wildlife, historic sites, and pollution.

ADMINISTRATION Antipodes Islands are the responsibility of the New Zealand Department of Lands and Survey under the Director-General of Lands. The Outlying Islands Reserves Committee, a body composed of personnel with a range of expertise and involvement in subantarctic and island matters, provides advice on planning, policy, management, and co-ordination of activities. Policy issues may also be referred to the National Parks and Reserves Authority.

Contact address: Director-General
Department of Lands and Survey
Head Office
Private Bag
Wellington
NEW ZEALAND
MANAGEMENT POLICY There are two main objectives of New Zealand management policy regarding subantarctic island reserves:

(i) Preservation of the reserve as far as possible in its natural state.

(ii) Preservation of indigenous flora and fauna, ecological associations, and natural environment.

Entry to the Antipodes Islands Nature Reserve requires a permit from the Department of Lands and Survey. Groups visiting the island include either a member or a representative of the Department.

A draft management plan has been prepared by the Department of Lands and Survey. This plan details management policies and measures associated with their implementation. Research necessary for management of the reserve is permitted, although limits are placed on frequency of visits to the islands. Strict measures to minimise risk of inadvertent introduction of plants and animals (especially rats) are outlined, such as package of supplies and equipment in sealed airtight containers. Waste must be removed from the reserve. The management plan also proposes implementation of a controlled marine buffer zone.

The reserve has been proposed for National Reserve status, whereby an Act of Parliament is required to alter legal conditions of the reserve, thus increasing its security.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Sealing in the early 1800s decimated populations of southern elephant seal and New Zealand fur seal. Both species are recovering from this exploitation, but fur seals have not re-established a breeding population on the island.

In the 1880s, a castaway depot for shipwrecked sailors was established on the island. Goats (Capra hircus), sheep (Ovis aries), and cattle (Bos taurus) were introduced on several occasions to provide food, and exotic trees and grasses were planted. The grass Poa annua is the only surviving introduced plant and has a restricted distribution on the main island. The only alien mammal is the mouse (Mus musculus), first reported in 1950, and abundant over the entire island. Impact of mice on the indigenous fauna and flora appears minor.

SCIENTIFIC RESEARCH Scientific expeditions have periodically visited the Antipodes Islands since their discovery, but no regular research programme has been conducted. Biological surveys in the 1960s and 1970s detailed the faunal and floral composition, and species lists are probably complete for the major groups.
Conservation of Islands in the Southern Ocean

An aluminium hut was erected in 1978 for use by scientific personnel, adjacent to the castaway hut which has been restored.

ASSESSMENT OF PRESENT CONSERVATION STATUS The Antipodes Islands are largely unmodified by man, despite sealing operations in the 1800s and introduction of some mammals and plants. No indigenous plants or animals are endangered, although the Antipodes Island parakeet (Cyanoramphus unicolor) is regarded as Rare (Red Data book of New Zealand, 1981) and the endemic herbs Senecio antipodus and Gentiana antipoda are not abundant. Legislation in force, and management policies of the New Zealand Department of Lands and Survey, should ensure effective conservation of the islands' biota.

Mice are the only alien mammals found on the main island. They are abundant, but are thought to have a minor impact on the indigenous fauna and flora. Prevention of further introductions, especially of rats, is the main conservation concern for the islands. Adherence to guidelines in the management plan by parties visiting the islands should ensure this, underlining the desirability of completing the management plan as soon as possible.

The likelihood of increased commercial exploitation in the area is not high. A trawl fishery occurs on the Campbell Plateau at present, and regular surveillance is required to ensure vessels do not approach close to the islands, and that people do not attempt to land. Regulations pertaining to island nature reserves are fully explained to masters of fishing vessels licensed to fish New Zealand waters, but policing vessel movement is difficult. Current fishing pressure is regarded as low.

Manganese nodules occur on the seabed near the Antipodes Islands, but are not of commercial interest at present. Oil exploration on the Campbell Plateau has been unsuccessful to date, but further exploration, and development if oil is found in commercial quantities, could have serious consequences for the environment and biota of the islands. Pressure for use of the islands as sites for navigational structures, stores, and shelter could occur, and oil spills could be disastrous for both the Antipodes and Bounty groups, due to their position to the east of the plateau with a prevailing west to east current flow.

National Reserve status would increase the security of protection afforded the islands, as this would require an Act of Parliament to revoke parts of, or change conditions of, the reserve.
SELECTED REFERENCES

Conservation of Islands in the Southern Ocean

AUCKLAND ISLANDS

GENERAL INFORMATION

COUNTRY New Zealand

GEOGRAPHICAL LOCATION 50°29′-50°59′S, 165°52′-166°20′E, in the South Pacific Ocean, 460 km south of the South Island of New Zealand.

AREA 62 564 ha

MAXIMUM ALTITUDE 667 m (Mt Dick on Adams Island)

PHYSICAL FEATURES The group consists of the main Auckland Island, with Adams, Disappointment, Enderby, Ewing, Rose, Ocean, and Dundas Islands, and numerous islets and stacks.

Auckland Island is roughly pear-shaped, 40 km by 27 km, with an area of 51 000 ha. The west coast consists of an almost continuous line of steep cliffs, backed by hilly terrain with deep valleys. The east coast features numerous bays and inlets. Two natural harbours occur, Port Ross in the north, and Carnley Harbour in the south.

The islands are the eroded remains of cones of two basaltic volcanoes, which underwent a major eruptive phase in the Oligocene/Miocene. Composition is of volcanic lava and scoria, and the oldest dated rocks are 95 MYr basement granites. The islands have been subject to several periods of glaciation. Peat soils are widespread.

There is little climatic information, and climate varies over the length of the main island. Generally, the group is subject to strong westerly winds, humidity of 80-90%, mean annual temperature of about 8°C, and rainfall 1500-2000 mm/yr. The islands lie 200-300 km south of the Subtropical Convergence.

FLORA AND VEGETATION Vascular flora consists of 228 species, including 44 ferns.

On the main Auckland Island, southern rata (Metrosideros umbellata) forest dominates to an altitude of 50 m. Above this, a broad belt of scrub occurs, comprising Dracophyllum longifolium, Coprosma spp., Myrsine divaricata, Pseudopanax simplex, Cassinia vauvilliersii, with the fern Polystichum vestitum. Bogs of cushion sedge Oreobolus pectinatus are common. Above 300 m, tussock grassland of Chionochloa antarctica predominates, giving way to herbfield (dominated by Pleurophyllum spp.) and fellfield (of bryophytes, mosses, lichens, sedges) at around 500 m.
AUCKLAND ISLANDS
SOUTH PACIFIC
OCEAN

Spot heights in metres

AUCKLAND ISLAND

North-west Cape
Disappointment I.
Haskell Bay
Chambres Inlet
Norman Inlet
Deep Inlet
Cavern Peak
Mt D'Urville
Mt Dick
Carnley Harbour
South-west Cape

ADAMS ISLAND

SCALE
0 2 4 6 8 km

166° 00' E South Cape 166° 10' 166° 20'

50° 30' 50° 40'S

50° 50'

50° 50'
Conservation of Islands in the Southern Ocean

This basic vegetation pattern varies among the islands, largely depending on the extent of modification by man and introduced animals. Adams Island is the least disturbed, and is known internationally for its herbaceous flora. Ewing Island features dense stands of *Olearia lyallii*. Disappointment Island has a coastal grassland of *Poa* species. On Enderby Island, grazing has enabled the spread of the herb *Bulbinella rossii*.

41 alien vascular species have been recorded from Auckland Island, with the grasses *Agrostis tenuis* and *Poa annua*, and herbs *Cerastium fontanum* and *Sagina procumbens*, widespread.

The flora of the Auckland Islands is notable for the occurrence of three species of *Pleurophyllum*, a genus endemic to the New Zealand subantarctic islands and Macquarie Island, the existence of southern rata forest, and the occurrence of *Cyathea smithii* on Auckland Island representing the southern limit of tree ferns in the world.

Bull kelp (*Durvillaea antarctica*) is abundant around the coasts, with dense beds of *Macrocystis pyrifera* in deeper waters.

**FAUNA** The islands have a rich avifauna, with at least 46 species of breeding bird. Rockhopper penguin (*Eudyptes chrysocome chrysocome*) are abundant, with erect-crested penguin (*Eudyptes schlegeli*) and yellow-eyed penguin (*Megadyptes antipodes*) common. Wandering albatross (*Diomedea exulans*), southern royal albatross (*Diomedea epomophora*), shy (*Diomedea cauta*) and light-mantled sooty albatross (*Phoebetria palpebrata*) occur. Sooty shearwater (*Puffinus griseus*), Auckland Island prion (*Pachyptila desolata alter*), white-headed petrel (*Pterodroma lessonii*), white-chinned petrel (*Procellaria aequinoctialis*), common diving petrel (*Pelecanoides urinatrix*), Antarctic tern (*Sternula vittata*), southern skua (*Catharacta lonnbergi*), and Auckland Island shag (*Leucocarbo colensoi*) are common. Landbirds such as hedge sparrow (*Prunella modularis*), bellbird (*Anthornis melanura*), blackbird (*Turdus merula*), Auckland Island pipit (*Anthus novaezelandiae aucklandicus*), and Auckland Island tomtit (*Petroica macrocephala marrineri*), are abundant.

The islands are among the major breeding grounds in the world of wandering and shy albatross.

Eight endemic birds are found: Auckland Island prion, Auckland Island shag, Auckland Island teal (*Anas aucklandica aucklandica*), Auckland Island rail (*Rallus pectoralis muelleri*), Auckland Island banded dotterel (*Charadrius bicinctus exilis*), Auckland Island snipe (*Coenocorypha aucklandica aucklandica*), Auckland Island pipit, and Auckland Island tomtit. Auckland Island merganser (*Mergus australis*) are presumed extinct, and banded dotterel are rare. The South Georgian diving petrel (*Pelecanoides georgicus georgicus*) has been recorded previously from Dundas Island.
Auckland Islands

Enderby and Dundas Islands are the world’s main breeding grounds for Hooker’s sea lion (Phocarctos hookeri), with populations of about 5000 animals (including pups) in 1983. New Zealand fur seal (Arctocephalus forsteri) breed on exposed west coast beaches of the group. Southern elephant seal (Mirounga leonina) may breed on Dundas Island. Whales occasionally occur near the islands (eg southern right whale Eubalaena australis and pilot whale Globicephala melas).

Mice (Mus musculus), rabbits (Oryctolagus cuniculus), cats (Felis catus), cattle (Bos taurus), pigs (Sus scrofa), and goats (Capra hircus) are present on some islands.

Several hundred species of terrestrial invertebrate occur. There is a rich insect fauna (springtails, beetles, flies, and butterflies) with a high degree of endemism.

The freshwater fauna is not well-known. Small fish Galaxias brevipinnis are common.

The littoral zone includes barnacles (Epopella plicata), limpets (Cellana, Rerguelenella), and mussels (Mytilus edulis, Aulacomya ater maoriana).

Crustaceans such as spider crab (Jacquinotia edwardsii) and Munida gregaria are abundant in nearshore areas. Eight fish species have been recorded in coastal waters, notothenid cods being common.

HISTORICAL FEATURES The Auckland Islands were discovered in 1806 by Captain Bristow of the British whaling vessel Ocean. Sealing operations followed, until the 1830s, with later whaling. Auckland Island was inhabited by a small group of Maoris from about 1842. A colonial settlement (Hardwicke) was established in Port Ross in 1849 by the British Southern Whale Fishery Company, under Charles Enderby. At this time, up to 300 people were on the island, but settlement was unsuccessful, and Hardwicke was abandoned in 1852. The last Maori inhabitants departed in 1856. Numerous shipwrecks occurred in the last half of the 19th, and early 20th, centuries. Attempts at sheep farming, 1874-77 and 1895-1910 failed. Coast-watching parties were based on Auckland Island from 1941 to 1945. The islands are now visited principally by scientific expeditions.

HABITATION There are no permanent inhabitants. The settlement of Hardwicke, 1849-1852, had a population of up to 300, including Maoris.
Conservation of Islands in the Southern Ocean

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Auckland Islands Nature Reserve.

IUCN category I (Scientific/Strict Nature Reserve), although limited tourist access is permitted.

DATE ESTABLISHED
1910 - Adams Island was declared a Reserve for the Preservation of Fauna and Flora
1934 - rest of Auckland Islands included in the Reserve
1975 - reserve extended to cover foreshore
1977 - classified as Nature Reserve

AREA Entire island group (62 564 ha)

LAND TENURE Crown land

LEGAL PROTECTION The Reserves Act 1977 provides for the protection of indigenous fauna and flora, the environment, and the preservation of community relationships. Entry to the reserve is by permit only. The killing or taking of animals and plants, introduction of any fauna and flora, and erection of structures, are illegal without a permit.

Hooker's seal (Phocarctos hookeri) and New Zealand fur seal (Arctocephalus forsteri) have been protected since the late 1880s, all marine mammals are protected under the Marine Mammals Protection Act 1978. Several other New Zealand statutes apply generally to management of wildlife, fisheries, historic sites, and pollution.

ADMINISTRATION The Auckland Islands are administered by the New Zealand Department of Lands and Survey under the Director-General of Lands. The Outlying Islands Reserves Committee, a body composed of personnel (11 in 1984) with a range of expertise and involvement in subantarctic and island matters, provides advice on planning, policy, management and co-ordination of activities. Policy issues may also be referred to the National Parks and Reserves Authority.

Contact address: Director-General
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NEW ZEALAND
MANAGEMENT POLICY The principal management policy objectives of
the Department of Lands and Survey, embodied in the Reserves Act
1977, are the preservation of the reserve in its natural state as far as
possible, and the preservation of indigenous flora and fauna, ecological
associations, and natural environment.

Entry to, and activities on, the islands are governed by permit, obtained
from the Department of Lands and Survey. Generally, access is gained
only by legitimate scientific teams. Limited tourism is permitted but
carefully regulated, and other operations (eg shipwreck salvage
expeditions) may be allowed in certain circumstances. A representative
of the Department of Lands and Survey must accompany such visits to
the islands.

A management plan is currently being prepared by the Department of
Lands and Survey.

The NZ Ministry of Agriculture and Fisheries has recently imposed a 12
mile limit around the Auckland Islands, inside which fishing is prohibited.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Marine
mammals were extensively exploited in the 19th century, but most
pinniped and whale populations appear to be increasing. However,
Hooker's sea lion have never been abundant, and there is concern about
the mortality of adults caused by capture in the nets of trawlers fishing
for squid near the islands.

Introduced mammals occur on several of the islands: cattle (Bos taurus),
goats (Capra hircus), mice (Mus musculus), pigs (Sus scrofa), rabbits
(Oryctolagus cuniculus), and cats (Felis catus).

Auckland Island has goats, mice, cats, and pigs, with formerly horses
(Equus caballus), cattle (Bos taurus), dogs (Canis familiaris), and sheep
(Ovis aries). Vegetation has been modified, by pigs in particular, and
liliaceous herbs of the genera Pleurophyllum, Stilbocarpa, and
Anisotome, have been heavily grazed in some areas. The Port Ross
region has been the most modified by domestic and feral animals, and
the planting of alien flora by settlers. Cats are widespread over the
island, and together with pigs are thought responsible for the low number
of burrowing petrel species. Goats have a localised distribution and
minor impact. 41 species of introduced plant occur on the main island,
but are not considered a problem.
Conservation of Islands in the Southern Ocean

Enderby Island has been greatly modified by fire and grazing by domestic stock and rabbits. Cattle, mice and rabbits are present, formerly goats, sheep, dogs and pigs. The herb Bulbinella rossii, unpalatable to these animals, has increased markedly. The biota, although considerably altered, is thought to be in balance.

Other islands have been less modified. Rabbits are found on Rose Island, but the remaining islands are now free of introduced mammals. Goats were formerly present on Ewing Island, with sheep and goats on Ocean Island and Adams Island. Removal of sheep and goats from Ocean Island resulted in considerable regeneration of vegetation.

SCIENTIFIC RESEARCH A considerable amount of research has been conducted in the past. Frequency of visits by scientists has increased in recent decades, but there is no co-ordinated research programme, and few regular expeditions to the islands. Some huts are present, but there are no scientific facilities. Transport to the islands is by chartered vessel, or in association with naval fisheries patrols or cruises of fisheries/oceanographic research vessels.

Extensive faunal and floral inventories have been compiled over the years, but little ecological research has been conducted. Recent attention has focussed on Hooker's sea lion, and the impact of introduced mammals on the islands.

ASSESSMENT OF PRESENT CONSERVATION STATUS Conservation prospects for the Auckland Islands are generally good. Auckland, Rose, and Enderby Islands have been considerably affected by activities of man or introduced mammals, but other islands in the group (especially Adams, Disappointment, Dundas Islands) are in a largely unmodified state. Protection afforded under the Reserves Act 1977, and other general statutes, should be adequate for conservation. However, it is stipulated in the Reserves Act that exotic fauna and flora should be exterminated where possible from nature reserves. To date, no specific decisions have been made on the future of remaining introduced animals on the Auckland Islands. This emphasises the importance of completion and implementation of the management plan currently in preparation.

Rats are not present in the group. The existing strict precautionary measures need to be maintained for expeditions visiting the islands to prevent inadvertent introduction of rodents.

The islands have a rich and diverse biota. More regular and co-ordinated research than that conducted in the past would be valuable for management of the reserve.
Mortality of Hooker’s sea lion caused by the fishery for squid around the Auckland Islands is an issue receiving much publicity and attention in New Zealand. An increase in research, to establish the extent of sea lion mortality and their feeding range in relation to the area of the fishery, is necessary to evaluate proposals for an increase of the 12 mile limit closed to fishing (eg 100 km radius proposed by Greenpeace). This highlights the need to consider terrestrial-marine interactions in development of management policies for islands.

The Auckland Islands are of little commercial interest. Squid is the only resource currently exploited near the islands. There are no known mineral deposits of economic importance on the islands. Manganese nodules and phosphate deposits occur on the seabed in several areas of the Campbell Plateau, but are of no commercial interest at present. Oil exploration has been unsuccessful to date, although if oil or gas resources were found, the possibility of use of the Auckland Islands as anchorages, sites for navigational structures and storage of materials, may arise.

Occasional visits by vessels carrying naturalist tourists appear to have a benign impact only, and given current strict supervision and control on landing sites pose no problems.

An increase in status of the islands from Nature Reserve to National Reserve has been proposed (NZ Gazette No 165, 1983). This would increase security of the protection afforded the islands to the maximum possible in New Zealand, by requiring an Act of Parliament to alter any conditions of the reserve.

SELECTED REFERENCES

7 Rudge, M R; Campbell, D J. 1977: The history and present status of goats on the Auckland Islands (New Zealand subantarctic) in relation to vegetation changes induced by man. *New Zealand journal of botany* 15: 221-53.


Bounty Islands

BOUNTY ISLANDS

GENERAL INFORMATION

COUNTRY New Zealand

GEOGRAPHICAL LOCATION 47°42'S, 179°03'E, in the South Pacific Ocean, 700 km east-south-east of the South Island of New Zealand.

AREA 135 ha

MAXIMUM ALTITUDE 88 m

PHYSICAL FEATURES The Bounty Islands comprise over 20 small islands, islets and rocks, in three groups: Main, Centre, and East. They are of granitic composition, of early Jurassic age. They are bare and spray-swept, with no soil development. Guano deposits accumulate in summer.

There are no long-term climatic data. Likely climatic conditions are: strong, persistent westerly winds, high humidity, rainfall 1000-1500 mm/yr, and mean annual temperature about 10°C. The islands lie approximately 500 km south of the Subtropical Convergence.

FLORA AND VEGETATION No terrestrial vegetation has been described, although lichens and green algae reportedly occur on a few sheltered rock faces.

Bull kelp (Durvillea antarctica) is common around the coasts.

FAUNA The islands support the largest known breeding population of New Zealand fur seal (Arctocephalus forsteri). The total population (including pups) numbers about 16 000 (1980) and is increasing.

Seven species of bird breed. Erect-crested penguin (Eudyptes sclateri) are very abundant, as are Salvin's mollymawk (Diomedea cauta salvini) which are endemic to the Bounty and Snares Islands. The rare Bounty Island shag (Leucocarbo ranfurlyi), and a race of fulmar prion (Pachyptila crassirostris crassirostris) are endemic to the island group. Antarctic tern (Sterna vittata), Cape pigeon (Daption capense), and southern black-backed gull (Larus dominicanus) breed, with possibly also rockhopper penguin (Eudyptes chrysocome chrysocome).
BOUNTY ISLANDS

MAIN GROUP

Skua Rock
Bradley Cove
Depot Island
Proclamation Island
Tunnel Island
Ranfurly Island
Lion Island
Penguin Island
Ruatara Island

CENTRE GROUP

Funnel Island
Prion Island
Castle Island

EAST GROUP

North Rock
Molly Cap

Spot heights in metres

SCALE

0 1 2 km

179° 02′E 179° 04′
There are numerous invertebrate species, including 11 terrestrial arthropods (two spiders, eight insects, one amphipod). These exhibit a high degree of endemism, four species belonging to endemic, monotypic genera. Marine invertebrate communities include 75 mollusc and eight echinoderm species.

**HISTORICAL FEATURES** The group was discovered in 1788 by Captain Bligh of the **Bounty**. Sealing operations commenced soon after and populations were decimated by 1830. The islands became New Zealand territory in 1870. A castaway depot was established in the 1880s, but no shipwrecks are known to have occurred. Scientific expeditions have sporadically visited the islands.

**HABITATION** The islands are uninhabited.

**PROTECTED AREA INFORMATION**

**MANAGEMENT CLASSIFICATION** **Bounty Islands Nature Reserve**

IUCN category I (Scientific/Strict Nature Reserve)

**DATE ESTABLISHED** 1961 - declared a Reserve for the Preservation of Fauna and Flora  
1975 - foreshores added to reserve  
1977 - classified as Nature Reserve

**LAND TENURE** Crown land.

**LEGAL PROTECTION** The Reserves Act 1977 provides for the protection of indigenous fauna and flora, protection of the environment, and preservation of community relationships. Entry to the reserve, killing, taking, or introduction of fauna and flora, and erection of structures, are illegal without a permit.

Marine mammals are additionally protected under the Marine Mammals Protection Act 1978 (New Zealand fur seal were first afforded protection in the 1880s). Other New Zealand statutes deal with general conservation and management of wildlife, fisheries, historic sites, and pollution.

