Prince Edward Islands Management Committee Meeting

17 - 18 April 1996

Prof Valdon Smith

AGENDA
FIRST PRINCE EDWARD ISLANDS MANAGEMENT COMMITTEE MEETING

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VENUE: Department of Environmental Affairs and Tourism (DEA & T)
Directorate: Antarctica and Islands
8th Floor Conference Room (Rm 813)
Fedlife Forum Building
cnr Pretorius and van der Walt Streets
PRETORIA, 0002

DATE: 17 - 18 April 1996

TIME: 10:00

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1. WELCOME AND OPENING

2. COMPOSITION OF THE COMMITTEE *Doc. 2*

3. TERMS OF REFERENCE / FUNCTIONS OF THE COMMITTEE *Doc. 3*

4. MANAGEMENT PLAN *Doc. 4*

   4.1 Zoning of the Prince Edward Islands *(Prof S L Chown)* *Doc. 4.1*
   4.2 Increasing Public Awareness / Education Policy (p. 59) *Doc. 4.2*
   4.3 International Cooperation (pp. 61-62)
   4.4 Printing / Format / Cover Page
   4.5 Appointment of "Conservation Officers"

5. PERMITS ISSUED FOR MARION ISLAND RELIEF VOYAGE: APRIL/MAY 1996

   5.1 Entry Permits:

Mr J A Dreyer	*(Officer-in-Charge: DEA & T)*
Mr S Morrison	*(Department of Public Works)*
Maj A Stroebel	*(South African Air Force)*
Dr V J Miller	*(Medical Doctor)*
Messrs J Simmons & D Coleman	*(Chefs)*
Chaplain F Tereblanche	

   5.2 Research Permits:

Mr P King	*(South African Weather Bureau)*
Mr S M Ferreira	*(University of Pretoria)*
Prof V R Smith	*(University of the Orange Free State)*
Mr K Rice	*(University of Natal, Durban)*

5.3 **Collection Permits:**

Dr M N Bester *(University of Pretoria)*

5.4 **Entry & Research Permits:**

Mr D Yelverton *(Marion 53)*
Mr P M J Smal *(Marion 52)*
Captain B van Oord *(mv S A Agulhas)*

5.5 **Research & Collection Permits:**

Prof S L Chown *(University of Pretoria)*
Mr B M Dyer *(Sea Fisheries Research Institute)*
Dr J C Boelhouwers *(University of the Western Cape)*
Mr D C Nel *(University of Cape Town)*

5.6 **Entry, Research & Collection Permits:**

Dr E A Pakhomov *(Rhodes University)*

6. **REQUESTS TO VISIT THE PRINCE EDWARD ISLANDS**

6.1 Zegrahm Expeditions *Doc. 6.1*
6.2 Starlight Cruises *Doc. 6.2*

7. **FINAL REPORT: MOUSE WORKSHOP** *(Prof S L Chown)* *Doc. 7*

8. **ERADICATION OF *AGROSTIS GIGANTIA* ON MARION ISLAND** *Doc. 8*

9. **MATTERS ARISING FROM THE BIOLOGICAL SCIENCES TASK GROUP MEETING OF 15 AUGUST 1995**

9.1 Monitoring of Experiments *Doc. 9.1*

10. **MATTERS ARISING FROM THE ANTARCTIC MANAGEMENT COMMITTEE MEETING OF 20 FEBRUARY 1996** Doc. 10

10.1 Antarctic Treaty Consultative Meeting Information Paper: "Prince Edward Islands Management Plan"
10.2 Workshop to discuss the Management Plan
10.3 Declaration of Marion Island as a World Heritage Site

11. **UPGRADING OF BUILDINGS ON MARION ISLAND**

12. **CLOSING**

COMPOSITION OF THE COMMITTEE

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Prince Edward Islands Management Committee

TERMS OF REFERENCE:

To advise the Director-General of the Department of Environmental Affairs and Tourism (DEA & T) on the management of the Prince Edward Islands in accordance with the Management Plan for the Prince Edward Islands and on any amendments required to this Management Plan

FUNCTIONS:

1. Advise on the implementation of the Management Plan and/or any amendments
2. Compile an Annual Report to the Director-General
3. Review of scientific proposals from the South African Committee for Antarctic Research (SACAR)
4. Evaluate and recommend research projects to SACAR
5. Review annual Progress Reports from Project Leaders
6. Identify specific research objectives to be addressed
7. Advise the Director-General on the issue of Entry Permits
8. Provide the Director-General with a list of Special Entry Areas, recommend new areas and delist areas as and when it becomes necessary
9. Define the boundaries of Zone 1 - Service Zone, Zone 2 - Natural Zone, Zone 3 - Wilderness Zone and Zone 4 - Protected Zone (Special Entry Areas)
10. Advise the Director-General regarding requests for private visits to the Prince Edward Islands and make recommendations for the issue of permits in this regard
11. Advise the Director-General on the frequency, duration and number of visitors per entry to Prince Edward Island
12. Establish an Environmental Impact Assessment (EIA) procedure for any new structural developments on these Islands
13. Draft a Rehabilitation Plan for old waste disposal sites
14. Determine the scope, duration and reporting of bulk fuel spillage
15. Advise the Director-General on specific quantities of fish to be captured for a specified purpose

DOC. 4

A MANAGEMENT PLAN FOR THE PRINCE EDWARD ISLANDS

A DOCUMENT
COMPILED BY THE PRINCE EDWARD ISLANDS MANAGEMENT
PLAN WORKING GROUP

10 APRIL 1996 (REV. 10)

CONTENTS

A MANAGEMENT PLAN FOR THE PRINCE EDWARD ISLANDS

PART 1

RESOURCES OF THE PRINCE EDWARD ISLANDS

GENERAL INTRODUCTION

1. CURRENT LEGAL STATUS

The Prince Edward Islands Act, 1948 (Act No. 43 of 1948) formally declared and annexed the Islands as part of the Union (now Republic) of South Africa. Responsibility for the administration of the Islands now rests with the Department of Environmental Affairs and Tourism (DEAT). For purposes of administering justice and for the general application of the laws of the Republic of South Africa, the Islands are deemed part of the Cape Town magisterial district. Roman Dutch law as applied in the Cape Province is the common law of the Islands.

The Prince Edward Islands Act extends various laws in the schedule to be in force on the Islands, in so far as they are applicable. It further provides for the State President to declare, by proclamation in the Government Gazette, any law in force in the Cape Province also to be applicable to the Islands. Although impressions exist that the Islands enjoy provincial nature reserve status, this is not the case.

The Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973) provides for the protection and control of the capture, and killing, of most species of seabirds and seals occurring on the Islands. Originally the Minister of Transport was responsible for the execution of this Act at the Prince Edward Islands, including the issue of permits for the capture, or killing, of seals and seabirds. The Minister of Environmental Affairs and Tourism has now assumed this responsibility and Article 16.(2) of Act 46 provides for exemption from its provisions in any area defined by notice of the Minister in the Gazette and declared to be a National Park under Section 2 of the National Parks Act, 1962 (Act No. 42 of 1962). Schedule 1 of the latter Act does not explicitly list either Marion or Prince Edward Island and hence neither Island has been declared a National Park.

Apart from the protection afforded most species of sea-birds and seals through the Sea Birds and Seals Protection Act, no other statutory environmental protection exists for the land areas of the Prince Edwards. Proclamations No. 169 of 1970 and No. 140 of 1979 respectively extend application of the Territorial Waters Act, 1963 (Act No. 87 of 1963) and Territorial Waters Amendment Act, 1977 (Act No. 98 of 1977) to Island waters. Article 54 of the Sea Fishery Act, 1988 (Act No. 12 of 1988) specifically provides for the control and conservation of sea fisheries in the Islands' territorial waters (12 nautical miles) and Fishing Zone (200 nautical miles). The Fishing Industry Development Act 1978 (Act No. 86 of 1978) also applies to this area and provides for the development of the fishing industry and the marketing of fish and fish products.

2. TENURE AND CLASSIFICATION

The Prince Edward Islands are representative of some eight Subantarctic islands. They offer a unique example of Subantarctic environmental and biotic conditions which are reflected in their bio-diversity and by the fact that prevailing climatic conditions at the Prince Edward Islands are essentially warmer than comparable islands elsewhere. The Prince Edward Islands are legally bounded by:

- Annexation of the Prince Edward Islands

  On 29 December 1947 a South African expedition aboard H.M.S.A.S *Transvaal*, under Lieutenant-Commander John Fairbairn, annexed Marion Island. This was followed by annexation of Prince Edward Island on 4 January 1948 by the same expedition. According to the official record (see South African Parliament Assembly Debates, 22 September 1948, pp. 3040 - 3046) the annexations were carried out following consultations between the British and South African Governments. The annexations were formally incorporated into national law by the Prince Edward Islands Act, 1948 (Act No.43 of 1948).

- Antarctic Treaty

  South Africa is one of twelve original signatories to the Antarctic Treaty, which came into force on 23 June 1961. The Prince Edward Islands lie to the north of the Treaty Area (south of 60° S) and therefore are not subject to its provisions.

- Convention on the Conservation of Antarctic Marine Living Resources

  South Africa is an original signatory of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) which entered into force in 1982. The Convention's area of applicability lies farther to the north than that of the Antarctic Treaty Area and encompasses the Antarctic Polar Front zone, including the Prince Edward Islands. While not impinging on national sovereignty rights, CCAMLR attempts to manage the exploitation of marine living resources from an ecosystem perspective and its provisions therefore focus not only on resources of potential commercial value, but also on closely related and/or ecologically dependent species. Such species include land-based seabirds and seals which utilize marine resources such as squid and fish as a food source.

- Department of Environmental Affairs and Tourism (DEAT) Code of Conduct

  In the absence of a formal management plan, the DEAT Code of Conduct has served as an interim guideline for all organisations and their personnel operating at, or in the vicinity of, the Islands (Visagie 1988). Section 5 (Protection and Conservation of Fauna and Flora) of the Code states that activities at the Islands should be conducted in accordance with the "Agreed Measures for the Conservation of Antarctic Fauna and Flora" of the Antarctic Treaty, and CCAMLR.

- The Prince Edward Islands: A Special Nature Reserve

It is internationally accepted that Subantarctic islands require conservation. Given the unique properties of the Prince Edward Islands already highlighted, as well as their history of relatively limited human interference (especially Prince Edward Island) compared with other similar islands, the need for elevation of the Islands' conservation status has been recognised. For this reason, a proclamation of the Prince Edward Islands to **the low water mark** as a Special Nature Reserve under Section 18 of the Environment Conservation Act, 1989 (Act No. 73 of 1989) was passed on {.....}

The above Proclamation was accompanied by a detailed Management Plan and a description of the resources of the Prince Edward Islands. The latter is intended to serve as a foundation on which to base an appreciation of the unique character and inherent ecological value of the Islands. Expansion of this description into a Code of Conduct for and a readable Visitor's Guide to the region is essential to ensure that the Islands' conservation status is communicated to the widest possible audience.

The Management Plan, on the other hand, has as its primary aim the conservation and sustained preservation of this unique ecosystem for all the people of South Africa and for the scientific community at large. The Prince Edward Islands are an integral part of South Africa's national heritage and territorial integrity; their rational and strong management will serve to offer a model to the World in keeping with the new and emerging international political order which recognises a strong environmental ethic.

3. LOCATION, GENERAL DESCRIPTION AND ACCESS

The Prince Edward Islands comprise Marion and Prince Edward Island and are located in the southern Indian Ocean. They lie approximately 2 180 km southeast of Cape Town, about 1 770 km south southeast of Port Elizabeth and some 2 300 km north of Lutzow-Holm Bay, Antarctica (Fig. 1).

Marion Island (46° 54' S and 37° 45' E) is about 290 km^2 in extent with a relatively unindented coastline of approximately 72 km. About 138 km^2 of the Island are below 200 m altitude and the highest peak is 1 230 m above sea level. At a distance, Marion Island presents a low dome-like profile, broken by several conical hills comprised of volcanic ash and scoriae.

Prince Edward Island (46° 38' S and 37° 57' E) is located 19 km to the northeast of Marion and is approximately 45 km^2 in extent. Its highest peak is about 672 m above sea level.

The closest landfall to both Islands is Île aux Cochons of the Crozet Island Group, a French possession, about 950 km to the east (Fig. 1).

Marion Island

Physiographically, Marion Island can be divided into three zones with the central highland and island slope being separated by a steep 400 m high escarpment, from the coastal plain which has a mean altitude of about 100 m in the southwest. The island slope is not even, and is divided into relatively low and high lying areas.

The central highland is an arcuate plateau surmounted by a series of volcanic cones responsible for the serrated skyline of the summit area. The plateau comprises two series of prominent cones aligned along two different trend lines that meet in the vicinity of Jan Smuts Peak. The plateau has an average elevation of 1000 m above sea level and coincides with the summer snow line.

The island slope comprises the greater part of the island and extends from the central highland down to the north, east and south-east coast and the edge of the escarpment in the west. The angle of the slope varies due to differential tilting, but is generally steeper on the western than on the eastern side. It is as high as 19° above Santa Rosa Valley and as low as 2° at East Cape.

The coastal plain lies at the foot of the western escarpment approximately 50 m above sea level. It is a volcanic outbuilding rather than a raised marine terrace. The coastline on the western side of the island is irregular with numerous capes, deep inlets, offshore rocks, stacks, arches and caves due to etching out of initial weaknesses. The land generally terminates in vertical cliffs up to 15 m high.

Transvaal Cove is one of the few black lava boulder beaches. Where the older succession meets the coast, the original shore has receded to such an extent that cliffs as high as 30 m and an escarpment of several hundred metres have been formed.

Marion has a relatively poorly developed radial drainage pattern, especially over the western half of the Island. The Softplume River is apparently the only perennial stream on the Island.

Prince Edward Island

Viewed from the southwest, Prince Edward Island has a markedly asymmetric profile. It consists of a central, lozenge-shaped block which ends abruptly at a high western escarpment and centrally elevated massif. The latter gradually slopes eastwards. There are four other hills lower down the eastern slope, one of which is not a scoria cone, and several less conspicuous centres.

The western escarpment rises steeply to 400 m above the coastal plain and consists of vertical cliffs alternating with talus-covered slopes. The western coastal plain lies about 50 m above sea level. The plain is diversified by scoria cones. The eastern coastal plain merges with the eastern slope and its surface is moulded entirely by the hummocky Wolkberg flow.

Both Islands are accessible only by sea.

4. HISTORY

It should be noted that as far as possible throughout this, and subsequent sections, reference to published work is confined to review articles only. For additional information, the reader should refer to these articles for details of other published works.

Early History

The following historical account is summarised from Cooper and Headland (1991).

On 14 February 1663, a Dutch East Indiaman of the Vereenigde Oostindische Compagnie, the 1210-ton *Maerseveen* under the command of Barent Barentszoon Lam (or Ham), left the Cape of Good Hope on its second voyage to Batavia. Having travelled off course it discovered two islands at 41° south on 4 March. The more northerly island was named Denia, the other Maerseveen. A hundred years passed before Denia and Maerseveen were rediscovered in quite a different position on 13 January 1772 by the French naval officer, M.M. Marion du Fresne of the frigates *Le Mascarin* and *Marquis de Castries*. du Fresne gave the islands the names Île de l'Espérance (now Marion Island) and Île de la Caverne (Prince Edward Island).

Captain James Cook, on his second voyage of exploration, visited Cape Town with the *Resolution* and *Adventure* in 1775, where he obtained information of du Fresne's island discoveries from Crozet. On his third voyage, having been provided with Crozet's chart, Cook left the Cape with the *Resolution* and *Discovery* on 30 November 1776 and reached du Fresne's island discoveries on 12 December. Crozet's chart did not give the names bestowed by du Fresne, so Cook called them the Prince Edward Islands. Like du Fresne before him, Cook did not land.

Contrary to practically all 20th Century accounts, Cook did not give individual names to the two islands. In fact, the name Marion Island was used by him in the combination Marion and Crozet Islands to refer to the modern-day Îles Crozet, also discovered by du Fresne, and not to what is the present-day Marion Island. Not until the middle of the 19th Century was the name "Marion Island" first recorded as being used by sealers for the larger of the two Prince Edward Islands.

The exploration by Cook and others of the Southern Ocean led to the development of the southern sealing industry. The Prince Edward Islands were not spared and by 1810 fur seal populations on the Islands had been all but exterminated. Given that the first recorded landing was in either December 1803 or January 1804 from the *Catherine* commanded by Henry Fanning who left a shore-sealing crew before sailing for Îles Crozet, this was a short period of exploitation indeed.

On 21 and 22 April 1840, H.M.S. *Erebus* and *Terror* of Captain James Clark Ross' expedition sailed past the Prince Edward Islands. No landing was made due to bad weather, but soundings and dredges were made by the *Erebus*. Ross Rocks off Prince Edward Island, and Capes Crozier and Hooker on Marion Island commemorate the visit.

Sealing and whaling vessels from France, England, the Cape Colony and the United States visited the Prince Edward Islands post-1810, but generally took few fur seals, concentrating rather on elephant seals. Elephant sealing soon became uneconomic as

animal numbers were reduced. There were sporadic attempts to recommence sealing until the 1930s, when the South African-based Kerguelen Sealing and Whaling Company (a subsidiary of Irvin & Johnson) sent sealers to the Prince Edwards as well other Subantarctic islands in the Indian Ocean. One vessel, the ex-mystery 'Q' ship *Kildalkey*, is commemorated by the name Kildalkey Bay on Marion Island. Many of the historical remains on the Islands are thought to date from this period

There have been several shipwrecks on both Marion and Prince Edward (Marsh 1948), although few have been well documented.

During the sealing period, the Prince Edward Islands were visited on 26 December 1873 by H.M.S. *Challenger*, a British scientific research vessel. Biological and geological observations were made ashore and samples taken. This was not the first scientific endeavour ashore. Richard Harris of the sealer *Betsey and Sophia* had observed and collected seabirds during a visit in 1830-31.

On 23 January 1939, the little known French scientific expedition by the *Bougainville* briefly visited Marion Island on its way to the French Subantarctic Islands. A small amount of specimen collecting and some photography was undertaken.

South African Occupation

Following the above, the resurgence of whaling expeditions to the Southern Ocean, especially by the then Soviet Union, the post-war strategic value of the Prince Edward Islands was realized. In 1947, the South African frigate H.M.S.A.S. *Transvaal*, commanded by Lieutenant-Commander John Fairbairn, sailed from Simonstown to occupy Marion Island on 29 December 1947 and Prince Edward Island on 4 January 1948. The South African Parliament passed the Prince Edward Islands Act 1948 (No. 43 of 1948) which entered into force on 7 October 1948.

The *Transvaal's* occupying party landed on Marion Island at Gunner's Point in Transvaal Cove. This party was replaced in February 1948 by the first meteorological team led by Allan B. Crawford.

Until April 1956, expeditions to Marion Island were relieved twice a year, thereafter annually as at present. Relief voyages were mainly undertaken by frigates of the South African Navy until the national Antarctic research and supply vessel *RSA* took over in 1962.

Between October 1951 and April 1952, the biologist, R.W. (Bob) Rand, studied birds and seals on Marion and conducted the first censuses as well as undertaking bird-ringing and biological studies. Probably the most significant event during this early period of the Islands' occupation was the introduction of five domestic cats to Marion Island in 1949. These animals were to control introduced house mice in the base. Several other animals (and plants) were also introduced to Marion during this early period, but all domestic stock (e.g. sheep) have subsequently been removed. The

Brown Trout was introduced for recreational purposes to the Van Den Boogaard River, but is now extinct.

In late 1986, the possibility of building an emergency landing facility on Marion Island was mooted. A detailed environmental impact assessment (EIA) was carried out (Heymann *et al.* 1987) and based on recommendations from this assessment, the building of the landing facility was subsequently abandoned. The EIA report stands as a model of its kind and much of the information/wisdom contained therein has also been incorporated into this Management Plan.

Research Activities

Terrestrial biological research formally commenced at the Islands in 1965, with the First Biological & Geological Expedition led by Professor Eduard M. van Zinderen Bakker Sr. Many publications and a substantive number of postgraduate degrees have now emerged from studies of the Islands' biota, both natural and introduced. Reviews of this research have been published by Gremmen (1981) for plants, Smith (1978; 1987; 1991), and Cooper & Brown (1990) for birds. Smith's (1978; 1987) reviews provide a most useful introduction to the natural environment of Marion Island. Up to 1989, research was directed by the South African Council for Scientific and Industrial Research (CSIR). Research at the Islands is now administered and directed by the DEAT's South African Committee for Antarctic Research (SACAR).

Research in the physical sciences has predominantly focused on geology, but a modern review of findings is still awaited. Perhaps the most exciting geological event was a totally unexpected volcanic eruption on Marion Island in December 1980.

Relatively few visits have been made to Prince Edward Island. This has been due to both the relative difficulty of access and a need to minimise disturbance of this near-pristine island.

5. OCEANIC CIRCULATION AND HYDROGRAPHY

The Prince Edward Islands are surrounded by ocean with Africa being the closest continental land mass some 2 000 km away. This vast body of water, the Southern Ocean, plays a crucial role in the Islands' weather and, in combination with the atmospheric circulation, serves to create average temperatures, cloudiness and rainfall, or "climate" (see Section 6 below). All these factors impact on the Islands' biota (Cooper & Lutjeharms 1992) with ocean productivity providing a source of essential food for many land-dwelling and marine animals alike (Perissinotto *et al.* 1990).

Oceanic influences affect the Islands over various spatial and temporal scales. Since the oceanic environment exerts both direct as well as indirect influence on ecological variability, it must be considered in this context when developing any proposed plan to manage the Islands as an integral ecological unit. Many aspects of the oceanic environment of the Prince Edward Islands, however, are still poorly understood.

5.1 General hydrography

The Prince Edward Islands are situated directly within the path of the easterly-flowing Antarctic Circumpolar Current (ACC). As part of the so called "Southern Ocean" this current forms an unbroken annulus around the continent of Antarctica and hydrographically comprises a series of concentric zonal bands (Nowlin & Klinck 1986). These bands are delimited by strong zonal fronts which usually exhibit high meridional gradients in a number of the following properties - temperature, salinity or dissolved salts such as nitrate, nitrite, phosphate and silicate (Allanson *et al.* 1981).

The Islands are located in the Subantarctic which is distinguished from the Subtropics to the north and Antarctic zone to the south. The Subtropical Convergence (STC) constitutes the border between the Subtropics and the Subantarctic with the Antarctic Polar Front (APF) being the southern limit (Deacon 1983). Between the STC and APF, which define the Subantarctic, may be found another, less well-known surface front, the Subantarctic Front (SAF)(Perissinotto *et al.* 1995; van Ballegooyen *et al.* 1994). The SAF probably plays an important role in the oceanic environment of the Prince Edward Islands.

5.2 Currents, fronts and water masses

On average, the mean flow of surface waters past the Islands exhibits a slight northerly of westerly component. A southerly component is thought to be topographically induced by the influence of the Southwest Indian Ocean Ridge on the easterly flow of the ACC (Deacon 1983). Hydrographic measurements intimate that the observed surface flow is coherent over the top 2000 m in the vicinity of the Islands which suggests that measurements of water movement in the upper water column are probably representative of far greater depths (Duncombe-Rae 1989a; 1989b).

Hydrographic and biological studies over the past decade have shown that water masses and organisms that are not endemic to the Subantarctic may on occasion be found at, or near, the Prince Edward Islands (Miller 1985; Boden *et al.* 1988). Foreign water masses and organisms are considered to reach the Islands through the formation of intense eddies at both the STC and APF (Miller *et al.* 1984; Lutjeharms 1990). It is not yet known where such eddies form, how rapidly they drift towards the Islands and how frequently such phenomena occur or for how long they persist.

In the absence of foreign water mass influences, the upper water column moving past the Islands consists of Subantarctic Surface Water (SSW). The salinity of this water mass lies between 33,7 psu (practical salinity units) and 34,4 psu, and the temperature varies between 3°C and 7°C. Daily sea surface temperatures at Marion Island show a clear seasonal cycle with a maximum temperature of *ca* 6,5°C usually occurring in February/March. A seasonal minimum of *ca* 4,3°C is observed in August. Some variability in these seasonal trends is evident, although no secular trend, as would be predicted by global warming, has yet been observed. Recent studies have demonstrated an inverse relationship between silicates and primary production in the SSW around the Islands (Perissinotto *et al.* 1995).

Few direct measurements of current speed and direction have been carried out in the vicinity of the Islands, although recent dedicated surveys have provided detailed information on the surrounding ocean and its inherent variability (Duncombe-Rae 1989b; 1989c; van Ballegooyen *et al.* 1989). The circulation on the shallow shelf between Prince Edward and Marion has, however, received considerable attention recently. It is now hypothesised that water overlying the shelf may be retained for substantial periods (days to weeks) only to escape if prevailing conditions permit (Perissinotto & Duncombe-Rae 1990). A large-scale turbulent wake downstream of the Islands may also form from time to time (van Ballegooyen *et al* 1994).

Although, the SAF has often been observed in the general vicinity of the Prince Edward Islands, it shifts meridionally over short periods (Nagata *et al.* 1988). Long-term records of daily ocean temperatures at Marion Island, however, show no clear evidence of such shifts. Nevertheless, various observations tend to indicate that the movement of the SAF influences the gross oceanic circulation around, as well as close to, the Islands (Perissinotto & Duncombe-Rae 1990; van Ballegooyen *et al.* 1994) along with the general physical/biological milieu (Perissinotto *et al.* 1995)

5.3 Waves and tides

A tide gauge has been operational on Marion Island for a short period and no data are presently available. Tidal models predict that the Prince Edward Islands should lie in an area of semi-diurnal tides with the M_2 tide having an amplitude of 40 cm, that of the 0_1 tide 10 cm (Cartwright *et al.* 1988). Tidal sea level changes are therefore small.

Prevailing wave conditions at the Islands are perhaps of greater significance biologically. Wave action plays a crucial role in the creation of salt spray. The former renders colonisation by certain benthic organisms unlikely while the latter makes some coastal areas uninhabitable for nesting birds. Waves are not independent of tides in this regard and, for example, an exceptional wave at high tide is likely to induce a decidedly different effect to one during low tide.

