Stacks

South African Antarctic Biological Research Programme

SASCAR

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JULY 1981

ERRATA

1. Page 2, 4th paragraph, line 5 - insert comma after plant ecology,
2. Page 2, 4th paragraph, line 6 - palinology to read palynology
3. Page 8, 3rd paragraph, line 9 - southern african te read Southern African.......
4. Page 12, line 2 - invertibrate to read invertebrate
5. Page 12, 2nd paragraph, line 8 - insert comma after Agrostis stolonifera,
6. Page 43, 3rd reference (SMITH, V.R. 1980) - determiniation to read determination
7. Pages 24-51 (BIBLIOGRAPHY) - page numbers of listings published in S. Afr. J. Antarct. Res. 8 (1978) should read as follows:

p.26 - 2nd listing, pp 99-103
p.27 - 3rd listing, pp 87-99
p.28 - 1st listing, pp 59-70
p.29 - 1st listing, pp 42-48
sting, pp 38-42 and 9th listing, pp 113-118
sting, pp 30-34, 2nd listing, pp 75-87 and 6th
p 35-38
sting, pp 21-30, 7th listing, pp 106-113 and 9th
p 103-105
sting, pp 13-21
sting, pp 71-74 and 4th listing, pp 49-53
sting, pp 53-59

South African Antarctic Biological Research Programme

SASCAR

Programme developed by the South African Scientific Committee for Antarctic Research (SASCAR)

SOUTH AFRICAN NATIONAL SCIENTIFIC PROGRAMMES REPORT NO

50

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PREFACE

South Africa is one of the original signatories of the Antarctic Treaty and South African scientists have been involved in Antarctic research since the early 1960's. Research in the Antarctic is coordinated internationally through the Scientific Committee on Antarctic Research of the International Council of Scientific Unions. The CSIR is a member of SCAR and coordinates the South African programme through the South African Scientific Committee on Antarctic Research (SASCAR).

This document sets out the biological research programme which SASCAR has recommended should be undertaken in the sub-Antarctic and Antarctic regions by South African research groups. It has been developed in consultation with the scientists and scientific institutions currently active in Antarctic research, with due regard also to international activities in the area. It draws on the knowledge and experience gained during the past decade, takes into account the manpower, facilities and expertise which are available in the country, and concentrates on activities which can be regarded as logical extensions of existing research activities.

The document will serve to direct the efforts of those already involved in Antarctic research, will be of interest to those not involved, and will guide those who may wish to initiate an activity.

ABSTRACT

This document provides a description of the past, current and planned South African biological research activities in the sub-Antarctic and Antarctic regions. Future activities will fall under one of five components of the research programme, viz palaeo-ecological and biogeographical studies, ecosystem studies, autecological studies, studies on alien biota and monitoring studies. These components accommodate national and international needs within the constraints of available manpower, finances and logistical support.

SAMEVATTING

Hierdie dokument verskaf 'n beskrywing van vorige, huidige en beplande Suid-Afrikaanse biologiese navorsingsaktiwiteite in die sub-Antarktiese- en Antarktiese streke. Toekomstige aktiwiteite sal onder een van die volgende vyf komponente van die navorsingsprogram ressorteer: palaeo-ekologiese studies; ekosisteemstudies; autekologiese studies; studies oor vreemde biota en moniteringstudies. Hierdie komponente maak voorsiening vir nasionale en internasionale behoeftes binne die beperkings van beskikbare mannekrag, finansiële en logistieke ondersteuning.

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INTRODUCTION

Biological studies on Marion Island date back to the first collections made during the scientific cruises of *HMS Challenger* in 1873. Over ninety years passed before the Biological and Geological Expedition to Marion and Prince Edward islands in 1965 initiated a new phase of South African biological research in the sub-Antarctic. The first expedition (1965-1966) presented a description of the Prince Edward islands and was followed by more detailed analytical studies conducted on Marion Island through the 1970's. Because of the considerable body of knowledge generated during the 1970's (see Bibliography), a recommendation was made at the 1978 'Symposium on the Biology of Marion Island' (S. Afr. J. Antarct. Res., 8, 1978) that a workshop be convened to synthesize available data and to develop a basis for closer integration of research activities in the future.

As considerable differences existed in the several approaches adopted by the various groups conducting terrestrial research at the islands, a general review of the progress made, the research opportunities available, and possible avenues for future study were seen to be a first priority. A workshop meeting was convened in June 1980 to consider these matters and to develop a programme that would embrace integrated, multi-disciplinary team research on specific island communities as well as research by individual workers, capitalizing on other opportunities not normally available to South African biologists.

This document summarizes the workshop discussions. It outlines the directions the future SASCAR (South African Scientific Committee on Antarctic Research) biological research programme is expected to take. Throughout the document attention is focused on Marion Island. While the SASCAR biological effort is not confined to this one island, incorporating Prince Edward and Gough islands, it is nevertheless centred at Marion Island. The research programme outlined is also designed to tie in where appropriate with the South African Southern Ocean Programme of purely ship-based research, funded by another body known as SANCOR (South African National Committee for Oceanographic Research).