**ADMINISTRATION** The Bounty Islands are administered by the New Zealand Department of Lands and Survey under the Director-General of Lands. An Outlying Islands Reserves Committee advises the department on matters of planning, policy, management, and co-ordination of activities. This committee is composed of personnel with a range of expertise and experience with subantarctic islands. Policy issues may also be referred to the National Parks and Reserves Authority.
Management Policy

General management policy objectives of the Department of Lands and Survey for the New Zealand subantarctic islands apply to the Bounty Islands. These are embodied in the Reserves Act 1977:

(i) Preservation of the reserve as far as possible in its natural state.

(ii) Preservation of indigenous flora and fauna, ecological associations, and natural environment.

Access to the islands is limited, entry and activities governed by permit.

A draft management plan has been prepared by the Department of Lands and Survey. This plan details management measures regarding granting of permits, activities permissible on the islands, construction of buildings, frequency of visits, precautions against introductions of animals and plants, economic exploitation, and proposes the introduction of a marine buffer zone.

The Bounty Islands, together with Auckland, Campbell and Antipodes Islands have been proposed for National Reserve status.

Management Problems and the Impact of Man

Fur seal (Arctocephalus forsteri) were heavily exploited in the early 1800s, but populations are now recovering.

There are no introduced mammals or alien plants.

Scientific Research

Scientific expeditions to the islands have occurred infrequently. There is currently no regular research programme. Recorded composition of the biota is, however, probably fairly complete.

Assessment of Present Conservation Status

The Bounty Islands are in a largely unmodified state, the impact of man having been limited to sealing operations and scientific investigations. The islands are not readily accessible from New Zealand, there are no good landing beaches, and no safe anchorages. This isolation, with protection afforded by the Reserves Act 1977 and other statutes, should adequately safeguard the wildlife. Completion and publication of the management plan for the islands should, however, occur as soon as possible.
A concern for conservation of the islands' fauna is the prevention of introduction of mammals. Rats (*Rattus* spp.) and mice (*Mus musculus*) are the most likely animals to be able to reach the islands, from fishing vessels in the area or with supplies and equipment for scientific expeditions. The rocky nature of the substrate prevents the presence of small, burrowing, petrel species that have proven vulnerable to rodent predation on other subantarctic islands. It is unlikely that rodents could establish on the islands, due to lack of vegetation cover, but in the short-term rats, in particular, could have considerable impact on the bird populations.

The Bounty Island shag (*Leucocarbo ranfurlyi*) is the world's rarest shag, with a breeding population estimated at about 550 pairs (1982). Regular visits to the islands by ornithologists to monitor its population size and study its ecology would help ensure its survival.

The Bounty Islands have little commercial significance. Fishing occurs in the region, which is known to be a nursery area for some deepwater fish species on the Campbell Plateau. The large number of birds which nest on the islands are dependent on marine resources in their vicinity, a feature which is an important consideration in management of fishing operations near any subantarctic island.

A change in status from Nature Reserve to National Reserve (proposed in *New Zealand Gazette* No 165, 1983) would increase security of the reserve, by requiring any change in legal conditions of the reserve to be effected by an Act of Parliament.

**SELECTED REFERENCES**

Conservation of Islands in the Southern Ocean

CAMPBELL ISLANDS

GENERAL INFORMATION

COUNTRY New Zealand

GEOGRAPHICAL LOCATION 52°33'S, 169°09'E, in the South Pacific Ocean, 700 km south of the South Island of New Zealand.

AREA 11 331 ha.

MAXIMUM ALTITUDE 567 m (Mt Honey)

PHYSICAL FEATURES The group consists of Campbell Island, with a number of offlying islets and rocks (principally Jacquemart Island, Dent Island, and Île de Jeanette Marie).

Campbell Island has an irregular shape, 16 km by 16 km, with an area of 11 268 ha. Steep cliffs dominate the western shores, while the east coast is broken by several large inlets. Terrain is hilly, with deep gullies and numerous streams.

Campbell Island is a remnant of a dissected volcanic dome. Marine erosion has removed most of the western section, and the east coast has fiord-like inlets formed by the 'drowning' of lower reaches of radial valleys. The island was glaciated in the Pleistocene. The oldest basement rocks are schist, 640 MYr, overlain with a series of sandstone, conglomerate, mudstone, limestone, marine deposits of volcanic sediment, and volcanic flows dating from the late Miocene. Peat soils are well-developed.

The islands lie midway between the Subtropical and Antarctic Convergences. Climate is characterised by strong westerly winds, 60-70% humidity, rainfall of 1450 mm/yr, and mean annual temperature of about 6°C (mean monthly range 4.4 to 9.4°C).

FLORA AND VEGETATION The vascular flora consists of 218 species, subspecies, and hybrids, with 119 species of moss.

Three vegetation types predominate on Campbell Island: tussock grassland, shrubland, and herbfield. In coastal areas, moss Muelleriella crassifolia is common, with the herbs Crassula moschata, Colobanthus mucoideus, and Scirpus cernuus. In sheltered areas and in deep gullies to an altitude of 180 m, 'dwarf forest' of woody shrubs Dracophyllum longifolium and D. scoparium, with species of Coprosma and Myrtaceae, and ferns Polystichum vestitum and Histiopteris incisa, occurs. Above this, vegetation is dominated by tussock grassland of Poa littorosa, with Chionochloa antarctica in valleys, ferns and herbs Pleurophyllum speciosum, Bulbinella rossii, and species of Anisotome.
Conservation of Islands in the Southern Ocean

Above 300 m, Bulbinella and the rush Marsippospermum gracile dominate an underturf of grasses, forbs, lichens, and bryophytes. Areas of sphagnum bog, peat moors, and cushion bog (dominated by Pleurophyllum, Bulbinella, and Scirpus) also occur.

81 alien species have been recorded, 10 of which are established with a widespread distribution, in particular Poa annua.

The offshore islets, which have not been influenced by man, have dominant vegetation associations of Poa litorosa, Poa foliosa, with herbs Stibocarpa polaris and Anisotome latifolia.

Large kelp beds of Durvillea antarctica and Macrocystis pyrifera occur close to shore.

There are no endemic plant species, and no indigenous trees.

No plant species are endangered, but two species of grasses are regarded as rare: Poa breviglumis var. brockei, and P. novae-zeelandiae var. desiliens.

FAUNA Southern elephant seal (Mirounga leonina), New Zealand fur seal (Arctocephalus forsteri), and small numbers of Hooker's sea lion (Phocarctos hookeri) breed. Southern right whale (Eubalaena australis) congregate near the islands for mating.

29 species of bird breed on the islands. Rockhopper penguin (Eudyptes chrysoocome chrysoocome) are very abundant, with erect-crested penguin (Eudyptes schlegeli) and yellow-eyed penguin (Megadyptes antipodes) also breeding. Southern royal albatross (Diomeda epomophora), black-browed albatross (Diomedea melanophris impavia), and grey-headed albatross (Diomedea chrysostoma) are common, with northern giant petrel (Macronectes halli), Cape pigeon (Daption capense), southern skua (Catharacta lombergi), Campbell Island shag (Leucocarbo campbelli), Antarctic tern (Sterna vittata), pipit (Anthus novaezelandiae), hedge sparrow (Prunella modularis) and redpoll (Carduelis flammea).

Yellow-eyed penguin are endemic to the southern New Zealand region. Black-browed albatross breed only on Campbell and Antipodes Islands, and Campbell is the major breeding area for southern royal and grey-headed albatross. Campbell Island shag are endemic to the island. Dent Island is the only location of the rare, endemic, Campbell Island teal (Anas aucklandica mesiotis). The offshore islands of Dent and Jacquemart support large populations of petrels and prions, which are rare on the main Campbell Island.
The islands have a rich terrestrial arthropod fauna, with over 300 species. Insects dominate, principally springtails and beetles. Other invertebrate fauna is not as comprehensively known, although numerous species of spider, land snail, and marine mollusc have been recorded.

The freshwater fauna is diverse. Amphipods and isopods are common, with endemic midge and polychaete species. The small galaxiid Galaxias brevipinnis is the only fish present.

Littoral and marine communities are not diverse. Several species of limpet and mussel occur. Fishes are not abundant close to shore.

There are numerous introduced animals. Mammals currently on Campbell Island are sheep (Ovis aries), Norway rats (Rattus norvegicus), and cats (Felis catus).

HISTORICAL FEATURES The islands were discovered by the sealer Hasselburg in 1810. Sealing continued into the 1830s, by which time stocks were very depleted. Whaling operations also occurred, the last station located at Northwest Bay 1909-16. The islands were visited sporadically by scientific and exploration voyages, such as the Transit of Venus Expedition in 1874. Several shipwrecks occurred in the 19th century. Sheep-farming commenced in 1895, but was uneconomic, and was terminated in 1931. A war-time coast-watching station was manned from 1941 to 1945. The station was subsequently taken over as a meteorological base. This was replaced in 1958 by the present station.

HABITATION There are no permanent residents.

The meteorological station is operated by the New Zealand Ministry of Transport. This is staffed by 10-12 people, relieved annually. Additional scientific personnel are present at times.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Campbell Islands Nature Reserve

IUCN category I (Scientific/Strict Nature Reserve), although limited tourism is permitted.

DATE ESTABLISHED 1954 – declared Reserve for the Preservation of Fauna and Flora
1975 – foreshores added to the reserve
1977 – designated Nature Reserve
Conservation of Islands in the Southern Ocean

**AREA** Entire Island group (11 331 ha)

**LAND TENURE** Crown land.

**LEGAL PROTECTION** Under the Reserves Act 1977, indigenous fauna and flora, and the environment, are completely protected. Entry to the island reserve is by permit from the Department of Lands and Survey. It is illegal to take or kill animals, collect plants, introduce any fauna or flora, or erect structures, without a permit.

Marine mammals are protected by the Marine Mammals Protection Act 1978 (fur seal and Hooker's sea lion have been protected since the 1880s).

Other New Zealand statutes relate to general protection and management of wildlife, fisheries, historic sites, and pollution.

**ADMINISTRATION** Campbell Islands are the responsibility of the New Zealand Department of Lands and Survey under the Director-General of Lands. The Outlying Islands Reserves Committee, a body composed of personnel (11 in 1984) with expertise and involvement in subantarctic and island matters, provides advice on planning, policy, management, and co-ordination of activities. Policy issues may also be referred to the National Parks and Reserves Authority.

Contact address: Director-General
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**MANAGEMENT POLICY** There are two principal policy objectives for management of New Zealand's subantarctic island reserves:

(i) Preservation of the reserve in its natural state as far as possible.

(ii) Preservation of indigenous flora and fauna, ecological associations, and natural environment.

A management plan for the Campbell Islands has been published. This outlines information on resources, and details aspects of management of the reserve: entry to the islands, scientific research, historical sites, tourism, management of fauna and flora, monitoring of changes in biota, building construction and maintenance, transport on and near the islands, waste disposal, pets, commercial developments, management of adjacent waters, and pollution.
Limited tourism is permitted, but carefully regulated. Visits by World Discoverer, Lindblad Explorer and other cruise vessels occur on occasions with landings of tourists supervised by a representative of the Department of Lands and Survey.

The Officer-in-Charge of the meteorological station is generally appointed an honorary ranger by the Department of Lands and Survey, with powers to ensure adherence to management conditions by people on the island. Meteorological station personnel are briefed on conservation and protection of the islands and their biota before leaving New Zealand for Campbell Island.

Human impact beyond the confines of the station is kept to a minimum. Construction of tracks is limited, to reduce risk of peat erosion, and there is a long boardwalk on the main track.

Conditions of entry permits are detailed in the management plan. All research must be approved by the Director-General of Lands. There may be no interference with any animal, plant, soil or artefact unless covered by the permit.

A cull of the feral sheep (Ovis aries) is being conducted (July 1984), but policy is to retain a stock of about 800 to allow further investigation of their genetic characteristics. These sheep are confined by a fence to the south-western area of Campbell Island.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Sealing and whaling operations had considerable impact on stocks in the early 19th and 20th centuries, respectively. Most species are, however, now increasing in numbers.

Sheep, goats (Capra hircus), and pigs (Sus scrofa) were liberated on Campbell Island on several occasions in the 1800s as food for shipwrecked sailors. Goats and pigs did not become established. Norway rats (Rattus norvegicus) were probably introduced with sealers, and were common on Campbell Island by the 1870s. They also occur on Folly Island. On both, they have had considerable effect on populations of ground- and burrow-nesting birds. Small petrels and prions are now largely restricted to rodent-free islets. Feral cats (Felis catus) occur on Campbell Island but are not common.

Sheep were farmed from 1895 to 1931. Burning of scrub for pasture, and grazing of animals, had marked effects on Campbell Island. Reduction of vegetation cover exposed the peaty soils, and led to considerable erosion. Selective grazing by sheep and cattle (Bos taurus) facilitated a change in floral dominance from Chionochloa spp. to Poa litorosa and Bulbinella rossii, and greatly reduced the abundance of the megaherbs Pleurophyllum spp., Anisotome spp., and Stilbocarpa polaris.
Conservation of Islands in the Southern Ocean

When sheep farming was abandoned in 1931, 4000 sheep and between 20 and 30 cattle were left on the island. Numbers of sheep declined to about 1000 until the 1960s, when they increased substantially. A fence was erected in 1970 from Tucker Cove to the west coast, and all sheep on the north side were killed. Rapid regeneration of vegetation occurred on the northern side. Subsequently in 1984 another fence was constructed from Northwest Bay to Rocky Bay, and all sheep apart from about 800 to the west of this fence, are currently being shot out (July 1984). Cattle have also been exterminated.

At least 81 alien plant species have been recorded on Campbell Island. Ten have been classified as 'widespread and naturalised' (principally Cerastium holosteoides, Poa annua, Poa pratensis, Stellaria media, Sagina procumbens, Festuca rubra, and Agrostis tenuis), but they are not regarded as a threat to indigenous vegetation.

SCIENTIFIC RESEARCH A considerable amount of research has been conducted on Campbell Island. Scientific expeditions occurred spasmodically until the 1960s, but visits to the islands have now become frequent.

Research activity is co-ordinated by the Outlying Islands Reserves Committee. Current research emphasis is on ecology of the avifauna, and effects of introduced mammals. There is, however, no overall scientific strategy for research on the islands. Detailed forward planning has been impractical due to limitations of transport to the islands and the expense involved. There is considerable co-operation between New Zealand bodies involved with Campbell Island, and transport for scientists is often provided in association with naval fisheries patrols or Ministry of Transport supply trips to the meteorological station, as well as through chartered vessels or occasional fisheries or oceanographic research vessel cruises.

Laboratory facilities exist at the station, and up to 13 scientists can be accommodated. There are also several huts around the main island.

ASSESSMENT OF PRESENT CONSERVATION STATUS Campbell Island has been substantially modified by man and introduced animals. Current conservation and management measures should ensure that further impact on indigenous fauna and flora is minimised. The control programme against sheep will enable regeneration of vegetation over most of the island. Action against the widespread rats and alien plants is impractical.
Hence, it is very important that the offshore islets in a 'virgin' state (such as Dent and Jacquemart) remain so. Extreme care needs to be exercised by people visiting these islets. They have rarely been visited, and biological surveys are needed to detail the fauna and flora present. This would aid identification of priority areas for conservation. This aspect was emphasised by a trip to Dent Island during the 1975-76 Campbell Island Expedition, when numbers of Campbell Island teal (Anas aucklandica nesiotis) were found. Several teal have recently been collected and transported to New Zealand for breeding, with the aim of supplementing the stock on this one islet, and possibly establishing new populations. Constant monitoring of the islets for rats (which could swim the 1-2 km distance from the main island) is necessary to enable immediate action if rats are found.

Strict control measures to prevent introductions of alien plants and animals with parties visiting the islands are outlined in entry permits. However, the onus to comply with these conditions is largely on the visiting parties themselves. Expeditions to the Campbell Islands often comprise scientists from several different institutes, and it would be desirable to have either a form of standardisation to ensure equipment and supplies are alien-free, or one agency responsible for supervision or packing of all materials destined for the islands. This is highlighted by the introduction of alien ryegrasses Vulpia bromoides and Bromus brevi-aristatus with a party to Campbell Island in 1970, most likely through seeds present in camping gear or clothing. Consideration should also be given to special packaging at the outset of an expedition of any equipment or supplies to be used by scientists visiting the offshore islets, as an extra precaution against inadvertent introductions of species currently confined to the main Campbell Island.

The Campbell Islands have little commercial potential. An increase in fishing activity on the Campbell Plateau by New Zealand vessels may result in the islands being used for shelter. This would involve the harbours on the eastern side of Campbell Island, and presence of ships in the harbours would not pose major problems.

Tourism occurs at present, with visits of the cruise ships World Discoverer and Lindblad Explorer. Visits ashore by tourists are strictly controlled and supervised by a representative of the Department of Lands and Survey.

Proposals have been submitted to raise the status of the Campbell Islands from Nature Reserve to National Reserve (New Zealand Gazette No 165, 1983). This status requires an Act of Parliament to alter any conditions of the reserve, not solely the assent of the Minister of Lands as at present. The Snares Islands have been accorded National Reserve status.
Conservation of Islands in the Southern Ocean

SELECTED REFERENCES

10 1964: Insects of Campbell Island. Pacific insects monograph 7: (several papers on the islands).
SNARES ISLANDS

GENERAL INFORMATION

COUNTRY New Zealand

GEOGRAPHICAL LOCATION 48°02'S, 166°35'E, in the South Pacific Ocean, about 200 km south-west of the South Island of New Zealand.

AREA 328 ha

MAXIMUM ALTITUDE 152 m

PHYSICAL FEATURES Snares Islands comprise two groups of islands: North East Island, with Broughton Island, Alert Stack and several small islets and rocks; and the Western Chain, of five islets with rocks and stacks.

The main island is North East Island, with an area of 280 ha. There are steep cliffs on the western side, with gentle gullies sloping to the east.

The islands are composed of jointed granite, and are probably part of a large batholith including areas of Stewart Island, formed about 120 MYr ago, and subsequently eroded. Peat soils are widespread.

The Snares Islands lie in the zone of the Subtropical Convergence. Climate is cool, with a mean annual temperature of 11°C, with persistent strong westerly winds, high humidity, and rainfall around 1200 mm/yr.

FLORA AND VEGETATION Flora of the islands comprises 20 vascular, 27 moss and bryophyte, 6 fungi, and 45 lichen, species.

Vegetation is dominated by forests of Olearia lyallii, with some Senecio stewartiae. Ferns (Polystichum vestitum, Blechnum durum, Asplenium obtusatum) occur in the sub-canopy and in gullies. In open areas in the forest, the herb Stilbocarpa robusta occurs. Dense scrub of Hebe elliptica is present on forest margins. Grassland of Poa tennentiana and Poa astonii, with the herb Colobanthus muscoideus, predominates in coastal areas of North East Island between the cliffs and forest, as well as much of Broughton Island. Islets of the Western Chain are largely devoid of vegetation.

Bull kelp (Durvillea antarctica) is widespread around the coasts.
The only endemic plant is the herb *Anisotome acutifolia*. This occurs in small patches, and is regarded as one of New Zealand's rarest plants. *Stilbocarpa robusta* is endemic to the Snares and Little Solander (west of Stewart Island) Islands.

There are two introduced vascular species, the grass *Poa annua* and the herb *Stellaria media*, both of which are well-established.

**FAUNA** 23 species of bird breed. There are large populations of Snares crested penguin (*Eudyptes robustus*), Salvin’s mollymawk (*Diomedea cauta salvini*), Buller’s mollymawk (*Diomedea bulleri*), sooty shearwater (*Puffinus griseus*), mottled petrel (*Pterodroma inexpectata*), fairy prion (*Pachyptila turtur*), fulmar prion (*Pachyptila crassirostris*) and common diving petrel (*Pelecanoides urinatrix*). Antarctic tern (*Sterna vittata*), Cape pigeon (*Daption capense*), red-billed gull (*Larus scopulinus*), and southern skuas (*Catharacta lommergi*), are common. Silvereye (*Zosterops lateralis*) and fantail (*Rhipidura fuliginosa*) are self-introduced, established species.

Sooty shearwater are the most abundant birds, with the population on North East Island estimated at 2.75 million burrow-holding pairs (1982). Salvin’s mollymawk and fulmar prion breed only on the Western Chain islets. The colonies of Cape pigeon are the northern-most known in the world.

Snares crested penguin is an endemic species. Buller’s mollymawk breed elsewhere only on the Chatham and Solander Islands, Salvin’s mollymawk only on the Bounty Islands. Three land birds are endemic to the Snares Islands: Snares tomtit (*Petroica macrocephala dannefaerdii*), Snares fernbird (*Bowdleria punctata caudata*), and Snares Island snipe (*Coenocorypha aucklandica huegeli*).

Two species of marine mammal breed on the islands: New Zealand fur seal (*Arctocephalus forsteri*), and small numbers of Hooker’s sea lion (*Phocarctos hookeri*). Southern elephant seal (*Mirounga leonina*) and leopard seal (*Hydrurga leptonyx*) are occasional visitors.

Some 250 species of invertebrates are reported, many of which, particularly the insects, have a high degree of endemism.

Little is known of the freshwater fauna and flora in streams on North East Island.

The littoral zone includes the small gastropod *Melarapha cincta*, the barnacle *Elminius plicatus*, and an endemic limpet *Cellana strigilis flemingi*. 
Conservation of Islands in the Southern Ocean

Several species of fish are found close inshore, especially cods of the genus Notothenia.

HISTORICAL FEATURES Pre-European history is unknown, although there is evidence of Maori presence. The first recorded discovery was by Vancouver in 1791 (sighted later on the same day by Broughton). Within a year, sealing operations had commenced, and continued spasmodically for the next century, with sealing gangs often left for periods on the islands. A castaway depot was established in 1867 and maintained until 1929. The islands were surveyed in 1889-90 for the site of a lighthouse but this was not built. A crayfishing industry commenced in 1952 around the islands. A biological station was established by the University of Canterbury in 1961, and there have been frequent scientific expeditions since.

HABITATION There are no permanent inhabitants.

The biological station is periodically occupied by scientific teams of up to 6 people.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Snares Islands National Reserve.

IUCN category I (Scientific/Strict Nature Reserve).

DATE ESTABLISHED 1961 - declared Reserve for the Preservation of Fauna and Flora
1975 - extended to include foreshore
1977 - designated Nature Reserve
1983 - designated National Reserve

AREA Entire island group (328 ha).

LAND TENURE Crown land.

LEGAL PROTECTION The Reserves Act 1977 provides for the protection of indigenous fauna and flora, the environment, and preservation of community relationships. The killing of animals, introduction of fauna and flora, collection of fauna and flora, and construction of buildings etc is illegal without a permit. Entry to the reserve is by permit from the Department of Lands and Survey.