Little is known about the wave climate. Since the prevailing storm system moves from west to east, the most visible wave effects are generally westerly. No wave-measuring devices have been moored near the Islands to establish the average wave climate, peak waves or any seasonal variations thereof. Satellite remote sensing of average wave heights has suggested that the Prince Edwards are situated on the border of a region of extreme wave action which forms a zone across the Southern Ocean stretching over the southern Indian Ocean to Australia (Gründlingh 1993). These satellite data also indicate that the wave climate may vary considerably from year-to-year.

6. CLIMATE AND CLIMATIC CHANGE

Meteorological data have been collected continuously on Marion Island since 1949 with the weather station featuring prominently in both national as well as international forecasting. An account of Marion Island's climate from 1949-1966 may be found in Schulze (1971) and a synthesis of temperature, precipitation and radiation measurements for the Island between 1949 and 1989 has been undertaken by Smith & Steenkamp (1990). No climatic data is available for Prince Edward Island, but the macroclimates of the two Islands are probably very similar and characterized as follows [values presented below are those measured at the meteorological station on Marion Island - after Schulze (1971)]:

(a) Low average annual air temperature (ca. 5°C - measured in a Stevenson screen), with small diurnal (mean 1,9°C) and seasonal (4,1° C) variations. Monthly mean air temperatures are above 0°C throughout the year. Absolute minimum temperature is below zero each month, but even in the winter rarely falls below -4°C;

(b) Very high precipitation (>2500 mm per annum), mainly in the form of rain, which is distributed fairly evenly throughout the year, although the late winter months (August to October) are marginally drier;

(c) A high level of cloudiness (annual sunshine duration *ca* 30% of the maximum possible with yearly mean radiation receipt at the surface being *ca* 3,5 kW m^{-2} day^{-1}, compared with *ca* 7 kW m^{-2} day^{-1} at the top of the atmosphere);

(d) High relative humidity (annual mean screen value 83%, range 4%);

(e) Strong, predominantly westerly, wind with an average of 107 days per annum experiencing gale force (>55 km h^{-1}) winds blowing for at least 1 h.

The Islands' climate is unique and comparable only with that for more northerly Subantarctic islands, oceanic areas off the southern tip of South America and some (especially in New Zealand) montane sites. In particular, it is in marked contrast to that of the Subarctic tundras, with which the terrestrial Subantarctic is most often compared in respect of ecosystem structure and functioning.

The climate of the two Islands is influenced by oceanic and atmospheric circulation of both Antarctic and subtropical origin. In addition, they are the most temperate of all Subantarctic islands, being almost in the southern cold temperate region of most climatic, bioclimatic or biogeographic zonal classifications. Perturbations in the climate might therefore be expected to be sensitive indications of overall global climate change and the Islands thus offer remarkable opportunities to research the dynamics of processes underlying global change. Their ecosystems are now well-understood and provide an unparalleled chance of studying the effects of climate change on ecological structure and function. For example, since 1968 mean surface air temperature has increased significantly, by 0,025 °C y^{-1}, and the following scenario has been presented (Smith and Steenkamp 1990) to depict possible ecological implications:

Primary production on the island is high and consequently the vegetation has a large annual requirement for nutrients. There are no macro-herbivores and even the insects play only a small role as herbivores, so most of the energy and nutrients incorporated into primary production go through a detrital, rather than grazing, cycle. Ameliorating temperatures and increasing CO_2 levels are expected to increase productivity and nutrient demand even further. Most of the plant communities, however, occur on soils which have especially low availability levels of nutrients and nutrient mineralization from organic reserves constitutes a major bottleneck in nutrient cycling and primary production. Increasing temperatures will not significantly enhance microbial-mediated mineralization rates since soil microbiological processes on Marion Island are strongly limited by waterlogging, rather than by temperature. The Island supports large numbers of soil macro- arthropods, which are responsible for most of the nutrient release from peat and litter. The activities of these animals are strongly temperature dependent and increasing temperature will result in enhanced nutrient availability, allowing the potential for increased primary production due to elevated temperature and CO_2 levels to be realised. House mice occurring on the island have an important influence on the ecosystem, mainly by feeding on soil invertebrates (see Section 10 below). The mouse population is strongly temperature-limited and appears to be increasing, possibly as a result of ameliorating temperatures. It is therefore suggested that such an increase, through enhanced predation pressure on soil invertebrates, will decrease overall rates of nutrient cycling and cause some imbalances between primary production and decomposition. This, along with more direct effects of mice (e.g. granivory) has important implications for vegetation succession and ecosystem structure and functioning. Some such effects are already apparent from comparisons with nearby Prince Edward Island where mice do not occur.

Other implications of climatic change for both Islands are that changing sea level patterns may affect the movement of seabirds between the islands and their feeding areas, and also allow opportunities for colonization by new biota. These may have an even more important influence on the Islands' ecosystems than associated changes in temperature or precipitation.

7. GEOLOGY AND SOILS

Detailed accounts of the Islands' geology may be found in Verwoerd (1971) and Chevalier (1986) while a description of Marion Island's glacial and vegetative history is given in Hall (1978) and Scott (1985). The Islands are located near the centre of the West Indian Ocean Ridge and represent summits of a shield volcano which, until recently, was thought to be extinct. They are considered to be at least 500 000 years old (Verwoerd 1971). For the past 300 000 years, Marion Island has been subjected to three glacial episodes. The ice cover of the last glacial disappeared rapidly about 12 000 years ago. Radiocarbon dating of some mire peats on the Island indicates minimum ages of *ca.* 3000 to 4000 years B.P. Many of the lava flows and overlaying peats are much younger, however, and in September 1980 a volcanic eruption occurred on the Island's west coast (Verwoerd *et al.* 1981). Nothing is known about the glacial history of Prince Edward Island.

Two stages of volcanic activity can easily be recognized on both Islands: "older grey lava" and "younger black lava" flows. The morphologies of the two types are very distinct. Grey lavas have been glaciated and mainly occur as elevated ridges with a

smooth topography. The black lavas mainly occupy intervening valleys between the ridges. They have never been subject to glaciation so their topography is uneven; most often hummocky. These younger flows are associated with red scoria cones, a distinctive feature of the geomorphology of both Islands.

Three features make it difficult to classify Island soils according to accepted international schemes. These are: (a) their immaturity, (b) the negligible influence of parent material on the profiles and (c) the marked effect of slight variations in topography and wind exposure on these profiles. Soils of low-altitude, vegetated areas are peats (often deep), containing volcanic ash in various amounts (Smith 1978). Horizontal differentiation is poor and best developed on better-drained slopes where they consist of a dark coloured A horizon up to 39 cm deep containing much litter. Below this, a well-developed B horizon of yellow-brown loamy clay occurs, usually stained in the upper regions by the organic A horizon. Indurated plinthic layers may occur in this B horizon and these usually overlie a well-developed layer of manganese nodules. In poorly-drained soils on less steep slopes, a gleyed horizon occurs beneath the plinthic layer and extends to bedrock. Some slope soils show evidence of podsolization. On flat areas covered by mire vegetation, a typical profile consists of a light-brown surface horizon approximately 20 cm deep overlying a yellow-orange to light-brown organic "clay" usually extending to bedrock. Iron pans and/or organic pans sometimes occur in this clay layer, in which case gleying occurs and the clay is a yellow-grey colour beneath the induration. On the many ridges and plateau, where vegetation is sparse, the soils are skeletal and gravelly and show no horizon development.

8. MARINE AND LITTORAL COMMUNITIES

Accounts of the marine fauna at, and surrounding, the Prince Edward Islands are given by Miller (1982; 1985) in general, Gon & Klages (1988) on fish, Branch *et al.* (1991a) on crustacea, Branch *et al.* (1991b) on molluscs and brachiopods, and Arnaud & Branch (1991) on Pycnogonida. The littoral ecology of the Islands has been described by De Villiers (1976).

The Islands are influenced by waters of subtropical, Subantarctic and Antarctic origins and their marine and littoral communities comprise species from all of these waters. Since anticyclonic circulation patterns serve to trap organisms and nutrients on the Islands' shelves, productivity on the shelf is higher than in the surrounding ocean.

Thirty-three fish species have been recorded within 300 km of the Islands (estimated to be within the maximum daily foraging range of island-nesting, seabirds). The demersal fish fauna of the inshore and shelf waters is dominated by Antarctic elements (particularly Nototheniidae, Muraenolepidae, Harpagiferidae and Channichthyidae). In deeper waters remote from the shelf, demersal fish belong mainly to the widely- occurring families, Moridae and Macrouridae. The pelagic fish fauna inshore, and over the shelf and deep waters are comprised almost exclusively of myctophids, a family of non-Antarctic origin. Pelagic fish have been identified as an important food resource for several seabirds on the Islands, including all the penguin species, and both fur seal species.

There are 125 species of benthic crustacea, 12 of which have never been recorded elsewhere (i.e. are considered "endemic"). The former comprise 71 Amphipoda, 32 Isopoda, 10 Tanaidacea, 11 Decapoda and a single barnacle (Cirripedia). Eighty-five benthic molluscs (37 endemic species) have been recorded, comprising 46 gastropods, 32 bivalves, four polyplacophorans and single representatives of the Cephalopoda, Scaphopoda and Solenogastres. Three brachiopods and 17 pycnogonids have also been recorded.

Based on the species composition of the Crustacea and Mollusca, and on substratum/ depth considerations, seven benthic community groups have been recognized. These range from deep-water (>500 m) to intertidal and subtidal communities. The bio-geographical affinities of the organisms in all these groups, especially those in shallow water, are predominantly similar to other Subantarctic islands (especially Kerguelen and the neighbouring Crozets), and only to a lesser degree with the Antarctic.

The Islands' shores are all rocky and exposed with those on the west coasts being especially so. Despite the small tidal range (only 71 cm at spring tides - one of the smallest in the world), zonation of littoral communities is marked, being mainly affected by the swell and waves. There is a great deal of variation in zonation depending on the degree of exposure, substrate stability and slope. The basic pattern of zonation is a black lichen (*Verrucaria*) zone in the supra-littoral, a *Porphyra* zone in the mid- and upper-littoral, a kelp zone of *Durvillea antarctica* in the lower-littoral and a lower red zone of rhodophytes in the upper sub-littoral. A variety of invertebrates occurs in these zones, especially in association with the kelp, and the importance of littoral organisms in the overall trophodynamics of the Islands has been highlighted by De Villiers (1976). As is the case for the terrestrial organisms, there is a low degree of endemism in the intertidal biota. In both cases, this is ascribed to the relatively young geological age of the two Islands.

9. TERRESTRIAL VEGETATION COMMUNITIES

Comprehensive descriptions of the plant communities on the Prince Edward Islands have been provided by Huntley (1971) and Gremmen (1981).

Owing to their relatively recent origin, isolation from other land masses and possibly also to the rigorous climate, the biota of the two Islands are extremely species poor and the vegetation comprises only 38 vascular species, of which 14 are alien. Many of the indigenous species are non-specialists in their ecological requirements and occur in many of the different habitat types. Mosses (72 species) and liverworts (35 species) form an important component of the vegetation and approximately 100 species of lichen have also been recorded. The last comprises mainly epilithic crustose forms and dominate the vegetation at higher altitudes, although lichens are also abundant on the lowland plains. None of the vascular plant species, and only a few (probably less than six) bryophytes are endemic to the Islands. The degree of lichen endemism is unknown, but it is also likely to be low.

Phytosociologically, 41 plant communities have been distinguished at the association or sub-association level. The most prominent factors affecting the distribution and occurrence of these communities are the soil-water regime (especially water content and lateral subsurface water movement), the influence of salt-spray and mechanical damage (e.g. trampling and manuring) by seabirds and seals. Multivariate analysis has

shown that the distribution of the main vegetation components is determined by the degree of wetness and biotic activity (manuring) experienced, so supporting similar conclusions based on phytosociological, ecological and edaphic considerations. Wetness and biotic activity together account for 65% of the variation in species composition and cover. Parallel with the wet-dry gradient is a change from organic to mineral soil, which is also associated with a trend from sheltered to strongly exposed conditions.

The 41 plant communities can be grouped into six community complexes, based on their species composition and on structural and ecological considerations:

(i) The salt-spray (*Crassula moschata*) complex which is restricted to shore-zone areas strongly affected by wind-blown sea spray;

(ii) The 'biotic' (*Callitriche antarctica-Poa cookii*) complex which is influenced by trampling and manuring by animals. This complex consists of a wide variety of communities, most of which occur on the coastal zone near seal and penguin colonies. Inland, the influence of surface-nesters and burrowing species is also manifested by the presence of communities belonging to this complex;

(iii) The *Acaena magellanica-Brachythecium* complex, which forms at mire and lowland slope sites where there is pronounced lateral subsurface water movement. Communities of springs, flushes and drainage lines belong to this complex;

(iv) The mire and bog (*Juncus scheuchzerioides-Blepharidophyllum densifolium*) complex which is dominated by bryophytes and graminoids and occurs on wet peat;

(v) The *Blechnum penna-marina* complex (fernbrake communities) that dominates the vegetation of the well-drained lowland slopes, and

(vi) The wind-desert or fjaeldmark (*Andreaea-Racomitrium crispulum*) complex which forms on rocky areas strongly exposed to wind. This complex, consisting of communities of the cushion-forming dicot *Azorella selago*, bryophytes and lichens, dominates the vegetation above 300 m altitude. Fjaeldmark communities also occur at lower altitudes where they exhibit fairly high (up to 60%) aerial vegetation covers.

Vegetation production and nutrient cycling in the Marion Island ecosystem have been extensively studied. The oceanic climate results in general wetness and a lack of cold winters mean that the vegetative growing season is long (about 300 days for vascular plants and 365 days for bryophytes). The total annual production of the vegetation can, therefore, be very high. The plants are not particularly efficient in conserving nutrients through back-translocation from senescing tissue which means that substantial amounts of nutrients are required annually to support the potentially high levels of primary production. At most plant communities remote from the shore-zone, nutrient inputs through seal and seabird manuring or salt spray are negligible, as are other inputs such as precipitation, chemical weathering of parent rock and biological nitrogen fixation.

The fact that the Marion Island ecosystem has evolved relatively recently and in isolation from other land masses has resulted in the general absence of indigenous mammalian herbivores. Even insect herbivory is less important than in most other ecosystems. Consequently, most of the energy and nutrients trapped by primary production pass through a detrital, rather than a grazing, chain. In view of the small external inputs of nutrients by most of the plant communities, the bulk of the nutrients taken up by the vegetation is supplied by decomposition processes (i.e. through mineralization of organic forms of these nutrients in the plant litter and peat). The same oceanicity of climate (no warm periods, high precipitation leading to acid, leached soils and excessive soil moisture), however, reduces microbial activity so that it alone is too low to meet the nutrient demands of the vegetation.

There are high densities of macro-invertebrates (mainly earthworms, weevil larvae, lepidopteran larvae and snails) in the Island soils. Most of these are detritivores or microbivores which, by short-circuiting the slow mineralization of nutrients due solely to micro-organisms, enhance rates of nutrient mineralization from plant litter and peat. Hence, insects and other terrestrial invertebrates are cardinal agents of ecosystem functioning (see Section 10 below) and should be afforded a high conservation status on the Islands.

10. TERRESTRIAL INVERTEBRATE COMMUNITIES

Following the 1965/66 biological expedition to the Prince Edward Islands (van Zinderen Bakker *et al.* 1971), various systematists have provided inventories of invertebrate taxa collected on both Islands. These lists have usually proven to be incomplete, especially in the case of the less accessible Prince Edward Island. In the recent past (and currently), only the macro-invertebrates identified as important primary consumers in the terrestrial system have formed the subject of intensive study, although *ad hoc* collecting by various visiting and shore-based scientists has provided systematists with access to a number of poorly studied taxa on the island such as Tardigrada and soil ciliates. Consequently, only a very incomplete inventory can be provided for the bulk of the terrestrial invertebrate fauna of the Prince Edward Islands, especially the non-arthropod invertebrates. Any discussion of the ecology and biology of the Islands' invertebrates will therefore, of necessity, be restricted to some of the insects, the indigenous snail, *Notodiscus hookeri*, and an introduced slug, *Deroceras caruanae*.

Seventy-nine free-living and 10 parasitic invertebrates have been documented on the Islands (Van Zinderen Bakker *et al.* 1971; Crafford *et al.* 1986). The indigenous insects are most closely related to species occurring on Iles Crozet, Iles Kerguelen and Heard Island (Chown 1990), although more distant relationships with the faunas of South America and New Zealand have been found. The Prince Edward Islands are relatively species-poor compared with similar-sized islands in the Crozet Archipelago, and this has been ascribed to heavy Neogene glaciation (Chown 1990; 1992). Nonetheless, at least eight species are endemic to the Islands, although the taxonomic status of *Pringleophaga marioni* has recently been questioned, being thought conspecific with *P. kerguelensis*.

10.1 Indigenous invertebrates

The species composition of indigenous invertebrates does not appear to differ between Marion and Prince Edward Islands, although *Pringleophaga kerguelensis* has not been recorded on Marion (see above discussion). The indigenous invertebrates on the Islands, particularly the insects, may be divided into two broad categories on the basis of their microhabitat distributions. "Epilithic biotope" species occur away from habitats supporting higher plants (angiosperms and ferns) and tend to be restricted to shoreline, rock face and fellfield habitats. "Vegetated biotope" species are found almost exclusively in habitats supporting higher plants. The former group has the greater species richness, but, with the exception of weevils, its constituent species have been given less attention. On the other hand, the distribution and ecology of the macro-invertebrates inhabiting the "vegetated biotope" have been well studied, largely because energy and nutrient flow are thought to be greatest in these habitats. In the "vegetated biotope", species do not appear to be restricted to particular plant communities or associations, although densities vary greatly between community complexes (*sensu* Gremmen 1981). In general, the heavily manured, biotic complex supports the highest densities and fellfield the lowest, with densities in the remaining community complexes lying between these limits (Crafford *et al.* 1986). The sole exception to this trend appears to be *Ectemnorhinus similis* which has the highest biomass in lowland communities dominated by the cushion plant *Azorella selago* (Chown & Scholtz 1989). In general, invertebrate densities are high compared to similar continental sites (Crafford *et al.* 1986).

Very few data are available on population trends for invertebrate species on the Islands. Numbers and biomass of *Pringleophaga marioni* appear to have remained stable over the past 14 years (Crafford 1990a). Differences in sampling techniques, and inadequate taxonomic resolution, invalidate comparisons of weevil densities found by Chown & Scholtz (1989) and Burger (1978). Unfortunately, no long-term data are available for any other invertebrate species. Crafford & Scholtz (1987) ascribed differences in biomass of *Pringleophaga* on Prince Edward and Marion Islands to size-selective predation by house mice and Crafford (1990b) demonstrated the latter by means of mouse gut-content analyses. Crafford (1990b) and Rowe-Rowe *et al.* (1989) suggested that *Pringleophaga* may be under considerable threat from mouse predation on Marion Island and Smith & Steenkamp (1990) have proposed that predation would increase with increasing temperatures (i.e. as a consequence of global warming). Given the importance of *Pringleophaga* in energy and nutrient cycling on the Islands, a reduction in population density of this species may have profound consequences on the terrestrial system. Recent investigations have indicated that mice are also having an enhanced impact on *Ectemnorhinus similis* in *Azorella selago*-dominated communities, and this may be due to increases in mouse population density towards the end of the austral summer. In March 1992, mice were found feeding on a variety of weevils and flies restricted to rock faces or beaches on the coast (Chown & Smith 1993). Although both *Pringleophaga marioni* and *Ectemnorhinus similis*

may be regarded as vulnerable on Marion Island, healthy populations of both species occur on Prince Edward Island (Crafford & Scholtz 1987; Chown 1992).

10.2 Introduced invertebrates

Approximately 23 invertebrate species have been introduced onto the Prince Edward Islands, either with sheep fodder, supplies to the base or as a result of other activities associated with logistical support for the scientific station on Marion Island. Prince Edward Island has a lower number of alien invertebrates and there appears to have been no recent introductions, despite a number of expeditions to the Island. At least three of the introduced species are now thought to be extinct and a single, unconfirmed introduction is thought to have occurred since the Crafford *et al.* (1986) review of the Islands' insect fauna. An adult blowfly (Diptera: Calliphoridae) was recorded on an Elephant Seal carcass at Ship's Cove in February 1988. Two specimens of a similar fly were found in the old upper air building, but these were not identified. No subsequent flies were reported until a team member claimed to have seen blowfly adults and larvae on a seal carcass at Kildalkey Bay. This introduction has been confirmed by Chown and Language (1994).

Two recent invertebrate colonizations of the Islands have been the subject of preliminary studies. The Diamondback moth *Plutella xylostella* (Lepidoptera: Plutellidae), appears to have reached Marion Island in 1985 (Crafford & Chown 1987; Crafford *et al.* 1986). Although originally thought to have been introduced to the Island with fresh cabbages supplied to the scientific station, Crafford & Chown (1990) and Chown & Avenant (1992) suggested that *P. xylostella* may have colonized Marion Island on its own. Despite causing occasional, severe damage to individuals of its host plant, *Pringlea antiscorbutica* (Brassicaceae), the Diamondback Moth does not seem to present a threat to this rather scarce plant. In 1992, plants marked in 1987/88, which had been heavily damaged during the latter season, showed no evidence of long-term debilitation. In addition, moth populations vary markedly between seasons. Chown & Avenant (1992) have recorded very high population densities in the Tafelberg area in 1991, but the same plants hosted very few larvae in 1992. As frost is the major limiting factor for *P. xylostella* on Marion Island (Crafford & Chown 1990), reduction in the severity of frost on the Island, due to climatic warming may necessitate revision of the status of this species.

Deroceras caruanae (Pollonera) is a slug thought to have been introduced to Marion Island sometime during the 1960s in provisions supplied to the scientific station. This species has, however, not been recorded on Prince Edward Island. Densities are highest in areas surrounding the Marion Island base station and decrease to zero with increasing distance, although populations are also centred around field huts which appear to be the foci of recent introductions *via* helicopter-transported packing crates. As is the case with many of the indigenous insects, the population density of slugs is highest in the biotic and drainage line complexes and lowest in the fellfield complex and densities, as well as individual masses, appear to have increased over the last 15 years. Laboratory studies have not only shown that *D. caruanae* considerably enhance nutrient release in the terrestrial system *via* herbivory

on bryophytes and angiosperms (Steenkamp 1991), they have also shown that the house mice do not feed on this species. Given the current impact of mice on indigenous invertebrates as a whole, and a predicted increase in this impact (Smith & Steenkamp 1990), this suggests the increasing importance of slugs in the Marion Island terrestrial ecosystem.

No introduced invertebrates appear to be exerting any major effect on the Marion Island ecosystem, although blowflies could considerably alter the food web in coastal areas. Similarly, both the Diamondback Moth and introduced slug could prove to have a considerable impact if global climatic warming persists. In addition, introduction of any plant diseases which have aphids as their vectors could spread rapidly on the Island, as may already be the case for *Pringlea antiscorbutica*.

11. BIRD COMMUNITIES

The Prince Edward Islands are known for their bird life, which has been relatively well-studied, especially the larger surface-nesting species (Cooper & Brown 1990 and references therein). The latest available population estimates are given in Table 1. Estimates for Marion Island are more reliable than those for Prince Edward Island. Population estimates for burrowing petrels are little more than educated guesses. There are no endemic species on the Islands, and only one endemic subspecies, the Lesser Sheathbill *Chionis minor marionensis*. Although a number of vagrant species has been recorded over the years, individual vagrants do not survive long. Six breeding species, the Greatwinged and Softplumaged Petrels *Pterodroma macroptera* and *P. mollis*, the Grey Petrel *Procellaria cinerea*, the Common Diving Petrel *Pelecanoides urinatrix* and the Antarctic and Kerguelen Terns *Sterna vittata* and *S. virgata*, have been included in the South African Red Data Book for birds as a result of assumed effects of cat predation.

All birds are wholly or partially dependent on the sea for food, although Lesser Sheathbills obtain most of their food terrestrially, as to a certain extent do the two sibling species of giant petrels Macronectes spp. and the Kelp Gull *Larus dominicanus*. Only a few species are year-round residents of the Islands (e.g. the Kelp Gull, Lesser Sheathbill, Gentoo Penguin *Pygoscelis papua* and Imperial Cormorant *Phalacrocorax atriceps*). Most species migrate away from the Islands outside their breeding seasons. The Islands are thus most important as breeding, and in the case of penguins, moulting platforms. The rich bird life has in turn resulted in the import of nutrients, primarily in the form of guano, which influence the Islands' vegetation.

Seabirds are generally long-lived and commence breeding sometimes only after a prolonged juvenile stage. Most of the seabirds on the Islands (the tubenoses or Procellariiformes) lay a single egg. Coupled with delayed maturity, this means that changes in population status tend to be slow and intensive monitoring over a number of years is necessary to obtain meaningful demographic data. Ongoing studies at Marion Island suggest that Wandering Albatross *Diomedea exulans* and Southern Giant Petrels *Macronectes giganteus* populations may be decreasing, whereas the Northern Giant Petrel *Macronectes halli* may be increasing in numbers. The reasons for these changes seem related to at-sea conditions, both changes in food availability and incidental mortality from fishing operations in the Southern Ocean (*cf.* Gales 1993). In contrast, most species of burrowing petrels at Marion Island appear to have

suffered population reductions as a result of predation by feral cats (see Section 12). The recent perceived extinction of cats has resulted in a increase in the breeding success of at least three bird species studied to date (Cooper & Fourie 1991; J. Copper unpublished data). Population increases following the eradication of cats, however, are likely to be very slow. Prince Edward Island, having always been free of cats, can be regarded as having a substantial burrowing petrel population and the density of occupied burrows is certainly far higher on this Island.

The Marion Island population of the Lesser Sheathbill has halved in the last 20 years. This is probably due to competition with introduced house mice, since the population on mouse-free Prince Edward Island appears stable.

Penguins

The four species of penguins breeding at the Prince Edward Islands (Table 1) form by far the largest proportion of the Islands' avian biomass. They breed at, or close to the coast, and often in very large colonies.