HISTORY OF SOUTH AFRICAN BIOLOGICAL RESEARCH AT THE PRINCE EDWARD ISLANDS

The establishment of a South African weather station on Marion Island (46° 52'S, 37° 51'E) in 1948 opened the possibility for scientific research at the Prince Edward islands. During the 1950's and early 1960's a few members of resident meteorological teams, and a few observers visiting the islands during relief voyages, published accounts on the occurrence, population sizes and local distributions of various plants and animals they found there.

The work done by these people was of value, even though purely opportunistic and not part of any official research programme. Members of the first properly organized South African scientific expedition to the islands landed on Marion Island in 1965. Between January of that year and March 1966 they concentrated on descriptive biology and geology. Their results are documented in the monograph "Marion and Prince Edward Islands; Report on the South African Biological and Geological Expedition, 1965-1966" (Van Zinderen Bakker, Winterbottom & Dyer 1971).

The arrival on Marion Island of members of a second biological expedition, from December 1971 to April 1972, signalled the next phase in the development of the research programme. Studies of a more analytical and quantitative nature were carried out and work was initiated on the autecology of freshwater bodies, nitrogen fixation in mires and the mineral status of selected soils and plants. Cores for palaeo-ecological studies, and fish, marine invertebrates, lichens and soil macrofauna for additional descriptive work were also collected. Field-work was continued the following summer, from December 1972 to April 1973, by a third expedition which also began work on the littoral ecology and fur seal population of Marion Island.

A major development in the research programme occurred in 1973, with the implementation of an official, SASCAR supported five-year programme of research conducted by three independent groups invited to participate in the programme by the CSIR - the Institute for Environmental Sciences of the University of the Orange Free State (studies on plant ecology palinology, limnology, soil chemistry and nutrient cycling), the Mammal Research Institute of the University of Pretoria (studies on the seals, feral cats and mice) and the Percy FitzPatrick Institute of African Ornithology of the University of Cape Town (studies on surface-nesting seabirds) - and financially and logistically supported by the Department of Transport on the advice of SASCAR.

During the five-year programme, from 1973 to 1978, effort was concentrated primarily at Marion Island, though some work was done at neighbouring Prince Edward Island and also at Gough Island. The development of a whole-island model was aimed at, although this was never formally adopted as the ultimate goal of the effort.

During this period, SASCAR also undertook a brief programme of marine biological research in cooperation with the French Antarctic authority, TAAF (Terres Australes et Antarctiques Françaises). The work was conducted from the French research/supply ship *Marion Dufresne* from 8 March to 26 April 1976, and involved an investigation of the Marine fauna around the Crozet Archipelago and the Prince Edward islands, and a study of the distribution and abundance of seabirds at sea along the ship's route from Réunion to the Kerguelen, Crozet and Prince Edward islands.

In 1978 a second five-year research programme commenced, with the increased awareness of the importance of living resources in the Southern Ocean having a marked influence on research proposals. It was considered necessary to upgrade studies on littoral, sub-littoral and local offshore systems and a fourth research institute - the School of Environmental Studies of the University of Cape Town - was brought into the programme. A number of the current projects were designed so that, together with the South African Southern Ocean Programme, they would contribute to international research efforts such as the BIOMASS programme. At the same time, work on plant ecology, nutrient cycles, seabird and seal populations, and alien species continued, with the whole-island model still being considered by some participants to be the final goal. With BIOMASS, the whole-island model plan, the need to address certain management/conservation problems (eg feral cats) and the desire to concentrate at least some research effort on other special opportunities all influencing the direction of projects, research activities began to reflect a divergence in goals potentially too great to accommodate, both financially and logistically. With the limited funds available the need to start considering priorities was becoming increasingly urgent.

It also became clear that, while there was partial agreement on the merits of adopting a single goal at which to direct the whole research effort, the restrictions that would be imposed on the freedom of exploitation of research opportunities was not acceptable. With the closing stages of the second five-year programme (1978-1982) at hand, it was felt that an attempt to resolve this complex issue was necessary. The workshop in June 1980 was held to discuss this and the nature of the future research effort.

INTERNATIONAL REPRESENTATION AND CONTACT

South Africa has been a member of SCAR (Scientific Committee on Antarctic Research) since its inception in 1958. Although the Prince Edward islands do not fall within the Antarctic Treaty area (south of 60°S), South Africa voluntarily conducts its affairs at, and manages, these islands in the spirit of the Antarctic Treaty.

Cooperation with other nations within the framework of SCAR has been, and continues to be stimulating, especially in the SCAR Working Groups. South Africa has been a member of the SCAR Working Group on Biology since 1964. A number of South Africans are also members of various BIOMASS groups (Group of Specialists, Technical Groups and Working Parties).