Marine mammals are additionally protected by the Marine Mammals Protection Act 1978. Fur seal (Arctocephalus forsteri) and Hooker's sea lion (Phocarctos hookeri) have been protected since the 1880s.
Conservation and management of wildlife, fisheries, historic sites, and pollution, in general, are covered by other New Zealand statutes.

**ADMINISTRATION** Snares Islands are administered by the New Zealand Department of Lands and Survey under the Director-General of Lands. The Outlying Islands Reserves Committee, a body comprising personnel with expertise and involvement in subantarctic island matters, provides advice on planning, policy, management, and co-ordination of activities on the islands. Policy issues may be referred to the National Parks and Reserves Authority (NPRA).

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**MANAGEMENT POLICY** Management objectives of the Department of Lands and Survey for the reserve system of subantarctic islands are principally:

(i) Preservation of the reserve as far as possible in its natural state.

(ii) Preservation of indigenous flora and fauna, ecological associations, and natural environment.

Entry to the islands is controlled by permit, and is generally restricted to parties associated with scientific research or management.

A management plan has been published. This details conditions of research, the preservation of historical sites and artefacts, precautionary measures to be taken to prevent introduction of exotic animals and plants, restrictions on construction of buildings and tracks, waste disposal, prevention of fire, aspects of search and rescue, limitations on helicopter use, prevention of pollution, aspects of education and information to the public, and tourism. Tourist visits, but not landings, are permitted under close supervision.

Stern moorings to the island for crayfishing vessels exist in Hoho Bay. Their use is governed by permit, six issued in 1983. Present policy is to restrict the issue of permits to previous holders. Provisions exist under an amendment to the Reserves Act 1977 to prohibit anchoring or mooring of vessels within 0.5 nautical miles of the shore of a nature reserve, but these have not been invoked.
Conservation of Islands in the Southern Ocean

The Ministry of Agriculture and Fisheries has imposed a 12 mile radius around the islands within which fishing is only permitted with a licence.

**MANAGEMENT PROBLEMS AND THE IMPACT OF MAN** New Zealand fur seal were heavily exploited in the 19th century, but with protection since the 1880s have been increasing in numbers. In 1970, about 1100 seals (excluding pups) were recorded on North East Island. Sealing gangs were occasionally left on the islands. Potatoes were cultivated at one time but there are now no remains of these.

Sooty shearwater (*Puffinus griseus*, known commonly as 'mutton birds' in New Zealand) were also exploited in the early 1900s, but effects on their populations were small.

There are no alien mammals on the islands. Two goats were liberated in the late 1880s, but did not survive.

The New Zealand Red Data Book (1981) lists two plants as endangered: *Stilbocarpa robusta*, and *Anisotome acutifolia*. An exotic aphid species has recently been found on *Anisotome* plants, but the effects of this are unknown.

Vegetation can be considerably affected by birds, through trampling, burrowing (with subsequent undermining of trees) and defaecation, but this is a natural process on the islands and is not a major problem.

**SCIENTIFIC RESEARCH** The Snares Islands have been visited by scientific expeditions since the 1880s, but these were infrequent until the commencement of University of Canterbury expeditions in 1961. The islands have been regularly visited since, and a considerable amount of research has been conducted. Faunal and floral composition has been well documented, and current research is focusing on the biology and ecology of the fauna.

**ASSESSMENT OF PRESENT CONSERVATION STATUS** The Snares Islands are largely unmodified by man. Fur seal and sooty shearwater stocks have recovered from previous exploitation. Two species of alien plant are established, but these have no effect on indigenous vegetation.

There is good legal protection for the islands and biota under the Reserves Act 1977. Their biological importance has been recognised by New Zealand authorities, and their designation as a National Reserve (the first such reserve in New Zealand) affords the maximum level of protection. A management plan for the islands is currently in press.
There are no introduced mammals. Maintenance of the islands in this state is the principal management objective. Inadvertent introduction of rodents is a major risk for continued conservation, and strict conditions are imposed on expeditions visiting the islands and crayfishing vessels which moor in Hoho Bay. The mooring of fishing vessels at the Snares has been the subject of considerable recent publicity in New Zealand and the NPRA has been active in consultation with the department and the fishing community involved. Mooring permits are controlled by the Department of Lands and Survey, under policies agreed by the NPRA, and stringent measures to reduce the risk of rodent introductions are included in permit conditions. Nevertheless, the fishermen themselves are largely responsible for ensuring their vessels are free of animals or plants which could establish on the Snares, and that their activities around the islands comply with conditions of the permit and the Reserves Act 1977. Contact with the islands should be the minimum necessary, and regular checks on fishing activities are needed to ensure that the risk of alien introduction is minimised.

A considerable amount of research has been undertaken on the islands. However, much work in the past has been descriptive, and there is a need for more research on the ecology of plant and animal species (especially those that are endemic or rare) and also monitoring of natural changes in species composition and abundance. The unmodified state of the Snares Islands provides a good opportunity to improve knowledge of ecosystem dynamics in the absence of man.

SELECTED REFERENCES

Conservation of Islands in the Southern Ocean.

BOUVETOYA

GENERAL INFORMATION

COUNTRY Norway

GEOGRAPHICAL LOCATION 54°25'S, 3°24'E, in the South Atlantic Ocean, 3330 km south of South Africa.

AREA 5000 ha

MAXIMUM ALTITUDE 780 m

PHYSICAL FEATURES The island is roughly oval in outline, 9.5 km by 7 km. It is a domed plateau, with steep cliffs except on the eastern side. A low lava platform (Nyroya) exists on the west coast, the result of a landslide in 1957/58. A single rocky islet, Larsoya, occurs to the south-west.

Bouvetoya is of volcanic origin, probably a complex of volcanic cones, and is of basaltic composition. It is heavily glaciated, being 93% ice-covered.

Climate is oceanic with heavy cloud and fog, and mean annual temperature of -1.5°C. Bouvetoya lies about 500 km south of the Antarctic Convergence, and pack ice from the Weddell Sea is occasionally present.

FLORA AND VEGETATION The cryptogamic, non-vascular, flora consists of about 20 bryophyte and 50 lichen species.

Lichens (Caloplaca spp.) and the alga Prasiola crispa occur on coastal cliffs. Mosses of the genera Tortula, Brachythecium and Andreaea, with lichens (Usnea spp.) predominate in most vegetated areas up to about 400 m.

The flora is regarded as impoverished, bearing affinities with island groups to the west such as the South Sandwich Islands and South Shetland Islands.

FAUNA Antarctic fur seal (Arctocephalus gazella) are numerous, and southern elephant seal (Mirounga leonina) probably also breed.
Conservation of Islands in the Southern Ocean

Macaroni penguin (Eudyptes chrysolophus) and chinstrap penguin (Pygoscelis antarctica) are abundant. Adélie penguin (Pygoscelis adeliae) breed also, but are not common. Other breeding seabird species include Cape pigeon (Daption capense), Antarctic fulmar (Fulmarus glacialoides), snow petrel (Pagodroma nivea), southern skua (Catharacta lomhbergii), and Antarctic tern (Sterna vittata) which are common, with southern giant petrel (Macronectes giganteus), southern black-backed gull (Larus dominicanus), black-bellied storm petrel (Fregetta tropica) and Wilson's storm petrel (Oceanites oceanicus) probable breeders in small numbers.

Several invertebrate, arthropod species have been recorded, with collembolans particularly prevalent.

HISTORICAL FEATURES Bouvetóya was discovered in 1739 by the Frenchman, Jean-Baptiste Lozier de Bouvet. Sporadic sealing occurred in the 1800s. The island was claimed by Norway in 1928, with formal annexation in 1930. Several scientific expeditions have visited the island this century.

HABITATION Uninhabited.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Bouvetóya Nature Reserve.

IUCN category I (Scientific/Strict Nature Reserve).

DATE ESTABLISHED 1971

AREA Entire island (5000 ha)

LAND TENURE Crown land

LEGAL PROTECTION An Order of Council, December 1971, protects the flora and fauna; prohibits alien introductions, construction of buildings, roads etc, vehicular transport, disposal of waste which could harm flora and fauna; and governs scientific activities by permit. The conditions include territorial waters.

Seals are additionally protected by Norwegian Ordinance.

The island is within the boundaries defined by the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR). This deals with maintenance of population levels and ecological relationships, and prevention of irreversible changes in antarctic ecosystems.
Bouvetøya

ADMINISTRATION Bouvetøya is administered by the Norwegian Ministry of Justice (Polar Department) (Justis-og politidepartementet), in conjunction with the Ministry of Environment. These bodies are advised by the Norsk Polarinstitutt (Norwegian Polar Research Institute).

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2 Ministry of Environment
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3 Norsk Polarinstitutt
PO Box 158
1330 Oslo Lufthavn
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MANAGEMENT POLICY Activities on the island are governed by permit. No management plan is known. Details of management policy, apart from measures outlined in the Order of Council 1971, are also unknown. These measures restrict human activities on the island, and are sufficiently detailed to serve as general management guidelines.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Antarctic fur seal (Arctocephalus gazella) were exploited sporadically from the early 1800s until the 1930s, but stocks are now increasing.

There are no introduced animals.

SCIENTIFIC RESEARCH There have been occasional visits by scientific expeditions since the first landing of scientists from the Norvegia in 1927. More regular visits to the island are now made by Norwegian Antarctic Research Expeditions (NARE).

Automated weather stations have been established on the island since 1977.

A wide range of research has been conducted, but has tended to be on an irregular basis. Much basic biological research remains to be conducted.
Conservation of Islands in the Southern Ocean.

**ASSESSMENT OF PRESENT CONSERVATION STATUS** Bouvetóya is very isolated, and few landings have been made in the past. With the exception of exploitation of Antarctic fur seal, man's impact on the fauna and flora has been negligible.

Conditions of the 1971 Order of Council should be adequate to ensure conservation of the island's biota, although this would be aided by preparation of a detailed management plan.

The level of scientific research has recently increased with several NARE expeditions, but further detailed biological surveys of Bouvetóya appear to be needed.

**SELECTED REFERENCES**

Marion Island

MARION ISLAND

GENERAL INFORMATION

COUNTRY South Africa

GEOGRAPHICAL LOCATION 46°54'S, 37°45'E, in the southern Indian Ocean, 2300 km south-east of South Africa, 925 km west of Iles Crozet.

AREA 30 000 ha

MAXIMUM ALTITUDE 1230 m (State President Swart Peak)

PHYSICAL FEATURES The island is roughly oval, measuring 24 km (east-west) by 17 km (north-south). A central mountainous area slopes in all directions with steep escarpments above a coastal plain. There is a prominent radial pattern of elevated lava ridges, and numerous scoria cones. Peat soils occur at low altitudes.

Marion Island is the summit of a basaltic volcano rising from the Mid-ocean Ridge. The oldest known rocks are 500,000 yrs old. Geological history includes two distinct volcanic phases, interspersed by glaciation. There has been recent volcanic activity. In 1980, a fissure eruption occurred on the west coast. Permanent ice occupies a small valley on the summit plateau, but there is no ice cap.

Climate is oceanic, with little diurnal or seasonal variation. Strong westerly winds prevail, with much cloud, high humidity, a mean annual temperature of 5°C, and rainfall of about 2500 mm/yr. The island is approximately 200 km north of the Antarctic Convergence.

PLORA AND VEGETATION 38 vascular species (14 alien), 72 moss, 36 hepatic and 50 lichen species are known. 24 vascular plants are probably indigenous, but only one, Elaphoglossum randii, is endemic to Marion and Prince Edward Islands.

Around the perimeter of the island, in the salt-spray region, herbs Crassula moschata and Cotula plumosa are common. Further inland, on well-drained exposed slopes and in areas affected by animals, tussock grass Poa cookii dominates. On protected well-drained slopes, extensive stands of the fern Blechnum penna-marina occur with dwarf shrub (Acaena magellanica), cushions of Azorella selago, and in wet areas and near springs, the moss Brachythecium rutabulum is common.
Vegetation of mires and bogs is dominated by the rush *Juncus scheuchzerioides* and the grass *Agrostis magellanica*. Above 300 m, a feldmark community occurs, dominated by *Azorella selago* cushions, and up to 1200 m, a bryophyte community of *Ditrichum* and *Bartramia* moss species.

Kerguelen cabbage (*Pringlea antiscorbutica*) occurs on the island.

Kelp beds of species of *Macrocystis* and *Durvillea* are extensive around the coast.

There are no trees or large shrubs.

There is a high level of endemism among hepatic species.

A number of widespread naturalised aliens are present, including *Poa annua*, *Sagina apetala*, *Agrostis stolonifera*, *Stellaria media* and *Cerastium fontanum*.

**FAUNA** Marion has a very rich avifauna. There are 29 breeding bird species and a total number of about two million birds. King penguin (*Aptenodytes patagonicus*), macaroni penguin (*Eudyptes chrysocome chrysocome*) and rockhopper penguin (*Eudyptes chrysocome chrysocome*) are very abundant. Wandering albatross (*Diomedea exulans*), grey-headed albatross (*Diomedea chrysostoma*), sooty albatross (*Phoebetria fusca*) and light-mantled sooty albatross (*Phoebetria palpebrata*) are common. Lesser broad-billed prion (*Pachyptila salvini*) are particularly abundant, with white-chinned petrel (*Procellaria aequinoctialis*), Kerguelen petrel (*Pterodroma brevirostris*), blue petrel (*Halobaena caerulea*), southern skua (*Catharacta lonsbergi*) and lesser sheathbill (*Chionis minor marionensis*). Estimates and censuses of bird populations exist for most species.

Several burrowing petrel species (great-winged petrel (*Pterodroma macroptera*), soft-plumaged petrel (*Pterodroma mollis*), grey petrel (*Procellaria cinerea*)) are regarded by the South African authorities as Endangered, due to predation by feral cats; Antarctic tern (*Sterna vittata*) and Kerguelen tern (*Sterna virgata*) are listed as Rare.

The island is notable for the world's second largest breeding population of king penguin (approximately 200,000 pairs). The subspecies of lesser sheathbill is found only on Marion and Prince Edward Islands.

Large but declining numbers of southern elephant seal (*Mirounga leonina*), and increasing populations of both Antarctic fur seal (*Arctocephalus gazella*) and Amsterdam Island fur seal (*A. tropicalis*) are present.
Conservation of Islands in the Southern Ocean

There is a substantial invertebrate fauna, with four endemic species of weevil, and several species of fly, butterfly, moth, and spider.

Littoral ecology is relatively well known. A rich planktonic and benthic marine fauna is found in coastal waters.

Cats (*Felis catus*), and mice (*Mus musculus*) are established aliens.

**HISTORICAL FEATURES** Marion Island was probably discovered by a Dutchman, Barent Ham in 1663 but the first confirmed sighting was by Marion Dufresne in January 1772. Captain James Cook visited in 1775 and named the islands of Marion and Prince Edward. This was followed soon after by arrival of sealers, who by 1802 had set up temporary bases on the island. Many shipwrecks have occurred.

Marion Island was annexed by South Africa in December 1948. A meteorological station was established in January 1949.

**HABITATION** South Africa maintains a scientific station on Marion Island. Personnel can number up to 22, comprising support staff, meteorologists, biologists and geologists. The station is relieved twice annually.

There are no permanent inhabitants.

**PROTECTED AREA INFORMATION**

**MANAGEMENT CLASSIFICATION** While the Sea Birds and Seals Protection Act (1973) gives some specific legal protection to fauna, the island itself is not legally protected. However, the island is essentially managed as a nature reserve (together with Prince Edward Island) equivalent to IUCN category I (Scientific/Strict Nature Reserve).

**DATE ESTABLISHED** Not applicable. (South African control of the island dates from 1948 (Prince Edward Islands Act, No 43 of 1948)).

**AREA** Not applicable. (Entire island (30 000 ha) is, however, managed for conservation purposes).

**LAND TENURE** State-owned territory.

**LEGAL PROTECTION** This is limited to protection of seabirds and seal fauna, in the Sea Birds and Seals Protection Act (No 46 of 1973). This restricts access to Marion and Prince Edward Islands, and prohibits interference with seals and birds without a permit.
Marion Island

Marion Island is within the boundaries of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), regulating commercial exploitation of marine animals.

ADMINISTRATION Activities at Marion and Prince Edward Islands are administered jointly by the South African Scientific Committee for Antarctic Research (SASCAR), a body within the Council for Scientific and Industrial Research (CSIR), and the Antarctic Section of the Department of Transport.

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MANAGEMENT POLICY Research and associated activities on the island are conducted under the auspices of SASCAR, which adheres to the conservation principles of the Antarctic Treaty, specifically the Agreed Measures for the Conservation of Antarctic Fauna and Flora, and the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) as well as recommendations of the Scientific Committee on Antarctic Research (SCAR).

A conservation policy, including 'operational guidelines' for visiting scientists, has been prepared, and is equivalent to a management plan. This set of guidelines regulates construction and maintenance activities, sets out procedures for disposal of waste materials and prevention of pollution, restricts tourism, limits taking of fauna and flora, and deals with certain aspects of aircraft and ship operation to minimise disturbance to animals. Various areas are designated 'Wilderness Areas', in which human activities are minimised (Goney Plain, Fur Seal Bay, Kildalkey Bay, Kerguelen Rise, Stony Ridge, East Cape, Ship's Cove, Piew Craggs, Grey-headed Albatross Ridge), and sealer's and shipwreck remains are totally protected (at Ship's Cove, Sea Elephant Bay, Cape Davis, Mixed Pickle Cove, Swartkop Point, Sealer's Cave).

Tourism is not encouraged, and the Lindblad Explorer has been denied calling rights.
Conservation of Islands in the Southern Ocean

Strict controls are imposed on visiting expeditions, to minimise the risk of introduction of alien fauna and flora.

An extensive control programme is in operation against cats.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Populations of fur seal and southern elephant seal were heavily exploited during the 19th century. Fur seal stocks are increasing rapidly, but elephant seal populations are slowly declining.

In the past there have been numerous introductions. Some plants were deliberately introduced (eg poplar and willow as windbreaks, although unsuccessful). Several widespread naturalised alien plants occur, in particular Poa annua. Modification of natural vegetation is most pronounced around the scientific station.

Mice (Mus musculus) are abundant, and were probably introduced through sealing expeditions or from shipwrecks. They are not regarded as a serious problem.

Cats (Felis catus) were introduced in 1949 to control mice in and around the scientific station. They increased at a rate of about 20%/yr, numbering 2000 by 1975. They have had a severe effect on avifauna, especially burrowing petrels (estimates of 450,000 killed by cats per year). A control programme was started in 1977 using cat flu, feline panleucopaenia (FLP) virus, through the reintroduction of infected island animals. This resulted in an immediate reduction of the population, and the control programme is continuing to prove effective.

From the early 1950s, sheep and chickens were introduced annually as a source of fresh food for station personnel. Overgrazing near the station led to bringing in of fodder, and probably resulted in some alien plant introductions. All sheep and poultry were removed in 1968-69. A greenhouse, formerly used for plant storage and cultivation, was recently demolished.

SCIENTIFIC RESEARCH An active research programme is conducted by SASCAR. Organised scientific research began in 1963, and the 1965/66 expedition to Marion and Prince Edward Islands laid the foundations for annual expeditions which have occurred since 1971. These are sponsored by the Department of Transport, which provides transport, food and clothing, and are managed and coordinated by the CSIR. In 1972 a large, well-equipped laboratory replaced the old field station. A small hydroelectric power station has recently been built on the van den Boogaard River, which will probably become fully operational in late 1984, supplying much of the meteorological and scientific station's power. Up to 12 scientists are present during summer periods, fewer over winter.
Marion Island

Research, which concentrated on basic biological and geological description in the 1960s, now emphasises geological processes, ecosystem dynamics, and terrestrial/marine interaction. The annual research budget (1983) is approximately R300,000. A research and supply vessel, 'S.A. Agulhas' visits Marion Island twice a year (as well as Gough Island once a year).

ASSESSMENT OF PRESENT CONSERVATION STATUS

Overall, conservation prospects for Marion Island are regarded as good. The impact of alien fauna and flora is limited largely to areas of human disturbance. However, cats and mice are widespread. Cats have exerted severe pressure on populations of small seabirds, and are the main management problem. Current control measures are proving effective.

Further introductions to the island must be avoided, especially of rats which are not present. Research and station-supply expeditions are well-organised, and thorough measures are taken to reduce the risk of alien animal and plant introductions.

There is at present no legal basis for conservation of the island biota as a whole, apart from the Sea Birds and Seals Protection Act of 1973. This provides protection for sea birds and seals but not other elements of the fauna and flora. This is not at present a serious shortcoming in view of the current level of co-operation and joint administration by scientific organisations and the Department of Transport, the latter responsible for running the station and providing logistic support for scientific expeditions. Nevertheless, legal formalisation of the island's status as a nature reserve would be welcomed.

There are no rangers or independent organisations to oversee management. Minor pollution of inshore and beach areas, by dumping of contaminated diesel fuel into a stream near the station, has occurred in the past, and stricter controls have been implemented. The hydroelectric power scheme will reduce this risk, however, at the expense of temporary damage to fauna and flora during construction, and permanent modification of the local environment.

SELECTED REFERENCES

Conservation of Islands in the Southern Ocean


PRINCE EDWARD ISLAND

GENERAL INFORMATION

COUNTRY South Africa

GEOGRAPHICAL LOCATION 46°38'S, 37°57'E, in the southern Indian Ocean, 22 km north-north-east of Marion Island.

AREA 4400 ha

MAXIMUM ALTITUDE 672 m (van Zinderen Bakker Peak)

PHYSICAL FEATURES The island is roughly oval in shape, measuring 10 km by 5 km. A high central area, comprising several volcanic cones, slopes gently to a coastal plain in the east, to precipitous vertical cliffs in the north and south, and with cliffs to a small coastal plain in the west.

Prince Edward Island is the summit of a shield volcano. Oldest rocks are approximately 5000 years old. Two distinct periods of volcanic activity have taken place. Glacial history is uncertain. Peat soils are widespread.

Climate is oceanic, with no permanent snow, and is very similar to that at Marion Island: strong westerly winds, mean annual temperature 5°C, rainfall 2500 mm/year, humid, and cloudy. The Subtropical Convergence lies about 500 km to the north, the Antarctic Convergence 200 km to the south.

FLORA AND VEGETATION Vegetation is similar to that of Marion Island.

The flora includes 21 indigenous species of vascular plant, one of which, Elaphoglossum randii, is endemic to Prince Edward and Marion Islands. Also 28 moss, 25 hepatic, and 12 lichen, species have been recorded.