King Penguins *Aptenodytes patagonicus* are unusual in that they have no fixed nest site, making accurate counts of population numbers very difficult. The breeding interval of this species is poorly understood, although it has now been studied at Marion Island and reveals that although annual breeding can occur, most individuals breed at longer intervals. The largest breeding localities of King Penguins at Marion Island are at Kildalkey Bay and King Penguin Bay. New breeding colonies have been established at Marion Island in recent years, suggesting that the population is increasing, but lack of accurate censuses, especially of the very large colonies which contain thousands of pairs, precludes certainty.

Gentoo Penguins, the rarest penguin at the Islands (Table 1) are resident, winter breeders. The species is easily disturbed when breeding, losing eggs and small chicks to predators such as Subantarctic Skuas *Catharacta antarctica*. Breeding is asynchronous, taking place in vegetated areas some distance from the coast. The foraging range is the smallest of the four penguin species, falling entirely within the 200-nautical mile fishing zone.

Rockhopper Penguins *Eudyptes chrysocome* breed all around the coasts of the Islands. The species is the smallest of the four penguins and moults after breeding in summer, leaving the Islands between late May and early November. Very little is know about at-sea distribution. Macaroni Penguins *E. chrysolophus* on the other hand breed in larger colonies, but are restricted to the more sheltered east coasts, where they breed in areas of grey lava. Two very large colonies, at Kildalkey Bay and Bullard Beach, are present on Marion Island. The breeding season is similar to that of the Rockhopper Penguin.

Albatrosses

Four species of albatross breed at the Islands, but the Yellownosed Albatross, *Diomedea chlororhychos* breeds only at Prince Edward Island.

Wandering, Greyheaded *D. chrysostoma* and the two sooty albatrosses *Phoebetria* spp. are biennial breeders whereas Yellownosed Albatrosses are annual breeders. Wandering Albatrosses lay eggs in late December to early January, but chicks do not fledge until a year later. The species breeds on the marshy plains around the coasts of both Prince Edward and Marion. The diet comprises squid and fish, caught both by active predation and through scavenging at night and day. The species' pelagic range extends to Australian waters in the nonbreeding period. Greyheaded Albatrosses breed predominantly on east-facing cliffs at Greyheaded Albatross Ridge on Marion Island and in "Albatross Valley" on Prince Edward Island.

Sooty Albatrosses *P. fusca* and Lightmantled Sooty Albatross *P. palpebrata* breed singly or in small colonies on cliffs. Sooty Albatrosses are the more abundant (Table 1). The diet of both species comprises squid, fish and scavenged material, including small seabirds.

Scavenging species

This group of birds is made up of the Northern and Southern Giant Petrels, the Subantarctic Skua, the Kelp Gull and the Lesser Sheathbill.

The Northern is the rarer of the two giant petrels at the Prince Edward Islands. It breeds in summer slightly earlier than its congener, and in smaller groups in more sheltered localities. The diet includes marine prey, but scavenging from seals and other seabirds is an important foraging technique. The Southern Giant Petrel is roughly 10 times more abundant than the Northern Giant Petrel. Breeding takes place in colonies around the whole coastline and is often concentrated near seal and penguin (especially King Penguin) breeding localities, from where the species scavenges. The species is sensitive to human disturbance and in recent years its breeding success has been low.

The Subantarctic Skua breeds territorially on the coastal plains of both Prince Edward and Marion. Most of the birds leave the Islands during winter with only a few remaining to scavenge around the base and at King Penguin colonies. The numbers of skuas at Marion Island may have decreased in recent years, since birds holding territories where burrowing petrels form their main prey breed less successfully than do those birds primarily scavenging from penguins. This is thought to be due to the reduction in numbers of burrowing petrels, which, along with penguin eggs, form an important part of the diet.

The Kelp Gull is a summer-breeding species and feeds terrestrially on earthworms and scavenged material, as well as on limpets and bivalves in inshore waters. The species is probably resident at the Islands, being present in winter months.

Burrowing petrels

Twelve species of burrowing petrels have been recorded breeding, or are thought to breed, at the Islands. However, firm evidence for breeding by the small storm petrels Oceanitidae is restricted to Prince Edward Island (Table 1). At least one species of diving petrel, the Common, is thought to be extinct as a breeder at Marion Island, presumably as a result of predation by cats.

The gadfly petrels (Softplumaged, Kerguelen *Pterodroma brevirostris* and Greatwinged) have been greatly reduced in numbers at Marion Island by cats, but at least for the winter-breeding Greatwinged Petrel, breeding success has increased from zero in some years to "normal" levels with the eradication of cats.

The Whitechinned Petrel *Procellaria aequinoctialis* is the largest burrowing petrel at the Islands and it still occurs in some numbers possibly as a result of its relatively large size having offered some protection from cat predation. Its winter-breeding congener, the Grey Petrel, is very rare at Marion, but is still abundant at Prince Edward Island.

The Blue Petrel *Halobaena caerulea* and Salvin's Prion *Pachyptila salvini* are still common on Marion Island, probably because of their initial high numbers rather than any protection from cat predation. Blue Petrels breed in dense colonies close to the coast, where their guano causes distinctive dark green patches of *Poa cookii* tussock. Fairy Prions *P. turtur* breed along cliffs and probably have always been rare on both Marion and Prince Edward.

The diets of burrowing petrels range from squid, fish and crustaceans in the larger species to crustaceans in the smaller species. Except for Greatwinged and Grey Petrels, all breed in summer months and are largely absent from the Islands during winter. All are known, or thought, to be annual breeders.

Other breeding species

The Imperial Cormorant breeds in small colonies on the coastal cliffs of the Islands. It is a strictly resident species, feeding benthically on fish in territorial inshore waters. The breeding season is extended and eggs may be found from June through to December.

Antarctic and Kerguelen Terns are summer-breeding species which occur in small numbers. They breed on rocky ridges and feed inshore on small fish. No evidence of cat predation exists but these particular species are likely to have been at considerable risk.

Vagrants

European Swallows *Hirundo rustica* and Cattle Egrets *Bubulcus ibis* occur most commonly, being recorded in most years. Most vagrants are land birds from farther north, but a few southern seabirds have been recorded as non-breeders.

12. MAMMAL COMMUNITIES

The marine mammal fauna of the Prince Edward Islands, which have a terrestrial phase in their annual cycle comprise the Southern Elephant Seal *Mirounga leonina*, the Antarctic Fur Seal *Arctocephalus gazella* and the Subantarctic Seal *A. tropicalis*. Vagrant species include the Leopard seal, *Hydrurga leptonyx*, and Weddell seal, *Leptonychotes weddellii*, and one South African (Cape) Fur Seal *Arctocephalus pusillus pusillus*.

The terrestrial mammal fauna of Marion Island currently comprises only one species, the House Mouse *Mus musculus*, with the Feral Domestic Cat *Felis catus*, having recently been eradicated. Both of these are the result of human introduction. Other human-introduced terrestrial mammals present at one time or another were domestic sheep, dogs, pigs, goats and donkeys. Prince Edward Island is devoid of a terrestrial mammalian fauna.

The Prince Edward Islands serve as platforms for the three established seal species, and as such are the only locality where they breed within South African territory. The latest population estimates are given in Table 1. The largest species of pinnipeds, adult Elephant Seals are ashore from August to November and after a sojourn at sea, return for the moult haulout that peaks in January and February, for cows and bulls, respectively. The peak in births occurs during the third week in October and after weaning at three weeks and completion of their first (natal) moult, underyearlings depart from the Islands by early January. Commencing in early November yearlings and subadults haul out for their moult, and most return to the sea by the end of

January. Elephant Seals are largely absent from the Islands during winter (Condy 1979; Bester 1988).

The decrease in the Southern Elephant Seal population at Marion Island since about the mid-1960s is continuing, in contrast to the apparent stabilization of other declining Elephant Seal populations (Macquarie Island and Îles Kerguelen) in the Indian Ocean. This continued population decline may be a potentially important indicator, the cause of which is yet to be identified, of environmental change in the Indian Ocean Region (Bester & Wilkinson 1994).

Both fur seal species show similar seasonal haul-out patterns with summer (breeding) and autumn (moulting) peaks in numbers ashore in December and March respectively. The Antarctic Fur Seal, however, has an earlier median date of birth (6 December versus 17 December), earlier weaning (at 112 versus 300 days) and higher pup growth rate, which place a higher demand on the mothers. By contrast, the mean duration of feeding trips to sea and the percentage of time spent at sea do not differ significantly between lactating females of the two species. Both fur seal species feed almost exclusively on meso-pelagic myctophid fish in the vicinity of the Islands, in contrast to the almost exclusive krill feeding of the Antarctic fur seal elsewhere in the South Atlantic. Furthermore, Antarctic fur seals, in contrast to the large rapidly increasing Subantarctic fur seal population, remain in an establishment phase of slow population growth with the lactating females' attendance patterns seeming to follow those of other Antarctic fur seal populations during poor breeding seasons. This unique situation where two sympatrically breeding species, which co-exist, hybridize on a small scale and exhibit different maternal adaptations, and where one species of which is apparently finding itself in a marginal feeding area, facilitates the selection and monitoring of parameters of their breeding populations (Bester & Bartlett 1990; Bester & Skinner 1991a).

Feral Cat *Felis catus*

The Feral Domestic Cat *Felis catus* population, which originated from five pets introduced in 1949, was estimated as 2139 $\pm$ 290 individuals in 1975 with an annual rate of increase of about 23%. It is estimated that the 1975 cat population consumed

450 000 burrowing petrels and consequently posed a serious threat to the remaining birds. In fact, the common Diving Petrel *Pelecanoides urinatrix* was seriously affected by as early as 1965 (Bester & Skinner 1991b; Bloomer & Bester 1992).

Feline panleucopaenia (FPL), to which all cats were supposedly susceptible, was introduced as a primary control measure in 1977 when the population was estimated to be 3405 individuals. Following the resulting epidemic, numbers decreased by 29% annually to an estimated 615 $\pm$ 107 cats in 1982. At these reduced densities, nocturnal hunting constituted a feasible secondary control measure and full-scale hunting was initiated in the austral spring of 1986 (Bloomer & Bester 1992). Scheduled for three summers (1986/87, 1987/88 and 1988/89), eight two-man teams using battery operated spotlights and 12-bore shotguns killed 458, 206 and 143 cats, respectively. The progressive decrease in hunting success and sighting rate of cats over the three seasons suggested that hunting alone was not reducing numbers sufficiently. Traps were then used experimentally in the winter of 1989 (by four teams) and in increasing numbers for the following two years ending in April 1991. Trapping (by five teams) proved to be a more effective technique than hunting alone, accounting for 30%, 60% and 92% of all cats removed (50, 95 and 120) between 1989 and 1991 (Bloomer & Bester 1992).

Most recently, activities have been directed at mass trapping and the use of poisoned bait following due consideration of humaneness, risks to handlers and possible environmental pollution. Despite a vastly increased trapping effort (from 110 to 1200 traps deployed), only eight cats were trapped during the 12-month period post April 1991. Since there were also no recorded sightings of any cats by the three trapping teams it is now believed that complete eradication of Feral Cats on Marion Island has been achieved (Bloomer & Bester 1992).

House Mouse *Mus musculus*

The House Mouse (*Mus musculus*) has colonized at least eight Subantarctic islands, including Marion, where mice have been resident for about 170 years (Berry *et al.* 1978; Gleeson 1981). This population is known to be endocyclic [frequencies of occurrence of individuals with a specific genetic constitution changing within a generation - Matthewson 1993; Matthewson *et al.* 1993] and exists close to the physiological limits for the species. Despite this, mice have become firmly established within the Marion Island ecosystem and, with the removal of cats (see above), are considered the most important mammalian "carnivore" on the Island (Gleeson & van Rensburg 1982). Research on this isolated population has provided a significant contribution to understanding adaptations to extreme environments.

Mice studies on Marion Island have focused on demography and the species' potential impact on the local fauna and flora. Most recently, research has been motivated by the suggestion that mice numbers have increased since the 1970s, possibly as a result of some climatic shift resulting in an increase in ambient temperature at the Prince Edward Islands as well as elsewhere in the Subantarctic. The associated increase in predation by mice on invertebrates responsible for litter turnover may also have important consequences for ecosystem functioning (see Section 6 above). Thus, even the most recent studies may have underestimated the potential impact of mice on the Marion Island ecosystem.

Recent research has shown that mice densities on Marion change seasonally (by as much as ten-fold) and differ between habitats. Peak densities occur towards the end of the summer and are associated with high invertebrate biomass and refuge availability. Summer density during 1991/92 (6,5 months) and mean litter size (7,24 $\pm$ 1,7) were of the same order as recorded in 1979/80, as was age and sex-specific mortality. The incidence of pregnancy (7,27 litters/season) was higher (not significant) than that recorded during 1979/80. Since recorded trends in population variables may result from yearly changes in environmental conditions these data cannot, at present, be used to test the hypothesis that such trends may have resulted from medium-term changes in climatic conditions in the Subantarctic as a whole.

13. ECONOMIC RESOURCES

13.1 Non-renewable resources

There are no known non-renewable resources of any economic significance at the Prince Edward Islands, including their territorial waters. No mineral deposits of economic value are known and none are likely to be found.

13.2 Renewable resources

Potential renewable resources of possible economic value include seals (for sale to zoological gardens, and for pelts and oil), seabirds (especially penguins for zoological gardens and their eggs/guano), peat, kelp, fish, cephalopods and crustaceans.

Seals and seabirds (and their eggs) are currently protected by the Seabirds and Seals Protection Act, 1973 (Act No. 46 of 1973). Collection of guano, peat and kelp, which have commercial value in some parts of the world (e.g. the Falkland/Malvinas Islands), appears impractical. Peat from the Islands does not seem suitable for either horticultural purposes or as fuel. Guano does not accumulate because of high rainfall while rough seas will inhibit the collection of kelp.

The Prince Edward Islands are surrounded by a small shelf area, so it is unlikely that fish, cephalopods or crustaceans occur in economically exploitable populations unlike fish at some other Subantarctic Islands in the Indian Ocean (e.g. Kerguelen). Whereas no known exploratory commercial-type fishing, except perhaps by Russian vessels, has yet been undertaken within territorial waters, it may be assumed that any resource found would be small and therefore vulnerable to overfishing. Rock lobsters *Jasus* spp., commercially fished elsewhere in the Southern Ocean, do not occur so far south.

Whereas farming and ranching have been suggested as activities in the past (Cooper & Headland 1991), the experience with domestic stock and the growing of introduced trees and domestic vegetables at Marion Island in the 1950s to 1970s suggests that such activities would be doomed to failure if undertaken for economic gain. The collection of animals and plants for scientific purposes is currently strictly controlled by a permit system administered by DEAT.

13.3 Other resources

The Prince Edward Islands, with their spectacular scenery, large populations of seals and seabirds, their little modified environment (especially Prince Edward Island) and an interesting history of human exploitation, represent a potentially valuable resource for scientific study, for conservation, for controlled tourism if allowed, and for educational and inspirational experiences. However, with the exception of tourism and perhaps the production of audiovisual material, none of these is deemed to have any immediate or direct economic significance.

The meteorological station on Marion Island is important for the collection of data as part of South Africa's contribution to the World Meteorological Organisation. Scientific research is undertaken on both Marion and Prince Edward Islands in support of the nation's membership of, and involvement with, SCAR, CCAMLR and the Antarctic Treaty System as a whole. In this context, it is important to appreciate that the Islands constitute a "frontier zone" with respect to the emerging international regime on regulating/monitoring environmental impact in Antarctica and closely adjacent areas (i.e. the Madrid Protocol to the Antarctic Treaty on the Protection of the Antarctic Environment).

14. ADMINISTRATION

Legislatively, Marion and Prince Edward Islands fall within the Cape Town magisterial district. The overall management and administration of the Islands is the responsibility of the Directorate: Antarctica and Islands of DEAT.

The Directorate: Antarctica and Islands provides all logistic and support facilities for participating personnel in the annual South African National Antarctic Programme (SANAP) expeditions to Marion Island. It also administers, co-ordinates and financially supports the scientific research programmes. Daily administration on Marion Island is the responsibility of the Expedition Team Leader who is a DEAT employee.

15. INFRASTRUCTURE

As far as possible, the impact of human erected structures on Marion Island in recent years has been limited to the Base Station and to the various field huts. The Base Station is located at Transvaal Cove, Marion Island (Fig. 2) and comprises:

- a permanent meteorological station;
- administration complex;
- five laboratories;
- store rooms;
- helipads and a hanger for one helicopter;
- bulk fuel storage facilities;
- numerous aerials, and
- a power shack and emergency power shack.

The Weather Bureau of the DEAT is responsible for operating the meteorological station, which consists of an office in the Administration complex, and a building for daily meteorological balloon ascents ("upper-air" building).

The Administration complex consists of sleeping quarters comprising 32 rooms, each able to accommodate two persons, a recreation room, gymnasium, kitchen and dining facilities, ablution and laundry facilities. A medical surgery and store are located within the main administration complex.

Various store rooms are located throughout the Base as are five laboratories and one hut which accommodates scientific equipment for the research groups working on the Island. All buildings are connected by metal or wooden cat walks and are well distributed to give adequate access to all facilities and to minimise the risk of accidental fire destroying the Base completely. Most of the older buildings are constructed of wooden panels consisting of two outer layers of plywood and a central layer of fibre glass insulation. All the weather exposed panels are covered with aluminium corrugated sheets and building materials have been fire-proofed. The new sleeping quarters and upper air building are constructed of insulated panels, consisting of two outer layers of Chromadek material and a centre layer of polyurethane foam insulation.

Ten, four-bed, huts have been erected around the Island and nine are currently used by research workers. The huts are located along the coastline at, or near, Kildalkey Bay, Water Tunnel stream, Grey Headed Albatross Ridge, Rooks Bay, Swartkop Point, Mixed Pickle Cove, Laekop, Cape Davis and Repetto's Hill. (Fig. 2).

16. CONCLUSION

This description of the Islands indicates their unique character and inherent ecological value. It provides a baseline on which to build a management plan and the necessary detail on which to evaluate potential displacement or violation of important features or ecological processes. Any ensuing management plan should be sufficiently dynamic and flexible to accommodate future change(s) in a non-deleterious manner. Only in this way will the primary management goal of maintaining the Islands' biological diversity be adequately met.

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FIGURE LEGENDS

Fig. 1. Geographic location of the Prince Edward Islands including the location of the major oceanic fronts. These are the Subtropical Convergence (STC), the Subantarctic Front (SAF) and the Antarctic Polar Front (APF). The wide meridional range of these fronts should be noted as well as the fact that the Prince Edward Islands clearly lie within the Subantarctic Frontal area.

Fig. 2. Schematic map of Marion Island showing the location of the Base and support buildings.

Fig. 3. Proposed Management Zones for the Prince Edward Islands.

MANAGEMENT PLAN FOR THE PRINCE EDWARD ISLANDS

PART 2

MANAGEMENT OBJECTIVES

1. INTRODUCTION

Like many remote oceanic islands, the Prince Edward Islands exhibit a rare potential for the study of ecological processes, the monitoring of ecological change and the preservation of biological diversity. In the current absence of demonstrable economic resources, this potential imparts a unique and inherent scientific value to the Islands. Consequently, their intrinsic ecological value exceeds all other values and as their custodian the South African Department of Environmental Affairs and Tourism (DEAT) aims to ensure that they are afforded the highest possible conservation status. To protect the nationally and internationally important values identified in Part 1, the Prince Edward Islands have been declared a Special Nature Reserve under the Environment Conservation Act, 1989 (Act 73 of 1989). All animals and plants beyond the low-water mark and in the Fishing Zone (seaward to 200 nautical miles) have also been afforded protection under the Sea Fishery Act, 1988 (Act 12 of 1988). The status of Special Nature Reserve may only be repealed or amended by an Act of Parliament.

2. MANAGEMENT OBJECTIVES

The objectives below, which conform with the statutory requirements of the Environment Conservation Act of 1989, set out the primary aims for management of the Prince Edward Islands. In conjunction with the attached Management Plan, these objectives also provide a framework for decision-making and aim to protect the Islands' biological diversity and ecological integrity. Through the Plan's effective implementation it is hoped to perpetuate the natural values and features of the Islands identified in Part 1. The objectives are:

1. To maintain biological diversity, including genetic diversity, species diversity and the diversity of ecological processes;
2. To maintain geological and scenic objects;
3. To minimize interference with natural processes and the destruction or degradation of natural features resulting from human interference;
4. To ensure that obligations to, and the provisions of, the Convention for the Conservation of Antarctic Marine Living Resources are met;
5. To protect historic features and objects from human interference;
6. To encourage activities aimed at restoring and rehabilitating damage due to local human activities;
7. To encourage research applicable to objectives (1) through (6) above;
8. To seek cooperation with all parties interested in the conservation of the Southern Ocean and its islands;
9. To create an awareness of the value and fragility of the Islands' ecosystems, and
10. To allow scientific research not in conflict with objectives (1) to (9).

PART 3

MANAGEMENT POLICIES AND GUIDELINES FOR IMPLEMENTATION

1. LEGAL PROTECTION

Policy

To afford the desired degree of protection to the Prince Edward Islands, or parts thereof, in terms of an appropriately defined legal category of protected area.

Implementation

The land areas of Marion and Prince Edward Islands above the low-water mark have been declared Special Nature Reserves, henceforth called the "Protected Area", in terms of Section 18 of the Environment Conservation Act, 1989 (Act 73 of 1989). Subject to Section 18(3) of this Act, the declaration of a Special Nature Reserve shall not be withdrawn or the boundaries altered except by a resolution of Parliament. In accordance with the stated policy (Part II) of the Sea Fishery Act, 1988 (Act No. 12 of 1988) and Sections 33 and 54 of that Act all fish shall be protected in the area 200 nautical miles seaward of the low-water mark (as defined in Section 1 of the Sea Fishery Act) to the boundaries of the Fishing Zone defined by the Territorial Waters Amendment Act, 1977 (Act No. 98 of 1977) and specifically applied to the Prince Edward Islands (Proclamation No. 140 of 1979). The removal of any aquatic plant in the Fishing Zone shall be in accordance with Part IX of the Sea Fishery Act and by permit only.

In addition to the Environment Conservation Act, other national legislation deemed applicable to the Islands includes:

- Prince Edward Islands Act, 1948 (Act No. 43 of 1948)
- South African Citizenship Act, 1949 (Act No. 44 of 1949)
- Territorial Waters Act, 1963 (Act No. 87 of 1963)
- National Monuments Act, 1969 (Act No. 28 of 1969)
- Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973)
- Territorial Waters Amendment Act, 1977 (Act No. 98 of 1977)
- Dumping at Sea Control Act, 1980 (Act No. 73 of 1980)
- Sea Fisheries Act, 1988 (Act No. 12 of 1988)

The Prince Edward Islands also fall within the area of application of the international Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), Canberra, 1980. South Africa is an original signatory of this Convention.

DEAT is aware of the provisions of the above national legislation and international agreement and recognises national obligations thereto. The Department is therefore responsible for ensuring that all visitors to the Islands accordingly comply with such provisions and subsequent measures that may be in force from time to time.

1.1. Access to the Protected Area

Policy

The management aims and objectives of the access policy are:

- To afford Prince Edward Island the status of Special Entry Area in accordance with Section 18(6) of the Environment Conservation Act 1989, (Act 73 of 1989);

- To permit entry to the Prince Edward Islands for scientific, management and other legitimate purposes, consistent with the protection status of the Islands;

- To control access and entry to the Islands, and

- To authorize and regulate the number of visitors to the Islands.

In terms of Section 18(6) of the Environment Conservation Act;

- No person shall gain admittance to a Special Nature Reserve;

  or

- Perform any activity in or on a Special Nature Reserve.

Subject to Section 18 (7) of the Act, the controlling authority may, on the conditions determined by it, after consultation with the Minister, in writing grant exemption from the provisions of subsection 6 to:

- any scientist occupied with any specific project; or

- any officer charged with specific official duties.

Section 18(8) of the Act states that for the purpose of subsection (6) a Special Nature Reserve shall include the air space to a level of 500 metres above ground level of that special nature reserve.

Under Section 33(1) of the Sea Fishery Act (Act 12 of 1988), the Minister of Environmental Affairs and Tourism will, after consultation with the Sea Fishery Advisory Committee, prohibit the catching or disturbing of all fish species in the zone seaward of the low-water mark to the outer boundary of the Prince Edward Islands Fishing Zone. "***Fish***" are defined as every species of sea animal, whether vertebrate or invertebrate, including the spawn or larvae of such sea animals, excluding any seal or seabird. The "***low-water mark***" means the lowest line to which the water of the sea recedes during ordinary periods of spring tides.

Similarly, in accordance with the stated policy of the Sea Fishery Act (Part I of Act 12 of 1988) and control of other marine resources under that Act (Part IX), the collection or removal of aquatic plants in the zone , subject to any provision made

under Section 45 of the Sea Fishery Act, shall only be authorised on the issuing of a permit by the Minister of Environment Affairs. "***Aquatic plants***" are defined as any kind of plant, alga or other plant organism found in the sea or on the seashore.

In the zone seaward of the low-water mark to the outer boundary of the Fishing Zone, control over seabirds and seals will be afforded by the Minister of Environment Affairs in terms of Section 2 of the Seabird and Seals Protection Act (Act 46 of 1973).

These applications of the Sea Fishery and Sea Birds and Seals Protection Acts have been instituted to protect species in the zone seaward of the low water mark to the outer boundary of the Prince Edward Islands Fishing Zone, henceforth called the "Marine Zone". Further information on the policy, and implementation thereof, in respect of the Marine Zone around the Islands is provided in Section 18 below.