Coastal vegetation is dominated by the herbs Crassula moschata and Cotula plumosa. Inland, grass Poa cookii, fern Blechnum penna-marina, dwarf shrub (Acaena magellanica), and carpets of moss Brachythecium spp. are abundant. Feldmark vegetation occurs above 250-300 m, comprising Azorella selago, grass Agrostis magellanica, and species of the moss Andreaea.

A high incidence of endemism has been found among hepatic species.

Only one introduced plant occurs, the grass Poa annua.
Prince Edward Island

FAUNA  Southern elephant seal (Mirounga leonina) and fur seal (Arctocephalus tropicalis, and probably also A. gazella) breed.

The island has a rich avifauna. Rockhopper penguin (Eudyptes chrysocome chrysocome) are abundant, with macaroni penguin (Eudyptes chrysolophus), king penguin (Aptenodytes patagonicus), and gentoo penguin (Pygoscelis papua), yellow-nosed albatross (Diomedea chlororhynchos), wandering albatross (Diomedea exulans), grey-headed albatross (Diomedea chrysostoma), and sooty albatross (Phoebetria fusca), northern giant petrel (Macronectes halli) and southern giant petrel (Macronectes giganteus), lesser broad-billed prion (Pachyptila salvini), fairy prion (Pachyptila turtur), soft-plumaged petrel (Pterodroma mollis), great-winged petrel (Pterodroma macroptera), Kerguelen petrel (Pterodroma brevirostris), blue petrel (Halobaena caerules), South Georgian diving petrel (Pelecanoides georgicus), black-bellied storm petrel (Fregetta tropica), and lesser sheathbill (Chionis minor marionensis) being common.

Avifauna is similar to that of Marion Island, apart from large populations of yellow-nosed albatross, black-bellied storm petrels, and probably only small colonies of white-chinned petrel (Procellaria aequinoctialis) on Prince Edward Island.

Lesser sheathbill are a subspecies endemic to Prince Edward and Marion Islands.

Numerous invertebrate species have been recorded, most in common with Marion Island. An endemic genus of weevil, and reduction of wings in flying insect groups, are notable features of the fauna of both islands.

HISTORICAL FEATURES  The island was probably discovered by the Dutchman Barent Ham in 1663 (with Marion Island), but the first confirmed sighting was in 1772 by Marion Dufresne. Captain James Cook named the island in 1775. Exploitation of seals and whales on and near the island occurred in the 1800s. It was the scene of several shipwrecks. The island was annexed by South Africa, together with Marion Island, in 1948 and 1949.

HABITATION  The island has no permanent inhabitants but is visited not more than twice yearly by small groups of scientists.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION  There is no specific designation. The island is not formally protected, but is managed essentially as a nature reserve (IUCN category I (Scientific/Strict Nature Reserve)).
Conservation of Islands in the Southern Ocean

DATE ESTABLISHED Not applicable (South African control of the island dates from 1948: Prince Edward Islands Act, No 43 of 1948).

AREA Entire island (4400 ha) is managed for conservation purposes.

LAND TENURE State-owned territory.

LEGAL PROTECTION There is no legislation concerning conservation of the island as a whole. The Sea Birds and Seals Protection Act (No 46 of 1973) limits access to the island and provides protection for most species of seabird and seal occurring at Marion Island and Prince Edward Island.

The island is within the boundaries governed by the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), regulating exploitation of marine animals.

ADMINISTRATION As with Marion Island, Prince Edward is administered jointly by the South African Scientific Committee for Antarctic Research (SASCAR), a body within the Council for Scientific and Industrial Research (CSIR), and by the Antarctic Section of the Department of Transport.

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MANAGEMENT POLICY Only genuine research workers are permitted on the island, which is visited once or twice a year for 5 to 10 days. Research is conducted under the auspices of SASCAR, which adopts the conservation principles of the Antarctic Treaty (the Agreed Measures for the Conservation of Antarctic Fauna and Flora), CCAMLR, and recommendations of the Scientific Committee on Antarctic Research (SCAR).

A conservation policy, including 'operational guidelines' exists for Marion and Prince Edward Islands, and is equivalent to a management plan. These guidelines regulate construction and maintenance activities, specify procedures for disposal of waste materials and prevention of pollution, restrict movement on the island, limit interference with fauna and flora, and deal with aspects of aircraft and ship operation to minimise disturbance to animals.
Under this set of guidelines, Prince Edward Island is designated a 'wilderness area' and greater restrictions are placed on access to and activities on the island by official parties. Only essential research may be conducted. Rigid precautions, involving packing of equipment and supplies in steel, rodent-proof containers, and washing of footwear and helicopter wheels, are taken to prevent accidental introduction of alien plants or animals. Historical sites at Cave Bay and Vaalkop are totally protected from interference.

Tourist landings on the island are not permitted.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Populations of southern elephant seal (Mirounga leonina) and fur seal (Arctocephalus gazella, A. tropicalis) were heavily exploited in the 19th century, but have recovered to a large extent.

There are no alien animals on the island, and only one introduced plant, the grass Poa annua.

SCIENTIFIC RESEARCH Research on Prince Edward is linked to that on Marion Island, but is more strictly regulated. Only research projects specifically requiring data from the island are permitted.

ASSESSMENT OF PRESENT CONSERVATION STATUS The impact of man on Prince Edward Island is small, and prospects for conservation are very good.

The principal management concern is to ensure no introductions of alien plant or animal occur. Conditions imposed by South African authorities on people visiting the island are stringent. However, Russian fishing vessels are alleged to have landed parties on the island at times. Greater surveillance and monitoring of activities of vessels in the area may be needed.

There is a need for a legal basis for conservation of the island environment and its biota. This would probably involve only formalisation of the current situation, but would increase the security of the island's status.

SELECTED REFERENCES


Tristan da Cuhna Islands

TRISTAN DA CUNHA ISLANDS

GENERAL INFORMATION

COUNTRY United Kingdom

GEOGRAPHICAL LOCATION 37°02'-37°24'S, 12°12'-12°42'W, in the mid-Atlantic Ocean, 2800 km from South Africa and 3200 km from the eastern coast of Brazil.

AREA 11 100 ha

MAXIMUM ALTITUDE 2060 m ('The Peak' on Tristan Island)

PHYSICAL FEATURES The group comprises 3 major islands: Tristan da Cunha (commonly referred to as 'Tristan'), Nightingale, and Inaccessible.

The main island, Tristan, is roughly circular, with a diameter of 12 km. Several coastal strips occur, backed by steep cliffs up to 600 m, with a sloping plateau area ('The Base') rising to a central conical peak ('The Peak'). The island is the summit of a volcanic cone, with several parasitic cinder cones, composed of interbedded basaltic lavas and pyroclastics. The oldest rocks have been dated at about 1 MYr.

Inaccessible Island, 40 km south-west of Tristan, measures 5 km by 4 km, with a maximum altitude of 600 m. Steep coastal cliffs are present, with deep ravines and gullies inland. The island is a remnant of the side of a large eroded volcano, composed of thin basaltic lava flows, with oldest rocks of approximately 6 MYr.

Nightingale Island, 38 km south-south-west of Tristan, is 2.5 km by 1.5 km, with a maximum elevation of 400 m. The island is composed of trachyte lava flows, as are the two small offlying island groups, Middle and Stoltenhoff. The oldest rocks are 18 MYr. There are signs of recent (less than 3600 yrs BP) volcanic activity.

The islands experience a cool, humid, oceanic climate: mean annual temperature of 15°C, rainfall of 1700 mm/yr, prevalent westerly winds, often with heavy cloud cover. The islands are usually north of the Subtropical Convergence.
TRISTAN DA CUNHA ISLANDS

SETTLEMENT OF EDINBURGH

SOUTH ATLANTIC OCEAN

INACCESSIBLE ISLAND

NIGHTINGALE ISLAND

KEY
■ Hut

SCALE
0 5 km

0 1 km

(Sketch map only)

(Sketch map only)
FLORA AND VEGETATION The native flora of Tristan Island comprises about 40 species of flowering plant and 30 pteridophytes, less on Nightingale and Inaccessible.

On Tristan Island, tussock grass *Spartina arundinacea* dominates coastal areas unaffected by grazing. Near the settlement, and in grazed areas, alien grasses are abundant. In lowland areas and on cliffs, thickets of the small tree *Phyllica arborea* occur among fern bush vegetation composed principally of *Blechnum palmiforme*. There is transition to wet heath vegetation at about 750 m, composed of the fern *Blechnum penna-marina* with alien species *Rumex acetosella* and *Holcus lanatus*. Above 900 m, moor and feldmark vegetation occur, dominated by small shrub *Empetrum rubrum*, moss *Rhacomitrium lanuginosum*, with sedges of *Acaena stangi*.

On Inaccessible and Nightingale Islands, dense stands of *Spartina* up to 2 m tall occur, with *Blechnum palmiforme* and *Phyllica arborea* in gullies. In upland areas, *Empetrum rubrum* and the sedge *Scirpus thouarsii* predominate.

Extensive beds of giant kelp (*Macrocystis pyrifera*) surround much of the coast.

About 100 species of alien vascular plant have been recorded from Tristan Island (20 from Inaccessible, six from Nightingale). Several species, such as *Cerastium fontanum*, *Poa annua*, and *Rumex acetosella*, are widespread.

Several native species are regarded as Rare (IUCN classification) but none is Endangered.

FAUNA The group has a rich avifauna, with a total of 24 breeding species (16 on Tristan, 19 on Inaccessible, 16 on Nightingale). Species composition and abundance varies considerably among the three islands. Common species include: Moseley's rockhopper penguin (*Eudyptes chrysocome moseleyi*), yellow-nosed albatross (*Diomedea chlororhynchos*), sooty albatross (*Phoebetria fusca*), broad-billed prion (*Pachyptila vittata*), white-chinned petrel (*Procellaria aequinoctialis*), soft-plumaged petrel (*Pterodroma mollis*), little shearwater (*Puffinus assimilis*), the largest world populations (4-5 million breeding birds) of great shearwater (*Puffinus gravis*) on Nightingale Island, common diving petrel (*Pelecanoides urinatrix*), white-bellied storm petrel (*Fregetta grallaria*), white-faced storm petrel (*Pelagodroma marina*), southern skua (*Catharacta lonnbergi*), Antarctic tern (*Sterna vittata*), brown noddy (*Anous stolidus*), with endemic Tristan thrush (*Nesocichla eremita*), Tristan bunting (*Nesospiza acunhae*) and Tristan large-billed bunting (*Nesospiza wilkinsi*). Inaccessible rail (*Atlantisia rogersi*) are endemic to Inaccessible Island. Population estimates exist for most seabird species breeding in the group.
Conservation of Islands in the Southern Ocean

Amsterdam Island fur seal (*Arctocephalus tropicalis*) breed on Nightingale Island and Inaccessible Island, southern elephant seal (*Mirounga leonina*) on Inaccessible Island.

Features of the invertebrate fauna are the low number of native species (although high degree of endemism among them), and numerous alien species. Springtails, moths, butterflies, beetles (especially weevils), and flies are relatively well-represented.

Several introduced mammals are present on Tristan Island, including cats (*Felis catus*), dogs (*Canis familiaris*), black rats (*Rattus rattus*), mice (*Mus musculus*), donkeys (*Equus asinus*), pigs (*Sus scrofa*), cattle (*Bos taurus*), and sheep (*Ovis aries*).

Crayfish (*Jasus tristani*) are abundant around the coasts to depths of 400 m, and are commercially fished. Several fish species are also common (eg five-finger *Acantholatris monodactylus*, mackerel *Decapterus longimannus*, snoek *Thyrsites atun*, bluefish *Seriolella antarctica*).

**HISTORICAL FEATURES** The islands were discovered by the Portugese admiral Tristao d'Acunha in 1506. They were frequented by sealers and whalers from the late 1700s to late 1800s, with heavy exploitation of fur seal and elephant seal.

The settlement of Edinburgh was established on Tristan Island in 1811 by Jonathan Lambert, who introduced livestock, poultry, and cultivated crops (mainly potato). The islands were annexed by Britain in 1816, and a military garrison was present on Tristan Island 1816-17.

A crayfish industry started in 1949, and a canning factory was built in 1950. An eruption on Tristan Island in 1961 forced the evacuation of islanders, most returning in 1963. A new factory was built, and crayfishing and farming recommenced.

**HABITATION** A resident population of 314 (1977 census) is based at the settlement of Edinburgh on the northern coast.

**PROTECTED AREA INFORMATION**

**MANAGEMENT CLASSIFICATION** The islands have no specific classification. The entire group is protected, but the degree of protection varies island to islands.

Protection afforded to Inaccessible, Nightingale, Middle and Stoltenhoff Islands approximates IUCN category I (Scientific/Strict Nature Reserve), with the exception of provision for local islanders to kill some birds.
Tristan da Cuhna Islands

The protected status of Tristan Island approximates IUCN category VIII (Multiple-use Management Area/Managed Resource Area). Jews Point is specifically protected as a sanctuary (IUCN category I).


**AREA** Entire island group (11 100 ha).

**LAND TENURE** Crown land.

**LEGAL PROTECTION** The Tristan da Cunha Conservation Ordinance 1976 covers the islands of the Tristan da Cunha group, and Gough Island.

General provisions prohibit: importation of non-indigenous fauna and flora, liberation of existing animal species in areas not currently used for agricultural or horticultural purposes, and activities causing damage to soil or vegetation unless permitted by permit. Restrictions are also placed on use of fire and chemicals.

Specifically protected species are: southern right whale (*Eubalaena australis*), southern elephant seal (*Mirounga leonina*), fur seal (*Arctocephalus spp.*), wandering albatross (*Diomedea exulans*), Tristan thrush (*Nesocichla eremita*), and Gough Island rail (*Gallinula nesiotis*).

On Tristan Island, areas may be declared sanctuaries, imparting protection to all indigenous birds and mammals. To date, one sanctuary (Jews Point) has been created.

On Inaccessible, Nightingale, Middle and Stoltenhoff Islands, construction of buildings and other structures, as well as agricultural or horticultural activities, is prohibited. It is illegal to capture, molest, or kill any native mammal or bird without a permit, with the exception of three bird species (great shearwater *Puffinus gravis*, sooty albatross *Phoebetria fusca*, rockhopper penguin *Eudyptes chrysolophus moseleyi*) which can be taken by Tristan residents without a permit. Collection of native plants on Inaccessible Island by Tristan residents is also permitted.

**ADMINISTRATION** The islands are the responsibility of the Administrator of Tristan da Cunha, assisted by the Island Council of Tristan da Cunha, based at Edinburgh. There are currently two conservation officers, appointed by the Administrator, together with the island's policeman, an *ex officio* conservation officer.
Conservation of Islands in the Southern Ocean

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MANAGEMENT POLICY  
The Tristan da Cunha Conservation Ordinance 1976 is the basis of conservation in the island group. This affords different degrees of protection, recognising present agricultural and horticultural activities and human disturbance on the main island of Tristan, and provides for future concentration of development there. Protection is centred on the other islands.

A formal management plan does not exist, although an overall strategy was outlined by Wace and Holdgate (1976) in a section entitled 'Suggested guidelines for environmental management in the Tristan da Cunha Islands', and this has been adopted by the authorities.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN  
Man has had a considerable impact on Tristan Island. Seals and whales were exploited extensively in the 1800s. Mice (Mus musculus) were introduced with sealers, and rats (Rattus rattus) following a shipwreck in 1882. Pigs (Sus scrofa), horses (Equus caballus), cattle (Bos taurus), sheep (Ovis aries), goats (Capra hircus), and poultry have been kept in the past. Extensive cultivation of coastal plain areas, and overgrazing of regions of 'The Base', have led to modification of the vegetation, principally a change in dominance from Agrostis and Deschampsia to alien Rumex and Holcus species. Extensive areas of Phylica arborea have been cleared around the settlement for building and fencing purposes, and erosion has occurred. Amsterdam Island fur seal (Arctocephalus tropicalis) and southern elephant seal (Mirounga leonina) no longer breed on Tristan Island, nor do southern giant petrel (Macronectes giganteus), or wandering albatross (Diomedea exulans), and rockhopper penguin (Eudyptes chrysocome moseleyi) are much less abundant than formerly. This is due to a combination of predation by man, predation by introduced mammals, and modification of nesting habitat. Following the volcanic eruption in 1961, with subsequent evacuation of the islanders, dogs (Canis familiaris) left on the island became feral. They exterminated geese (Anser anser) on the island, and also preyed heavily on nesting birds, lambs, calves, and donkey foals. Extinction of Tristan bunting (Nesospiza acunhae), and reduction in numbers of Gough Island rail (Gallinula nesiotis) and small seabirds, are attributed to predation by rats and cats.
On Inaccessible Island, several alien plant species are widespread. Cattle, sheep, goats and pigs were on the island at times, but all have been removed. There are no cats or rodents.

Nightingale Island is visited several times a year by Tristan islanders to collect seabird eggs, bird fat, and guano. Alien New Zealand flax (Phormium tenax) became established in the 1960s. Because of its aggressive nature and consequent reduction of nesting habitat for birds, especially great shearwater (Puffinus gravis), efforts are being made to control it by uprooting of plants. Sheep were introduced in the 1930s but died out. There are no alien vertebrates and few alien invertebrates.

The crayfish fishery (for Jasus tristani) is regarded as over-exploited at present.

SCIENTIFIC RESEARCH The islands have received attention from several major scientific expeditions (eg Norwegian Expedition 1937-38, Royal Society Expedition 1962), but there have been no regular, long-term, research programmes.

There has been interest shown in establishment of a research station on Tristan Island, but this has not developed.

Composition of fauna and flora is relatively well-known, but research to date has been largely descriptive.

ASSESSMENT OF PRESENT CONSERVATION STATUS The influence of man in the Tristan da Cunha group has been most pronounced on the main island of Tristan. Areas in the south-east of the island, away from sites of settlement and agricultural/horticultural activities, are relatively unaltered, but most of the island has been considerably modified. Conservation management is directed at minimising disturbance to the biota and environment associated with current farming practices, and possible future development of agriculture, forestry and fisheries. Placing of conservation emphasis on other, uninhabited, islands in the group is a realistic policy for island groups with permanent, self-supporting human populations. It is, nevertheless, important to limit animal and plant introductions and restrict the distribution of species already established. Strict quarantine regulations need to be maintained on Tristan Island.

Wace and Holdgate (1976) provided a detailed review of management requirements for the Tristan da Cunha Islands. One of the main objectives they identified is to keep Inaccessible and Nightingale Islands free of alien mammals. This is particularly important for Inaccessible Island, as it is the least disturbed of the three major islands, and its rich avifauna would be vulnerable to effects of rats and cats (especially Inaccessible rail Atlantitisa rogersi).
Knowledge of the composition of fauna and flora of Tristan and Nightingale Islands is thought to be fairly complete, but much basic research is needed on aspects such as population size, distribution, and reproduction of the birds and marine mammals on the islands. A detailed biological survey of Inaccessible and other smaller islands is needed. Such research is also necessary to ensure traditional cropping of wildlife by the Tristan islanders is kept within biologically sustainable limits. Collection of specimens for scientific and museum purposes, especially rare species of high interest and monetary value (e.g., Inaccessible rail, Tristan large-billed bunting *Nesospiza wilkinsii*), must also be carefully monitored.

Overall, legal protection of the biota and environment of the Tristan da Cunha group is adequate. Greater protection could, however, be placed on Inaccessible, Middle, and Stoltenhoff Islands, restricting entry to the islands and the taking of any native species. This would help to ensure these islands remain as unmodified by man as possible. Preparation of a detailed management plan would also be beneficial, assisting future planning of developments such as expansion of farming activities, or tourism.

**SELECTED REFERENCES**

Gough Island

GOUGH ISLAND

GENERAL INFORMATION

COUNTRY United Kingdom

GEOGRAPHICAL LOCATION 40°20’S, 10°00’W, in the central South Atlantic Ocean, 350 km south-south-east of Tristan Island.

AREA 6500 ha

MAXIMUM ALTITUDE 910 m (Edinburgh Peak)

PHYSICAL FEATURES Gough Island is roughly rectangular in shape, 13 km by 5 km. It has a central plateau of rounded hills with several mountain peaks. Steep coastal cliffs occur up to 450 m high, but with several deep valleys on the northern and eastern sides. There are about 13 offlying islets.

Gough Island is the summit of a volcanic mass (separate from the Tristan group). Rocks are of basaltic composition, 6 MYr old. Peaty soils are widespread.

Climate is cool, temperate and oceanic, characterised by occasional snow, a mean annual temperature of 11°C, and rainfall of 3400 mm/yr. The island lies just south of the Subtropical Convergence.

FLORA AND VEGETATION Vascular flora consists of 35 native and 12 introduced flowering plants, with 27 pteridophyte species.

Coastal areas are dominated by tussock grasses, Spartina arundinacea and Poa flabellata. More sheltered ground up to 300 m is covered by fern bush (small tree fern Blechnum palmiforme, fernbrake Histiopteris incisa) with thickets of the small tree Phylica arborea. Above this, to 600 m, is a zone of wet heath, comprising the small shrub Empetrum rubrum, and Blechnum spp., with sedges and mosses. Above 600 m, feldmark and montane vegetation occur, with Empetrum, moss Rhacomitrium spp., grass Agrostis c. c. c. carmichaelii, and lichens. Upland valley peat bogs are dominated by Sphagnum spp.

Giant kelp (Macrocystis pyrifera) is abundant around the coasts.

The herb, Ranunculus caroli, is listed by IUCN as Rare.

Several alien species are widespread; eg Poa annua, Agrostis stolonifera, Holcus lanatus, Rumex obtusifolius, Sonchus oleraceus.
Gough Island

**FAUNA** Amsterdam Island fur seal (*Arctocephalus tropicalis*) are abundant, and increasing in number. Elephant seal (*Mirounga leonina*) breed also.

There are large seabird populations. Moseley's rockhopper penguin (*Eudyptes chrysocome moseleyi*) are very abundant. Yellow-nosed albatross (*Diomedea chlororhynchos*), sooty albatross (*Phoebetria fusca*), broad-billed prion (*Pachyptila vittata*), little shearwater (*Puffinus assimilis*), great shearwater (*Puffinus gravis*), soft-plumaged petrel (*Pterodroma mollis*), Kerguelen petrel (*Pterodroma brevirostris*), Shlegel's petrel (*Pterodroma incerta*), great-winged petrel (*Pterodroma macroptera*), common diving petrel (*Pelecanoides urinatrix*), grey-backed storm petrel (*Garrodia nereis*), white-bellied storm petrel (*Fregattula grallaria*), southern skua (*Catharacta lomnbergi*), Antarctic tern (*Sterna vittata*), pediunker (*Adamastor cinereus*), and noddy (*Anous stolidus*) are abundant also.

The island is the main breeding area for a subspecies of wandering albatross, *Diomedea exulans dabbenena*.

There are two endemic land birds: Gough Island rail (*Gallinula nesiotis comeri*) and Gough Island bunting (*Rowettia goughensis*).

A large number of terrestrial invertebrates are present, with several endemic species. There are also several introduced species.

Mice (*Mus musculus*) are the only alien vertebrates found.

**HISTORICAL FEATURES** Gough Island was discovered by the Portugese captain Goncalo Alvarez in 1505, but resighted and named by Captain Gough of the Richmond in 1731. With exploitation of seals in the 19th century, sealing gangs often lived on the island. It was annexed by Britain in 1938, with the Tristan da Cunha group, as a dependency of St. Helena. The Gough Island Scientific Survey, 1955-56, established a base and meteorological station. This was later occupied by the South African Weather Bureau, and a new station was built in 1958.

**HABITATION** There are no permanent residents.

Meteorological station personnel number about 10. They are relieved annually, the station being serviced by the vessel *SA Agulhas*.
Conservation of Islands in the Southern Ocean

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION Gough Island Wildlife Reserve
IUCN category I (Scientific/Strict Nature Reserve)

DATE ESTABLISHED 1976

AREA Entire island (6500 ha)

LEGAL PROTECTION The Tristan da Cunha Conservation Ordinance 1976 covers the islands of the Tristan da Cunha group, and Gough Island.

This Ordinance prohibits: killing, capture, or molestation of native birds and mammals; interference with native vegetation; introduction of non-native fauna and flora; construction of buildings, roads, and structures without a permit. Certain birds and mammals are specifically protected. The area of protection includes a three nautical mile territorial waters zone.

LAND TENURE Crown land.

ADMINISTRATION Administration of Gough Island is the responsibility of the Administrator of Tristan da Cunha, with the Island Council of Tristan da Cunha, based at Edinburgh (Tristan Island).

Contact address: The Administrator
Edinburgh
TRISTAN DA CUNHA
c/- The Foreign Office
London, U.K.

MANAGEMENT POLICY The Tristan da Cunha Conservation Ordinance 1976 includes details of conservation and management measures. Designation of Gough Island as a Wildlife Reserve imposes more stringent controls on activities than those operating on the other islands (where residents of Tristan Island are able to kill some animals without a permit). Activities on Gough Island are regulated by permit.

No formal management plan exists. Guidelines for environmental management in the Tristan da Cunha Islands (including Gough) were outlined by Wace and Holdgate (1976), and these are followed by the authorities.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN Mice (Mus musculus) are the only alien vertebrates established on the island. They are abundant, but their impact on the native fauna and flora is thought to be minor.
Sheep (Ovis aries) kept at 'The Glen' from 1956 to 1963 caused localised damage to vegetation.

Poultry are the only alien animals permitted on the island. None have been kept since the mid-1960s.

Several introduced invertebrate species, and some plant species, are widespread but not abundant.

Scientific research There is no organised research programme, although some studies are periodically conducted by South African scientists. Expeditions have visited Gough in conjunction with wide-scale investigations of the Tristan da Cunha group. Nevertheless, faunal and floral communities on the island have been relatively well-described.

Assessment of present conservation status Gough Island is largely unmodified by man. Several alien invertebrate and plant species occur but the only mammal present is the mouse, Mus musculus. Fur seal stocks are recovering from exploitation in the 1800s. The island has a very rich avifauna.

The main risks to future conservation of the island identified by Wace and Holdgate (1976) are fire and introduction of alien vertebrates. Use of fire on Gough Island is prohibited, but greater safeguards against accidental introduction of animals and plants may be necessary.

The Tristan da Cunha Conservation Ordinance 1976 provides a considerable degree of protection to the island's biota, although entry to the island is not specifically dealt with. Restrictions on access to the island, or compliance with certain conditions of entry, specifically to prevent introductions, could be instituted. The main danger is introduction of rats to the island, which could result in devastation of bird populations. The South Africans using the island observe strict measures, as on Marion and Prince Edward Islands, to prevent alien introductions. Nevertheless, there has been an alleged sighting of a rat on the island in October 1983, which may have gained entry with construction materials brought in for the rebuilding of the weather station planned for 1984-85. A subsequent investigation mounted by SASCA found no signs of rat presence, but the incident highlights the need to maintain stringent precautionary measures against possible introductions of aliens. Other users of the island are the Tristan Development Company, whose crayfishing vessel, until recently has taken on water from a stream in 'The Glen', and fishermen occasionally use the huts present. There is no safe anchorage at Gough Island, and visits are usually short. Nevertheless, extreme care is needed under such circumstances to ensure no inadvertent introductions occur.
Conservation of Islands in the Southern Ocean

Preparation of a detailed management plan is recommended, and consideration should be given to regular monitoring of the efficiency of conservation measures.

SELECTED REFERENCES

Falkland Islands (Islas Malvinas)

FALKLAND ISLANDS (ISLAS MALVINAS)

GENERAL INFORMATION

COUNTRY Sovereignty is claimed by both the United Kingdom and Argentina. Administration is exercised by the Governor-in-Council, appointed by the UK Government, and the Falkland Islands Executive Council.

GEOGRAPHICAL LOCATION 51°00'-52°30'S, 57°40'-61°30'W, 800 km north-east of Cape Horn.

AREA Approximately 1,300,000 ha

MAXIMUM ALTITUDE 705 m (Mt Usborne on East Falkland Island)

PHYSICAL FEATURES The group comprises the main islands of East Falkland and West Falkland, with about 340 associated islands and islets.

The countryside is generally rugged and hilly, with the exception of the flat plain of Lafonia in the south of East Falkland. The coastline of West Falkland is bounded by steep cliffs, but the shoreline elsewhere is greatly indented by bays and inlets. Several small rivers occur. Peaty soils are widespread, with stony, gravel soils at high elevations.

The islands are composed of Palaeozoic and Mesozoic sediments, with considerable folding. The oldest rocks are Pre-Cambrian, about 2.5 billion years old.

Climate is oceanic: strong prevailing westerly winds, high humidity, low rainfall (mean of about 635 mm/yr), cloudy, frequent snow (but no permanent ice), mean annual temperature 5-6°C.

FLORA AND VEGETATION A large number of plant species occur: 163 native and 92 introduced vascular species are known.

Coastal areas of the main islands are dominated by oceanic heath vegetation: grass Cortaderia pilosa and the small shrub Empetrum rubrum. Scrub associations of Empetrum, Baccharis magellanica, Pernettya pumila, and fern Blechnum penna-marina are common inland on well-drained slopes. Above 600 m, feldmark vegetation predominates, with cushion plants of Bolax gymnifera and Azorella selago. In areas of bog, the lily Astelia pumila, and rushes Juncus scheuchzerioides and Rostkovia magellanica, occur. The water plant Myriophyllum elatinoides is common in ponds.
There are no trees. Localised patches of bush occur, and two native species are common: Chiliotrichum diffusum and Hebe elliptica.

Vegetation of offshore islands and of lowland areas on the main islands not affected by grazing is dominated by dense stands of tussock grass Poa flabellata, with the grass Poa alopecurus and the herb Apium australis.

Kelp beds of Macrocystis pyrifera, Lessonia spp., and Durvillea spp. are common around the coasts.

Two endemic plant species are listed as Endangered by IUCN (IUCN Plant Red Data Book 1978) due to sheep grazing; herbs Calandrinia feltonii and Arabis macloviana.

Alien species are widespread, in particular Stellaria media, Sagina procumbens, Coronopus didymus, and Poa annua.

FAUNA The Falkland Islands have an extensive avifauna, especially of land birds, in comparison with other subantarctic islands. Breeding bird species number 63, of which 16 are endemic to the islands.

On the main islands of East and West Falkland, rockhopper penguin (Eudyptes chrysocome chrysocome), Magellan penguin (Spheniscus magellanicus), and gentoo penguin (Pygoscelis papua) are very abundant, with small numbers of king penguin (Aptenodytes patagonicus) and macaroni penguin (Eudyptes chrysolophus). Endemic flightless steamer duck (Tachyeres brachypterus) are widely distributed, with Chloeo widgeon (Anas sibilatrix), yellow-billed teal (Anas flavirostris), endemic Rolland's grebe (Podiceps rollandi), endemic night heron (Nycticorax nycticorax nycticorax), endemic upland goose (Chloephaga picta), crested duck (Anas cristata), and ruddy-headed goose (Chloephaga rubidiceps) common in coastal areas and near ponds. Inland, military starling (Pezites militaris falklandicus), black-throated finch (Melanodera m. melanodera), Falkland pipit (Anthus correndera travy) (all endemic races) Cassin's falcon (Falco peregrinus), and red-backed buzzard (Buteo polyosoma) are common.

On offshore islands, seabirds are particularly abundant. The above penguin species, black-browed albatross (Diomedea melanophris), narrow-billed prion (Pachyptila belcheri), Wilson's storm petrel (Oceanites oceanicus), an endemic subspecies of common diving petrel (Pelecanoides urinatrix berard), southern black-backed gull (Larus dominicanus), South American tern (Sterna hirundinacea), king cormorant (Phalacrocorax albilventer), an endemic species of Falkland thrush (Turdus falklandii) and tussock bird (Cinclodes antarcticus) are common. Beauchene Island hosts the world's largest breeding population of black-browed albatross.
Conservation of Islands in the Southern Ocean

Offshore islands are notable as the main breeding areas of striated caracara (Phalacrocorax australis), one of the world's rarest birds of prey, which is restricted to the Falklands and some remote islands off Cape Horn.

Other endemic birds are: ashy-headed goose (Chloephaga poliocephala), kelp goose (Chloephaga hybrida malvinarum), Garnot's ground tyrant (Muscicaxicola m. macloviana), grass wren (Cistothorus platensis hornensis), and Cobb's wren (Troglodytes musculus cobbi).

Southern elephant seal (Mirounga leonina), southern sea lion (Otaria flavescens), and South American fur seal (Arctocephalus australis) are common. Leopard seal (Hydrurga leptonyx) are occasionally present.

Introduced mammals include mice (Mus domesticus), rats (Rattus norvegicus), rabbits (Oryctolagus cuniculus), hares (Lepus europaeus), Patagonian foxes (Dusicyon culpaeolus), cattle (Bos taurus), sheep (Ovis aries), horses (Equus caballus), pigs (Sus scrofa), cats (Felis catus), and dogs (Canis familiaris).

The arthropod fauna is diverse, comprising mainly flies, beetles, moths, butterflies, weevils, crickets, mites, and spiders.

Several endemic species of freshwater fish occur, of the genus Galaxias.

A rich invertebrate marine fauna is found inshore, including Paralomus and Lithodes crabs, clams, and mussels. Further offshore, euphausiids and Munida crustaceans are abundant.

Fish are common nearshore, in particular species of cod and mullet.

HISTORICAL FEATURES The islands are thought to have been discovered in 1592 by an English Captain, John Davis. The first recorded landing was in 1690, by Captain John Strong, who named the islands after Viscount Falkland, then Treasurer of the British navy.

British, French, and Spanish settlements were established spasmodically during the 1700s. Current British occupation dates from 1833. Farming was the main industry, although the islands were frequented by sealers and whalers in the 18th and 19th centuries. The Falkland Islands Company was founded in 1851, and is the main landowning and trading company to the present.

In 1982, hostilities occurred between the United Kingdom and Argentina over sovereignty of the islands.
HABITATION There has been continuous settlement since 1833. In 1980 there were 1800 residents, based mainly in Stanley (the capital) with a small population in Goose Green. Since 1982, there has been a garrison of several thousand British soldiers stationed at Stanley.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION There are numerous government nature reserves and wildlife sanctuaries, together with private reserves.

GOVERNMENT RESERVES AND SANCTUARIES (including officially gazetted reserves on private land):

- Cape Dolphin
- Volunteer Point
- Cape Pembroke Peninsula
- Kidney Island
- Cochon Island
- Bleaker Island
- Bird Island
- Arch Islands
- Sea Dog Island
- Middle Island
- Low Island
- Jason Islands:
  - Jason West Cay
  - Jason East Cay
  - The Fridays
  - Flat Jason
  - Seal Rocks
  - Elephant Jason
  - South Jason
  - North Fur Island
  - South Fur Island
  - White Rock
- Beauchene Island

These reserves are essentially IUCN category I (Scientific/Strict Nature Reserve).

RESERVES AND SANCTUARIES ON PRIVATELY-OWNED LAND (unofficial):

- Steeple Jason
- Grand Jason
- New Island (and 7 small offlying islands)
- The Twins
- West Point Island
- Carcass Island
Wildlife is protected but farming operations occur on several of these reserves, and limited tourism is permitted. These conditions approximate IUCN category VIII (Multiple-use Management Area/Managed Resource Area).

**DATE ESTABLISHED** Government reserves and sanctuaries have been periodically established since 1964. Unofficial protected areas on privately-owned land have been created since 1970.

**AREA**
- Government reserves and sanctuaries: approximately 6000 ha
- Private reserves and sanctuaries: approximately 4000 ha

**LAND TENURE** Combination of Crown, and privately-owned land.

**LEGAL PROTECTION** Nature reserves are established under the Nature Reserves Ordinance 1964, and sanctuaries under the Wild Animals and Birds Protection Ordinance 1964.

1. **Nature Reserve**
   This is land reserved for the purposes of protecting flora and fauna, and for providing opportunities for research on the biota. Entry into, and activities within, the reserve are restricted, including burning and cutting of vegetation and hunting of animals.

2. **Animal and Bird Sanctuary**
   This is established for protection of animals and birds, with specified exceptions. Introduction of animals is prohibited. There is provision for scientific research.

3. **Private Reserve and Sanctuary**
   This can be declared under both Ordinances, with the consent of the landowner. Protective provisions are as above, although subject to landowner's stipulations. Limited farming, tourism, and research, can occur.

The Wild Animals and Birds Protection Ordinance provides also for the general protection in the Falkland Islands of animals and birds. Some hunting of specified animals at certain times is permitted.

Fur seal (Arctocephalus australis) have been protected since 1921.

**ADMINISTRATION** Responsibility for reserves and sanctuaries lies with the Governor-in-Council of the Falkland Islands.

Contact address: The Chief Executive
The Secretariat
Stanley
FALKLAND ISLANDS
MANAGEMENT POLICY

Management has been directed at conservation of islands with no history of animal stocking, or exploitation. Islands supporting populations of the rare striated caracara (Phalcoboenus australis) have been accorded high priority for protection. A major aim has also been protection of a wide range of habitats.

Since the early 1960s a programme of resource identification and protection has been carried out. The extent of government involvement has been mediated by declining economic circumstances, but private conservation organisations have pursued an active policy of land acquisition for establishment of reserves (eg New Island Preservation Company, Royal Society for Nature Conservation, The Falklands Islands Foundation). Some of these private reserves incorporate limited farming and tourism activities, with a policy of compatible conservation and economic concerns.

Since 1982, there has been an increase in military and economic development, but biological considerations are taken into account.

No published management policies or plans are known.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN

In the 18th and 19th centuries, fur seal (Arctocephalus australis), sea lion (Otaria flavescens), and sea birds (in particular penguins) were heavily exploited for fur, oil and eggs. Exploitation of sea lion continued spasmodically to the 1960s. Whales have also been hunted.

The introduction of pigs (Sus scrofa), rabbits (Oryctolagus cuniculus), goats (Capra hircus) and cattle (Bos taurus) into East Falkland in the 1760s, and later into West Falkland and adjacent islands, led to the destruction of much native vegetation, especially tussock grass Poa flabellata. Sealers and whalers also burnt tussock to flush animals out of the vegetation. The commencement of sheep farming in the 1860s further decimated the native flora. Effects of tussock removal have been severe, with erosion of exposed peat, reduction of food and shelter for stock, and reduction of suitable habitat for many seabirds, especially burrowing petrels. Small offlying islands, which have retained stands of tussock grass, still maintain large colonies of seabirds, but the main islands do not.

Rats (Rattus norvegicus), cats (Felis catus) and mice (Mus domesticus) are widespread on the main islands, and are likely to have had a significant impact on seabird populations in the past. They are not present on many of the offshore islands. Horses (Equus caballus), dogs (Canis familiaris), and foxes (Dusicyon culpaeolus) are also present.
Conservation of Islands in the Southern Ocean

An indigenous Falkland fox (‘warrah’) Dusicyon antarcticus australis was hunted to extinction in the late 1800s.

Kelp was harvested from 1970 to 1976. This industry was regulated by the Control of Kelp Ordinance 1970. No information on biological effects of the kelp harvesting is available, but they are likely to have been minor.

Tourism is established with visits having frequently been made to the Falklands by cruise ships such as the Lindblad Explorer. Landings have occurred on islands such as Carcass, Westpoint, and New, and, although controlled, appear to have caused some localised disturbance to seabird colonies.

The 1982 conflict between Britain and Argentina is likely to have had some impact on the biota of the Falkland Islands. However, the majority of reserves and sanctuaries are offshore islands, and for the most part have not been physically affected.

In December 1982, a £31 million development programme was initiated to improve harbour, road and airport facilities on the islands, and to develop inshore fisheries. Construction work on various projects has commenced, with localised disturbance to the environment.

Scientific Research

Most research has been conducted on a non-governmental basis, with the assistance of the World Wildlife Fund. This research has been directed primarily towards identification of areas of high ecological value.

There are no regular, co-ordinated research programmes covering the islands as a whole. Studies have focussed on inventories of offshore islands.

Assessment of Present Conservation Status

The Falkland Islands have been sporadically inhabited by man since the 1760s. Seal, bird and whale stocks were heavily exploited in the past, but stocks of most species are now recovering. The main islands of East and West Falkland have been considerably modified by domestic animals introduced by man, sheep in particular. The area of coastal tussock grassland has been greatly reduced on these islands, and with it, populations of seabirds. Introductions of other mammals have also contributed to destruction of vegetation and reduction of seabird stocks. Current government policy is to encourage subdivision of land, from large ranches to smaller units, and this is thought likely to result in higher stocking rates, and to cause further damage to vegetation. Hence, the main islands of East and West Falkland have been substantially modified by man, and will probably remain so.
Seabird populations on the main islands have been dramatically reduced by farming operations, but land birds on the islands have generally not been greatly affected.

Since 1982 the number of people on the islands has increased. Concerted efforts are being made by the British forces to minimise disturbance to wildlife. Major breeding colonies and important wildlife areas have been identified, and are avoided where possible. In addition, the military has appointed a training officer to inform troops of wildlife conservation.

A considerable number of protected areas have been established in the last 20 years. Most of these have been on offlying islands, and conservation prospects appear very good. Conservation legislation, namely the 1964 Nature Reserves Ordinance, and 1964 Wild Animals and Birds Protection Ordinance, appears to be adequate. Most wildlife is protected, and efforts are being made to protect and replant the rare and endangered flora. However, introductions of animals into reserves is not totally prohibited, and in view of the impact on vegetation and consequently on wildlife, of domestic stock animals, consideration should be given to tightening of these regulations.

Local conservation organisations are active in promoting protection of areas of high ecological value, and also monitor management of existing reserves. Ownership of land by some of these organisations should ensure protection of the biota. A higher level of governmental involvement in research and conservation of the Falkland Islands fauna and flora would nevertheless be desirable, and would place management on a more official basis.

The Shackleton Report (1982) recommended designation of protected wetland areas in the islands, due to their importance as waterfowl habitat. The report also advised the establishment of an Environmental and Resource Management Committee, and a Scientific Research Agency, and recommended that measures be taken to restore tussock grassland and attempt to stabilise peat bog. These recommendations are being considered, and if implemented will be beneficial to conservation in the Falkland Islands.

The Shackleton Report dealt primarily with development of the islands, and advocated limited expansion of tourism and development of fisheries.

Tourism would be based on wildlife attractions, and in view of the concern that has been expressed of the impact of tourists in localised areas, this must be carefully controlled.
Conservation of Islands in the Southern Ocean

Similarly, development of fisheries in the area needs to be monitored. Fishing already occurs near the Falklands, primarily by Russian and Japanese vessels. Annual yields of 4-5 million tonnes have been estimated for certain fishes on the Patagonian Shelf (in particular hake Merluccius hubbsi, blue whiting Micromesistius australis, and squid) and krill are also of commercial interest. Large-scale development is unlikely, but little is known of possible consequences of increased fishing, and with dependence on the marine environment of species which breed on the islands, development must be carefully managed.

Prospects for oil exploration and development in the region are uncertain, but the likelihood of any immediate development is slight.

SELECTED REFERENCES

2. Falkland Islands Government. 1964: An ordinance to amend the law with regard to the preservation of wild animals and birds. (No. 15 of 1964) Falkland Islands Gazette 73: 193-7.
GENERAL INFORMATION

COUNTRY Sovereignty is claimed by both the United Kingdom and Argentina. Administration as part of the Falkland Islands Dependencies is exercised by the Governor-in-Council of the Falkland Islands, appointed by the UK Government, and the Falkland Islands Executive Council.

GEOGRAPHICAL LOCATION 53°30'-55°00'S, 35°30'-38°30'W on the Scotia Ridge in the South Atlantic Ocean, 1350 km east-south-east of the Falkland Islands.

MAXIMUM ALTITUDE 2950 m (Mt Paget).

AREA 375 600 ha

PHYSICAL FEATURES The South Georgia group comprises the main island of South Georgia with numerous rocky islands off its coast (eg Bird Island, Willis Island, Annenkov Island, Cooper Island; Clerke Rocks to the south-east; Shag Rocks well to the north-west).

The main island is crescent shaped, 170 km by 5-40 km. A central mountain range dominates the island's topography, with high sea cliffs except on the north coast, and deep bays and fiords. The island is composed largely of Mesozoic-Cretaceous quartzose and tuffaceous sedimentary rocks, with scree slopes, leached soils, podzols, and peat accumulation where the land is vegetated. About 60% of the island is glaciated, with numerous glacial ponds and streams.

Climate is oceanic, with low temperatures (mean annual temperature of 2°C, and monthly mean range -2°C to 5°C), strong winds, much cloud, and rainfall of about 1500 mm/yr.

FLORA AND VEGETATION Flora comprises 80 vascular species, including 20 flowering plants, and several hundred species of moss and lichen.