Implementation

Access to the Islands shall be controlled subject to the stated management aims and objectives as well as in the light of the considered vulnerability of fauna and flora, the limited facilities on the Islands and the undesirability of providing additional facilities, given their concomitant potential for environmental impact(s). Hence:

- Entry Permits shall be issued only to *bona fide* scientists undertaking projects registered or approved by DEAT;

- Entry Permits shall be issued to members of maintenance teams and support service staff who are specifically requested by the Director General of DEAT (hereafter referred to the Director General) to undertake a specific maintenance task or who are necessary for the conduct of any authorized research and/or management activity on the Islands;

- In cases of emergency, the Team Leader (see definition in Section 2 below) may issue an Emergency Entry Permit. On notification within 24 hours of such issue, the Director General may then issue a Temporary Entry Permit for the duration of the emergency;

- On the advice of the Prince Edward Islands Management Committee (see Section 2 below for definition) and at his/her own discretion, the Director General may issue an Entry Permit for non-study visits in accordance with Section 9 below;

- An Entry Permit shall not normally be issued to any person who on a previous visit has not abided by the conditions of entry or has not provided DEAT with a report on the visit or who has not complied with any of the conditions stipulated on the Entry Permit;

- No person who has failed the medical examination required by DEAT will normally be issued with an Entry Permit;

- The Prince Edward Islands Management Committee (see Section 2) shall advise the Director General on the issue of Entry Permits to the Islands, and

- The Director General may stipulate conditions of entry in order to fulfil the objectives of the management plan and/or to enhance the safety of the permit holder.

1.2 Closure of areas

Policy

The objective of closure is to limit the number of visitors or to exclude visitors entirely from an area considered too sensitive to tolerate external interference.

Implementation

In order to afford added protection to a particular species, special ecosystems and/or historic locations, the Director General may declare any area on the Islands, or the whole Island in the case of Prince Edward Island, as a Special Entry Area. These areas will normally remain out of bounds to all persons on the Island. Thus:

- All Regular Entry permits will automatically exclude entry to Special Entry Areas as declared by the Director General from time to time. These Special Entry Areas will be indicated on a map and issued to all visitors to the Islands;

- The Director General may issue a Special Entry Permit or endorse an Entry Permit which would then permit the holder thereof to enter a specific Special Entry Area excluded from the general entry permit for a specified period of time. Entry into special areas is restricted to persons carrying out special programmes approved by the management authority;

- The Prince Edward Islands Management Committee (see Section 2) will provide the Director General with a list of Special Entry Areas and will recommend new areas and the de-listing of areas as and when it becomes necessary;

- In terms of this Management Plan, Prince Edward Island is listed as a Special Entry Area and all access is prohibited except on the authorization of the Director General;

- Entry Permits will be issued for the duration of each visit and not for the duration of a project or management activity;

- The frequency of visits to Prince Edward and the number of visitors per entry shall be determined by the Director General on the advice of the Prince Edward Islands Management Committee;

- The designated officer in charge can, on instruction from the Director General, withdraw or endorse an existing Entry Permit.

Draft permits are illustrated in Appendices I (**Standard Entry Permit**), II (**Entry Permit for a Special Entry Area**) and III (**Entry Permit for Research and for the Collection of Biological and Archaeological Material**).

2. ADMINISTRATION

DEAT, being the management authority for the Prince Edward Islands in terms of Section 18 of the Environment Conservation Act (Act 73 of 1989), is responsible for the management of the Islands in accordance with the Act and with this Management Plan. Through its Chief Directorate: Sea Fisheries, **DEAT** is also responsible for managing the Marine Zone seaward of the low-water mark to the outer boundary of the Fishing Zone.

Policy

The objective of the administration policy is to provide the level of management necessary to achieve the stated objectives.

Implementation

The following actions are required to ensure that **DEAT** complies with, and correctly administers, the provisions of Section 18 of the Environment Conservation Act (Act 73 of 1989), the various provisions of the above.

- The Director General will control and manage the Islands in accordance with Section 18 of the Act (Act No. 73 of 1989), and with the full means at his/her disposal, ensure their maintenance, protection and preservation. This shall extend to the Marine Zone (see Section 18 below) in accordance with various provisions of the Sea Fishery Act (Act 12 of 1988) and the Seabirds and Seals Protection Act (Act 46 of 1973) identified in the Management Plan;

- The Director General will comply with the Management Plan and any amendments thereto;

- The Director General will appoint a Management Committee to oversee the implementation of the Management Plan. This committee will be known as the Prince Edward Islands Management Committee and will convene preferably under the chair of the Department's representative;

- The Prince Edward Islands Management Committee will advise the Director General on management matters and on any amendment required to the Management Plan;

- The Prince Edward Islands Management Committee will compile an annual situation report to the Director General. The report will be

submitted by 31 December each year. A situation report will be made public within three months of submission to the Director General;

- The Prince Edward Islands Management Committee will comprise a maximum of seven members who shall either be representatives of other government departments whose assistance is essential in the administration of the Islands, or individuals who, because of their familiarity with the Islands and/or their expertise, can provide valuable advice on the management of the Islands;

- The Chairman of the Prince Edward Islands Management Committee will have the right to co-opt the necessary expertise to the Management Committee and will serve on the Antarctic Management Committee (**AMC**);

- The Prince Edward Islands Management Committee will meet at least once per year. This meeting will be scheduled to be held sufficiently in advance of the annual relief voyage to the Islands to allow for review by the Committee of scientific proposals forthcoming from the South African Committee for Antarctic Research (**SACAR**), to enable Entry Permits to be issued and to ensure that the Management Committee's recommendations are reviewed by the **AMC**.

2.1 Day-to-day administration

The isolation of the Prince Edward Islands gives rise to special problems in the staffing and the day-to-day administration of the protected area. The Directorate: Antarctica and Islands co-ordinates the provision of all facilities and logistic support for personnel working on the Islands. Although the current system avoids self-serving value judgements, there is room for on-going improvement.

To ensure that the Management Plan is implemented and that the level of effective management action is enhanced, **DEAT** will appoint an officer to serve as "**Conservation Officer**" for the Islands. This Officer will be located in either the Directorate: Antarctica and Islands or the Directorate: Environmental Management of the Chief Directorate: Environmental Conservation. He will serve as an *ex officio* member and secretary of the Prince Edward Islands Management Committee. He shall also be familiar with the Islands and their conservation needs. **DEAT** will report to the Director General *via* the Prince Edward Islands Management Committee and the **AMC**.

The officer designated as "**Team Leader**" shall be the ultimate enforcement officer on the Islands. It will be the Team Leader's duty to ensure that all visitors comply with the conditions of their respective entry permits and that the activities of persons visiting or stationed on the Islands are controlled. It is also the Team Leader's responsibility to ensure that the policies of this Management Plan are complied with and that all infringements are timeously reported to the Directorate: Antarctica and Islands. In this context, the responsibilities of the team leader will be delegated to the "**Departmental Co-ordinator**" during takeover periods.

3. SUPPORT SERVICES

Policy

The objective of support services is to ensure cooperation within those agencies providing such services.

Implementation

All services provided should be consistent with the management objectives. Facilities on the Islands must be properly maintained and serviced. Meteorological, scientific and other activities should be supported and coordinated with the tasks essential for the management of the Islands.

The Directorate: Antarctica and Islands will co-ordinate a series of planning committees to ensure that all essential tasks are co-ordinated and harmonised, and that visits to the Islands are effective. A summary of final arrangements will be forwarded to the Prince Edward Islands Management Committee for comment. The Committee will then ensure that activities are consistent with the management objectives.

4. MANAGEMENT ZONES

Policy

The Islands will be demarcated into management zones in order to facilitate achievement of management objectives. Access to such zones will be restricted in accordance with their conservation status.

Implementation

It is desirable to demarcate the Islands for various activities in order to achieve the Plan's management objectives and to afford maximum protection to species and ecosystems, natural features and historic sites. Four zones can be identified to allow for the attainment of the management objectives. A fifth zone, the Marine Zone, is considered under Section 18.

4.1 Zone 1 - Service Zone

The objective of the Service Zone is to centralize support and administrative facilities in one area so as to minimize their impact on adjacent or nearby protected areas. This zone includes the area occupied by the present Base which has already undergone considerable modification. The Base is well established and well suited to support necessary scientific, meteorological and administrative programmes.

The Zone allows for the construction, removal/alteration and/or placement of necessary buildings, facilities and scientific/meteorological equipment to conduct approved research and management programmes, to house support staff and support facilities for personnel working in the protected areas. The construction or extension, alteration/removal of buildings, facilities and/or the placement of scientific or

meteorological equipment may only be carried out with the written approval of the Director General or his delegate acting, on the advice of the Management Committee.

Access to Zone 1 for re-supply and logistic purposes may be across the beach at Transvaal Cove or by means of helicopter or dinghy transfer from the supply ship. Under normal circumstances, daily access of persons to Zone 1 will be limited to numbers compatible with the Zone's conservation status. Such numbers will be determined by the **Departmental Co-ordinator** in consultation with **DEAT**. Overnight access, however, will be limited in strict accordance with the number of beds available to accommodate persons at the Base. For 1993/94, 64 beds were available.

The Prince Edward Islands Management Committee shall from time to time advise the Director General on the necessity of the construction or placement of equipment and on the necessity for an environmental impact assessment. Should an Environmental Impact Assessment be deemed necessary, the Management Committee will compile the brief and review the results of the assessment.

On the advice of the Management Committee, **DEAT** may exclude any area within the boundaries of the Service Zone from development or disturbance where it is thought necessary to protect wildlife or historic sites of special significance.

The Prince Edward Islands Management Committee will define the boundaries of Zone 1 and submit its proposals to the Director General for approval. On approval, the boundaries of the zone will be incorporated into this Management Plan.

4.2 Zone 2 - Natural Zone

This is a buffer zone between the Service Zone and Protected Area Zone. In this Zone, impact(s) will be carefully monitored and reported. Limited free walking in the area will be permitted and only development in accordance with the conservation status of the Zone will be allowed. The areas around each of the existing field huts will be zoned as Natural Zones. Should the huts be removed, their areas and environs will be re-zoned as Wilderness Zones.

The Prince Edward Islands Management Committee will define the boundaries of Zone 2 and submit its proposal to the Director General for approval. On approval the boundaries of the zone will be incorporated into this Management Plan.

4.3 Zone 3 - Wilderness Zone

The remainder of the Islands is demarcated as a Wilderness Zone, compatible with the high degree of protection afforded the Islands. Preservation of the natural resources and the character of the environment are the primary purposes of this Zone. The Zone is open to research which has been approved by the management authority, but is normally closed to general access by members of the take-over and management teams. The designated officer-in-charge may issue permits to "permanent" staff to undertake certain activities in the Wilderness Zone. Permits may also be issued for special activities such as the rehabilitation of particular site(s). The Prince Edward

Islands Management Committee will advise the Director General on the use of this Zone.

4.4 Zone 4 - Protected Zone (Special Entry Areas)

All areas/sites potentially sensitive to human interference are to be demarcated for special protection. The Prince Edward Islands Management Committee will make recommendations on these areas/sites to the Director General. A proposed zone plan is given in Fig. 3.

No development or establishment of structures, either temporary or permanent, will be allowed in Special Entry Areas. Visits to these areas will be strictly controlled and will be limited in number and duration. They will also require permits from the management authority. Normally entry will only be for scientific purposes and will be limited to the researcher and support personnel of projects approved by the management authority.

All Prince Edward Island is demarcated as a Zone 4 - Protected Zone and all entry is prohibited subject to a Special Permit being issued by the Director General.

5. INFRASTRUCTURE

The construction of any facility must be carefully handled and facilities should be kept to the absolute minimum to support only those activities considered necessary for research and management.

Policy

The policy on infrastructure has a variety of objectives. These are:

- To maintain properly existing facilities and structures and to permit the provision of new structures (including alteration/removal of old structures) and facilities necessary for the proper management of the Islands;

- To ensure that all development is confined to the appropriate management zone;

- To ensure that all facilities and structures are located where they will not cause undue disturbance to plants, animals or natural processes;

- To ensure that all facilities and structures are located where they will not cause any disturbance to historic sites;

- To ensure that all structures and facilities will be located and designed so as not to impact on the visual and aesthetic qualities of the Islands, and

- To ensure that all redundant facilities and structures are removed and the sites rehabilitated as far as feasible to a pristine state.

Implementation

Environmental Impact Assessments (**EIA**) will be conducted for any new development. An **EIA** procedure will be established by the Prince Edward Islands Management Committee and after review will be recommended to the Director General.

A survey will be conducted by the Directorate: Antarctica and Islands and the Chief Directorate: Environmental Conservation on the adequacy of all facilities on the Islands. A long-term development plan will then be recommended to the Director General.

As far as possible, all redundant buildings and structures will be removed and all sites will be rehabilitated (but also see Section 12).

5.1 Camping

Permission may be granted for research workers to erect a tent or temporary structure in the Protected Area if this will be of assistance in conducting the approved study/project. All applications for such structures will be submitted to the Directorate: Antarctica and Islands at least four months prior to a relief voyage. If permission is granted, stringent precautions must be taken to ensure that equipment is free from any organisms which could be accidentally introduced to the Islands. All camping equipment will be fumigated before being allowed onto the Islands. The **Conservation Officer**, or as represented on the Islands in his/her absence by the **Departmental Co-ordinator**, will be responsible for ensuring that all camping equipment is adequately sterilised. The **Conservation Officer** will issue a permit to this effect.

6. WASTE AND SEWAGE DISPOSAL

Definition

For the purpose of this Management Plan, the term "waste" shall normally only refer to waste material which has accumulated due to human activities on the Islands since 1948. All materials deposited on the Islands prior to 1948 shall be considered to have historical interest and will be managed in terms of the policy set out in Section 12.

Policy

The objectives of the waste and sewage disposal policy are:

- To ensure that activities at the Prince Edward Islands do not lead to undue, unsightly or irreversible pollution, marring of the environment or to the building up of waste or debris on the Islands;

- To remove all non-biodegradable waste in a way which does not modify or endanger the natural ecosystems, and

- To prohibit the lighting of exposed fires for waste disposal.

6.1 Old waste disposal sites

Old waste disposal sites will be cleared of all surface waste, after a decision has been made on whether the sites have archaeological significance or not. Native vegetation will be used to rehabilitate all disturbed areas in accordance with a rehabilitation plan approved by the Prince Edward Islands Management Committee.

6.2 Waste reduction

In transporting materials and equipment to the Islands, **DEAT** will make every effort to minimise the amount of potential waste material. Every effort will be made to avoid the use of plastic packing materials when transporting materials and equipment to the Islands. Where the use of these materials is essential, the material will be returned to South Africa for reuse or disposal at approved disposal sites.

Polystyrene beads and other small pieces of plastic material are not permitted as packaging material.

Appropriate waste material will be burnt in a high-temperature incinerator located at the Base. The incinerator will be equipped with the necessary scrubbers to reduce any polluting effects. Residual ash, together with non-combustible materials (glass, metals, building material) as well as all plastic material, will be returned to South Africa for disposal at approved disposal sites at the earliest opportunity.

6.3 Waste oils and fuels

All waste oils and fuels will be suitably containerized on the Islands and returned to South Africa at the earliest opportunity.

6.4 Radioactive material

The use of radioactive material in the Protected Area must be authorized in writing by **DEAT** in accordance with Atomic Energy Board and Department of Health regulations. The attached entry permit is to be endorsed accordingly.

No radioactive waste material may be deposited on the Islands or within surrounding marine waters. All radioactive waste will be returned to South Africa for disposal at approved disposal sites. No radioactive material will be left on the Islands for use at a later stage.

Packaging of all radioactive material shall be in accordance with the instructions issued on the permit and in accordance with any instruction issued by the captain of the supply vessel.

The officer or researcher responsible for the radioactive material will submit a full report on material used and returned to South Africa within 14 days of his return to the country.

6.5 Sewage disposal

The current system of sewage and domestic liquid disposal is unsatisfactory. A suitable system will be investigated and installed at the Islands by mid-1994. The Directorate: Antarctica and Islands and the Chief Directorate: Environmental Conservation will investigate a suitable sewage disposal system and report to the Director General by not later than 30 June 1996.

6.6 Chemical and meteorological wastes

Hydrogen gas produced by an electrical generator is used for meteorological studies. This generator occasionally malfunctions, necessitating the use of a back-up system which relies on the chemical reaction between sodium hydroxide (caustic soda) and aluminium pellets to generate hydrogen gas. This back-up method is tested at least once per month.

Waste produced from the chemical reaction has been channelled into a small water reservoir below the upper-air laboratory. This system of waste disposal was terminated during the 1993 take-over and waste produced by the back-up method is now containerized and returned to South Africa for disposal at an approved disposal site.

All waste chemicals from laboratories (e.g. photographic waste) will be containerized and returned to South Africa for disposal at an approved disposal site.

6.7 Poultry produce

Given the large population of birds on the Islands, the introduction of avian diseases is a potential hazard of some concern. Avian diseases such as Newcastle Disease can be transmitted to birds by feeding them poultry produce. Consequently:

- All poultry produce, including eggs, taken to the Island shall be irradiated;
- No poultry produce which has been taken to the Islands shall be fed to the local avifauna and all waste material must be properly incinerated;
- No poultry produce may be taken to Prince Edward Island, and
- No poultry produce, including eggs, from the supply vessel may be deposited in the Marine Zone (see Section 18). All waste poultry produce, including eggshells, will be returned to South Africa for disposal.

Wherever applicable, respective responsibility for ensuring that these various provisions are adhered to shall rest with **DEAT**, the **Conservation Officer**, the **Master** of any South African vessel supplying the Islands or working in their waters, the **Departmental Co-ordinator** or the **Team Leader**.

6.8 Kitchen waste

Food scraps must be incinerated.

All waste produced in the kitchen area must be separated into the following five categories:

- **Food:** to be incinerated by closed incineration
- **Cans:** to be crushed and packaged for return to South Africa where they will be disposed of at an approved disposal site (includes all metal containers)
- **Glass:** to be suitably packaged for return to South Africa where it will be disposed of at an approved disposal site
- **Paper:** to be incinerated (including cardboard)
- **Plastic:** to be returned to South Africa and disposed of at an approved disposal site.

6.9 Marking of waste material for return to South Africa

All containers containing waste material for return to South Africa will be fully marked in a manner to be prescribed by the Directorate: Antarctica and Islands and in accordance with any instruction issued by the ship's captain.

6.10 Quarantine regulations

All biological material, animal and plant specimens, soil, water and geological samples may be subject to quarantine regulations upon entry to South Africa. It is the responsibility of the research worker or project supervisor to ensure that the necessary veterinary or quarantine control permits have been obtained prior to embarking for the Islands. Copies of permits must be lodged with the Directorate: Antarctica and Islands. Collections will not be allowed without a valid permit. Removal of collected items will also be subject to the possession of a valid collecting permit (see Section 13).

7. FUEL SUPPLY AND STORAGE

Bulk fuel may only be stored at the Marion Island Base for the purpose of running the facilities and heating the buildings and for conducting any of the permitted activities. No more than 18 months' estimated requirements of fuel may be stored at any one time.

Details of any spillage of bulk fuels, whether during transfer or storage must be reported to **DEAT** immediately. The report must contain details of the type of fuel, quantity and any corrective measures taken, as well as the obvious initial impact on wildlife and the environment. The staff present on the Island shall immediately establish a monitoring programme to assess the effects of the spill on the wildlife and the environment. The scope, duration and reporting of such a programme will be determined by the Prince Edward Islands Management Committee.

An oil spill contingency plan will be set in place for the Protected Area and this will be drawn up by **DEAT** in consultation with the Management Committee.

7.1 Ship to shore transfer

The utmost care must be taken to avoid spillage during fuel transfer operations.

7.2 Storage

Bulk fuel must be stored in properly constructed fuel tanks which are situated in a storage area surrounded by a containment structure capable of retaining any accidental spillage from the tanks.

Where fuels are stored at field huts or other sites outside of the Service Development Zone (Zone 1), storage must be confined to stainless steel or other corrosion-proof containers.

8. VEHICLE, BOAT AND AIRCRAFT USE

To limit disturbance, the use of mechanized transport on, and around, the Islands must be strictly regulated and monitored. Potential disturbance to wildlife will be at a maximum when animals are confined to breeding colonies. Proper timing of such activities as field hut re-supply is essential to minimize any possible disturbance.

Policy

The objectives of the policy for the use of mechanised transport are:

8.1 Land vehicles

The use of motorized vehicles on the Islands is prohibited.

8.2 Amphibious craft

Amphibious craft and boats may land to re-supply the main facilities in the Base area as well as on the beaches close to field huts for re-supply and waste removal, provided that breeding colonies of birds and seals are not disturbed.

8.3 Aviation operations

Helicopters are prohibited from landing on the Islands except for search and rescue operations, for the gathering of scientific information, during re-supply and waste removal or for any operation which promotes the proper management of the Islands. All the necessary precautions are to be taken not to disturb or endanger plant and animal life. In this regard, low flying over animal colonies, especially those of breeding birds and seals is strictly prohibited. No helicopter shall land within 200 m of any colony of animals (see also Appendix VII). No helicopter shall be permitted to land in a Special Entry Area. The **Departmental Co-ordinator** shall, with the full sanction of **DEAT**, be responsible for ensuring that aviation operators abide by the above provisions.

8.4. Airdrops

Airdrops may be carried out only with prior written permission of **DEAT** in accordance with the provisions attached as Appendix VII.

8.5 Search and rescue

Helicopters, fixed-wing aircraft and amphibious craft may be used to carry out necessary search and rescue operations without prior permission of the management authority, including in the Special Entry Areas and Prince Edward Island, where a ship-based landing is not feasible. A full report of circumstances must be forwarded to **DEAT** within 30 days. During a search and rescue operation, every effort should be made to minimize disturbance of natural features and objects, plants and animals.

9. TOURIST AND NON-STUDY VISITS

The continued preservation of the natural ecosystems of the Prince Edward Islands is considered to be a principle benefit of their judicious management. Public interest is also served by other measures in this Plan designed to disseminate information about the Islands.

In terms of the Environment Conservation Act, 1989 visits other than for research and management are prohibited. Moreover, facilities on the Islands are limited and are sufficient only for those persons engaged in official meteorological, research and management activities. At present it is necessary to devote all available resources, including domestic facilities and search and rescue services, to the conduct of official meteorological, research, maintenance and management activities.

<u>Policy</u>

The admission policy to the Islands serves to regulate visits to the Islands to ensure protection of natural features, ecosystems and cultural values.

Implementation

At present no tourism, either ship- or land-based, is envisaged for the islands. Non-study visits will be considered on merit and *bona fide* educational visits will be encouraged (see also Section 19). The Prince Edward Islands Management Committee will advise the Director General on any proposed visit to Marion Island and on the potential development of tourism to the Islands as a whole.

10. IMPORTATION OF PLANT AND OTHER MATERIAL

All alien plants, animals and other organisms pose a threat to indigenous fauna and flora on the Islands.

Policy

The importation of plant and other material to the Islands is prohibited as follows:

- No plant or animal may be taken onto the Islands;
- No cats, dogs or any other pets or domestic animal may be kept on the Islands, except for management purposes at the discretion of the Director General, and
- No horticultural activity may be undertaken on the Islands.

Implementation

No domestic pets will be allowed on the Islands.

Organic material and ornamental plants will not be permitted on the Islands. Fresh vegetables of the Brassicacae family, such as cabbages, cauliflowers, broccoli and Brussels sprouts will not be permitted on the Islands. The diamond backed moth may have been transported to the Marion Island in one of these vegetables.

Because of the danger of introducing potentially dangerous invasive organisms in the treads of vehicle/helicopter tyres or on other field equipment, such items will be fumigated with methyl bromide, hosed down or scrubbed as appropriate before being transported to the Islands.

Construction material (e.g. soil, stone and cement) required for building should be sealed in suitable packages and sterilised before being transported to the Islands. The **Conservation Officer** and **Departmental Co-ordinator** will be responsible for ensuring that adequate sterilisation is undertaken and tested. The **Conservation Officer** will also issue a certificate stating that said sterilisation is satisfactory.

11. RESEARCH

Scientific knowledge of the Prince Edward Islands is essential for their effective management. It provides the necessary understanding of natural processes and human influences in, and adjacent to, the Islands. The Islands exhibit tremendous natural heritage value and every effort should be made to ensure that wildlife populations and historic resources remain intact and unmodified.

Policy

The research policy serves to ensure that scientific research is conducted in such a manner as to:

- Assure protection of the natural ecosystems and mitigate against lasting changes in indigenous wildlife populations or community relationships;

- Avoid conflict with essential management operations;

- Prohibit the collection of specimens except where this is specifically approved and justified as part of scientific research or necessary for management purposes, and

- Arrange, facilitate and support a programme of scientific research necessary for better management of the Islands.

Implementation

Applications for scientific research should normally be submitted to the Department at least nine months prior to the commencement of any voyage or visit. Applications for such research must be submitted on a SACAR 1 form which can be obtained from the Directorate: Antarctica and Islands.

All research proposals will be evaluated by **SACAR** and its relevant Task Groups. Subsequent to **SACAR's** process of peer-review and scientific evaluation, such proposals shall then be forwarded to the Prince Edward Islands Management Committee which will then formulate recommendations to the **AMC** on the management implications. Both the Director General and the **AMC** may also refer projects to **SACAR** and the Prince Edward Islands Management Committee for independent evaluation and advice.

On approval of a project and/or programme the researcher and/or institution will be required to enter into a contract with **DEAT**.

All scientific collections remain the property of the State and will be curated at a recognized institution. A detailed report on collections undertaken on the Islands must be lodged with the Director General within 30 days of an expedition's return to South Africa. Copies of all reports (unpublished and published) of field activities must be submitted to the Director General within 30 days of the expedition's return to

South Africa. The responsibility for compiling these reports shall rest with the **Chief Scientist** on the Island.

A detailed report is to be submitted to the Director General within three months of the expedition's return. This report must detail achievements, specimens collected, research analyses, proposed publications, management recommendations and other information relevant to management. The **Departmental Co-ordinator** is responsible for this report.

Annual progress reports on research activities must be submitted by the **Project Leader** to the Director General, the Prince Edward Island Management Committee and **SACAR** by 30 June each year. Re-entry permits will only be issued to the researcher and/or institution on completion of a satisfactory annual progress report. The **Project Leader** will also submit a final research report to the Director General by 31 March of the final year of completion of the project. Where appropriate, these should also be submitted to **SACAR** for review and evaluation. **SACAR** will advise the **AMC** accordingly.

12. HISTORICAL CONSERVATION

Sites and elements of historical interest are found along much of the coastline of the Prince Edward Islands. All have suffered over the years to a greater or lesser extent not only from natural causes, but also from human interference, both accidental and deliberate. Cooper and Avery (1986) have collated the results of a workshop held under the auspices of SASCAR. Their report documents all the then known historical sites on the Prince Edward Islands from the early 19th century to the time of annexation. Cooper and Avery (1986) also made recommendations on research needs and the required protection of historical sites. More recently, a preliminary survey of the cultural resources of the Islands has been undertaken and recommendations for their protection as well as suggestions for research topics made (Graham 1989).