Tussock grassland and wet heath communities occur at low altitudes. Poa flabellata is dominant in coastal areas and on gentle slopes up to about 250 m. Inland, in well-drained areas, grass Festuca contracta and dwarf shrub (Acaena magellanica) are common; with rushes Juncus scheuchzerioides, Rostkovia magellanica, grass Deschampsia antarctica and mosses Polytrichum spp., in wetter regions. Above 250-300 m, cryptogamic communities dominate, with species of Andreaea, Dicranoweissia, Polytrichum, Brachythecium, and Rhacomitrium mosses; Buellia, Lecidea, Lecanora, Rhizocarpon, and Cladonia lichens.
Macrocystis kelp is abundant around the coasts.

There are two endemic plants: the herbs Acaena magellanica georgiaeaustralis and Uncinia smithii.

A large number of introduced plants are present, and several are widespread (particularly Poa annua, Poa pratensis, Cerastium fontanum, Rumex acetosella, Taraxacum officinale, Agrostis capillaris, Deschampsia caespitosa).

FAUNA Large seal and seabird colonies occur on South Georgia. Antarctic fur seal (Arctocephalus gazella), southern elephant seal (Mirounga leonina), and Weddell seal (Leptonychotes weddelli) breed.

Main breeding bird species are: king penguin (Aptenodytes patagonicus), gentoo penguin (Pygoscelis papua), macaroni penguin (Eudyptes chrysolophus), wandering albatross (Diomedea exulans), black-browed albatross (Diomedea melanophris), grey-headed albatross (Diomedea chrysostoma), light-mantled sooty albatross (Phoebetria palpebrata), northern giant petrel (Macronectes halli), southern giant petrel (Macronectes giganteus), Antarctic prion (Pachyptila desolata), white-chinned petrel (Procellaria aequinoctialis), Wilson’s storm petrel (Oceanites oceanicus), South Georgian diving petrel (Pelecanoides georgicus), common diving petrel (Pelecanoides urinatrix), southern skua (Catharacta lombergi), southern black-back gull (Larus dominicanus), and Antarctic tern (Sterna vittata).

The islands host more than half the world populations of macaroni penguin, grey-headed albatross, northern giant petrel and antarctic prion.

Two endemic land birds are found: South Georgia pipit (Anthus antarcticus), and South Georgia pintail (Anas georgica). American sheathbill (Chionis alba) breed also.

Numerous invertebrate species have been recorded, including 148 arthropod species, with a high degree of endemism. Several introduced species occur.

Alien mammals found are reindeer (Rangifer tarandus), Norwegian rats (Rattus norvegicus) and mice (Mus musculus).

HISTORICAL FEATURES The islands were formally annexed by Captain James Cook in 1775, but were probably discovered by the London merchant de la Roche in 1675. South Georgia was the centre of British and American sealing operations from 1790, and several whaling stations operated between 1904 and 1965. The elephant seal industry was revived from 1910 to 1964. The British Antarctic Survey (BAS) established a base in 1969 at King Edward Point, near the site of the earlier settlement of Grytviken.
Conservation of Islands in the Southern Ocean

HABITATION There are no permanent residents. Staff of the BAS station at King Edward Point generally number about 20. The base has not been occupied since 1982.

In the early 1900s, several whaling stations operated year-round, often with several thousand men during summer.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION

1. The entire island is protected, but has no specific designation. Protection is essentially IUCN category I (Scientific/Strict Nature Reserve).

2. Specially Protected Area (SPA):
   (i) Cooper Island (entire island)

3. Site of Special Scientific Interest (SSSI):
   (i) Bird Island (entire island)
   (ii) Annenkov Island (entire island)

DATE ESTABLISHED 1975

AREA

<table>
<thead>
<tr>
<th>Area Description</th>
<th>Area (ha)</th>
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<td>1 500</td>
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<tr>
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</table>

LEGAL PROTECTION The Falkland Islands Dependencies Conservation Ordinance 1975 prohibits interference with native animals and plants, introduction of alien biota, entry into SPA and SSSI areas, and confines tourism to designated areas.

Reindeer (Rangifer tarandus) are additionally protected.

The group is within the area covered by the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), which controls exploitation of antarctic animals.

LAND TENURE Under British claim of sovereignty, South Georgia is Crown land, part of the Falkland Islands Dependencies.

ADMINISTRATION South Georgia is administered by the Governor in Council for the Falkland Islands Dependencies. Responsibility for issue of permits and other duties is delegated to the Director of the British Antarctic Survey. The Commander of the BAS Station in South Georgia (or a resident magistrate) had local responsibility for protected areas when the base was operational.
MANAGEMENT POLICY

Under the conditions of the 1975 Ordinance, entry to and activities on the island are governed by permit, and are restricted to people associated with research and management. Entry into SPA and SSSI areas is further restricted for purposes of essential research only.

Under Section 6 of the 1975 Ordinance, permits are limited in order to ensure maintenance of species variety and natural ecological system balance, and to prevent depletion of native mammal and bird stocks. Permits may only be issued to provide essential food, specimens for scientific and educational purposes, and for management of the living resources.

Tourism is limited to 'Areas of Special Tourist Interest', at Grytviken and the Bay of Isles.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN

Intensive exploitation of Antarctic fur seal in the 1800s was followed by killing of elephant seal and penguins (particularly king penguin) for oil, and major whaling operations. The elephant seal industry restarted in 1910, and continued until 1964 under scientific management. Fur seal stocks are now recovering, especially at Bird Island. The population numbers about 800,000 individuals on South Georgia, and these cause considerable destruction of tussock vegetation with consequent reduction of nesting habitat for burrowing petrel species. It is planned to exclude fur seals from one promontory at Bird Island by construction of a fence.

There have been numerous introductions of mammals, invertebrates and plants.

Horses (Equus caballus), sheep (Ovis aries), rabbits (Oryctolagus cuniculus), mallard (Anas platyrhynchos), upland geese (Chloephaga picta), mice and reindeer were introduced, but only the last three animals became established.

Reindeer, first introduced in 1909, are now present in three areas, and number 2500-3000 animals. They have had a significant impact on vegetation in localised areas, especially on slow-regenerating Poa flabellata.
Conservation of Islands in the Southern Ocean

Rats have had a severe effect on bird populations, particularly South Georgia pipit (*Anthus antarcticus*), and some impact on vegetation.

Mice were recently discovered on South Georgia, but probably became established in the 1800s.

Over 60 species of plant have been introduced, some intentionally, others inadvertently with supplies for whaling stations and fodder for livestock and poultry. Several species are widespread, some (eg *Poa annua*) actively competing with native vegetation.

Human hunting of South Georgia pintail (*Anas georgica*) in the past has depleted populations.

**SCIENTIFIC RESEARCH** Since the establishment of the British Antarctic Survey station in 1969 at King Edward Point there has been an active research programme, including studies on vegetation, effects of reindeer and rodents, terrestrial production, pollution, marine biology, bird and marine mammal ecology, and geology.

Several field huts exist on South Georgia, and there is also a BAS base on Bird Island.

Bases have not been occupied since 1982.

**ASSESSMENT OF PRESENT CONSERVATION STATUS** Stocks of marine mammals and birds exploited by man in the past are recovering. Apart from this, man's impact has been limited largely to sites of settlement and whaling stations. Localised modification of vegetation by temporary introductions of animals, and introduced plant species, has occurred.

Rats are a major problem on the main island of South Georgia, in particular because of their predation on small birds. Offshore islands are free of alien mammals, and maintenance of this situation is a principal management objective.

Much scientific research has been conducted in the past, and the ecology of the fauna and flora is well known in comparison with most other subantarctic islands. However, a considerable amount of experimental work involving introductions of alien species (principally plants) has occurred, with establishment of several species. It is important that if such introductions are deemed necessary they should be very closely monitored, and the species removed after completion of the experiment.

Designation of the offshore islands of Cooper, Annenkov and Bird as SPA and SSSIs, and protection of the main island under the 1975 Ordinance, should provide an adequate legal basis for conservation.
Tourism has developed in recent years, but is well-regulated, and restricted to sites of 'Special Tourist Interest'.

Fishing operations occur in the vicinity of South Georgia. Some fish stocks are thought to have been over-exploited, and recent interest has centred on pelagic fishing for krill. Major research programmes have been conducted in the area, under the auspices of SCAR. Close monitoring and control of catches are necessary in view of the dependence on the marine environment of marine mammals and birds which breed on the islands.

SELECTED REFERENCES

1 Croxall, J P; Prince, P A; Hunter, I; McInnes, S; Copestake, P G. 1985: The seabirds of the Antarctic Peninsula, islands of the Scotia Sea and Antarctic continent between 80°E and 20° W: their status and conservation. In: The status and conservation of the world's seabirds. Croxall, J P; Evans, P G H; Schreiber, R W; eds. ICBP Technical publications No.2. ICBP, Cambridge.


Conservation of Islands in the Southern Ocean

SOUTH SANDWICH ISLANDS

GENERAL INFORMATION

COUNTRY Sovereignty is claimed by both the United Kingdom and Argentina. Administration of the islands as part of the Falkland Islands Dependencies is exercised by the Governor-in-Council of the Falkland Islands, appointed by the UK Government, and the Falkland Islands Executive Council.


AREA Approximately 31 000 ha

MAXIMUM ALTITUDE 1375 m (Mt Belinda, on Montagu Island)

PHYSICAL FEATURES The South Sandwich Islands are a volcanic arc of 11 islands, stretching over 340 km.

The southern islands of Thule, Cook, Bristol, Montagu, and Visokoi are largely ice-covered; Saunders and Candlemas are over half ice-covered; Bellingshausen, Vindication, Zavodovski, and Leskov are almost ice-free. The islands are of basaltic composition, with several islands currently or recently volcanically active. Soils, where developed, are ashy.

Climatic conditions vary between northern and southern islands. Mean monthly temperatures range from +3°C to -6°C on northern islands, and from -1°C to -11°C on the southern islands which are usually surrounded by heavy pack ice in winter. Strong, persistent, westerly winds, heavy fog and cloud occur.

FLORA AND VEGETATION Flora consists of 58 species: 8 alga, 16 lichen, 11 hepatic, 22 moss, and 1 angiosperm. Vegetation is dominated by non-vascular cryptogam and herb tundra formations, although there is considerable variation between islands.

Vegetation of the southern islands of Bristol, Cook, Montagu, Thule and Saunders is dominated by sparse, widely scattered, crustaceous lichens (of the genera Caloplaca, Xanthoria, Buellia, Lecanora and Lecidea) and green alga Prasiola crispa.

Vegetation of Bellingshausen, Candlemas, Leskov, Vindication and Visokoi Islands consists of more varied lichen flora (the fruticose lichen Usnea antarctica is particularly abundant) with carpets of moss (genera Andreaea, Polytrichum, Campylopus and Brachythecium).
Conservation of Islands in the Southern Ocean

A markedly richer flora occurs around fumaroles on Bellingshausen, Candlemas, Leskov, and Visokoi Islands, with dense bryophyte communities of Campylopus spp., Cryptochila grandiflora, Marchantia berteroana, and liverwort Drepanocladus spp.

On Candlemas Island, small stands of grass Deschampsia antarctica occur.

FAUNA Several colonies of Antarctic fur seal (Arctocephalus gazella) are present, centred on Visokoi Island. Southern elephant seal (Mirounga leonina), leopard seal (Hydrurga leptonyx) and Weddell seal (Leptonychotes weddellii) also occur.

Chinstrap penguin (Pygoscelis antarctica) are very abundant, with macaroni penguin (Eudyptes chrysolophus), gentoo penguin (Pygoscelis papua), and Adelie penguin (Pygoscelis adeliae) common. Antarctic fulmar (Fulmarus glacialoides), snow petrel (Pagodroma nivea), cape pigeon (Daption capense), southern giant petrel (Macronectes giganteus), Wilson’s storm petrel (Oceanites oceanicus), Antarctic tern (Sterna vittata), southern black-backed gull (Larus dominicanus), southern skua (Catharacta lonnbergi), and blue-eyed shag (Phalacrocorax atriceps) breed.

Invertebrate fauna is poorly known. 11 species of mite and two of collembola have been recorded.

HISTORICAL FEATURES The eight southern islands were discovered by Captain James Cook in 1775, the others by Bellingshausen in 1819. Seals were exploited in the 19th century, but knowledge is scant. The group has been visited by several scientific expeditions this century.

HABITATION Uninhabited.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION The islands are protected, but with no specific designation. Legal protection measures approximate IUCN category I (Scientific/Strict Nature Reserve).

DATE ESTABLISHED 1975.

AREA Entire island group (31 000 ha)

LAND TENURE Crown land.

LEGAL PROTECTION The Falkland Islands Dependencies Conservation Ordinance 1975 prohibits interference with native animals or plants, introduction of alien biota, and entry into certain areas, and restricts tourism to designated regions.
The islands are within the boundaries of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), which governs exploitation of antarctic animals.

**ADMINISTRATION** The islands are administered by the Governor in Council for the Falkland Islands Dependencies, in conjunction with the British Antarctic Survey.

**Contact addresses:**
1. The Chief Executive
   The Secretariat
   Stanley
   FALKLAND ISLANDS

2. British Antarctic Survey
   High Cross
   Madingley Road
   Cambridge CB3 0ET
   UNITED KINGDOM

**MANAGEMENT POLICY** Activities on the islands are controlled by permit. Under Section 6 of the 1975 Ordinance, permits are limited so as to ensure 'the variety of species and the balance of the natural ecological systems are maintained' and that native mammal and bird stocks are not depleted. Permits may be issued to provide essential food, specimens for scientific or educational purposes, and for management of the living resources.

**MANAGEMENT PROBLEMS AND THE IMPACT OF MAN** The islands are very isolated, and have generally been visited in the past by sealers and scientific parties for short periods only.

Fur seal populations are reported to be increasing.

There are no recorded alien plants or animals.

**SCIENTIFIC RESEARCH** Several scientific expeditions have visited the islands, but there is no regular scientific programme.

An Argentinian research station (Corbeta Uruguay) was established on the island of Southern Thule in 1976, under the direction of the Argentine Antarctic Institute (IAA). This was closed down in June 1982.

**ASSESSMENT OF PRESENT CONSERVATION STATUS** The South Sandwich Islands are largely in their natural state, and unmodified by man. Provisions of the Falkland Islands Dependencies Conservation Ordinance 1975, together with the islands' geographical isolation and climate, should ensure conservation.
Conservation of Islands in the Southern Ocean

The islands are visited occasionally by the antarctic cruise ships *Lindblad Explorer* and *World Discoverer*. Tourist interest in the antarctic and subantarctic regions has increased over recent years and needs to be carefully controlled to avoid introduction of alien plants and animals, and to minimise disturbance to the native biota. Designation of areas of 'Special Tourist Interest' under the 1975 Ordinance (as in South Georgia), seems an effective method of controlling small numbers of tourists as long as adequate supervision exists.

Fishing operations occur in the Scotia Sea. Catches are monitored by the Scientific Committee on Antarctic Research (SCAR) and the area is covered by CCAMLR. Fisheries must be carefully regulated in view of the dependence on the marine environment of animals breeding on the islands.

SELECTED REFERENCES

South Orkney Islands

SOUTH ORKNEY ISLANDS

GENERAL INFORMATION

COUNTRY The group lies within the Antarctic Treaty area.

GEOGRAPHICAL LOCATION 60°30'-60°50'S, 44°15'-46°15'W, in the South Atlantic Ocean, 480 km south-west of South Georgia.

AREA Approximately 62 000 ha

MAXIMUM ALTITUDE 1265 m (Mt Nivea, on Coronation Island)

PHYSICAL FEATURES There are four major islands in the group. The main island is Coronation, 48 km by 12 km, maximum altitude 1265 m, and with numerous glaciers. Signy Island is 2 km south of Coronation Island, and is triangular in shape, 8 km by 5 km, with an area of 1900 ha, and a highest point of 281 m. Powell Island (11 km by 3 km, maximum altitude 620 m) and Laurie Island (24 km by 6 km, maximum altitude 940 m) lie to the east of Coronation Island.

The islands are composed largely of metamorphosed sediments (schists, amphibolites), with some mineral and organic soil development.

The group is about 800 km south of the Antarctic Convergence, 600 km north-east of the Antarctic Peninsula, and subject to pack ice for much of the year. The islands are largely ice-covered, although areas of Coronation and Signy Islands are ice-free in summer.

The South Orkney Islands have a cold, oceanic climate. Strong westerly winds prevail, mean annual temperature is -3°C, and rainfall is low (400 mm/yr).

FLORA AND VEGETATION Only two vascular plants are found, with about 200 lichen, 75 moss, and 12 hepatic species.

Vegetation is typical 'maritime Antarctic'. In coastal areas, lichens Verrucaria, Xanthoria, and Caloplaca spp. are common. In well-drained, sheltered areas, grass Deschampsia antarctica and pearlwort (Colobanthus quitensis) are abundant. Generally, cushion mosses (Andreaea depressinervis, Polytrichum alpestre, Chorisodontium aciphyllum) and fruticose lichens (Usnea antarctica) are the dominant flora. These species form thick peaty cushions at low elevations, and more open communities at 100-150 m (up to 500 m on Coronation Island). In wet areas, green alga Prasiola crispa, with species of moss Brachythecium, Drepanoclados, and Acrocladium occur. At higher altitudes, lichens Usnea, Himantormia, and Rhizocarpon are abundant.
South Orkney Islands

FAUNA  Five species of seal occur: Antarctic fur seal (Arctocephalus gazella), southern elephant seal (Mirounga leonina), Weddell seal (Leptonychotes weddellii), leopard seal (Hydrurga leptonyx), and crabeater seal (Lopodon carcinophagus).

Large populations of chinstrap penguin (Pygoscelis antarctica) (especially on Laurie Island) and Adelle penguin (Pygoscelis adeliae) breed. Gentoo penguin (Pygoscelis papua) and macaroni penguin (Eudyptes chrysolophus) also occur. Southern giant petrel (Macronectes giganteus), Cape pigeon (Daption capense), snow petrel (Pseudobranta nivea), Antarctic fulmar (Fulmarus glacialoides), Wilson's storm petrel (Oceanites oceanicus), Antarctic prion (Pachyptila desolata), southern skua (Catharacta lombergeri), Antarctic tern (Sterna vittata), and American sheathbill (Chionis alba) are common.

The invertebrate fauna is not extensive, with only a few species but in large numbers. Collembola, Acarina and Diptera are the most abundant taxa.

HISTORICAL FEATURES  The islands were discovered in 1821 by the sealer, Captain Powell. Subsequent sealing operations severely depleted fur and elephant seal stocks. Several scientific expeditions took place in the early 1900s. A base was established on Laurie Island by the 1903 Scottish National Expedition, and used as a meteorological station (Orcadas) by the Argentinians from 1904 to the present. The British Antarctic Survey established a permanent research station on Signy Island in 1947.

HABITATION  There are no permanent residents.

The British Antarctic Survey station at Signy Island is manned by about 11 men (winter 1983), with often double this number in summer months.

Argentine base Orcadas personnel numbered 14 in 1981-82.

PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION

1  The entire island group is protected, without specific designation, but it is essentially IUCN category I (Scientific/Strict Nature Reserve).

2  Specially Protected Area (SPA)
   (i)  Moe Island (SPA No 13)
   (ii) Lynch Island (SPA No 14)
   (iii) Southern Powell Island and adjacent islands (Fredriksen Island, Michelsen Island, Christoffersen Island, Grey Island, and some others, unnamed) (SPA No 15).
Conservation of Islands in the Southern Ocean

DATE ESTABLISHED Entire island group 1964, SPAs 1966

AREA Entire island group 62,000 ha
  Moe Island SPA 117 ha
  Lynch Island SPA 8 ha
  Southern Powell and adjacent islands SPA 610 ha

LAND TENURE The islands are in the Antarctic Treaty area south of 60°S.

LEGAL PROTECTION The Agreed Measures for the Conservation of Antarctic Fauna and Flora, 1964, were ratified by signatories of the Antarctic Treaty. The 'Agreed Measures' cover areas south of 60°S latitude (including the South Orkney Islands), and provide that: killing, wounding, capturing or molesting any native mammal or bird is prohibited, except with a permit; harmful interference to habitat is to be minimised; introduction of non-indigenous species is prohibited without a permit; Specially Protected Areas may be designated.

Seals are additionally protected by the Convention on the Conservation of Antarctic Seals 1972 which prohibits taking of Ross seal (Ommatophoca rossii), southern elephant seal (Mirounga leonina), and Antarctic fur seal (Arctocephalus gazella); sets quotas for crabeater seal (Lopodon carcinophagus), leopard seal (Hydrurga leptonyx) and Weddell seal (Leptonychotes weddelli); and provides for an inspection system in the event of commercial sealing.

The South Orkney Islands are also within the boundaries of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), which deals with maintenance of stable population levels and ecological relationships, and prevention of irreversible changes in antarctic ecosystems.

ADMINISTRATION Activities of each country involved in operations on the South Orkney Islands are administered by national bodies.

The British include the South Orkney Islands in the British Antarctic Territory (established in 1962), which is administered by the Governor in Council, resident in Stanley, Falkland Islands. There is no formal administration of protected areas, although British Antarctic Survey station leaders are responsible for local permits.

Contact addresses: 1 The Chief Executive
                      The Secretariat
                      Stanley
                      FALKLAND ISLANDS
It is likely that a similar administrative situation exists for other countries involved in the area.

The Scientific Committee on Antarctic Research (SCAR) acts as an advisory body on matters of scientific research and management.

**MANAGEMENT POLICY** The overall management policy of Antarctic Treaty signatories is embodied in the Agreed Measures and CCAMLR, a major aspect being minimisation of harmful human influence on the natural ecosystem.

Tourism is limited so as not to affect the conduct of scientific research, conservation of fauna and flora, or operation of Antarctic stations.

Areas of outstanding scientific interest are additionally protected by SPA designation, which increases restrictions on access to, and activities in, the area. The criteria for classification of areas in the South Orkney Islands as SPAs are:

(i) **Moe Island**: is representative of the 'maritime Antarctic' ecosystem. Large bird populations are present, notably Adelie and chinstrap penguin. It is able to act as a 'control' in comparison with Signy Island, which is subject to experimental research.

(ii) **Lynch Island**: contains an extensive and dense area of grass *Deschampsia antarctica*, with associated soil and invertebrate fauna.

(iii) **Southern Powell and adjacent islands**: unmodified ecosystems, diverse and representative vegetation types, a rich bird and mammal fauna, an expanding colony of Antarctic fur seal, with elephant and Weddell seal colonies.

**MANAGEMENT PROBLEMS AND THE IMPACT OF MAN** Seals were heavily exploited in the 19th century, but populations are now protected and are increasing.

Organochlorine residues have been found in euphausiids, penguins, and seals at Signy Island.

There are no alien vertebrates.
Conservation of Islands in the Southern Ocean.

SCIENTIFIC RESEARCH An active research programme is conducted by the British Antarctic Survey, centred on its station at Signy Island. There is also a base, currently unoccupied, at Laurie Island. The base is serviced by the vessels Bransfield and John Biscoe.

Much multi-national marine biological research has also recently been undertaken by SCAR (eg BIOMASS and FIBEX programmes), emphasis being placed on the ecology of krill.

ASSESSMENT OF PRESENT CONSERVATION STATUS Visits to the islands by man have been irregular, and of short duration in the past. The islands are, for the most part, unmodified by man. Experimental research on Signy Island has involved some introductions of animals and plants, and manipulation of the environment, but impact is minor and localised.

Stocks of fur seal and elephant seal are increasing, as are populations of chinstrap penguin and Adelie penguin.

Conservation measures under the Antarctic Treaty and subsequent agreements should ensure a high level of security for the islands. However, only birds and mammals are specifically protected under these agreements. CCAMLR affords general protection to antarctic marine ecosystems. The number of SPAs is very low, and greater emphasis may be needed on designation of such areas in the future.

SELECTED REFERENCES

Conservation of Islands in the Southern Ocean

SOUTH SHETLAND ISLANDS

GENERAL INFORMATION

COUNTRY The group lies within the Antarctic Treaty area.

GEOGRAPHICAL LOCATION 61°00'-63°30'S, 53°30'-62°45'W, lying parallel to the Antarctic Peninsula in the Drake Passage of the South Atlantic Ocean.

AREA Approximately 470 000 ha

MAXIMUM ALTITUDE 1924 m

PHYSICAL FEATURES The group consists of a chain of 11 main islands, with numerous small islets and rocks, lying north-east to south-west. The islands fall into two groups: the Elephant (or north-east) group comprising Clarence and Elephant Islands; the Main (or south-west) group of King George, Nelson, Robert, Greenwich, Livingston, Snow, Deception, Smith, and Low Islands. The group extends over 530 km.

The islands have rocky jagged coastlines, and narrow beach areas backed by steep ice cliffs. All have active ice domes or glaciers. The group is an arc of submerged mountains. Several islands are volcanically active (especially Deception Island). Rock type varies from highly folded metamorphic schists, amphibolites, and marbles in the Elephant group, to Carboniferous and Jurassic sedimentary rocks of the Main group, with Tertiary basalts and andesites. Organic soils are present in some areas, with thick peat deposits.

Climate is 'maritime Antarctic'; cold (mean annual temperature on King George Island is -2.7°C), rainfall about 400 mm/yr, extensive cloud cover, and heavy fog. The islands are enclosed by pack ice for up to six months of the year.

FLORA AND VEGETATION Vegetation is characterised by non-vascular cryptogamic, and herb tundra, formations.

Crustose lichens of the genera Caloplaca, Xanthoria, and Verrucaria occur in exposed coastal regions. Small areas of grass Deschampsia antarctica and pearlwort (Colobanthus quitensis) are found in sheltered sites below 50 m. Sheets of alga Prasiola crispa cover wet ground in areas of disturbance near bird colonies. Characteristic of inland higher areas is the vegetation formation of fruticose lichens Usnea spp. – cushion moss Andreaea spp. association.
Areas free of permanent snow / ice
Operational research stations (1983 / 84)
Conservation of Islands in the Southern Ocean

The occurrence of Deschampsia and Colobanthus represents the southern-most global limit of vascular plants.

Vegetation cover is denser on southern coasts of the islands, which are less exposed.

**FAUNA** 16 species of bird breed: Adelle penguin (Pygoscelis adeliae), chinstrap penguin (Pygoscelis antarctica), gentoo penguin (Pygoscelis papua), macaroni penguin (Eudyptes chrysolophus), southern giant petrel (Macronectes giganteus), Antarctic fulmar (Fulmarus glacialoides), Cape pigeon (Daption capense), Antarctic prion (Pachyptila desolata), Wilson's storm petrel (Oceanites oceanicus), black-bellied storm petrel (Peregatta tropica), Antarctic skua (Catharacta maccormicki), southern skua (Catharacta lombergii), southern black-backed gull (Larus dominicanus), Antarctic tern (Sterna vittata), blue-eyed shag (Phalacrocorax atriceps), and American sheathbill (Chionis alba).

Southern elephant seal (Mirounga leonina), Antarctic fur seal (Arctocephalus gazella), and possibly Weddell seal (Leptonychotes weddellii) breed; crabeater seal (Lopodon carcinophagus) and leopard seal (Hydrurga leptonyx) occur.

The invertebrate fauna is poorly known, but is regarded as impoverished.

**HISTORICAL FEATURES** The islands were discovered by a British merchant captain, William Smith, in 1819, and explored by an American sealer Nathanial Palmer a year later. New England sealers used the islands, principally Deception, as bases during the 1820s and 1870s. Fur seals, elephant seal and penguins were heavily exploited. A British whaling station operated at Deception Island from 1906 to 1931. Elephant Island became well-known as the over-wintering site for some of Shackleton's crew from the wrecked Endurance, in 1916. In the 1940s, Argentine, Chilean and British scientific stations were established in the group, a Russian base in 1968, and a Brazilian station in 1984. The group is included in the area south of 60°S, and is covered by the Antarctic Treaty 1961.

**HABITATION** There are no permanent inhabitants.

Scientific stations of Argentina, Chile, Poland, Brazil, and Russia are operational (1983-84), with a variable number of personnel.
PROTECTED AREA INFORMATION

MANAGEMENT CLASSIFICATION

1 The entire group is protected, but has no specific designation. The islands are included in the Antarctic Treaty region, and hence are subject to provisions of the Agreed Measures for the Conservation of Antarctic Fauna and Flora.

Protection status is essentially IUCN category I (Scientific/Strict Nature Reserve) although tourism is permitted.

2 Specially Protected Area (SPA)
(i) Cape Shirreff, Livingston Island (SPA No 11).
(ii) Coppermine Peninsula, Robert Island (SPA No 16).

IUCN category I.

3 Site of Special Scientific Interest (SSSI)
(i) Fildes Peninsula, King George Island (SSSI No 5).
(ii) Byers Peninsula, Livingston Island (SSSI No 6).
(iii) Western shore of Admiralty Bay, King George Island (SSSI No 8).

IUCN category I

DATE ESTABLISHED Entire island group 1964 (Agreed Measures).

SPAs: Cape Shirreff 1966
Fildes Peninsula 1966-1975 (reclassification to SSSI)
Byers Peninsula 1966-1975 (reclassification to SSSI)
Coppermine Peninsula 1970

SSSIs: Fildes Peninsula 1975-1985 (expiry date)
Byers Peninsula 1975-1985 (expiry date)
Admiralty Bay 1979-1985 (expiry date)

AREA Entire island group 470000 ha
Cape Shirreff SPA 265 ha
Coppermine Peninsula SPA 65 ha
Fildes Peninsula SSSI 154 ha
Byers Peninsula SSSI 3027 ha
Shores of Admiralty Bay SSSI 1200 ha

LAND TENURE The group is in the Antarctic Treaty area, south of 60°S.
Conservation of Islands in the Southern Ocean

LEGAL PROTECTION The Antarctic Treaty 1961 is the basis for management of the area south of 60°S. It provides for the use of the Antarctic for peaceful purposes only, for freedom of scientific investigation, and for exchange of scientific information and personnel.

The Agreed Measures for the Conservation of Antarctic Fauna and Flora (1964) provide that: killing, wounding, capturing, or molesting any native mammal or bird is prohibited without a permit; harmful interference of habitat is to be minimised; introduction of non-native species is prohibited without a permit; Specially Protected Areas may be designated.

Seals are protected by the Convention on the Conservation of Antarctic Seals 1972; which prohibits killing of Ross seal (Ommatophoca rossii), southern elephant seal (Mirounga leonina), and Antarctic fur seal (Arctocephalus gazella); sets quotas for crabeater seal (Lopodon carcinophagus) and Weddell seal (Leptonychotes weddelli); and provides for an inspection system in the event of development of commercial sealing.

The islands also lie within the boundaries of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), which is concerned with maintenance of population levels and ecological relationships, and prevention of irreversible changes in antarctic ecosystems.

ADMINISTRATION Activities of each country involved in research on the South Shetland Islands are administered by national bodies.

The British have included the islands as part of the British Antarctic Territory which is administered by the Governor in Council in Stanley, Falkland Islands. There is no formal administration of protected areas, but local British Antarctic Survey station and expedition leaders are responsible for British activities in the area.

Contact addresses: 1. The Chief Executive The Secretariat Stanley FALKLAND ISLANDS

2. British Antarctic Survey High Cross Madingley Road Cambridge CB3 0ET UNITED KINGDOM

It is thought a similar situation exists for other countries with bases on the islands.
MANAGEMENT POLICY

The overall management policy of Antarctic Treaty countries is governed by provisions in the Agreed Measures and CCAMLR. The central objective is to minimise human influence on the natural ecosystem.

The Scientific Committee on Antarctic Research (SCAR) acts as an advisory body for the member countries on matters of scientific research and management.

Designation of areas as SPAs or SSSIs enhances protection over that of the entire area under the Agreed Measures. Restrictions on entry into, and activities within, SPA areas are increased, and collection of native plants or driving of vehicles are prohibited. Conditions are relaxed slightly with SSSI status to facilitate, and protect from disturbance, essential scientific research.

Areas for SPA or SSSI designation must be of 'outstanding interest' or possess a 'unique natural ecological system' (Agreed Measures). Criteria for classification of protected areas in the South Shetlands are as follows:

(i) Cape Shirreff SPA: supports considerable diversity of plant and animal life, including many invertebrates. Populations of southern elephant seal (Mirounga leonina), and Antarctic fur seal (Arctocephalus gazella) occur.

(ii) Coppermine Peninsula SPA: rich vegetation including vascular plants, a variety of terrestrial fauna, and a rich avifauna.

(iii) Fildes Peninsula SSSI: unique fossil ichnolites, and representative sequence of Tertiary strata (initial SPA designation due to biologically diverse region, small lakes ice-free in summer, representative of South Shetland environment and biota).

(iv) Byers Peninsula SSSI: rich fossil fauna (initial SPA designation due to diverse plant and animal life, many invertebrates, elephant seal, fur seal).

(v) Western shore of Admiralty Bay SSSI: 'exceptional assemblage' of Antarctic birds and mammals.

MANAGEMENT PROBLEMS AND THE IMPACT OF MAN

The islands were visited frequently by sealers in the 1800s. Fur seal, southern elephant seal, penguins, and whales were heavily exploited. However, most stocks appear to be recovering.

There are no alien mammals or plants. Several arthropod species may have been introduced during experiments on Robert Island.
Tourism has developed in recent years, with regular visits to islands such as Deception and King George by the cruise vessels World Discoverer and Lindblad Explorer.

**SCIENTIFIC RESEARCH** Six countries have scientific stations on islands of the South Shetlands:

- **Britain:** BAS bases at Admiralty Bay (King George Island) and Deception Island.
- **Argentina:** Jubany station (King George Island).
- **Chile:** Capitan Arturo Prat station (Greenwich Island), Teniente Rodolfo Marsh station (King George Island), Presidente Frei station (King George Island)
- **Poland:** Arctowski station (King George Island)
- **USSR:** Bellingshausen station (King George Island)
- **Brazil:** Commandante Ferraz station (King George Island)

All but the British stations and Presidente Frei are operational (winter 1983).

A wide range of research is conducted, including palaeontological investigations and biological studies of bird and marine mammal populations.

**ASSESSMENT OF PRESENT CONSERVATION STATUS** The environment of the South Shetland Islands is largely unmodified by man. Exploitation of marine mammals and seabirds occurred in the past, but these are now protected and most stocks are increasing. The nature of the climate prohibits establishment of most mammals, and, with the islands' isolation, populations of animals are relatively secure. Protection under the Antarctic Treaty and associated conservation agreements is adequate, although the Agreed Measures protect only birds and mammals except in SPA and SSSI areas. SPA designation provides protection to the natural ecological system in the area, and entry and activities are strictly limited. However, SSSIs are created principally to protect scientific investigations from disturbance. They do not provide total protection to the area and its biota, and generally have only a limited duration. Hence, reclassification of Fildes Peninsula SPA and Byers Peninsula SPA to SSSI status resulted in reduction of the level of protection. The existence at present of only two SPAs (with an area of only 330 ha) appears inadequate. There is also a need to increase the detail of management plans associated with SPAs and SSSIs, which are generally very brief.
Tourism has increased in recent years, with frequent visits by cruise ships to the islands. Concern has been expressed that greater regulation of such visits is necessary.

Scientific activities in the area need also to be conducted with care, and co-ordination. Six research bases were operational in 1983-84, five on King George Island. Such concentration of personnel could have detrimental effects on the biota unless regulated. Nevertheless, there appears the need for more basic descriptive biological studies on the fauna.

SELECTED REFERENCES

Scientific station at Campbell Island operated by the NZ Ministry of Transport (Meteorological Service). Such stations are conspicuous evidence of man's presence in many southern island groups. (Photo: NZ Department of Lands and Survey)
Conservation of Islands in the Southern Ocean

SECTION III  DISCUSSION

Principal conservation objectives

In a comprehensive review of conservation requirements in Antarctica and the Southern Ocean, Holdgate (1970) identified three principal management objectives:

1. The general protection of scenic beauty and the biota of the Antarctic region south of 60°S latitude.

2. The protection of remaining undisturbed ecosystems of oceanic islands north of 60°S, and as far as possible the restoration or stabilisation of those ecosystems that have been disrupted by actions of man.

3. The wise management of the biological resources of the Southern Ocean, to enable a sustainable harvest to be taken.

The second of these objectives is particularly relevant for conservation of the islands dealt with in this report. The principal objectives in management of the islands of the Southern Ocean must be protection in perpetuity of their natural landscapes and biota, and prevention of any further man-induced modifications. The best means of achieving these objectives is through the formal establishment of protected areas, and their effective management according to scientific principles.

The extent and adequacy of legal protection

The extent and status of established protected areas on islands of the Southern Ocean are summarised in Table 1. The twenty-two major oceanic islands or island groups, which incorporate over 800 individual islands and islets, cover a total land area of almost 32 000 km² (or 12 275 sq miles). This is approximately equivalent to the area of Belgium or about twice the size of the Hawaiian Islands. Approximately 1600 km² (618 sq miles), or some 5% of the total area, is set apart within legally protected areas.

According to IUCN's protected area classification system (IUCN 1978), based on management objectives, at least four categories of protected area are represented in the southern islands: scientific/strict nature reserve; multiple-use management area; wildlife sanctuary and biosphere reserve. Among the island reserves, protected areas which qualify as scientific/strict nature reserves are the most numerous. The predominance of these reserves of high security is indicative of the high level of protection and management accorded many of the southern islands.
### Discussion

**TABLE 1: PROTECTED AREA STATUS OF SOUTHERN ISLANDS.**

**EXPLANATION:**

**Legal protection:**

+ specific statutes exist for land and wildlife protection  
- no legal protection

**Protected area:**

defined as an area subject to specific legal protection of physical environment and biota

**Management plan:**

1 official published plan  
2 general guidelines for visiting personnel  
- no management plan is known

**Research programmes:**

+ research programmes are in operation, and research is undertaken regularly  
- regular research is not conducted
<table>
<thead>
<tr>
<th>Island group</th>
<th>Legal protection</th>
<th>IUON category</th>
<th>Protected area (ha)</th>
<th>Total island area (ha)</th>
<th>Management plan</th>
<th>Active research programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heard I</td>
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<td>-</td>
<td>-</td>
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</tr>
<tr>
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<td>-</td>
<td>-</td>
<td>260</td>
<td>2</td>
<td>-</td>
</tr>
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<td>12 785</td>
<td>12 785</td>
<td>2</td>
<td>+</td>
</tr>
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<td>+</td>
<td>IV</td>
<td>5 500</td>
<td>5 500</td>
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<td>-</td>
</tr>
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<td>+</td>
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<td>700</td>
<td>700</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
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<td>+</td>
<td>IV</td>
<td>22 500</td>
<td>50 000</td>
<td>2</td>
<td>+</td>
</tr>
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<td>700 000</td>
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<td>2 100</td>
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<td>-</td>
</tr>
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<td>62 564</td>
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<td>328</td>
<td>328</td>
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<td>+</td>
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<td>I</td>
<td>5 000</td>
<td>5 000</td>
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<td>-</td>
</tr>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>30 000</td>
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<td>+</td>
</tr>
<tr>
<td>Prince Edward I</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4 400</td>
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<td>+</td>
</tr>
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<td>Tristan da Cunha Is</td>
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<td>I, VIII</td>
<td>1 300</td>
<td>1 300</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gough I</td>
<td>+</td>
<td>I</td>
<td>6 500</td>
<td>6 500</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Falkland Is</td>
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<td>I, VIII</td>
<td>10 000</td>
<td>1 300 000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>South Georgia</td>
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<td>I</td>
<td>2 450</td>
<td>375 600</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>S. Sandwich Is</td>
<td>+</td>
<td>I</td>
<td>-</td>
<td>31 000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>S. Orkney Is</td>
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<td>I</td>
<td>735</td>
<td>62 000</td>
<td>2</td>
<td>+</td>
</tr>
<tr>
<td>S. Shetland Is</td>
<td>+</td>
<td>I</td>
<td>4 711</td>
<td>470 000</td>
<td>2</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 1: Protected area status of southern islands.
Marion and Prince Edward Islands are not legally established nature reserves, but essentially satisfy the IUCN criteria for such reserves on the basis of current management practice. Note that although the French islands are together designated as a 'Parc national'; their management is thought to approximate to that of a wildlife sanctuary rather than a national park in the international sense.

For individual islands and groups the proportion of land afforded legal protection varies considerably, from 100% of Macquarie Island, Gough Island, Bouvetøya and the New Zealand islands, to less than 1% for the Falkland Islands.

The South Shetland Islands and South Orkney Islands, lying within the Antarctic Treaty Area, are subject to the Agreed Measures for the Conservation of Antarctic Fauna and Flora. These include provision for the designation of Specially Protected Areas (SPAs) over sites identified as being of outstanding scientific interest and with unique natural ecosystems meriting special protection (Agreed Measures, Article VIII). There are only five SPAs on these island groups, covering a total of approximately 1065 ha, or 0.2% of the total land area.

Two areas in the South Shetland Islands originally designated as SPAs were subsequently reclassified as Sites of Special Scientific Interest (SSSIs). These sites, which are set apart according to Article II of the Antarctic Treaty and Recommendation VII-3 (7th Antarctic Treaty Consultative Meeting) are those where scientific investigations are being conducted or are planned which might be jeopardised by interference, or where the site is of exceptional scientific interest and requires long-term protection. Because the term of protection is normally limited and they are sites of active scientific research, and because permits for entry are not generally required, the security of protection is less for SSSIs than for SPAs.

Consideration should be given to protecting more and larger areas of these islands under SPA status. This should be part of a programme to increase the extent of legal protection over areas of other islands. Several island groups, notably Marion, Prince Edward, Heard and MacDonald Islands, have no statutory protection. Evidence suggests that these islands have natural qualities justifying provision of legal protection as an urgent priority. Consideration needs to be given also to increasing the network of protected areas on other islands which are not fully protected at present.
Management policy and plans

In conjunction with formal legal protection, specific management policy and management plans need to be prepared for protected areas on the islands. The principal objective of such policy should be the maintenance of island ecosystems in their natural state, and plans will need to deal with such aspects as the future of established aliens, measures to prevent further or new introductions of alien species, economic resources and commercial development, tracks, buildings, structures, scientific research, tourism, waste disposal, pollution, vehicular transport, and marine buffer zones.

Management plans should preferably be accompanied by an outline programme for implementation of management action, which should give priority to undertaking physical and biological inventories, to monitoring of the biota to ensure detection of any changes, and to instigation of appropriate action if these are man-induced. It is necessary to keep management policy and plans under continual review to accommodate new information and meet changing needs. Management plans should become the fundamental guide to decision-making and problem-solving.

Currently, management guidelines exist for many of the island groups (Table I) but detailed, officially approved and published management plans exist only for the Campbell Islands Nature Reserve and Snares Islands Nature Reserve (NZ Department of Lands and Survey 1983, 1984). Several other management plans are known to be in varying states of preparation. Their completion and implementation should receive concerted effort in the immediate future. There also needs to be a considerable improvement in the management planning which accompanies proposals for SPA and SSSI designation. Existing management plans are very brief, and insufficient for guiding management of the protected areas.

Human modification of island ecosystems

Most of the island groups considered in this study have been affected by the activities of man at some stage. The type of impacts and their magnitude vary widely (see Section II and Table 2). Human contact with the islands has been both accidental and deliberate, including whaling and sealing operations, shipwrecks, stocking with animals as a source of food for castaways, settlement, farming, tourism and the establishment of meteorological and scientific research stations. Some human uses of island resources have been transient and brief while in other cases they have been enduring and even permanent. Man has altered the flora and fauna of islands both by the direct destruction of native species and indirectly by the introduction of alien species.
### TABLE 2: HUMAN IMPACT ON SOUTHERN ISLANDS.

**EXPLANATION:**

**Habitation:**
- uninhabited
- permanent human settlement
- meteorological/scientific station manned year-round
- scientific station manned seasonally
- stations currently unoccupied

**Exploitation of indigenous fauna:**
- no exploitation is thought to have occurred
- in past only
- present

**Introduced flora and fauna:**
- defined as deliberate or accidental introductions associated with human activities
  + present
  - absent

**Degree of modification:**

1. Unaffected by man
2. Little modification: some exploitation of marine mammals and seabirds in the past, but populations are recovering; current alien species or human impact is minor; no permanent human presence.
3. Localised modification: significant modification may occur in small, localised area; permanent meteorological/research stations may exist; alien species may be established, but their impact and that of man is limited overall.
4. Significant modification: introduced species are well-established; native biota is modified to an irrevocable extent; human activities occur, with effects on biota and environment; permanent human settlements may be present.