Policy

The historical conservation policy aims to record and preserve in an appropriate manner those sites or objects which have cultural and/or historic significance.

Historical and archaeological research on the Prince Edward Islands will thus be authorized by permit only when it does not adversely affect natural ecosystems and/ biota.

Implementation

All archaeological sites older than fifty years are protected under the National Monuments Act, 1969 (Act No. 28 of 1969) and their destruction or disturbance is prohibited. The **Team Leader** shall report any contravention of the Act to the Director General.

DEAT will initiate an archaeological survey and cataloguing of site material and site distributions. This survey will recommend the necessary action to ensure the preservation of historic elements and sites. The South African Cultural History

Museum has been appointed by the Department as official custodian of all artifacts that had already been removed or which might be removed from the Islands. This arrangement will be maintained for the foreseeable future.

The Director General will, on the advice of the South African Cultural History Museum, authorize the collection and return to continental South Africa for conservation, artifacts discovered by field parties where it can be shown that without retrieval, serious damage or loss thereof may occur.

13. PROTECTION AND MANAGEMENT OF FLORA AND FAUNA

Policy

The objective of protection and management of flora and fauna is to ensure the protection, survival and biological diversity of the Islands' indigenous plant and animal taxa.

The indigenous biota of the Prince Edward Islands form a unique assemblage of plants and animals adapted to conditions in the Subantarctic. This assemblage is the result of dispersal, community interactions and environmental conditions that have occurred to date. There has been depletion by human activity of indigenous plant and animal populations and the Management Plan aims to halt this trend as far as possible. Specific policies are given in the various sub-sections below.

Implementation

In keeping with the management objectives, the Director General will encourage research programmes on the biology of indigenous and alien flora and fauna found on the Islands and where necessary fund such research .

Where research indicates, and **DEAT** considers it necessary, management programmes will be developed and implemented to ensure the protection of the indigenous, and/or control/eradication of alien, species. Every effort will be made to prevent further introduction of alien species.

Also whenever necessary, **DEAT** will establish liaison with biology and environmental departments at various universities and museums, state departments and with individual experts to seek advice and assistance as required. These agencies and individuals may be co-opted to the Prince Edward Islands Management Committee for the necessary period. **DEAT** will also make use of such relevant expertise and/or advice that is forthcoming from **SACAR**.

This Management Plan will follow the **General Rules of Conduct for the Preservation and Conservation of Living Resources in Antarctica**, the Articles of the **Agreed Measures for the Conservation of Antarctic Fauna and Flora of the Antarctic Treaty** (Appendix V), measures related to the Agreed Measures and relevant Conservation Measures promulgated under the **Convention on the Conservation of Antarctic Marine Living Resources** (Appendix VI).

In accordance with above the provisions, the Director General will issue a Collection Permit (Appendix IV) to a recognised authority or individual granting permission for, and setting out condition(s) attached to, the collection of specimens/samples at the Islands for educational or scientific purposes. The Director General may seek the advice of both **SACAR** and the Prince Edward Islands Management Committee as to the conditions to be stipulated in such a Permit.

14. CONTROL OF INTRODUCED PLANTS AND ANIMALS

It is thought that a total of 34 non-marine aliens presently occur on the Islands. This total is made up of 10 vascular plants, 23 macro-invertebrates and one mammal species.

Policy

The control of introduced plants and animals aims to eradicate alien plants and animals as far as possible on the Islands (where this can be achieved without undue disturbance or damage to indigenous taxa or natural features).

Specific sub-objectives are:

- To eradicate all feral cats on Marion Island;
- To eradicate all alien plants where possible and to elucidate the ecological impact arising from the introduction of alien plant populations to Marion Island and to make recommendations for their control;
- To elucidate the ecological impact arising from the introduction of the House Mouse *Mus musculus* population to Marion Island and to make recommendations for its control;
- To elucidate the ecological impact of introduced macro-invertebrates and to make recommendations for their control, and
- To ensure that all control methods which are employed are ecologically safe and do not create a permanent adverse impact on the Islands and their biota.

Implementation

In keeping with the management objectives, the Director General will encourage research programmes on the biology of alien flora and fauna found on the Islands and where necessary fund such research.

Where research indicates, and **DEAT** considers it necessary, management programmes will be developed and implemented to ensure control or eradication of alien species. Every effort will be made to prevent further introduction of alien species.

Also where necessary, DEAT will establish liaison with biology departments at various universities and museums, state departments and with individual experts to seek advice and assistance as required. These agencies and individuals may be co-opted to the Prince Edward Islands Management Committee for the necessary period. The management authority will also make use of such relevant expertise and/or advice that is forthcoming from SACAR.

15. PREVENTION OF INTRODUCTION OF NEW ALIEN SPECIES

From both a scientific and ecological perspective, it is imperative that every effort be made to prevent any further accidental introductions of alien species.

Policy

The objectives of alien control are to prevent the introduction of any new species of plants or animals to the Islands. Movement between Marion and Prince Edward Islands must therefore be minimized and no human-induced, genetic interchange between the two Islands is allowed.

A secondary objective is to embark promptly on effective extermination programmes when new alien species are discovered. All eradication methods should be ecologically safe.

Implementation

DEAT may require that any packing and materials, equipment, vehicles, vessels/helicopters, and foodstuffs, whether for scientific or personal use, be suitably cleaned, fumigated and/or irradiated and inspected before arriving on the Islands.

Waste foodstuffs, plants or plant material which may germinate or sprout, must either be incinerated, removed from the Islands or disposed of in a way previously approved of by DEAT.

DEAT requires that any vessel visiting the Islands is certified free of rodents. No wharves or mooring facilities will be constructed on the Islands. Any mooring directly onto the land will be prohibited. Vessels must be anchored at least 200 m from the Islands, except when pumping fuel ashore or where written permission to anchor closer for scientific and management purposes is granted by DEAT. When moored at any harbour, vessels likely to visit the Islands shall be fitted with rat guards on all mooring lines. The fitting of guards and the certification thereof shall be the responsibility of Marine Branch of the Chief Directorate: Sea Fisheries of DEAT.

16. RELEASE OF REHABILITATED INDIVIDUALS OF INDIGENOUS SPECIES

Policy

The objective is to prohibit the release of rehabilitated indigenous species to the Islands, unless considered necessary for conservation purposes (see Section 17 below).

17. CONTROLLED REMOVAL OF ENDANGERED SPECIES

Policy

The objectives of controlled removal, propagation and restoration of endangered species are to permit the removal of any plant or animal where this is considered necessary for species or sub-species survival and where there is no threat to other taxa.

Implementation

If the need should arise, the propagation and breeding of the Islands' endangered species will be encouraged provided that ecological restoration is feasible and if conditions permit. No habitat manipulation that may interfere with natural processes will be permitted.

18. MARINE ZONE

Policy

The objective is to afford protection to all fish species and aquatic plants within the Marine Zone around the Islands seaward from the low-water mark to the outer boundary of the Fishing Zone (i.e. 200 nautical miles). Said protection is to be in accordance with the provisions of the Sea Fishery Act, 1988 (Act 12 of 1988).

Implementation

Access to the Marine Zone will be controlled in accordance with Section 33(3) and Part IX of the Sea Fishery Act (Act 12 of 1988). The Director General will be responsible for issuing permits and setting out the conditions to be applied with respect to the protection of fish and collection of aquatic plants in the Marine Zone; including the granting of exemption in respect of specific quantities of fish caught for a specified purpose. The Director General will be advised accordingly by the Prince Edward Island Management Committee and the Chief Directorate: Sea Fisheries.

Protection of seabirds and seals in the Marine Zone as well as on the Islands will be afforded by Section 2 of the Seabirds and Seals Protection Act (Act 46 of 1973). Exemption from the provisions of this Act for the Marine Zone may be granted at the discretion of the Director General in accordance with Section 3 of the Act. In granting such exemption, the advice of the Prince Edward Islands Management Committee and the Chief Directorate: Sea Fisheries would again be sought.

19. INFORMATION AND EDUCATION

Every effort will be made to ensure that the activities of all persons visiting the Islands are in keeping with the principal management objectives. Human activities will remain secondary to, and compatible with, the preservation function of the Protected Area. Continued monitoring of the effects of human use on the environment and wildlife will be maintained.

Policy

The education policy aims to ensure that all persons visiting the Islands are aware of and appreciate the natural and historic features of the Islands as well as their ecological significance.

Implementation

DEAT accepts that access to the Islands and facilities thereon is at the discretion of the Director General. The staff of the Directorate: Antarctica and Islands and the **Team Leader**, however, are required to ensure that all visitors/scientists take the same precautions, especially with regard to the introduction of rodents, other animals and plants.

The Directorate: Antarctica and Islands will undertake the necessary training of all first-time visitors to the Islands. Where a research worker employs a support technician and where it is impossible for this technician to attend a training course, it is the responsibility of the researcher to ensure that the support person is fully trained and conversant with the Management Plan and Code of Conduct that emanates therefrom.

The Directorate will submit a training plan to the Prince Edward Islands Management Committee for comment and recommendation to the Director General.

All entries to the Islands will be controlled by permit and all persons will be made aware of their responsibilities for the protection of the Islands. All visitors will be informed of the activities and conduct permitted on the Islands. The **Team Leader** will be the ultimate enforcement officer when no Departmental **Conservation Officer** is present.

All visitors to the Islands will be required to undergo a prior medical examination and to be cleared as healthy to the satisfaction of the Director General.

All persons entering the Protected Area will be provided with a Code of Conduct based on this Management Plan.

20. INFORMATION TO THE SOUTH AFRICAN PUBLIC

It is recognized that access to the Prince Edward Islands is difficult and that the number of visitors to the Islands will be small. Since few members of the general public are likely to ever visit the Islands, it is important that the Department actively promote an interpretive programme to provide information about the Islands and their history. This programme should highlight the Islands' national and international ecological importance, inform the public of potential threats to the Islands and the management measures necessary to ensure their protection. The reasons for restricting visits to the Islands must also be explained.

Public awareness of the Prince Edward Islands and its fauna and flora should be encouraged. It is recognized that the South African public should be kept informed of all activities concerning the management of the Islands.

Policy

The information policy aims to:

- Ensure public awareness and appreciation of the natural and historic features of the Islands as well as their ecological significance, and

- Inform the South African public of research and management activities being undertaken on the Islands.

Implementation

DEAT will commence and maintain an active media campaign insofar as this does not conflict with the management objectives. It will publicize activities being conducted on the Islands at appropriate opportunities and venues. All research workers will be encouraged to produce popular articles for publication in suitable media. As far as resources permit, interpretive literature and video material *via* television, etc. will be prepared and distributed periodically.

Interesting events, management aspects and research findings will be communicated to the South African public on an ongoing basis.

21. INTERNATIONAL COOPERATION

Policy

The aims of international cooperation are:

- To seek and maintain contact with all agencies operating at other Subantarctic Islands and in the Southern Ocean;

- To cooperate with agencies operating at other Subantarctic Islands and in the Southern Ocean, and

- To exchange scientific data and information where this will improve understanding of Subantarctic and Southern Ocean ecosystems.

Implementation

DEATwill, where possible, participate in and encourage participation in all relevant international fora and meetings concerning Subantarctic Islands, taking cognisance of budgetary constraints. This will also allow for approved research at Marion Island by visiting scientists from other countries.

22. MONITORING AND REVISION OF MANAGEMENT PLAN

Policy

The Management Plan will be monitored and whenever necessary periodically revised in order to ensure its relevance to current situations. A comprehensive review of the Plan will be undertaken at five-year intervals.

As knowledge about the Islands expands and circumstances change, it will be necessary to review existing policies. It will also be necessary to implement new policies to maintain the Plan's utility and effectiveness as a management tool. Changes in the management philosophies of national and international protected areas will require ongoing evaluation of the overall management approach.

Implementation

The Prince Edward Islands Management Committee will advise the AMC on any necessary amendments to the Management Plan. The AMC will advise the Director General accordingly.

The Management Plan will be subjected to a full and comprehensive review and revision at five-year intervals (if necessary) after initial approval by the Director General.

23. AVAILABILITY OF MANAGEMENT PLAN

The Management Plan will be considered a public document and will be made available on request to the Director General.

24. REFERENCES

COOPER J & AVERY G (1986) Historical sites at the Prince Edward Islands. *S. Afr. Nat. Sci. Prog. Rep.* 128: 1-82.

GRAHAM T (1989) Cultural resource management of the Prince Edward Islands. *BA Hons Diss.* Department of Archaeology, University of Cape Town, Rondebosch. 85 pp.

APPENDIX 1

PRINCE EDWARD ISLANDS

STANDARD ENTRY PERMIT

Pursuant to the provisions of Section 18 of the Environment Conservation Act *(Act 73 of 1989)* and the provisions of the Prince Edward Islands Management Plan, permission is hereby granted to

..... of the ..... to enter onto Marion and/or the Prince Edward Islands during the period; ..... to....., subject to the following conditions.

1. This permit is valid for zones 1 and 2 as indicated on the attached map.

2. This permit does not authorize entry to any of the Special Entry Areas as designated on the attached map.

3. This permit does not authorize the collection of any wildlife or parts thereof, plants, relics or objects, including rocks.

4. The utmost care is to be exercised to minimize the disturbance to the habitat and the environment at all times.

5. This permit does not authorize the wilful disturbance of any wildlife.

6. While on the Island, the permit holder is under the control of the Officer-in-Charge and will obey any instruction issued to him or her.

7. This permit may be revoked by notice in writing by the Director General of the Department of Environmental Affairs and Tourism or any person to whom he has delegated such authority.

Date of issue:.....

DR C M CAMERON
DIRECTOR-GENERAL: ENVIRONMENTAL AFFAIRS AND TOURISM

APPENDIX II

ENTRY PERMIT FOR A SPECIAL ENTRY AREA

Pursuant to the provisions of Section 18 of the Environment Conservation Act (Act 73 of 1989) and the provisions of the Prince Edward Islands Management Plan of 1994, permission is hereby granted to

..... of .....
.....

to enter onto Marion Island or Prince Edward Island during the period;

..... to .....

subject to the following conditions.

1. This permit authorizes entry to The Special Entry Areas as indicated;

a. Entry is permitted on ..... occasion(s) for ..... days within the period ..... to ..... into the area known as .....

b. Entry is permitted on ..... occasion(s) for ..... days within the period ..... to ..... into the area known as .....

c. Entry is permitted on ..... occasion(s) for ..... days within the period ..... to ..... into the area known as .....

d. Entry is permitted on ..... occasion(s) for ..... days within the period ..... to ..... into the area known as .....

2. This permit does not authorize the collection of any wildlife, plants, relics or objects, including rocks.

3. The utmost care is to be exercised to minimize the disturbance to the habitat and the environment at all times.

4. This permit does not authorize the wilful disturbance of any wildlife.

5. While on the Island the permit holder is under the control of the officer in charge and will obey any lawful and reasonable instruction issued to him or her.

6. This permit may be revoked by notice in writing by the Director General of the Department of Environmental Affairs and Tourism or any person to whom he/she has delegated such authority.

Date of issue:.....

Issued by:.....
for DIRECTOR GENERAL ENVIRONMENTAL AFFAIRS AND TOURISM

APPENDIX III

PRINCE EDWARD ISLANDS

RESEARCH PERMIT

Pursuant to the provisions of Section 18 of the Environment Conservation Act *(Act 73 of 1989)* and the provisions of the Prince Edward Islands Management Plan, permission is hereby granted to

..... of ..... to enter onto Marion and/or the Prince Edward Islands during the period ..... to ..... for scientific study purposes and/or to undertake scientific studies on ..... as specified on the SACAR I (1996/97) project proposal, subject to the following conditions.

1. This permit authorize entry to zones 1, 2 and 3 as designated on the attached map or as indicated by the Officer-in-Charge of the Islands. To conduct scientific studies in any of the Special Entry Areas the permit holder must also be in possession of an Entry Permit For Special Entry Areas (zone 4).

2. This permit does not authorize the collection of any wildlife or parts thereof, plants, relics or objects, including rocks, except those specified on the collection permit.

3. A full report of the results of the activities authorized by this permit must be forwarded to the Director General, showing species and numbers collected, as well as the place of lodgement of the collection, within 30 days, following the expiry of this permit.

4. This permit may be revoked by notice in writing by the Director General of the Department of Environmental Affairs and Tourism or any person to whom he/she has delegated such authority.

5. Close liaison must be maintained with the Department's representative on the Island.

This authority is valid for the period .....to ....., unless earlier revoked by notice in writing by the Director General.

Date of issue:.....

DR C M CAMERON
DIRECTOR GENERAL: ENVIRONMENTAL AFFAIRS AND TOURISM

APPENDIX IV

PRINCE EDWARD ISLANDS

COLLECTION PERMIT

Pursuant to the provisions of Section 4(1) of the Sea Bird and Seals Protection Act, 1973 *(Act 46 of 1973)*, the provisions of Section 33(3) of the Sea Fishery Act, 1988 *(Act 12 of 1988)* and the provisions of the Prince Edward Islands Management Plan, permission is hereby granted to

..... to enter onto Marion and/or the Prince Edward Islands during the period ..... to ..... to collect and possess .....

subject to the following conditions.

1. The individual(s) to whom this permit is issued shall demonstrate to the Director General an acceptable familiarity with the relevant provisions of the Sea Birds and Seals Protection Act *(Act 46 of 1973)*, the Sea Fishery Act *(Act 12 of 1988)*, the Prince Edward Islands Management Plan, the Convention on the Conservation of Antarctic Marine Living Resources of 1980, the Convention for the Conservation of Antarctic Seals of 1972 and the Agreed Measures for the Conservation of Antarctic Fauna and Flora of 1964.

2. This permit does not authorize the collection of any wildlife or parts thereof, plants, relics or objects, including rocks, not specified on this permit.

3. None of the material collected is to be made available to private individuals for private collections.

4. Collection is to be kept to the absolute minimum and the utmost care is to be exercised to minimize any disturbance to fauna, the habitat and the environment.

5. All materials collected will be lodged with a recognized institution and made available for study purposes when required, unless destroyed due to scientific analyses.

6. A full report of the results of the activities authorized by this permit must be forwarded to the Director General, showing species and numbers collected, as well as the place of lodgement of the collection, within 30 days, following the expiry of this permit.

7. This permit may be revoked by notice in writing by the Director General of the Department of Environmental Affairs and Tourism or any person to whom he/she has delegated such authority.

8. Close liaison must be maintained with the Department's representative and the Chief Scientist on the Island.

This authority is valid for the period *24 April 1996* to *30 May 1996* unless earlier revoked by notice in writing by the Director General.

Date of issue:.....

DR CM CAMERON
DIRECTOR GENERAL: ENVIRONMENTAL AFFAIRS AND TOURISM

APPENDIX V

AGREED MEASURES FOR THE CONSERVATION OF ANTARCTIC FAUNA AND FLORA

Preamble

The Governments participating in the Third Consultative Meeting under Article IX of the Antarctic Treaty,

Desiring to implement the principles and purposes of the Antarctic Treaty;

Recognizing the scientific importance of the study of Antarctic fauna and flora, their adaptation to their rigorous environment, and their inter-relationship with that environment;

*Considering*the unique nature of these fauna and flora, their circum-polar range, and particularly their defencelessness and susceptibility to extermination;

Desiring by further international collaboration with the framework of the Antarctic Treaty to promote and achieve the objectives of protection, scientific study, and rational use of these fauna and flora; and

Having particular regard to the conservation principles developed by the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions;

Hereby considers the Treaty Area as a Special Conservation Area and have agreed on the following measures.

Article I
[Area of Application]

1. These Agreed measures shall apply to the same area to which the Antarctic Treaty is applicable (hereinafter referred to as the Treaty Area) namely the area south of 60° South Latitude, including all ice shelves.

2. However, noting in these Agreed measures shall prejudice or in any way affect the rights, or the exercise of the rights, of any State under international law with regard to the high seas within the Treaty Area, or restrict the implementation of the provisions of the Antarctic Treaty with respect to inspection.

3. The Annexes to these Agreed Measures shall form an integral part thereof, and all references to the Agreed Measures shall be considered to include the Annexes.

Article III
[Definitions]

(a) "Native mammal" means any member, at any stage of its life cycle, of any species belonging to the Class Mammalia indigenous to the Antarctic or occurring there through natural agencies of dispersal, except whales.

(b) "Native bird" means any member, at any stage of its life cycle (including eggs), of any species belonging of the Class Aves indigenous to the Antarctic or occurring there through natural agencies of dispersal.

(c) "Native plant" means any kind of vegetation at any stage of its life cycle (including seeds), indigenous to the Antarctic or occurring there through natural agencies of dispersal.

(d) "Appropriate authority" means any person authorised by a Participating Government to issue permits under these Agreed Measures. The functions of an authorised person will be carried out within the framework of the Antarctic Treaty. They will be carried out exclusively in accordance with scientific principles and will have as their sole purpose the effective protection of Antarctic fauna and flora in accordance with these Agreed Measures.

(e) "Permit" means a formal permission in writing issued by an appropriate authority as defined in paragraph (d) above.

(f) "Participating Government" means any Government for which these Agreed Measures have become effective in accordance with Article XIII of these Agreed Measures.

Article III
[Implementation]

Each Participating Government shall take appropriate action to carry out these Agreed Measures.

Article IV
[Publicity]

The Participating Governments shall prepare and circulate to members of expeditions and stations information to ensure understanding and observance of the provisions of these Agreed Measures, setting forth in particular prohibited activities, and providing lists of specially protected species and specially protected areas.

Article V
[Cases of extreme emergency]

The provisions of these Agreed Measures shall not apply in cases of extreme emergency involving possible loss of human life or involving the safety of ships or aircraft.

Article IV
[Protection of native fauna]

1. Each Participating Government shall prohibit within the Treaty Area the killing, wounding, capturing or molesting of any native mammal or native bird, or any attempt at any such act, except in accordance with a permit.

2. Such permits shall be drawn in terms as specific as possible and issued only for the following purposes:

   (a) to provide indispensable food for men or dogs in the Treaty Area in limited quantities, and in conformity with the purposes and principles of these Agreed Measures;
   (b) to provide specimens for scientific study or scientific information;
   (c) to provide specimens for museums, zoological gardens, or other educational or cultural institutions or uses.

3. Permits for Specially Protected Areas shall be issued only in accordance with the provisions of Article VIII.

4. Participating Governments shall limit the issue of such permits so as to ensure as far as possible that:

   (a) no more native mammals or birds are killed or taken in any year than can normally be replaced by natural reproduction in the following breeding season;
   (b) the variety of species and the balance of the natural ecological systems existing within the Treaty Area are maintained.

5. The species of native mammals and birds listed in Annex A of these Measures shall be designated "Specially Protected Species", and shall be accorded special protection by Participating Governments.

6. A Participating Government shall not authorise an appropriate authority to issue a permit with respect to a Specially Protected Species except in accordance with paragraph 7 of this Article.

7. A permit may be issued under this Article with respect to a Specially Protected Species, provided that:

(a) it is issued for a compelling scientific purpose, and
(b) the actions permitted thereunder will jeopardise the existing natural ecological system or the survival of that species.

Article VII
[Harmful interference]

1. Each Participating Government shall take appropriate measures to minimise harmful interference within the Treaty Area with the normal living conditions of any native mammal or bird, or any attempt at such harmful interference, except as permitted under Article VI.

2. The following acts and activities shall be considered harmful interference:
(a) allowing dogs to run free,
(b) flying helicopters or other aircraft in a manner which would unnecessarily disturb bird and seal concentrations, or landing close to such concentrations (e.g. within 200 m),
(c) driving vehicles unnecessarily close to concentrations of birds and seals (e.g. within 200 m),
(d) use of explosives close to concentrations of birds and seals,
(e) discharge of firearms close to bird and seal concentrations (e.g. within 300m)
(f) any disturbance of bird and seal colonies during the breeding period by persistent attention from persons on foot.

However, the above activities with the exception of those mentioned in (a) and (e) may be permitted to the minimum extent necessary for the establishment, supply and operation of stations.

3. Each Participating Government shall take all reasonable steps towards the alleviation of pollution of the waters adjacent to the coast and ice shelves.

Article VIII
[Specially Protected Areas]

1. The areas of outstanding scientific interest listed in Annex B shall be designated "Specially Protected Area" and shall be accorded special protection by the Participating Governments in order to preserve their unique natural ecological system.

2. In addition to the prohibitions and measures of protection dealt with in other articles of these Agreed Measures, the Participating Governments shall in Specially Protected Areas further prohibit:
(a) the collection of any native plant, except in accordance with a permit;
(b) the driving of any vehicle;

(c) entry by their nationals, except in accordance with a permit issued under Article VI or under paragraph 2(a) of the present Article or in accordance with a permit issued for some other compelling scientific purpose;

3. A permit issued under Article IV shall not have effect within a Specially Protected Area except in accordance with paragraph 4 of the present Article.

4. A permit shall have effect within a Specially Protected Area provided that;

(a) it was issued for a compelling scientific purpose which cannot be served elsewhere; and
(b) the actions permitted thereunder will not jeopardise the natural ecological system existing in the Area.

Article IX
[Introduction of non-indigenous species, parasites and diseases]

1. Each Participating Government shall prohibit the bringing into the Treaty Area of any species of animal or plant not indigenous to that Area, except in accordance with a permit.

2. Permits under paragraph 1 of this Article shall be drawn in terms as specific as possible and shall be issued to allow the importation only of the animals and plants listed in Annex C. When any such animal or plant might cause harmful interference with the natural system if left unsupervised within the Treaty Area, such permits shall require that it be kept under controlled conditions and, after it has served its purpose, it shall be removed from the Treaty Area or destroyed.

3. Nothing in paragraphs 1 and 2 of this Article shall apply to the importation of food into the Treaty Area so long as animals and plants used for this purpose are kept under controlled conditions.

4. Each Participating Government undertakes to ensure that all reasonable precautions shall be taken to prevent the accidental introduction of parasites and diseases into the Treaty Area. In particular, the precautions listed in Annex D shall be taken.

Article X
[Activities contrary to the principles and purposes of these Measures]

Each Participating Government undertakes to exert appropriate efforts, consistent with the Charter of the United Nations, to the end that no one engages in any activity in the Treaty Area contrary to the principles or purposes of these Agreed Measures.

Article XI
[Ship's crews]

Each Participating Government whose expeditions use ships sailing under flags of nationalities other than its own shall, as far as feasible, arrange with the owners of such ships that the crews of these ships observe these Agreed Measures.

Article XII
[Exchange of information]

1. The Participating Government may make such arrangements as may be necessary for the discussion of such matters as:

   (a) the collection and exchange of records (including records of permits) and statistics concerning the number of each species of native mammal and bird killed or captured annually in the Treaty Area;
   (b) the obtaining and exchange of information as to the status of native mammals and birds in the Treaty Area, and the extent to which any species needs protection;
   (c) the number of native mammals or birds which should be permitted to be harvested for food, scientific study, or other uses in the various regions;
   (d) the establishment of a common form in which this information shall be submitted by the Participating Governments in accordance with paragraph 2 of this Article.

2. Each Participating Government shall inform the other Governments in writing before the end of November each year of the steps taken and information collected in the preceding period of 1st July to 30th June relating to the implementation of these Agreed Measures. Governments exchanging information under paragraph 5 of Article VII of the Antarctic Treaty may at the same time transmit the information relating to the implementation of these Agreed Measures.

Article XIII
[Formal provisions]

1. After the receipt by the Government designated in Recommendation I-XIV(5) of notification of approval by all Governments whose representatives are entitled to participate in meetings provided for under Article IX of the Antarctic Treaty, these Agreed Measures shall become effective for those Governments.

2. Thereafter any other Contracting Party to the Antarctic Treaty may, in consonance with the purposes of Recommendation III-VII, accept these Agreed Measures by notifying the designated Government of its intention to apply the Agreed Measures and to be bound by them. The Agreed Measures shall become effective with regard to such Government on the date of receipt of such notification.

3. The designated Government shall inform the Governments referred to in paragraph 1 of this Article of each notification of approval, the effective date of these Agreed

Measures and of each notification of acceptance. The designated Government shall also inform any Government which has accepted these Agreed Measures of each subsequent notification of acceptance.

Article XIV
[Amendment]

1. These Agreed Measures may be amended at any time by unanimous agreement of the Governments whose Representatives are entitled to participate in meetings under Article IX of the Antarctic Treaty.

2. The Annexes, in particular, may be amended as necessary through diplomatic channels.

3. An amendment proposed through diplomatic channels shall be submitted in writing to the designated Government which shall communicate it to the Governments referred to in paragraph 1 of the present Article for approval; at the same time, it shall be communicated to the other Participating Governments.

4. Any amendment shall become effective on the date on which notifications of approval have been received by the designated Government and from all of the Governments referred to in paragraph 1 of this Article.

5. The designated Government shall notify those same Governments of the date of receipt of each approval communicated to it and the date on which the amendment will become effective for them.

6. Such amendment shall become effective on that same date for all other Participating Governments, except those which before the expiry of two months after that date notify the designated Government that they do not accept it.

ANNEXES TO THESE AGREED MEASURES

ANNEX A: Specially Protected Species

All species of the genus *Arctocephalus*, Fur Seals.
Ommatophoca rossii, Ross Seal.

ANNEX B: Specially Protected Areas

[See list in most recent edition of the Antarctic Treaty Handbook]

ANNEX C: Importation of animals and plants

The following animals and plants may be imported into the Treaty Area in accordance with permits issued under Article IX(2) of these Agreed Measures:

(a) sledge dogs,
(b) domestic animals and plants,
(c) laboratory animals and plants including viruses, bacteria, yeasts and fungi.

ANNEX D: Precautions to prevent accidental introduction of parasites and diseases into the Treaty Area

The following precautions shall be taken:

1. *Dogs*: All dogs imported into the Treaty Area shall be inoculated against the following diseases:

   (a) distemper;
   (b) contagious canine hepatitis;
   (c) rabies;
   (d) leptospirosis (*L. canicola* and *L. icterohaemorrhagicae*).

   Each dog shall be inoculated at least two months before the time of its arrival in the Treaty Area.

2. *Poultry*: Notwithstanding the provisions of Article IX(3) of these Agreed Measures, no living poultry shall be brought into the Treaty Area after 1st July, 1966.

APPENDIX VI

ARTICLE II OF THE CONVENTION ON THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES

The Convention on the Conservation of Antarctic Marine Living Resources comprises 33 Articles and an attached Annex and Statement on sovereignty rights. The Prince Edward Islands are situated within the Convention Area. The Convention's management objectives are set out in Article II as follows.

ARTICLE II

1. The objective of this Convention is the conservation of Antarctic marine living resources.

2. For the purposes of this Convention, the term "conservation" includes rational use.

3. Any harvesting and associated activities in the area to which this Convention applies shall be conducted in accordance with the provisions of this Convention and with the following principles of conservation:

   (a) prevention of decrease in the size of any harvested population to levels below those which ensure its stable recruitment. For this purpose its size should not be allowed to fall below a level close to that which ensures the greatest net annual increment;

   (b) maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources and the restoration of depleted populations to the levels defined in sub-paragraph (a) above; and

   (c) prevention of changes or minimization of the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades, taking into account the state of variable knowledge of the direct and indirect impact of harvesting, the effect of introduction of alien species, the effects of associated activities on the marine ecosystem and of the effects of environmental changes, with the aim of making possible the sustained conservation of Antarctic marine living resources.

From time-to-time, the Commission adopts specific Conservation Measures under the Convention and these may be directly applicable to the Prince Edward Islands.

APPENDIX VII

PROVISIONS GOVERNING AIRDROPS AT THE PRINCE EDWARD ISLANDS

Airdrops at the Prince Edward Islands will only be authorized in writing by **DEAT**. In the case of an emergency situation, authority for airdrops will be vested in the Director-General on the advice of the Directorate: Antarctica and Islands. The following provisions govern the conduct of airdrops at the Islands:

(1) Airdrops by fixed-wing aircraft will be restricted to the absolute minimum required for genuine emergencies. To mitigate against the need for drops, arrangements will be made to ensure that sufficient essential spare parts, equipment, medicines and medical supplies are stored at the Marion Island base;

(2) All visits by fixed-wing aircraft to the Islands for purposes other than airdrops shall not approach Prince Edward Island. Aircraft shall not approach Marion Island closer than five kilometres and/or should not fly lower than 500 m in the Island's vicinity;

(3) Every effort should be made to avoid airdrops in the period December to March, when King Penguins are incubating or brooding small chicks;

(4) Flights should make landfall on Marion Island at Hansen Point and thereafter fly inland of Archway Bay and not north of Ship's Cove. This is aimed at ensuring that overflying of King Penguin colonies is kept to a minimum. Low-altitude flypasts over the remainder of the Island and over Prince Edward Island are prohibited;

(5) The minimum number of passes should be made, and all but those on which airdrops are undertaken should be limited to altitudes in excess of 500 m;

(6) During airdrops, observers shall be stationed at King Penguin colonies close to the flight path and base in order to record, preferably on video, the reactions of King Penguins and other bird life to the passage of aircraft;

(7) These provisions will be subject to revision pending the accrual of evidence for, or records of, King Penguin mortality resulting from air operations, and

(8) Helicopters shall not fly at low altitudes or land within 200 m of bird and seal breeding colonies (see Section 8.3).

(9) The Directorate: Antarctica and Islands in the person of the **Conservation Officer**, or his identified delegate, will be responsible for ensuring that the contents and packing of airdrop packages are in strict accordance with the provisions of the Management Plan with respect to adequate sterilization and the use of appropriate packing materials.

TABLE 1 : Recent estimates of annual population sizes of breeding seabirds and seals at the Prince Edward Islands. Species marked (a) breed at intervals of more than one year. (b) denotes breeding suspected but not proven. [Reproduced from Cooper & Brown (1990) who cite sources for estimates and Wilkinson & Bester (1990) and Laws (1994)].

SPECIES	Marion Island	Prince Edward Island

King Penguin (a)	*Aptenodytes patagonicus*	215 000	5 000
Gentoo Penguin	*Pygoscelis papua*	900	650
Macaroni Penguin	*Eudyptes chrysolophus*	405 000	17 000
Rockhopper Penguin	*E. chrysocome*	137 600	35 000
Wandering Albatross (a)	*Diomedea exulans*	1 500	1 300
Greyheaded Albatross (a)	*D. chrysostoma*	5 000	1 500
Yellownosed Albatross	*D. chlororhynchos*	0	7 000
Sooty Albatross	*Phoebetria fusca*	2 000	700
Lightmantled Sooty Albatross	*P. palpebrata*	200	50
Northern Giant Petrel	*Macronectes halli*	300	180
Southern Giant Petrel	*M. giganteus*	2 900	400
Fairy Prion	*Pachyptila turtur*	> 100	> 100
Salvin's Prion	*P. vittata salvini*	> 100 000	> 10 000
Blue Petrel	*Halobaena caerulea*	> 10 000	> 100 000
Greatwinged Petrel	*Pterodroma macroptera*	> 10 000	> 1 000
Kerguelen Petrel	*P. brevirostris*	> 10 000	b
Softplumaged Petrel	*P. mollis*	> 1 000	> 1 000
Grey Petrel	*Procellaria cinerea*	> 1 000	> 1 000
Whitechinned Petrel	*P. aequinoctialis*	ca. 10 000	> 1 000
Blackbellied Stormpetrel	*Fregetta tropica*	b	> 1 000
Greybacked Stormpetrel	*Garrodia nereis*	b	b
South Georgia Diving Petrel	*Pelecanoides georgicus*	> 100	b
Common Diving Petrel	*P. urinatrix*	0	b
Imperial Cormorant	*Phalacrocorax atriceps*	600	120
Sub-antarctic Skua	*Catharacta antarctica*	900	60
Kelp Gull	*Larus dominicanus*	200	30
Antarctic Tern	*Sterna vittata*	< 25	< 25
Kerguelen Tern	*S. virgata*	10	20
Lesser Sheathbill	*Chionis minor marionensis*	980	420
Southern Elephant Seal	*Mirounga leonina*	2009	782
Antarctic Fur Seal	*Arctocephalus gazella*	> 335	-
Subantarctic Fur Seal	*A. tropicalis*	44822	25786

TO ALL PERSONS VISITING THE PRINCE EDWARD ISLANDS

The Prince Edward Islands Management Plan

Information Document for visits to Marion and Prince Edward Islands

INTRODUCTION

On the 3rd of November 1995 Marion and Prince Edward Island (Prince Edward Islands, PEIS) were declared Special Nature Reserves under Section 18 of the Environment Conservation Act. The management of the PEIS is the responsibility of the Directorate: Antarctica and Islands of the Department of Environmental Affairs and Tourism (DEAT), and this is done on the advice of the Prince Edward Islands Management Committee. All activities on the PEIS and in their vicinity are bound by the management policies set out in the Prince Edward Islands Management Plan (Revision 9). This document is available to all personnel through their group leaders or directly from the Directorate Antarctica and Islands. However, due to the different activities of different visitors to the PEIS, the provisions of the Management Plan pertaining to individuals, and the permits held for various activities may differ considerably. Hence, the aim of this short document is to explain some of the regulations that are liable to have the largest influence on the day-to-day activities of personnel, and to provide a working summary of the most important provisions of the Management Plan. Because of the substantial changes to the general running policy of the PEIS brought about by the declaration of the islands as Special Nature Reserves, it is of considerable importance that all visitors to the PEIS familiarize themselves with the provisions of the Management Plan, particularly those visitors who have been to the Islands prior to November 1995.

ZONATION OF THE PRINCE EDWARD ISLANDS

The islands have been divided into four major management zones. Access to Zones 1, 2 and 3 is by permit only, and access to Zone 4 by special permit only. The zone definitions and areas *(see attached map)* involved are, briefly, as follows:

Zone 1: Service Zone - A perimeter extending 10 m beyond the outermost buildings and masts of the scientific station as on 3rd November 1995, including the fuel transfer line, but not including Gentoo Lake and Transvaal Cove. All historical sites in Zone 1 are excluded from it. This zone is for major human activities, but all requests for building etc. must be made to DEAT through the Management Committee.

Zone 2: Natural Zone - This zone forms a triangle from the northern shore of Ships Cove to the Fault, south of Trypot and to the eastern slope and peak of Juniors Kop, including the entire perimeter of the crater lake. This is a buffer zone between Zones 1 and 3. Limited free walking is allowed in this zone provided that a permit is held and that the stipulations of the Management Plan are adhered to.

Zone 3: Wilderness Zone - The remainder of Marion Island is demarcated as the wilderness zone. Access to this zone is restricted to permit holders carrying out scientific work, and to those who have been issued permits by DEAT or their designated appointee. All hut sites lie within Zone 3, but a 50 m circumference around them will be considered Zone 2 for servicing of the hut sites.

Zone 4: Protected Zone (Special Entry Areas) - All sites sensitive to human disturbance fall in this zone. The whole of Prince Edward Island falls in this zone. On Marion Island, a perimeter extending 100 m around Gentoo Penguin Colonies and Southern Giant Petrel Colonies, a perimeter extending 200 m around Wandering Albatross demographic study colonies, the Grey-headed Albatross colony at Grey-headed Albatross Ridge (with the exception of the route from Santa Rosa Valley to Rooks Bay, traversing the ridge), and all historical sites fall within
Zone 4.

THE CENTRAL PROVISIONS OF THE MANAGEMENT PLAN

1. The Prince Edward Islands are Special Nature Reserves and the PEIS Management Plan is there to ensure the conservation of the fauna and the preservation of historical sites on the islands. As such it has been implemented to ensure that all visitors, both current and future, can enjoy the benefits of the islands as sites of national and international conservation value, and as sites of considerable scientific value. The provisions of the Management Plan were made in consultation with a wide variety of parties who have knowledge and experience of Marion and Prince Edward Islands. A Conservation Officer, whose duties it will be to see to day-to-day implementation of the Management Plan, in association with the Team Leader, will be appointed every year.

2. All visitors to the PEIS are bound by the permits they, or their group leader hold. Access to the various zones is indicated on the permit. Application in writing can be made through the DEAT

for access to zones not included in a permit. This must be accompanied by a motivation for reasons to enter the other zones. In addition, during emergencies, the designated appointee of the DEAT (usually the Team Leader) can issue an Emergency Entry Permit for access to any of the zones so long as this is confirmed in writing by the DEAT within 24 hours. Team members who do not hold permits for scientific work in Zone 3 will be issued with permits to Zone 3 for two "round island" sightseeing trips per year, lasting not more than seven days per trip. These permits will be issued at the request of the team member, through the Team Leader and/or

Conservation Officer, by the Directorate Antarctica and Islands of DEAT. Where field work has to be undertaken by a holder of a permit for work in Zone 3, and a second permit holder is not available on that programme, a team member who does not hold a permit to Zone 3 can accompany the permit holder for safety purposes. However, the holder of the permit is then responsible for the actions of that team member in Zone 3.

3. Camping is not permitted in any of the Management Zones, except where permission for this has been granted by DEAT. Permission must be applied for in writing, four months prior to a relief voyage.

4. Collection of any organic and/or inorganic material, including rocks and artefacts, is not permitted unless a collection permit has been issued to the individual making the collection. Permits are restricted to bona fide scientific activities and are issued by the DEAT on the advice of the PEIS Management Committee.

5. Wilful disturbance of any wildlife is not permitted in any of the zones.

6. Waste is a serious problem in all Antarctic and Sub-Antarctic environments. In the Management Plan, provision is made for regulation of waste disposal . Packing material should not include plastic if possible, and polystyrene beads and small pieces of plastic are not permitted as packing material. All chemical, radioactive, photographic and fuel waste is to be packaged and returned to South Africa. Plastic waste is not to be incinerated but returned to South Africa. All paper and kitchen waste is to be incinerated, with the exception of poultry. Poultry waste must be containerized and returned to South Africa. All glass and metal waste is to be containerized and returned to South Africa. All waste containers are to be marked as such and all waste must be sorted. No kitchen waste may be fed to birds on the islands.

7. The PEIS serve as a breeding site for many pelagic bird and mammal species. During the breeding season, breeding sites of these species should not be traversed or bisected unless no alternative is possible, or unless this is necessary for bona fide scientific work. In addition, fledgling seabirds are attracted to light and the scientific station should be darkened (blinds are provided) during fledging times of these birds.

8. No plant or animal material may be imported to the Prince Edward Islands, and there should be

no exchange of organic material between Marion and Prince Edward island and vice versa. Importation of building and other materials for use at the scientific station can only be undertaken with the permission of the DEAT.

9. In the case of servicing the scientific station and field huts during relief voyages, no overflights of surface-breeding seabird colonies are to be made. In addition flights should be made at an altitude of no less than 500 m, except where this is not possible for safety/emergency reasons and where landings have to be made. No landings shall be made within 200 m of seabird and seal colonies.

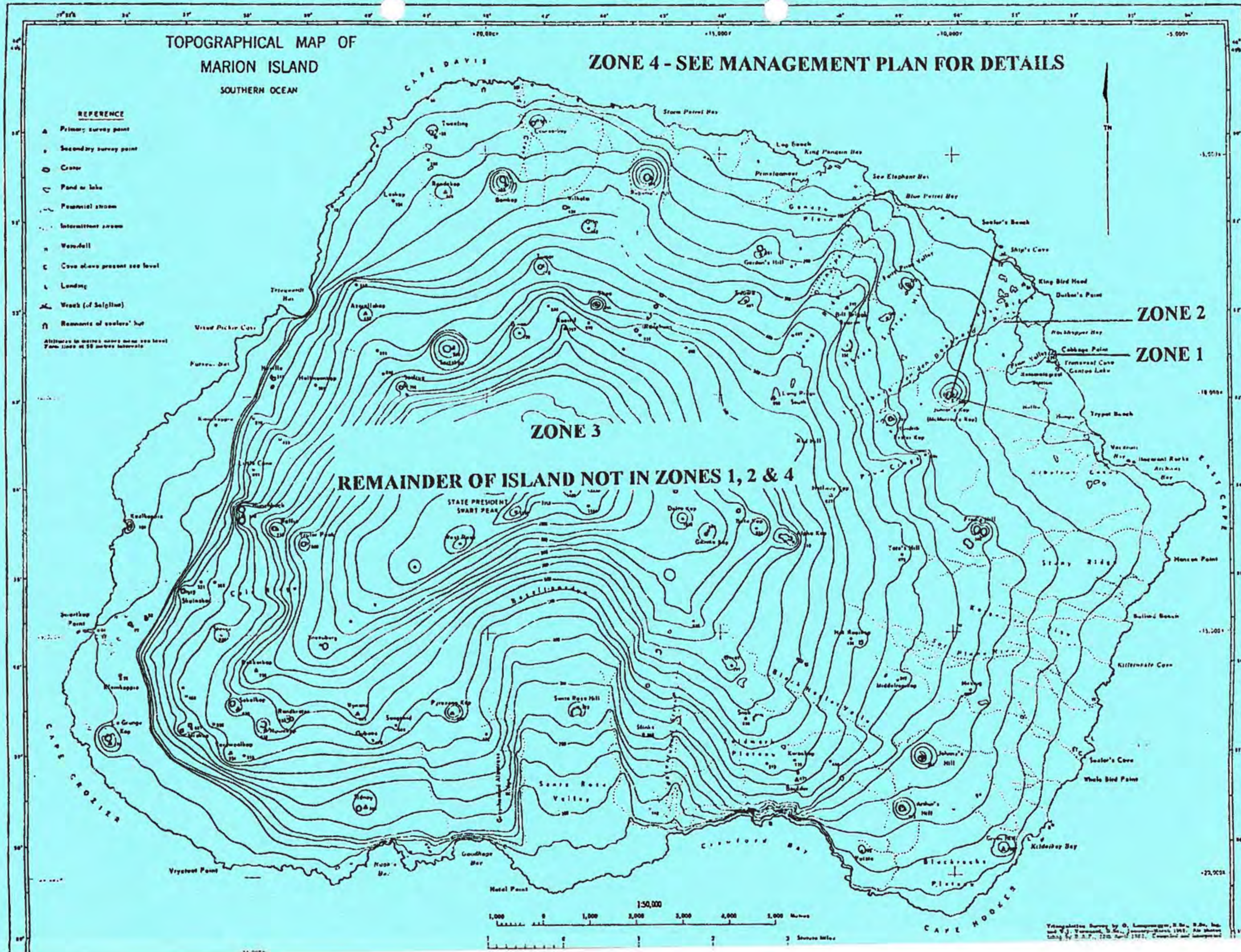
10. Any observations of newly introduced species, and fuel spills and/ or waste spills must be reported to the DEAT within 24 hours.

11. The Prince Edward Island Management Plan is a legal document and its provisions are enforceable via the Environment Conservation Act.

12. Thank you in advance for your assistance with the conservation of our Islands.

Kind regards

DR C M CAMERON
DIRECTOR-GENERAL: ENVIRONMENTAL AFFAIRS & TOURISM
Date:


TOPOGRAPHICAL MAP OF
MARION ISLAND
SOUTHERN OCEAN
REFERENCE
Primary survey point
Secondary survey point
Crater
Pond or lake
Perennial stream
Intermittent stream
Waterfall
Cave above present sea level
Landing
Wreck (of Solglimt)
Remnants of sealers' hut
ZONE 4 - SEE MANAGEMENT PLAN FOR DETAILS
ZONE 2
ZONE 1
ZONE 3
REMAINDER OF ISLAND NOT IN ZONES 1, 2 & 4
STATE PRESIDENT SWART PEAK
CAPE DAVIS
Storm Petrel Bay
King Penguin Bay
Sea Elephant Bay
Blue Petrel Bay
Sealer's Beach
Ship's Cove
King Bird Head
Duiker's Point
Rockhopper Bay
Cabbage Point
Transvaal Cove
Trypot Beach
EAST CAPE
Hansen Point
Killerwhale Cove
Sealer's Cove
Whale Bird Point
Kildalkey Bay
CAPE HOOKER
Crawford Bay
Natal Point
Goodhope Bay
Vrystaat Point
CAPE CROZIER
Swartkop Point
Santa Rosa Valley
1:50,000

DOC. 4.2

SC16 13/9/95

DEPARTEMENT VAN OMGEWINGSAKE EN TOERISME
DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM

VERWYSING: A2/B/2
REFERENCE:

TELEFOON: 310-3551
TELEPHONE:

NAVRAE: B Heiberg
ENQUIRIES:

DIREKTEUR-GENERAAL

BEKENDSTELLING VAN DIE ANTARKTIESE PROGRAM AAN DIE BREë PUBLIEK

1. In 'n poging om ekspedisielede uit die minder verteenwoordigende groepe te werf om ekspedisies na Antarktika, Marion- en Gougheiland mee te maak, het dit onder hierdie Direktoraat se aandag gekom hoe min die breë publiek in Suid-Afrika werklik van die werksaamhede van die wetenskaplike programme in die Suidelike Oseane weet.

2. Om verder ook te voldoen aan die opdrag binne die Marioneilandbestuursplan dat daar opvoedkundige aksies geloods kan word, sal dit waardeer word indien u beginselgoedkeuring kan verleen dat die volgende voorstelle aan die voorgestelde Bestuursplankomitee voorgelê word vir goedkeuring; dat:

   2.1 Die Marionbestuursplankomitee 'n projekonderwerp kies met betrekking tot die werksaamhede van die wetenskaplike programme in die Suidelike Oseane.

   2.2 Hierdie projek as 'n landwye kompetisie vir alle std. 8 leerlinge geloods word.

   2.3 Die Marionbestuursplankomitee die beoordeling waarneem waarna drie wenners aangewys word.

   2.4 Bogenoemde wenners saam met hul onderwyser van die spesifieke vakgebied 'n aflosvaart na Marioneiland sal meemaak.

3. Indien beginselgoedkeuring tot bogenoemde verleen kan word, sal die Departement eers die Departement van Onderwys nader om te verseker dat daar wel so 'n projek geloods mag word.

.....

HOOFDIREKTEUR: ADMINISTRASIE
Datum: 95 · 10 · 10

HOOFDIREKTEUR: ADMINISTRASIE

BEGINSELGOEDKEURING DAT 'N SKOOLKOMPETISIE GELOODS MAG WORD GOEDGEKEUR/~~AFGEKEUR/GEWYSIG~~

Onderhewig aan die beskikbaarheid van fondse

C.W. Cameron

....
DIREKTEUR-GENERAAL
Datum: 95-10-15.

DOC. 6.1

ZEGRAHM EXPEDITIONS
1414 Dexter Avenue North, #327
Seattle, WA 98109 U.S.A.
Phone: 206-285-4000 or 800-628-8747
Fax: 206-285-5037
E-mail: zegrahm@accessone.com

DATE: 18 March 1996
TO: Dept of Environmental Affairs and Tourism
FOR: Mr. R. Skinner, General Director
FAX: 011 27 12 351 1345
FM: Werner Zehnder
PGS: 9

Dear Mr. Skinner:

We are in receipt of a copy of your fax addressed to Mr. V. Lander with Combine Ocean, with regard to our request for permission to visit Marion Island in November 1997.

We wanted to contact you directly prior to the meeting of the Prince Edward Islands Management Committee later this month.

Zegrahm Expeditions has been operating environmentally sensitive, educational expeditions to the remote corners of the world for the past six years, although the seven founders of the company have been in the expedition travel industry for many years prior to forming our own company. We have applied our extensive field and operational experience and created our own special approach to adventure travel.

In order to minimize as much as possible the impact of our expeditions, we charter ships to our various different destinations. When we leave a destination, we leave nothing behind and take nothing with us. We operate well organized, ecologically responsible, educational programs which teach our clients the importance of preserving the environment.

Our expedition leading staff comprises a group of the most experienced lecturers and naturalists in the business. I have included a brief biography of each for your reference. In addition, our staff in our office in Seattle has been to the Antarctic many times and are all very aware of the delicacy of Antarctic and Sub Antarctic environs. Peter Harrison, a founding member of Zegrahm Expeditions, did research on Marion Island in the 1970's and in 1984.