Where islands in a group vary in degree of modification, the range of modification is indicated.
<table>
<thead>
<tr>
<th>Island Group</th>
<th>Habitation</th>
<th>Exploitation of Indigenous fauna</th>
<th>Introduced flora</th>
<th>Introduced fauna</th>
<th>No. of Introduced mammal species established</th>
<th>Overall degree of modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heard I</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>2</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Amsterdam</td>
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<td>1</td>
<td>+</td>
<td>+</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>I Saint-Paul</td>
<td>-</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>I Crozet</td>
<td>2</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>6</td>
<td>1-3</td>
</tr>
<tr>
<td>I Kerguelen</td>
<td>2</td>
<td>2</td>
<td>+</td>
<td>+</td>
<td>7</td>
<td>1-3</td>
</tr>
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<td>Antipodes Is</td>
<td>-</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Auckland Is</td>
<td>-</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>6</td>
<td>1-3</td>
</tr>
<tr>
<td>Bounty Is</td>
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<td>+</td>
<td>+</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Campbell Is</td>
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<td>1</td>
<td>+</td>
<td>+</td>
<td>3</td>
<td>1-3</td>
</tr>
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<td>Snares Is</td>
<td>3</td>
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<td>+</td>
<td>-</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bouvetoya</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Marion I</td>
<td>2</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
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<td>1</td>
</tr>
<tr>
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<td>2</td>
<td>+</td>
<td>+</td>
<td>8</td>
<td>1-3</td>
</tr>
<tr>
<td>Gough I</td>
<td>2</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>1</td>
<td>2</td>
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<td>+</td>
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<td>+</td>
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<td>-</td>
<td>0</td>
<td>1-2</td>
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<td>-</td>
<td>0</td>
<td>1-2</td>
</tr>
</tbody>
</table>
Experience has shown that plants and animals which have evolved on oceanic islands in the absence of terrestrial mammals are highly vulnerable and sensitive to disturbance. Moreover, the eradication of introduced mammals, especially rodents, from islands is often impossible and at best an extremely difficult task (eg Wodzicki 1978). Therefore, the introduction of rats to previously rat-free islands, for example, could result in an ecological catastrophe from which the islands may never recover. Some modifying influences are, however, alleviated or nullified by natural forces, as evidenced by numerous examples of animals failing to establish and dying out on southern islands, such as; mink on Îles Kerguelen; rabbits and goats on Île de la Possession (Îles Crozet); goats and pigs on Campbell Island; sheep on Nightingale Island (Tristan da Cunha Islands); and horses, sheep, rabbits and mallard ducks on South Georgia. Man-induced changes can also be partially reversed as shown by considerable regeneration of original vegetation following exclusion of sheep from parts of Campbell Island (Dilks and Wilson 1979, Meurk 1982).

However, on islands where alien animals have been established for a long period and the modified ecosystems are in balance, eradication programmes may not be appropriate. The need for animal control programmes, the likely success of those programmes, and their ecological repercussions should be carefully considered on the basis of sound scientific knowledge (Taylor 1968, Knox 1969). It is important that the removal of one conservation problem does not create another.

Some islands have been only slightly modified and remain in an essentially natural state. Included among these are Heard Island, MacDonald Islands, outlying islets of the Crozet and Kerguelen groups (eg Îlots des Apôtres, Îles des Pingouins, Île de l'Est of Îles Crozet), Antipodes Islands, several islands in the Auckland group (eg Adams, Disappointment, Dundas Islands), Bounty Islands, Snares Islands, Bouvetøya, Prince Edward Island, Inaccessible Island in the Tristan da Cunha group, Gough Island, outlying islands of the Falkland Islands (eg Jason Islands) and South Georgia, South Sandwich Islands, South Orkney Islands, and South Shetland Islands. They, along with the other southern islands, are the only breeding localities for many species of seabird and marine mammal, and their vegetation communities contain a host of endemic plants. The need to prevent introductions of alien plants and animals and to maintain undisturbed habitat is of paramount importance for the survival of many indigenous species.
Conservation of Islands in the Southern Ocean

Surveillance and monitoring of activities on islands

There is a strong need for strictly controlled access to protected areas on uninhabited and unmodified islands, and the employment of stringent precautionary measures against inadvertent animal or plant introductions. Standardisation of procedures for all people entering these islands and constant surveillance to ensure compliance with regulations are necessary.

Macquarie Island, Campbell Island and Tristan Island are the only groups known to have official rangers or wardens continually present. Such personnel are able to ensure that the operation of meteorological stations, scientific research, fisheries and tourism are conducted in compliance with legal requirements and do not adversely affect the environment or biota. Rangers or conservation officers, with full authority from administering agencies, should be included in staff of permanent meteorological stations and in scientific parties visiting islands. Alternatively, suitably qualified scientists or others could be appointed as honorary rangers or wardens.

Regular monitoring of floral and faunal composition of islands is necessary to ensure that entry of aliens is immediately discovered. This in itself may increase human contact with an island which increases also the risk of inadvertent introduction of alien plants and animals. In spite of this added risk, the possibility of unofficial and unapproved landings of people requires constant vigilance. Contingency plans to deal with accidental introductions, particularly of mammals, need to be prepared by island administrations to ensure that immediate action can be taken.

A network of representative reserves

The islands of the Southern Ocean are not isolated, independent units. Marine mammals and seabirds migrate over large distances between islands, and are dependent for survival on the sea and therefore the entire southern ecosystem. Numerous animal and plant species are endemic to island groups or to the region as a whole. Protection of the environment and biota therefore needs to be based on consideration of the Southern Ocean as an entity.

For conservation purposes it is desirable that a system of ecologically representative protected areas is established on the islands. This is particularly important because of the recent attention being given to the issue of exploitation of resources in antarctic regions. The existence of a network of representative protected areas would ensure that any plans for commercial development would be based around, and would be compatible with, such a network.
International co-operation and co-ordinated effort are needed to achieve this goal, but present conservation objectives and management programmes vary among individual national authorities. The biosphere reserve concept of UNESCO's Man and the Biosphere Programme (MAB) offers scope for co-ordinated protection without interfering with national jurisdiction of islands. Such reserves are intended to form a global network of ecologically representative reserves for ecosystem protection and monitoring of human impacts on natural environments (UNESCO 1974). Macquarie Island is the only designated biosphere reserve in the Southern Ocean. Wider establishment of biosphere reserves would provide a useful framework for co-operative effort in the application of conservation measures, and in research and ecosystem monitoring among the southern islands. In this context, IUCN and the World Wildlife Fund could play a much greater role in provision of scientific advice and support on general conservation, and protected area management in particular. Closer co-operation between IUCN and the Scientific Committee on Antarctic Research (SCAR), the scientific advisory body to Antarctic Treaty nations, would also enhance the application of research to management of islands of the Southern Ocean.

Marine reserves

Coastal waters are of vital importance to island fauna, in particular as feeding grounds for birds and marine mammals. Hence, changes in the nearshore environment can have significant consequences for the biota.

Protection of the coastal waters of southern islands varies among groups. Regulations governing human activities on the islands of Bouvetøya, Gough and the Tristan da Cunha group cover also territorial waters (3 nautical miles for Gough and Tristan). South African authorities restrict vessel movement around Marion and Prince Edward Islands. For New Zealand islands, legal provisions exist for control of anchoring and mooring of vessels within 0.5 nautical miles of an island reserve, and management policy is to investigate the inclusion of maritime zones around the islands into the reserves (e.g. Department of Lands and Survey 1983).

There are, however, no comprehensive provisions for protection of the marine environment in the vicinity of islands in the Southern Ocean. Consideration may need to be given to the establishment of formal marine buffer zones or reserves around islands. Regulation of activities such as fishing, anchoring of vessels, discharge of wastes, refuelling of vessels and exploitation of minerals on the seabed would reduce the potential for oil spills, fire, illegal landings and introduction of alien species, and would protect the feeding grounds of seabirds and marine mammals which breed on the islands.
Conservation of Islands in the Southern Ocean

Development of resources

Much attention has been directed in recent decades to marine resources in southern waters, especially that of krill (primarily *Euphausia superba*). Fisheries are currently exploiting krill (to the extent of 400 000 tonnes in 1979/80) as well as demersal fish species. Fisheries have developed and collapsed in the past: fur seal (*Arctocephalus* spp), southern elephant seal (*Mirounga leonina*), whales (eg blue *Balaenoptera musculus*, fin *Balaenoptera physalus*, sperm *Physeter catodon*), notothenid cods (primarily *Notothenia rossii*), and icefish (*Champsocephalus gunnari*) have all been heavily exploited.

Whaling operations have been declining in recent years due to reduced stocks of most species and management efforts of the International Whaling Commission. No commercial sealing occurs at present, and any operations south of 60°S would be subject to the conditions of the Convention for the Conservation of Antarctic Seals 1972, under the Antarctic Treaty. This allows for establishment of a sealing commission, scientific and advisory bodies, closed areas and seasons, quotas, and total protection of fur seal (*Arctocephalus* spp.) and southern elephant seal (*Mirounga leonina*).

International concern over development of fisheries in antarctic waters, particularly for krill, led to the formulation of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) in 1980. This covers all species of living organism within the Treaty area, and extends to some waters further north. The convention requires that harvesting or related activities be designed to ensure maintenance of stable population sizes, maintenance of ecological relationships between species and populations, and prevention of non-reversible changes in marine ecosystems. A commission to administer CCAMLR has been established in Hobart, Tasmania, with the responsibility to identify research needs, collect and analyse data, and adopt conservation measures. CCAMLR, once fully operational and given widespread support, should be able to provide adequately for the conservation and wise use of marine living resources.

In addition to fish and krill, oil and mineral deposits on the sea floor are the main resources of the Southern Ocean that may be exploited in the future. Areas of the Patagonian Shelf near the Falkland Islands, and the Campbell Plateau bordered by the New Zealand southern islands, have possible oil-bearing strata, although exploration has to date been unsuccessful on the Campbell Plateau. There is also interest in the Kerguelen Shelf as a source of hydrocarbons. Mineral deposits such as manganese and phosphate are known to occur on the seabed in relatively shallow areas of the Southern Ocean (eg Campbell Plateau). Technology to 'mine' such deposits exists with large suction dredges, but involves considerable disturbance to the seabed and associated fauna and flora.
There appears to be little immediate prospect of development of either oil or mineral resources, but such possibilities need to be taken into account in conservation and management policy.

Tourism

One of the most significant developments in Antarctica and the Southern Ocean over recent years has been the onset of commercial tourism. The southern islands are becoming increasingly popular as tourist destinations, especially among amateur naturalists and those seeking experiences in exploring the world's remote uninhabited areas. Tourist vessels such as World Discoverer and Lindblad Explorer have visited many of the islands, including Falkland, South Georgia, South Orkney, South Sandwich, South Shetland, and Macquarie Islands as well as all the southern islands of New Zealand.

National responses to tourism vary at present. South Africa does not permit tourists to land on Marion and Prince Edward Islands; British authorities restrict areas to which tourists have access; as do New Zealand authorities, who stipulate that tourists must be accompanied by an official government representative; Australian health regulations require clearance of vessels visiting Macquarie Island at an Australian quarantine port, and this has effectively halted visits of cruise vessels to the island since 1982.

It is unrealistic to lock-up the southern islands exclusively for meteorological or scientific purposes. Tourism has a valid place in the Southern Ocean, as long as it is regulated and carefully supervised.

Many animal species, in particular birds, are sensitive to human presence. Excessive disturbance of plants and animals by tourist visits, as reported from areas of the Falkland Islands (e.g. Lyster 1984), must be avoided. In addition, areas of tourist interest often coincide with areas of scientific interest and activity, and impacts of considerable numbers of people in one place need to be minimised. Managing authorities need to ensure appropriate supervision of visits, to provide detailed information on the islands and their conservation needs, and to consider designation of areas of Special Tourist Interest such as on South Georgia. International co-operation to allow a wide range of islands to be visited would enhance the viability of tourist operations. Moreover, if sufficient numbers of sites were available, areas could be rested periodically from tourist schedules, especially if adverse effects became evident.

With adequate precautions and international co-operation in regulating tourist operations, tourism should be compatible with scientific and conservation objectives in protected areas on islands of the Southern Ocean.
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Pollution

Islands of the Southern Ocean have few human inhabitants, and there is currently little pollution. Oil pollution has occurred with meteorological and scientific station operations, but has generally been minor. However, the grounding of a Soviet tanker near Îles Kerguelen in 1980 highlights the risks of pollution for island biota. An increase in the level of ship movement associated with mineral exploration, commercial fishing and tourism, or in the extent of research activities, will entail greater risks of pollution on and near the islands. Measures to reduce such risks need to be taken in the operation of bases and of vessels near the islands. Contingency plans to deal with oil spills should be prepared by all authorities.

Scientific research

Management to protect island ecosystems must be based on adequate knowledge if it is to be truly effective. This requires active and extensive research, especially that which has application to management problem-solving. A priority for attention in the Southern Ocean is completion of detailed biological inventories of all island groups. This is particularly important for islands which have not been substantially affected by man, or outlying islets of groups in which the main islands have been modified. Such inventories will enable ranking of islands and islets with respect to their biological value and priority for protection.

Ecological studies and long-term monitoring are also required, especially for species and populations of birds, marine mammals, and introduced mammals, to ensure that a sound scientific base exists on which management decisions can be made. Priority should be given to obtaining information on species which are rare or endangered. For some threatened species which are being adversely affected by introduced animals or man-induced habitat changes, consideration may need to be given to collection of some animals for breeding under controlled conditions, in order to supplement natural stocks and to establish new populations on other island refugia. This is currently being undertaken by New Zealand authorities with the rare Campbell Island teal (Anas aucklandica nesiotis), endemic to Dent Island in the Campbell group. Similar action may be warranted with species such as the Amsterdam Island albatross (Diomedea amsterdamensis).
Interactions between elements of terrestrial and marine environments also warrant extensive research. Seabird and marine mammal species depend upon the islands for breeding, and the sea for feeding. The impact on the biota of human activities on the islands themselves is usually readily apparent, but effects of exploitation and pollution in the sea are not. Fisheries are of major concern in this respect, as trawl fishing for krill and fishes may reduce the food supply for the birds and mammals, as well as increase their mortality by capture in fish nets. Much concern has been expressed about the amount of krill that man can harvest on a sustainable basis without affecting other components of Southern Ocean ecosystems. Extensive multi-national research programmes have been conducted on krill (eg BIOMASS), but reliable estimates of biomass and yield have been difficult to obtain on account of the patchy nature of krill distribution and deficiencies in knowledge of their biology and ecology (Gulland 1983). Krill are recognised to have a central role in antarctic food webs (eg Holdgate 1970, Laws 1983), and increases in seal and penguin populations in recent decades are attributed to greater availability of krill following decimation of whale stocks (eg Conroy 1975). SCAR is actively involved in organisation and co-ordination of a substantial research effort into the population dynamics of krill.

However, despite advocating here an increase in scientific research on and around southern islands, activities must be regulated to avoid unnecessary disturbance to wildlife and the environment. Research should be directed especially towards conservation and management of Southern Ocean ecosystems. Experiments involving introductions of animals and plants onto islands, as has occurred in the past on South Georgia, South Orkney Islands, Iles Kerguelen and Iles Crozet, need careful and critical scrutiny. Such experiments, while yielding information on the consequences of entry of alien fauna and flora, incur the risks of unforeseen disturbances which might jeopardise the survival of native species.

Priorities for future conservation

To conclude this discussion, priorities for ensuring improved protection for the environment and biota of the southern islands are identified below. They are not ranked in any particular order, as all are inter-related and are considered integral components of an overall strategy to protect the island ecosystems.

1. A legal basis for protection is required for Marion, Prince Edward, Heard, and MacDonald Islands, and the status and extent of protected areas of some other islands may need to be upgraded and expanded. Statutes should provide for protection of the environment, fauna, flora, and sites of historical significance.
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2. Formal management policies and plans should be prepared for those protected areas which lack them at present. These need to specify management objectives, and detail measures for implementing management policy. Management plans should become the fundamental reference for decision-making and problem-solving in protected areas.

3. Stringent precautionary measures are urgently required to prevent introductions of alien fauna and flora onto islands, particularly for islands which currently have no alien mammals.

4. Improved interchange of information is required for co-ordination of conservation and management efforts in the Southern Ocean as a whole, especially in view of the importance of the islands as breeding grounds for seabirds and marine mammals. There appears to be unrealised potential for further designation of biosphere reserves and untapped capacity within the network of IUCN members for additional scientific, technical and management support for island protection. Increased co-operation between IUCN and SCAR in conducting research and providing professional advice for improving conservation management is also desirable.

5. A greater level of well co-ordinated research is essential for adequate management of the islands, with special emphasis on:
   (i) completion of detailed biological inventories for all the island groups;
   (ii) ecological studies on both indigenous and alien species; and
   (iii) greater investigation of relationships between terrestrial and marine ecosystems, in particular with reference to the impact fisheries may have on seabirds and marine mammals.

6. Protection should be extended beyond the islands themselves to the nearshore marine environment. Conservation of island and adjacent marine ecosystems are intimately related.

7. An important objective of conservation in the Southern Ocean is the establishment of a network of fully representative protected areas. Efforts towards extending the existing protected area system should focus on the least modified islands.
ACKNOWLEDGEMENTS

Many people have contributed information to, and commented on, this document. These include individual and governmental members of IUCN, other government agencies, and embassies and consulates. They are too numerous to identify individually here, but their assistance is gratefully acknowledged. Special thanks are due to Mr J Harrison (IUCN Protected Areas Data Unit, Kew, United Kingdom), Dr N M Wace (Australian National University, Canberra, Australia), Mr B J Huntley and Dr P R Condy (Council for Scientific and Industrial Research, Pretoria, South Africa), Dr W N Bonner (British Antarctic Survey, Cambridge, United Kingdom), Dr V R Smith (University of the Orange Free State, Bloemfontein, South Africa), Mr P L Keage (Antarctic Division, Department of Science and Technology, Hobart, Australia), Mr G D Cole (British Foreign Office, London, United Kingdom), Lt Col C N Clayden (retd) (Ministry of Defence, London, Britain), Mr I J Strange (Stanley, Falkland Islands), Mr D Taylor (The Secretariat, Stanley, Falkland Islands), Mr H O Ostgaard (Norwegian Ministry of Justice, Polar Department), Dr O Rogue (Norwegian Polar Research Institute, Mr J A Bartie (National Museum, Wellington, New Zealand), Mr G D Goodwin (Department of Lands and Survey, Wellington, New Zealand), Dr C H Hay (New Zealand Oceanographic Institute, Wellington, New Zealand), and personnel of the South African and Norwegian Consulates and the French Embassy (Wellington, New Zealand). Mr P H C Lucas (Department of Lands and Survey, Wellington, New Zealand) provided helpful comments on the manuscript. Mrs M R Pomare of the New Zealand Department of Lands and Survey typed the report, and the figures were produced by the department's Draughting Section.
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APPENDIX I

The classification of Insulantarctica – a critique

Insulantarctica is one of 193 provinces identified by Udvardy (1975) in a global terrestrial biogeographic scheme designed as a basis for establishing a world-wide network of ecologically representative protected areas. This conceptual framework for world biogeography recognises Realms, which are continent or subcontinent-sized areas with unifying features of geography, fauna, flora and vegetation, and Provinces, based on ecological or biotic subdivisions of realms. Udvardy’s scheme is provisional and equivocal. On the basis of our review of the ecology and conservation of the world’s southern islands, we propose a revision of the classification of Insulantarctica.

Udvardy recognises an Antarctic Realm which comprises four provinces (Figure I): Maudlandia (East Antarctica), Marielandia (West Antarctica), Neozelandia (New Zealand and its associated shelf islands), and Insulantarctica (temperate and subantarctic islands of the southern seas).

The islands of Insulantarctica range widely in their latitudinal extent from the Tristan da Cunha group, at latitude 37°S and north of the Subtropical Convergence, to the South Shetland Islands, at latitude 62°S and enclosed by pack-ice for much of the year.

Udvardy has not detailed his criteria for including these islands within one province. In principle, the concept of grouping the world’s southern islands for defining ecologically-based conservation regions is a useful one. However, in view of the wide-ranging climatic, oceanographic, and biological factors that characterise the islands of Insulantarctica, such a grouping appears too broad.

Biogeographic classification of southern islands has received considerable attention in the past, in particular the distinctions between temperate, subantarctic and antarctic divisions. The criteria for subdivision have generally been characteristics of vegetation, climate (temperature especially), oceanographic features, and distribution of flora and fauna (Appendix Table). There is general agreement among many authors in the grouping of certain islands, and on the basis of this a further subdivision of Insulantarctica is proposed, using both physical and biotic factors.

(a) ‘Cool temperate’: northern limit approximately the Subtropical Convergence, southern limit north of the Antarctic Convergence; trees and woody plants are common; mean annual temperature is generally higher than 5°C.
(i) Tristan da Cunha Islands, Gough Island, Ile Amsterdam, Ile Saint-Paul.

(ii) New Zealand shelf islands: Antipodes Islands, Auckland Islands, Bounty Islands, Campbell Islands, Snares Islands.

(iii) Falkland Islands.

(iv) Islands off Tierra del Fuego*

(b) 'Subantarctic': islands in the vicinity of the Antarctic Convergence; phanerogamic communities dominate, with no trees; mean annual temperature ranges from 1° to 5°C (with exception of warmer Iles Crozet).

Iles Kerguelen, Iles Crozet, Heard Island, MacDonald Islands, Macquarie Island, Marion Island, Prince Edward Island, South Georgia.

(c) 'Maritime Antarctic': islands appreciably south of the Antarctic Convergence; cryptogamic flora, with no flowering plants; mean annual temperature is generally lower than 0°C.

South Sandwich Islands, South Orkney Islands, South Shetland Islands, Bouvetøya.

It is clearly difficult to define rigidly parameters for assigning island groups to a particular category. Characteristics of climate, vegetation and fauna are highly variable among the islands considered here, yet frequently overlap in some respects and differ markedly in others. This revision and refinement of Udvardy's definition of Insulantarctica is based on a review of much of the pertinent scientific literature, and the combination of salient features of several different biogeographic classifications. The results reveal that the province of Insulantarctica is too broadly based for characterising the diversity of terrain and biota among the world's southern islands. Our suggested subdivision provides a better focus for efforts at protecting the full range of representative ecosystems of the southern islands.

References


* These have been included by several authors with the Falkland Islands. They have not been covered in this study, and are provisionally assigned to a separate category.
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### Appendix Table: Some biogeographic classifications of islands in the Southern Ocean

<table>
<thead>
<tr>
<th>Author</th>
<th>Region</th>
<th>Definition</th>
<th>Basis for classification</th>
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<td>Shelf fauna</td>
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<td>(i) South America</td>
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<td>(iii) Kerguelen</td>
<td>Kerguelen, Heard, MacDonald</td>
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<td>South of Antarctic Convergence</td>
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<td>(i) Low Antarctic</td>
<td>South Georgia</td>
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<td>(ii) High Antarctic</td>
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