Zegrahm Expeditions is a charter member of IAATO (International Association of Antarctic Tour Operators) a self governing body which oversees Antarctic tourism The Guidelines of Conduct drafted by IAATO were used as the basis for Recommendation XVIII-1 written by the Antarctic Treaty Consultative Parties in 1994. They are currently being enforced by all members of IAATO. I personally was very instrumental in the organization and implementation of IAATO.

Zegrahm Expeditions presently works with a number of non-profit organizations and environmental groups including; World Wildlife Fund, National Geographic Society, The Harvard Museum of Comparative Zoology, The American Museum of Natural History and the Stanford University Alumni Association.

Our passengers are primarily Americans (80%-85%), although we also have a number of other nationalities traveling with us. As this trip commences in South Africa, we do hope we will be able to entice a few of our South African clients to join us.

We would be willing to offer our services to you as well. We are happy to transport limited supplies and perhaps even one or two personnel to the station at Marion Islands if this would assist you. Our expeditions will sail from Port Elizabeth on 19 November 1997. A copy of our proposed itinerary follows.

I have also put a package of reference information in the mail to you today. This will provide you will more detailed information about Zegrahm Expeditions, our staff and our approach to expedition travel.

Based on the above information, I hope you will look upon our request to grant permission to visit Marion Island favorably. I look forward to hearing from you. Thank you for your consideration.

With kind regards,

W. Zehnder

Werner Zehnder
President

cc: Mr. V. Lander / Combine Ocean

Spectacular new holiday cruises – at unbeatable all-in prices

MEALS are extra? No one mentioned that when you booked your holiday – nor the departure tax in foreign currency, the guides' fees, the hotel's additional bed levy.

Unexpected or hidden costs can put a serious dent in your travel budget and quickly sour your holiday spirit.

But a cruise aboard the Symphony enables you to budget for an all-inclusive package – tuck your wallet away knowing no nasty surprises will come your way. You'll need a little extra cash only for drinks, the casino and, of course, the duty-free shop.

And there's something else which makes it an unforgettable holiday experience: no ringing phones, gloomy newspapers or TV news reports, and you can take off your watch and forget about the real world for a few days.

You'll feel your worries slipping away and quickly fall in to the relaxed routine of tucking in to a continental breakfast at 10 am, then strolling off to find a spot in the sun. You may feel a wee bit guilty as you think of your friends and colleagues back home, but it will soon pass when an Italian waiter comes round to offer you a cocktail and you sit back and gaze dreamily at the wide blue ocean. Perhaps in the distance you'll spot some rolling green hills but from your deckchair they'll appear as remote as another planet.

The Symphony is due to arrive in South African waters in November 1996 and will operate 36 cruises during a six-month season of island and coastal cruising, ranging from three-day trips to 23 days for the voyages to and from Europe.

This luxury liner has just undergone a R70-million refurbishment and has been upgraded from stem to stern with modern safety features. She takes over from the Rhapsody which introduced over 19 000 South Africans to the joys of luxury ocean travel during the 1995/96 cruise season.

Included in the Symphony's cruise itinerary are visits to the Mozambique islands of Inhaca and Bazaruto, an 11-day cruise to Mauritius and a 15-day cruise to the Spice ports of Madagascar, Comores, Zanzibar and Reunion.

If you're in the mood for something different, be sure to book your leave between December 2-8. That's when the Symphony sails to the South African Polar Research Station on Marion Island close to Antarctica.

On board will be a world-renowned team of scientists who'll take passengers on guided tours of the island, give lectures on marine life and supervise whale and bird watching meetings on the deck. You can be a part of this unique voyage of discovery for as little as R3 480 a person.

If you have your eye on warmer climes, a trip to Inhaca and Bazaruto islands are sure to fulfil your tropical island fantasies.

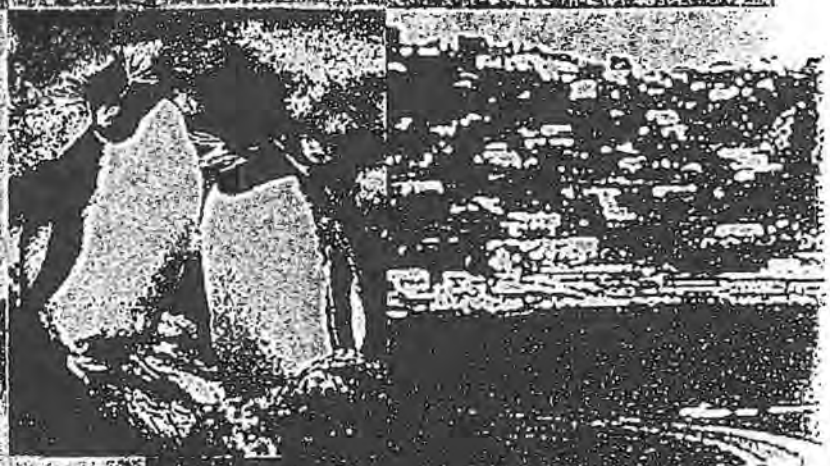
Passengers are ferried by powerful Zodiacs to the islands' white sandy beaches where they can try some snorkeling, fishing and volleyball and enjoy a special beach barbecue.

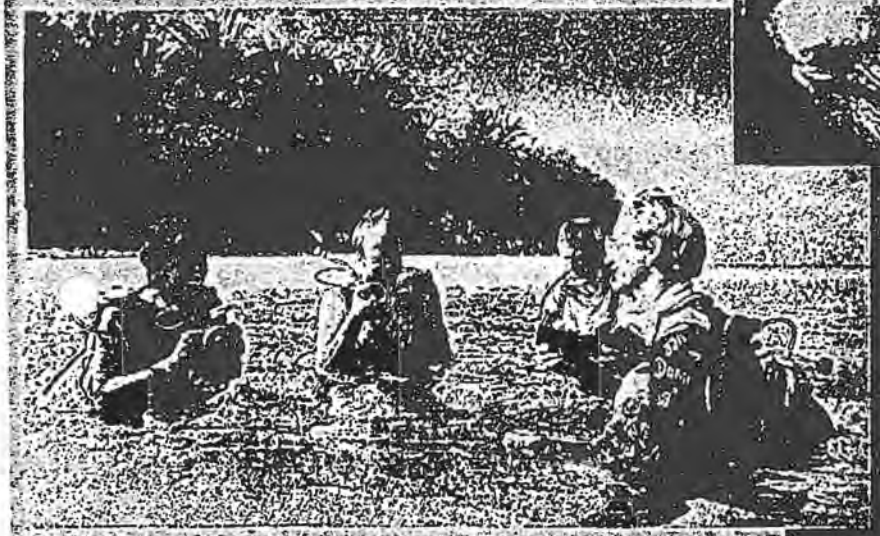
Departures to the Mozambique Islands are scheduled every month from December until May and prices start at just R1 263 per person sharing.

If you're planning to visit friends or relatives in Cape Town or Durban during the Symphony's cruise season, combine your trip with a four-day coastal cruise. The packages cost as little as R1 297 a person sharing and if combined with a special fly/cruise option you can cruise to your holiday destination and fly home.

Aboard the Symphony there's plenty to keep you busy as you wait to arrive at your next port of call. There are acres of open deck space so you'll never feel claus-

BELOW: *In the mood for something warmer? The Symphony also cruises to Mauritius where you can try out beach activities such as snorkeling.*





MAIN PICTURE: *In November the Symphony will sail into South African waters to start a six-month season of island and coastal cruises.*

Sun, sea and Symphony

trophobic, three swimming pools, a gymnasium, volleyball court and even a golf driving range. But the fun doesn't stop when the sun sets. You can stay up until dawn in two spacious lounges, four bars, a cinema, disco, card room, casino and two shops. Special performers such as rock singers, cabaret artists and magicians are employed to keep you amused and entertained throughout the voyage.

And you don't have to feel nervous about travelling on your own as the staff go out of their way to include all passengers in the ship's activities. By the end of your cruise you'll have made many new friends from South Africa and abroad.

Culinary delights aboard the Symphony are included in the price of your cruise. So forget about your diet – the food is out of this world and the sea air is bound to work up an appetite. On certain days there may be a cocktail party where you'll get to meet the captain, or a fancy dress evening.

The price of your package will be determined by the length of the cruise and the grade and location (inner or outer) of your cabin.

Infants under two years of age sharing with two full fare adults stay free. Children aged 3-12 sharing with two adults pay 25 per cent of the adult rate, and children between 13 and 16 pay 50 per cent. Children aged 3-15 staying in a separate cabin pay 75 per cent of the adult rate.

A 20 per cent discount is available to senior citizens on certain cruises. Honeymooners are upgraded by one cabin category from what they've booked, and receive a bottle of sparkling wine.

For more information about the Symphony cruise season or for a free colour brochure, write to:

[redacted]

DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM
DIRECTORATE : ANTARCTICA AND ISLANDS

FAX NO	: 011-884-7505
DATE	: 96/3/22
ATTENTION	: THE MANAGING DIRECTOR, STARLIGHT CRUISES
FILE NO	: A13/4/1
SERIES NUMBER FAX/	:
PAGES	: 1
FROM	: D J VAN SCHALKWYK
FAX NO	: 012 351-1345
TELEPHONE NO.	: 012-310-3560
E-MAIL ADDRESS	: ANT_DVS@OZONE.PWV.GOV.ZA

Dear Sir / Madam

PROPOSED MARION ISLAND CRUISE

1. Your recent article on a proposed cruise to Marion Island as published on pages 114 and 115 of the March 21 issue of the YOU magazine has reference.

2. As you may not be aware thereof, I wish to bring to your attention that Marion Island and Prince Edward Island which together constitute the Prince Edward Islands Group were during November last year in accordance with the Section 18 of the Environmental Conservation Act, declared "Special Nature Reserves".

   As a consequence a Prince Edward Islands Management Committee (PEIMC) was appointed to regulate all provisions of the Prince Edward Islands Management Plan and manage all related activities at these islands and surrounding waters.

   Access to these islands and its surrounding territorial waters is by permit only, issued by the Department of Environmental Affairs and Tourism. No request has as yet been received from you. Accordingly, I wish to advise that should you wish to pursue this venture you forward a fully motivated request for consideration to:

The Chairman
Prince Edward Islands Management Committee
Department of Environmental Affairs and Tourism
Directorate: Antarctica and Islands
Private Bag x447
PRETORIA
0001

3. For the record it should also be noted that the meteorological/research station at Marion Island is not a Polar Station as it is in fact neither close nor near to Antarctica as stated in your article.

4. It would be appreciated if you could in order to avoid unnecessary confusion and queries put the record straight in a forthcoming issue and withdraw any similar advertisements until such time as you have obtained the necessary approvals, if granted.

5. Should you require any further information please do not hesitate to contact me.

Yours sincerely

DIRECTOR-GENERAL

THE IMPACT OF FERAL HOUSE MICE AT SUB-ANTARCTIC MARION ISLAND AND THE DESIRABILITY OF ERADICATION : REPORT ON A WORKSHOP HELD AT THE UNIVERSITY OF PRETORIA, 16-17 FEBRUARY 1995

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EXECUTIVE SUMMARY

A workshop on the impact of feral house mice, *Mus domesticus*, at sub-Antarctic Marion Island was held because the draft Prince Edward Islands Management Plan (Rev. 7) requires that attention be given to the removal of aliens from the islands, and because a five-year programme concerning the impact of mice has provided considerable information on this topic and is nearing conclusion. Unpublished data were presented by various researchers on the demography of the mice and on their impact on the terrestrial ecosystem. Information on the eradication of rodents on various islands surrounding New Zealand, and a preliminary feasibility assessment for eradication of mice via aerial poisoning were also presented. It was concluded that feral house mice have reached a new, higher population level than was found in the 1970s and that mice are having a significant impact on macro-invertebrates, certain plant species, and therefore ecosystem functioning as a whole. However, considerable research is required, over a five-year period, to improve understanding of population fluctuations and the nature of the impact. Eradication of mice is feasible so long as research on the consequences of such a programme, and methods to reduce undesirable effects is undertaken. Control measures should also be investigated. Eradication is desirable, although only after baseline research on management issues and the impact of mice has been undertaken. A working group on mice at Marion Island should be established, under the auspices of the Prince Edward Island Management Committee of the South African Committee for Antarctic Research (SACAR), to oversee the research and management programmes. An eradication attempt is liable to enjoy a low national priority, and funding should be sought from international agencies, especially given the pristine condition of the Prince Edward Islands.

INTRODUCTORY REMARKS

The sub-Antarctic Prince Edward Islands lie approximately 2300 km south east of Cape Town and represent the coalescing peaks of a shield volcano. Marion Island is the larger of the two islands and has had a longer history of continuous human occupation than its smaller neighbour, Prince Edward Island (see Van Zinderen Bakker *et al.* 1971; Smith 1987). Although similar with regard to climate, geological history and native biotas, the islands differ considerably in terms of

introduced species. Marion Island has far more alien species than Prince Edward Island (Watkins & Cooper 1986). This situation presents ideal research opportunities in the context of the effects of alien invasive organisms on terrestrial ecosystems, especially in relation to the influence of global climatic change on ecosystem functioning (Smith & Steenkamp 1990).

Although long regarded to be *Mus musculus*, the house mouse at Marion Island may well be *Mus domesticus*. This conclusion is based on an on-going debate on the identity of house mice in Europe. Those in western Europe, from where the Marion Island population was derived, are thought to be *M. domesticus* (T.J. Robinson, University of Pretoria, personal communication). Feral mice were abundant on Marion Island by 1818 and were probably introduced shortly before this (the first known landing on Marion Island took place in 1804), although they have never been found on Prince Edward Island (Watkins & Cooper 1986). These feral mice have elicited comment from all visitors to the islands (e.g. Marsh 1948; Cooper & Headland 1991), and first formed the subject of research in 1975, when the late James Gleeson investigated the role of mice in the Marion Island ecosystem (Gleeson 1981; Gleeson & Van Rensburg 1982). Subsequently, Smith & Steenkamp (1990) proposed that climate change, particularly warming and drying of the islands, would have pronounced effects on the functioning of their terrestrial ecosystems. In particular, they argued that warming would enable house mice to produce more litters on Marion Island, increase their abundance, and thus have a greater impact on indigenous detritivores, their major dietary item (and possibly some native plants), than was the case in the past 100 years. The detritivores are responsible for the bulk of nutrient release from the large, dead standing crop of native plants on the islands. Smith & Steenkamp (1990) argued that if the nutrient release attributable to macro-invertebrate detritivores was diminished, substantial changes to vegetation structure and to ecosystem functioning would take place.

Based on this hypothesis, and some anecdotal evidence that mice seemed to be more abundant on Marion Island, an interdisciplinary research project was initiated in 1991 by the Department of Botany & Genetics, University of the Orange Free State, and the Mammal Research Institute, Department of Zoology, University of Pretoria. The aims of this project were to investigate the response of native plants and insects to changing abiotic conditions, and to investigate the population biology of feral house mice and their impact on indigenous plants and invertebrates, and to compare these data with those obtained by Gleeson almost 20 years earlier. The project was funded by the Department of Environmental Affairs and Tourism (DEAT) through the South African National Antarctic Programmes (SANAP), on the advice of the South African Committee for Antarctic Research (SACAR). This project has now entered its fifth year.

During this period, DEAT appointed a task group to draw up an environmental management plan for the Prince Edward Islands, which are to be declared Special Nature Reserves in terms of the Environmental Conservation Act of 1989. The plan aims to cover all aspects pertaining to the management of the islands including recommendations for the control or eradication of alien species. The management plan has now almost reached completion (seventh, and penultimate revision, released November 1994). In Part 3, Section 14 it is clearly stated that one of the sub-objectives of management is "To elucidate the ecological impact arising from the introduction of the House Mouse *Mus musculus* population to Marion Island and to make recommendations for its control".

Given the recommendations outlined in the management plan, and the fact that the

interdisciplinary research programme had run for four years, the Biological Sciences Task Group of SACAR, at its June 1994 meeting, recommended that a workshop on feral mice at Marion Island should be held. The task group recommended that the workshop should cover the current state of knowledge concerning the mouse population, its impacts on the Marion Island terrestrial ecosystem, and the desirability and feasibility of eradication or control of mice at the island. The task of organizing this workshop was given to ourselves and it was held over two days at the University of Pretoria. This report contains the conclusions reached by the delegates and their recommendations concerning research and management options over the short to medium terms.

WORKSHOP PROGRAMME

The full workshop programme is given in Appendix I, and a list of delegates is provided at the end of this document. Because the research programme on feral mice had only just emerged from the fieldwork phase, those participants who were directly involved in this programme were called on to present the data that they had collected over the past four years to provide delegates with a platform to work from. In addition, Dr. Marthán Bester was called on to present an overview of the successful feral cat eradication programme, which recently came to an end, to highlight logistic difficulties involved in large-scale management programmes at Marion Island. John Cooper had recently visited the Department of Conservation in New Zealand for a short sabbatical and was therefore requested to provide information on rodent eradication in New Zealand and to undertake a preliminary feasibility assessment for rodent eradication on Marion Island.

The first day of the workshop was devoted to the impact of mice on the terrestrial system. After the four presentations, the delegates split into two groups led by Perrin (Bester, Crafford, Smith, van Aarde, van der Merwe) and Nel (Avenant, Chown, Cooper, Ferreira, Rowe-Rowe, van Schalkwyk). The rapporteurs presented the findings of their groups which were summed up by Rowe-Rowe.

On the second day, John Cooper included a 30-minute video on rodent control on Chetwode Island, New Zealand in his presentation. The delegates split into two groups under the leadership of Crafford (Avenant, Chown, Ferreira, Nel, Smith, van der Merwe, Venter) and Cooper (Bester, Perrin, Rowe-Rowe, van Aarde, van Schalkwyk, Waters). The rapporteurs presented the findings of their groups, and Chown summarized the overall findings of the workshop.

PART I : THE IMPACT OF MICE ON THE TERRESTRIAL ECOSYSTEM

PRESENTATIONS

Bester : The success of any eradication programme rests on sound ecological knowledge of the target species as well as of the efficacy of the methods to be used. Once ecological knowledge of the species has been obtained a management decision has to be made. The choice available is between: i) no action, ii) regular control in perpetuity, iii) irregular control in perpetuity, iv) eradication. In the case of the Marion Island cat eradication programme, a biological control agent was shown to be successful for a reduction in numbers of feral animals and was therefore released. Once it had been established that the population had declined, it was decided to attempt eradication by hunting, trapping and poisoning. This eradication attempt was initiated and seen through until cats or their signs were no longer evident. It is of critical importance that the

political will and financial resources are available to complete an eradication programme. If this is not possible, the programme should not be undertaken given the logistic difficulties and concomitant expense of such an exercise. A detailed review of the programme is available in Bloomer & Bester (1992).

Van Aarde : Sampling of mice was carried out in exactly the same grid areas that Gleeson (1981) used. These were hummocky beach (biotic complex, Trypot Beach), vegetated lava (closed fernbrake, Nellie Humps) and dry mire (mire complex, Nellie Humps). Gleeson's raw data were re-analyzed to ensure more accurate comparisons because the sampling frequency in the more recent study was higher than that of Gleeson (1981).

Intra-annual variation in mouse population density showed similar trends in the three habitat types. Mean annual densities were significantly different in the three periods (1979/80, 1991/92 and 1993/94) in the vegetated lava and dry swamp habitats, but not in the hummocky beach habitat (Table 1). However, this appears to be due more to differences in late summer densities, than to those in winter (Table 2). High summer growth rates result in high densities at the end of summer, but high winter mortalities were also found. The trends in winter mortalities did not appear to be related to trends in minimum temperatures. Key factor analysis suggested that in high density areas (such as hummocky beach) there is undercompensating density dependence, which in turn suggests that there is a direct or indirect influence of density on mortality rates. There are forces which limit the size of the mouse population on the island, and an artificial reduction of the population would probably be followed by a rapid increase in population size through density-dependent factors. Further discussion can be found in Matthewson *et al.* (1994).

Table 1. Habitat-specific mean annual densities of feral house mice (no.ha^{-1} ± S.D.).

Habitat	1979/80	1991/92	1993/4	ANOVA
Hummocky beach	105±44	100±59	123±45	$P > 0.05$
Vegetated lava	40±16	26±23	62±30	$P < 0.05$
Dry mire	34±20	32±17	75±49	$P < 0.05$

Table 2 Habitat specific mean annual densities of feral house mice (no.ha^{-1} ± S.D.) on a seasonal basis.

Habitat	Hummocky beach		Vegetated lava		Dry mire	
	May	November	May	November	May	November
1979/80	127±18	70±6	62±7	23±3	65±14	11±2
1991/92	248±37	41±3	85±9	9	50±6	9±1
1993/94	179±19	62±6	107±13	31±5	115±19	17±2

Biomass of the flightless moth, *Pringleophaga marioni* Viette (Lepidoptera: Tineidae), the main prey item of mice, appears to have declined dramatically from a mean value of approximately 0.6 $g.m^{-2}$ in 1979/80 to less than 0.05 $g.m^{-2}$ in 1993/4. There also seems to be considerable fluctuation of densities between years, but with the lowest values recorded in the 1993/4 season. The percentage contribution of food items (weevil larvae and adults, moth larvae and adults, spiders, and "other") does not appear to have changed between 1979/80 and 1993/94. Mice must therefore be more efficient at locating their food resources than the sampling programme is at estimating densities of insects.

Avenant : Prey availability was sampled using a standard 8-cm diameter corer in the biotic zone as well as in mires in the 1992/93 season. In the biotic zone, it is clear that the biomasses of prey species have declined between 1976/77 (Burger 1978) and 1992/93 (Table 3), although not to the extent suggested by Prof. van Aarde's data. It is also noteworthy that the introduced slug, *Deroceras caruanae*, was never accepted by mice in laboratory palatability tests, and it is the only macro-invertebrate that increased in biomass over the 15 year period. Similar trends were found in the mires. These changes in densities imply that mice are now removing approximately 1.53% and 1.89% of the standing crop of moth larvae and weevil adults, respectively, on a daily basis. There also seems to have been a reduction of biomass of *Pringleophaga marioni* larvae on Prince Edward Island, although these data are derived from a single sampling event.

The percentage contribution of prey items to mouse stomach contents changed considerably between 1979/80 and 1992/93. *Pringleophaga marioni* larvae no longer contribute as much to the diet of mice as they used to, and weevil adults and larvae are of considerably greater importance. The incidence of other items has also risen considerably. This supports Chown & Smith's (1993) contention that mice are having a marked impact on weevil species on Marion Island. These authors have shown that mice are selective with regard to adult weevils, preferring the larger species and individuals. They have also demonstrated that there has been a significant reduction in the body length of prey species on Marion Island between 1986 and 1992, but no change has taken place in populations of the same species on Prince Edward Island. In addition, non-prey species on Marion Island have not changed over the six-year period and do not differ in body length from populations of the same species on Prince Edward Island.

Table 3. Mean biomass ($g.m^{-2}$) of macro-invertebrates recorded by Burger (1978), Crafford (1990) and Avenant & Smith (unpublished data) in the biotic zone.

Prey item	1976/77	1983/84	1992/93
Pringleophaga larvae	0.97	1.19	0.79
Weevil larvae	0.75		0.46
Weevil adults	0.35		0.14
Slugs	0.09		0.74
Spiders	0.29		0.05
Earthworms	43.14		11.05

These data suggest that mice are having a marked impact on their invertebrate prey species at Marion Island. Steenkamp & Smith (1990) showed that invertebrates are responsible for the bulk of the nutrient release from litter on Marion and Prince Edward Islands. If invertebrate densities are depressed by the mice, there is liable to be a significant impact on ecosystem structure and functioning on the island. Data provided by Chown & Smith (1993) also show that mice are having a significant direct effect on vegetation structure. The area covered by the sedge, *Uncinia compacta*, has increased at Prince Edward Island over the past 20 years, but has not done so at Marion Island. Mice remove seed heads of the sedge and most of these are absent by the start of winter, shortly after mouse population density has peaked. Mice may be having a similar effect on *Acaena magellanica* (Rosaceae), and seem to having a pronounced impact on the major peat-forming species, *Azorella selago* (Apiaceae), as a result of their predilection for burrowing in this cushion plant.

Smith : The climate is changing at Marion Island, as has been shown in papers by Smith & Steenkamp (1990) and Chown & Smith (1993). The most important of these changes, with regard to both the mice and the terrestrial ecosystem as a whole, are the increase in temperature and duration of sunshine, and the decrease in rainfall. The entire climate is becoming warmer and drier over the short term. When warming is expressed in terms of summed degree-days above 0°C, this is reflected in a 20% increase in "warmth" between the 1949-1970 period and the 1971-1992 period. Whether these trends will remain consistent in the long term is difficult to know, but this seems likely given current scenarios of global climate change.

Enhanced growing season warmth, and reduced precipitation has considerable ramifications for nutrient cycling through both plants, macro-invertebrates and bacteria, and this has been dealt with extensively by Smith & Steenkamp (1990). Enhanced growing season warmth should also have a marked effect on the survival of mice and the numbers of litters that can be produced per season. Should this be the case, and should mice be having an enhanced impact on macro-invertebrates as suggested by Avenant, it seems likely that ecosystem functioning will be altered considerably, particularly if warming continues.

One of the most important questions that remains to be addressed is the nature of the climate prior to 1949. Data on southern hemisphere temperature means for the 1949-1992 period are available and there is a good correlation between these means and those found at Marion Island. Extrapolation of this data to years prior to 1949 is liable to show a cooling trend, but more accurate data would be more valuable. Unfortunately, the pollen record at Marion Island does not have sufficient resolution to provide insight into short-term temperature changes, particularly those that have taken place since 1818.

GROUP CONCLUSIONS

Perrin

1. The Marion Island terrestrial ecosystem is abiotically stable in terms of temperature and rainfall, but is subject to longer-term climate change. The system is biologically productive and forms a spatially dynamic mosaic. It shows high resilience in the short term but appears to be more dynamic in the longer term.

2. Summer mouse population densities are at a new and higher equilibrium state. Food resources for the mice are available throughout the year, but a reduction in quantity of resources over winter may lead to enhanced winter mortalities of mice.

3. Mice are having a direct impact on vegetation via seed predation and perhaps other activities, which is leading to a change in germination of species and to plant composition/ vegetation structure.

4. Mice are having a direct effect on macro-invertebrates via predation. They are affecting densities and the genetic diversity of invertebrates in the system.

5. The nature of the impact of mice on the invertebrates is seasonally variable, with largest effects in April/May. However, additional data are required to determine the full extent of the impact.

6. The structure and functioning of the ecosystem at Marion Island are being significantly affected as a result of the impact of mice on vegetation and the detritivores which are responsible for nutrient release.

7. The terrestrial ecosystem may be in a non-equilibrium stable state. However, the long term cumulative impact of mice could bring about critical changes to the system.

8. There is a need for both medium-term and short-term research on the impact of mice on the system. The following research should be undertaken: i) Long term low-key (once yearly in April/May) monitoring of mouse population density; ii) Investigation of impact of mice vs. changing climate on invertebrates, Prince Edward Island to serve as a control; iii) Effects of cold and wetness on survival of mice; iv) Effect of food availability on mice via enclosure studies; v) Extent of seed predation by mice and the effects of burrowing on peat formation by plants; vi) Effect of moisture and temperature on decomposition of litter; vii) Patchiness of insects in terrestrial habitats; viii) Transit times of insects in gut and likelihood of chitin and cellulose digestion; ix) Determination of medium-term (180 yr) climate change since mice were introduced; x) Foraging time and foraging methods of mice.

9. Marion Island is a typical example of a sub-Antarctic island and should be used as an outstanding environmental laboratory.

<u>Nel</u>

1. There are clear intra-annual changes in population densities of mice at Marion Island, but inter-annual changes may be due to natural variability.

2. Macro-invertebrates are declining and the terrestrial ecosystem is consequently changing. However, the contribution of climate vs. mice to these changes in macro-invertebrate density need to be addressed. The impact of Lesser Sheathbills, *Chionis minor*, on invertebrates also requires attention.

3. There is a need for further research. The following work should be undertaken: i) Determination of climate change over the 180 yrs mice have been present on the island, cores from the ice-plateau may be of some value in this regard; ii) Monitoring of mouse population fluctuations; iii) Determination of the impact of mice vs. climate on invertebrates; iv) Determination of geographic variability of climate on the island; v) Determination of effects of prey availability on mice; vi) Comparative analysis of scat vs. stomach content analyses for assessment of the diet of mice.

CONCLUSIONS AND RECOMMENDATIONS

1. The population density of feral mice at Marion Island is at a new, higher level than what it was at the time of Gleeson's study. However, the extent of natural population fluctuations is unknown. Annual sampling in known grids should be continued for at least five years.

2. Mice are having a considerable impact on arthropods, vegetation and ecosystem processes. This is reflected in differences in macro-invertebrate densities and plant cover between the early and mid 1970s and the 1990s. However, the following studies are required: i) An investigation of the impact of changing abiotic conditions vs. the impact of mice on macro-invertebrates. ii) The effect of abiotic variables on litter decomposition and mouse survival. iii) Knowledge of the spatial and temporal variability of food availability, and its effect on mice. iv) The effect of abiotic variables on digestion in mice.

3. Macro-invertebrate populations have changed over time both in terms of densities and composition. Knowledge of this variation over a further five-year period is required. Key species are *Pringleophaga marioni*, earthworms and the *Ectemnorhinus*-group of weevils.

4. The climate is changing at Marion Island. However, longer term data from the past 180 yrs are required, as well as information on intra-island variability in climate. Microclimate stations should be deployed around Marion Island and on Prince Edward Island.

5. The Lesser Sheathbill is an important component of the interaction between introduced and alien species because it subsists mainly on invertebrates in winter months. This species may be used as an indicator of changes in the system because of the ease of monitoring these birds and because baseline studies have already been undertaken by A.E. Burger in the 1970s (e.g. Burger 1982).

6. There is a need for a five-year research programme to address the above issues. This programme will not only address management issues on the islands, but is also liable to produce high quality research which is in line with the International Geosphere Biosphere Programme (IGBP), Global Change in Terrestrial Ecosystems (GCTE) and Biological Investigations of Terrestrial Antarctic Systems (BIOTAS) programmes, and which is directly relevant to all studies of biological invasions. Such invasions are liable to become increasingly important in South Africa as economic contacts with other nations are renewed.

PART II: THE DESIRABILITY AND FEASIBILITY OF ERADICATION

PRESENTATIONS

Cooper : New Zealand Programme : The New Zealand Department of Conservation (NZ-DOC) leads the world in eradicating rodents from islands and in testing poisons for use as rodenticides (Eason 1991; references in Table 1). New Zealand expertise and knowledge are now being utilized worldwide to rid islands of rodents. In the 1980s efforts were ground-based, by using baited traps, bait stations or ground broadcast of poisoned bait (e.g. McFadden 1992). These techniques were labour-intensive, slow and sometimes failed to achieve eradication and were only feasible on small (< 100 ha) islands (I. McFadden, NZ-DOC, personal communication). On heavily vegetated islands paths had to be cut to dispense bait and this was expensive and caused environmental damage. More recently, single or double (approximately two weeks apart) aerial applications of poisoned bait from "monsoon buckets" suspended from helicopters has been very successful in eradicating rodents (usually Polynesian Rats or Kiore, *Rattus exulans*) on at least nine New Zealand islands up to 770 ha in size (Table 4). Bait is spread in a 80-100 m swath at 60 knots at a density of 5-18 $kg.ha^{-1}$. Flying time is approximately 100 $ha.h^{-1}$. The buckets can carry up to 900 kg and are suspended from small helicopters (Aerospatiale Squirrels and Bell Jet Rangers) by a 5-6 m line. The poison of choice is the second-generation single-dose anticoagulant Brodifacoum (formulated as pellets at 20 ppm), which is also toxic to birds.

Substantial research is first conducted on both target and non-target species. For some islands, animals may be taken into temporary captivity to avoid being poisoned. Future New Zealand efforts may take island size at which rodent eradications are attempted to over 10 000 ha (such as Campbell Island) and efforts to rid islands up to 3 000 ha of rodents are planned for the next few years (Clout 1992; McFadden 1995; Table 4). The New Zealand aerial baiting experience is being adopted by the French Antarctic Programme (TAAF) to rid St. Paul Island (700 ha) of rodents and rabbits in 1995/96, with international funding from the European Union (Patel 1994).

Cooper : Feasibility for Marion Island: Marion Island, at 29 000 ha, is far larger than any New Zealand island from which rodents have been eradicated, or for which plans have been made to do so (Clout 1992). However, New Zealand opinion is that island size mainly effects costs and that given sufficient funding aerial baiting could be used successfully on large islands (I. McFadden, NZ-DOC, personal communication). Generally, the larger the island, the greater the likelihood of their being non-target species which could be affected, since larger islands tend to support more species.

A very preliminary calculation suggests that 20 000 ha of Marion Island would need to be aerially treated with poisoned bait, and that this would require 100 tonnes of bait (current cost in South Africa, *c.* 2.75 million Rand) at 5 $kg.ha^{-1}$ for a single application and 2000 hrs of flying time. It is evident from these calculations that it will be an expensive undertaking. There will be a requirement to preplace bait in weatherproof containers around the island to save on flying time. One likely problem is bad weather interrupting the complete coverage of the island, and this could possibly allow mice to re-invade treated areas and re-establish themselves.

Because of the need to reduce incidental mortality of scavenging birds occurring at Marion Island, such as Subantarctic Skuas, *Catharacta antarctica*, Kelp Gulls, *Larus dominicanus* and Lesser

Sheathbills, which are likely to take both bait and poisoned mice, it would be desirable to dispense poison in winter. Few skuas are present at this time. However, the Lesser Sheathbill is both an endemic subspecies and a resident, so it will be necessary to investigate ways of reducing mortality of this species, such as taking birds into temporary captivity, using baits of no or low toxicity to birds, or colouring or chemically treating baits to make them less attractive. It will be necessary to conduct applied research in this field, since only one poisoning effort (ground-baiting for rabbits) has been made at two small islands in the Kerguelen archipelago where sheathbills, skuas and gulls could have been affected (Chapuis 1994). On Enderby Island (Table 4), at least two-thirds of the skua population was killed by taking poisoned bait directly (Torr 1993).

GROUP CONCLUSIONS

Cooper

1. The desirability and feasibility of eradication or control should be treated as two distinct issues.

2. Control (below "threshold of excessively deleterious effects") or eradication is desirable for the following reasons: i) Philosophical - mice do not belong in the system; ii) The Prince Edward Islands Management Plan states that wherever possible, alien species are to be removed from the islands; iii) Mice are having deleterious effects on indigenous species and ecosystem processes; iv) Eradication may provide an unparalleled opportunity for a study of the recovery/resilience of a sub-Antarctic ecosystem.

3. Eradication or control may be considered undesirable because mice have been present on Marion Island for 180 years and therefore present excellent research opportunities to study the effects of biological invasions over the long term and under scenarios of global change.

4. The options are to do nothing, to control the mice, or to attempt eradication. The Prince Edward Islands Management Plan effectively excludes the "do nothing" option.

5. Before any option is finally decided on additional research is required. This should include the following: i) Research on the system as indicated in Part I (above); ii) An investigation of the efficacy and desirability of various control measures vs. eradication; iii) The effects of eradication via aerial bait dispersal on non-target species; iv) The nature of the rodenticide to be used, and its behaviour under field conditions on the island.

6. The feasibility issue cannot be separated from the economic needs of the country. There are other, higher priorities such as the environmental requirements of the Reconstruction and Development Programme.

7. Eradication via aerial bait drops appears to be feasible. However, a 4-12 day weather window is required, and considerable information needs to be gathered on the possibility of taking non-target species, especially sheathbills, into captivity, the most suitable time for eradication, bait toxicity and the possibility of using other techniques such as chemosterilants, diseases and/or lethal genes.

Table 4. Removal of rodents from New Zealand islands by aerial baiting from helicopters.

ISLAND	YEAR	SIZE (HA)	SPECIES	REFERENCE
			SUCCEEDED	
Burgess	1990	73	Polynesian Rat	McFadden & Greene 1993
Stanley	1991	100	Polynesian Rat	Towns *et al.* 1993
Red Mercury	1992	225	Polynesian Rat	Towns *et al.* 1994
Tiritiri Matangi	1993	220	Polynesian Rat	I. McFadden, pers. comm.
Middle Chain	1993	40	Polynesian Rat	I. McFadden, pers. comm.
Watapuke	1993	100	Polynesian Rat	I. McFadden, pers. comm.
Inner Chetwode	1993	240	Polynesian Rat	I. McFadden, pers. comm.
Enderby	1993	770	House Mouse	Torr 1993, 1994
Lady Alice	1994	136	Polynesian Rat	I. McFadden, pers. comm.
			RECOMMENDED OR PLANNED	
Big South Cape		939	Black Rat	Clout 1992
Mayor		1277	Norway & Polynesian Rat	Clout 1992
Codfish		1396	Polynesian Rat	Clout 1992
Ruapuke		1525	House Mouse	Clout 1992
Motutapo		1560	Norway, Black, Polynesian Rat	Clout 1992
Great Mercury		1860	Black Rat	Clout 1992
Kapiti		1970	Norway & Polynesian Rat	Clout 1992
Antipodes		2025	House Mouse	Clout 1992
Rangitoto		2321	Norway, Black, Polynesian Rat	Clout 1992
Raoul		2938	Norway & Polynesian Rat	Clout 1992, Veitch 1994
Little Barrier		3083	Polynesian Rat	Clout 1992
			DESIRED	
Campbell		11 330	Norway Rat	A. Cox, pers. comm.

8. Control is feasible but at an extremely high long-term cost. Diseases and genetic manipulation appear preferable to chemosterilants.

9. Conclusion: Management research on the possible effects of eradication and/or control is necessary. Research to establish a baseline for the system prior to control, and with which to assess post-control changes is necessary. A watching brief on international developments in rodent control should be kept. This topic could be usefully revisited in a second workshop after five years of research.

<u>Crafford</u>

1. Eradication via aerial poisoning is feasible. However, it is liable to enjoy a low, national priority. Given the importance of Marion Island as an almost pristine sub-Antarctic system, international agencies should be approached by the responsible authority for funding for an eradication programme.

2. Although eradication is considered to be feasible, considerable research concerning the behaviour of the rodenticide under local conditions is required. In addition, research on the effects of secondary poisoning, and the half-life of the rodenticide is also required. Furthermore, data on the genetic variability of the sheathbill populations on both Marion and Prince Edward Islands are required to ascertain the "acceptable" levels of population reduction.

3. In terms of the desirability of control, there is a dilemma. From a scientific point of view, the presence of mice on Marion Island, but not on Prince Edward Island present incomparable research opportunities for assessing the effects of invasive organisms on natural ecosystems during a period of climate change. However, from a conservation point of view, control or eradication is obligatory, given the unique value of the system.

4. Over the short term, control may be easier to "sell" at a national level, than eradication.

5. Conclusion: Although eradication could be considered both desirable and feasible, considerable research is required on the impact of mice on the ecosystem, as set out in Part I above, and on management aspects such as those outlined in points 1 and 2. A five-year research programme should be implemented to address these issues.

CONCLUSIONS AND RECOMMENDATIONS

1. Eradication of feral house mice at Marion Island is feasible. However, considerable management research on secondary poisoning, the toxicity of the rodenticide to be used, logistic requirements, and the minimization of impact on non-target species is required. Five years is required to establish the nature of mouse population fluctuations and the impact of mice on the system as outlined in Part I. This will also provide an opportunity to establish a baseline for monitoring changes should an eradication attempt be made.

2. Eradication is desirable. However, local ecological research is required (Part I) and management research concerning possible options for control and the effects of eradication must be undertaken.

3. A watching brief on global developments in rodent eradication should be kept.

4. The research programme should be subdivided into two components, one dealing with the impact of mice on the system, the other with issues relating to management of the feral mouse population and its consequences.

5. It is suggested that the Prince Edward Island Management Committee establish a working group on mice at Marion Island. This group should address the recommendations set out in this report and monitor global advances in rodent control. The group should consist of permanent representatives from the Department of Environmental Affairs and Tourism, permanent representatives from local universities who are not involved in the research programmes, a permanent representative from the rodenticide industry who is not liable to supply rodenticides if eradication is attempted, a permanent representative from a conservation-minded, non-government organization, such as the World Wide Fund for Nature, and temporary members who are either involved in research programmes or who may be involved in an eradication programme. It is suggested that an impartial chair (non-rotating) be elected from within the Prince Edward Islands Management Committee. The Working Group will also advise the South African Committee for Antarctic Research on funding with regard to applied and basic research concerning feral house mice on Marion Island.

ACKNOWLEDGEMENTS

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LIST OF DELEGATES

Mr. N.L. Avenant, State Museum, Bloemfontein
Dr. M.N. Bester, Dept. Zoology & Entomology, University of Pretoria
Prof. S.L. Chown, Dept. Zoology & Entomology, University of Pretoria
Mr. J. Cooper, FitzPatrick Institute, University of Cape Town
Dr. J.E. Crafford, Dept. Zoology, University of Venda
Mr. S. Ferreira, Mammal Research Institute, University of Pretoria
Dr. F. Hanekom, Dept. Environmental Affairs and Tourism*
Prof. J.A.J. Nel, Dept. Zoology, University of Stellenbosch
Prof. M. Perrin, Dept. Zoology & Entomology, University of Natal
Dr. D.T. Rowe-Rowe, Natal Parks Board
Prof. V.R. Smith, Dept. Botany & Genetics, University of the Orange Free State
Prof. R.J. van Aarde, Dept. Zoology & Entomology, University of Pretoria
Mr. M. van der Merwe, Dept. Zoology & Entomology, University of Pretoria
Mr. D. van Schalkwyk, Directorate: Antarctica & Islands, Dept. Environmental Affairs and Tourism
Mr. L. Venter, Hoechst Schering AgrEvo (Pty) Ltd*
Mr. H. Waters, Hoechst Schering AgrEvo (Pty) Ltd*

* Delegates present on the second day only.

APPENDIX I - WORKSHOP PROGRAMME

THE IMPACT OF FERAL HOUSE MICE AT MARION ISLAND AND THE DESIRABILITY OF ERADICATION

THURSDAY 16TH FEBRUARY 1995

THE IMPACT OF MICE ON THE TERRESTRIAL ECOSYSTEM

09H00-09H15:	WELCOME
09H15-09H30:	WORKSHOP OUTLINE
09H30-10H00:	Historical background to alien vertebrates and control programmes at Marion Island. DR. M.N. BESTER
10H00-10H30:	Mouse population biology and the nature of the impact. PROF. R.J. VAN AARDE
10H30-11H00:	**TEA**
11H00-11H30:	The impact of mice - an invertebrate perspective MR. N. AVENANT
11H30-12H00:	The possible influence of climate change PROF. V.R. SMITH
12H00-13H00:	DISCUSSION I - THE NATURE OF THE IMPACT Session split into two groups: Leaders: Prof. M. Perrin & Prof. J. Nel
13H00-14H00:	**LUNCH**
14H00-14H30:	DISCUSSION I CONTINUED
14H30-15H00:	REPORT I: THE NATURE AND EXTENT OF THE IMPACT
15H00-15H30:	**TEA**
15H30-16H00:	REVIEW OF FINDINGS DR. D.T. ROWE-ROWE
16H00-17H00:	FINAL DISCUSSION : CONCLUSIONS TO BE DRAFTED **NATURE AND EXTENT OF IMPACT**
17H00:	***BRAAI***

FRIDAY 17TH FEBRUARY 1995

THE DESIRABILITY AND FEASIBILITY OF ERADICATION

08H30-09H00:	Rodent eradication on other sub-Antarctic islands. MR. J. COOPER
09H00-09H30:	Rodent control via aerial distribution of rodenticides VIDEO
09H30-10H00:	Feasibility for Marion Island. MR. J. COOPER
10H00-10H30:	**TEA**
10H30-11H30:	DISCUSSION II - DESIRABILITY AND FEASIBILITY OF ERADICATION Leaders: Mr. J. Cooper and Dr J.E. Crafford
11H30-12H00:	REPORT II - ERADICATION : OPTIONS
12H00-12H30:	REVIEW OF FINDINGS DR. J.E. CRAFFORD
12H30-13H00:	FINAL CONCLUSIONS TO BE DRAFTED: **DESIRABILITY OF ERADICATION**
13H00:	CLOSE

PROGRAMME FOR A WORKSHOP ORGANIZED BY S.L. CHOWN & J. COOPER; HELD AT THE DEPARTMENT OF ZOOLOGY & ENTOMOLOGY, UNIVERSITY OF PRETORIA, 16-17 FEBRUARY 1995.

THIS WORKSHOP WAS FINANCIALLY SUPPORTED BY THE DIRECTORATE: ANTARCTICA & ISLANDS OF THE SOUTH AFRICAN DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM, ON THE ADVICE OF THE SOUTH AFRICAN COMMITTEE FOR ANTARCTIC RESEARCH.

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From outside of South Africa replace 021 with 27-21

Dr N Gremmen
Erf 16
6644 VS Beuningen
Netherlands

7 September 1995

Dear Niek

AGROSTIS GIGANTEA AT MARION ISLAND

I have been intending to write to you about the new alien grass for months, to bring you up-to-date, and to obtain any further advice you may have.

The story is that on inspection during the takeover this year it was found that *A. gigantea* was occupying more of the slope below the base to Gentoo Lake than was expected from your report, and that any wholesale digging out of plants was not really practicable, given the short takeover and also the likelihood of removing so much plant material and peat that serious erosion would follow. Because of this finding, it was decided to leave the plants *in situ* (apparently they were easily recognized by Marthan Bester and his team). A field assistant staying on the island is going to attempt to remove some plants at least during the year, and will mark the sites of removals with bamboo poles, and monitor them for regrowth and new plants. I have also suggested that he cuts off and incinerates flowering heads before they set seed from plants he does not remove. Dug-out plant material will also be incinerated. I enclose a section of Marthan Bester's Chief Scientist's Report on the matter.

At this year's meeting of the SACAR Biological Sciences Task Group the matter was discussed and it was agreed that the situation needs to be re-evaluated at next year's takeover, and also should be referred to the Prince Edward Islands Management Committee. This committee, which will hopefully be set up before year end, will be taking over responsibility of dealing with conservation issues at the Prince Edward, such as that posed by *A. gigantea*, from the task group. I understand that biologists currently involved in conducting research at Marion Island will be invited to serve on this committee.

I would now appreciate your advice as to the next step to take. Should a herbicide be taken to the island next year? If so, do you have any knowledge which one? I assume any herbicide will also effect the other species of *Agrostis* in the vicinity? Do you see this as a problem? What is your opinion on causing serious local erosion from wholesale removal? Do you see this a necessary evil or not?

Lastly, do you wish to go to Marion next year yourself? If you do go, then a proper inspection of the problem can take place.

I, like you I am sure, am concerned that unless something is done no later than next takeover, we may have missed an opportunity to rid Marion of a new alien. Of course, we may already be too late, but that is no reason not to do our best now.

I look forward to hearing your views, which I will ask to be tabled at the first meeting of the management committee for a decision on the best action to take. I understand that the committee must be constituted and meet before next year's takeover, because it will have the responsibility, in terms of the management plan, of reviewing and approving new research proposals from the conservation point of view.

With kind regards

John Cooper

SANAP Antarctic Officer/ for Director

cc Mr DJ van Schalkwyk, SANAP, DEAT
Professor VR Smith, University of the Free State

Encl.

Extract from the:

MINUTES OF THE SIXTH SACAR BIOLOGICAL SCIENCES TASK GROUP MEETING HELD ON 15 AUGUST 1995

4.5 Conservation issues at Marion Island: Status of Management Plan and its Advisory Committee; experimental research on Gentoo Penguins; and eradication of *Agrostis gigantea.*

Mr Cooper informed the committee that problems had been experienced during the last takeover with stomach logger experiments being conducted on penguins, where two had died and two were reported to be in a serious condition. He reported that it had been suggested that the remaining two be returned to South Africa for treatment, but later decided that this would not be necessary. ***He added that the Prince Edward Islands Management Committee would have to monitor such experiments in the future.***

He closed by mentioning that the policy designed for flights over Marion Island was working, as there had been little disturbance to King Penguins by planes flying over the Island, and added that attempts should be made to assess the scale of the problems of *Agrostis gigantea* and that the eradication thereof should be attempted during the 1996 takeover .

DOC. 10

Extract from the:

DRAFT MINUTES OF THE TWELFTH ANTARCTIC MANAGEMENT COMMITTEE (AMC) MEETING HELD ON 20 FEBRUARY 1996

4.1 Report of the XIXth Antarctic Treaty Consultative Meeting (ATCM)

The Chairman informed that himself, Mr van Schalkwyk (logistics), Adv Hoffman (liability annex) and Mrs du Preez attended this meeting. He added that the Secretariat issue was in a deadlock, but that South Africa was keeping its eyes open.

Dr Miller felt that a large number of the resolutions made did not filter down to the people on the ground level, and that this could easily be consolidated into a document for expeditioners, as he had recently seen in New Zealand. Mr van Schalkwyk informed that a manual for this purpose had been drafted and was handed to each expedition member, but that the format could be improved and that the Department was in the process of formulating *inter alia* a leader's manual.

Dr Miller also added that New Zealand had compiled a document containing a description of its scientific programmes, principle investigators, etc. which was very handy. It was generally felt that South Africa's report to SCAR did not contain enough information, and the Chairman agreed to follow up on this suggestion.

With reference to CCAMLR, Dr Miller pointed out that South Africa was seen as a serious player and added that the Prince Edward Islands Management Plan (PEIMP) was important in this regard, as it could be implemented in the Antarctic area, especially in terms of nuclear waste disposal, etc. where South Africa had a moral obligation and was in a strong moral position. ***Mrs du Preez agreed that this was an excellent proposal, and added that the PEIMP could be incorporated into an Information Paper to be tabled at a future ATCM.***

Adv Hoffman felt that position papers were very useful, but not essential, and that it was necessary to reflect on and discuss these issues, including the Antarctic Policy document, in a more relaxed atmosphere, i.e. a workshop. He stressed that although he had been involved with Antarctic matters over the past few years, he had never actually sat down with the scientists. ***Mr van Schalkwyk agreed with these suggestions, and asked the committee to supply him with agenda items, after which a discussion document would be drawn up and a workshop arranged.***

Mr Jordaan felt that the Antarctic concept was not sold on the home front. The Chairman pointed out that efforts in this regard had been made, e.g. a full colour feature in *Archimedes*, but that manpower and funding were restricting. ***He added that this could be included in the workshop as well.*** Mr van Schalkwyk supported that the Antarctic programme had been handled on various radio stations, that information sessions had been held in rural areas and that the Department was embarking on a competition where the 2 - 3 best students would visit Marion Island. The Chairman added that exposure was also obtained through the B P Antarctic Award. Dr Miller felt that the Antarctic programme was a national showpiece in terms of national pride, and that this concept should be sold.

6. *Report on CCAMLR activities*

Dr Miller informed that Document 6 was a summary of his attendance of CCAMLR and provided a brief summary, including *inter alia*, that the PEIMP's areas of relevance had been summarised and referred to CCAMLR, that he had been approached to stand as Chairman of SC-CAMLR at C-CAMLR XV, that a mechanism to comment regarding the Spanish Secretariat issue was necessary and that in terms of continuity within CCAMLR someone needed to be trained in this area. ***Mr van Schalkwyk stated that only the PEIMP's zones needed to be finalised and he advised the AMC to recommend that the PEIM Committee look into declaring Marion Island a World Heritage Site. The committee accepted this recommendation.*** With reference to the Chairmanship, he added that a document for the Director-General's signature needed to be drafted to obtain approval for Dr Miller's acceptance of this position from the Chief Director: Sea Fisheries. He also felt that Dr Miller and the Department of Foreign Affairs should determine a strategy as far as the Secretariat matter was concerned, and that it should be brought to the Director-General's attention that Dr Miller needed an understudy in terms of South Africa's CCAMLR commitments. The report and comments were accepted by the committee.

Dr Miller added that Mr Jordaan had also attended the CCAMLR meeting, and the delegation report which he had compiled was handed to the Chairman. Mr Jordaan asserted that Dr Miller had covered the issues well and that he had nothing to add in this regard.