Persons participating in the SASCAR Biological Sciences research programme are encouraged to develop and maintain close liaison with colleagues throughout the world who are involved in similar research. In the past and at present, participants in the programme have developed and conducted joint projects with other national Antarctic research organizations. It is hoped that this will continue in the future, with the proviso that the work conducted contributes directly to the advancement of research being planned or conducted as part of SASCAR's programme.

THE SCIENTIFIC RATIONALE FOR SOUTH AFRICAN BIOLOGICAL RESEARCH IN THE SUB-ANTARCTIC AND ANTARCTIC

Proposals for funds to conduct biological research at the Prince Edward and Gough islands must ultimately be evaluated in the light of the full spectrum of national research needs in the field of biology.

Furthermore, in developing a case for biological research centred at the Prince Edward islands, it is essential that the special or unique opportunities present, as well as the islands' role in national and international biological research programmes, be assessed carefully.

The Prince Edward islands are situated in a truly remote oceanic situation. The comparative youth of the islands, almost complete glaciation during the last glacial maximum and the existence of several hundred small lakes of varying size, shape and altitude, offer unusual and varied opportunities for research. The extensive mires have already yielded important palynological information on the past climate of the islands, the Southern Ocean and indeed the Southern Hemisphere. The isolated islands are dependent entirely on long-distance dispersal mechanisms for the immigration of biota and are thus good field laboratories for studying dispersal, colonization, adaptation and competition in hostile environments.

The vegetation of the islands is typically sub-Antarctic. The simple physiognomy and more particularly the extreme species paucity of vascular plants and the absence of trees and shrubs result in a relatively simple plant community structure, which lends itself to a systems analytical approach in studies of community functioning. The apparently very high rate of primary productivity, near absence of herbivory and total absence of fire result in an unusually important role for the decomposers in the islands' terrestrial ecosystem. Another interesting feature of sub-Antarctic terrestrial ecosystems is their almost complete dependence on nutrient inputs from the marine environment - saltspray-laden winds reach every point on the Prince Edward islands and the lowlands are heavily manured by seabirds and marine mammals. Thus the initiation of closely integrated studies on community and ecosystem structure and functioning at the Prince Edward islands would clearly throw further light on fundamental ecological processes in the sub-Antarctic.

As much as special opportunities exist for studies at the community level, these opportunities also exist for autecological studies on plants, birds, mammals and invertebrates. Introductions of alien vascular plants and mammals to the Prince Edward islands, especially to Marion Island, have created a series of novel research challenges. The absence of almost all of these aliens on neighbouring Prince Edward Island provides a natural reference point for comparative studies.

Despite the severe local impact that man has had since the establishment of the Meteorological Station on Marion Island in 1948, the Prince Edward islands are relatively undisturbed by man. This feature, combined with their isolation from sources of pollutants, accounts for their suitability as baseline monitoring sites for pesticide residues, heavy metals and other environmental pollutants. These islands could prove to be valuable primary stations for monitoring bird and mammal populations in the BIOMASS programme, provided monitoring is supported by research into factors affecting the population- and tropho-dynamics of the selected indicator species.

The Prince Edward islands also offer outstandingly good opportunities for studying freshwater ecosystems subjected to different degrees of biotic enrichment and having limited food chains. The freshwater bodies could also be ideal for chemical monitoring studies.

APPROACH TO AND GOAL OF A LONG-TERM SASCAR BIOLOGICAL RESEARCH PROGRAMME CENTRED AT THE PRINCE EDWARD ISLANDS

The primary, long-term goal of the programme is to develop an understanding of the structure and functioning of selected communities and populations; and of their interrelations with local terrestrial, freshwater and marine ecosystems.

The goal will be approached through a series of related activities, these being:

- Palaeo-ecological and biogeographical studies : to obtain an understanding of the islands' palaeo-ecology and the evolution of its biota, and to use this to test theories on island biogeography.

- Ecosystem studies : to undertake detailed and integrated studies on selected terrestrial, marine and freshwater ecosystems which offer special opportunities for understanding ecological processes peculiar to sub-Antarctic islands.

- Autecological studies : to study the life history, physiology, genetics, population dynamics and behaviour of selected species.

- Studies on alien biota : to examine the utilization of resources by introduced alien biota, with a view to their management and the conservation of the natural ecosystem.

- Monitoring studies : to establish baselines and initiate monitoring programmes as a contribution to international projects such as BIOMASS and GEMS, and to resolve conservation and management issues related to the islands themselves.

COMPONENTS OF THE RESEARCH PROGRAMME

The five main fields of research activity outlined above offer numerous opportunities for closely integrated studies by multi-disciplinary teams aimed at developing systems models of communities, as well as studies in other directions and for other reasons by individual workers. They also accommodate studies based purely on academic merit, studies based on the needs of national or international programmes and studies based on local conservation and management issues.

(i) Palaeo-ecological and biogeographical studies

The Prince Edward islands are ideal for palaeo-ecological studies since they are extremely isolated, situated in a marginal climatic position, and have flora and fauna which are relatively poor in numbers of species. The islands lie in the West Wind Drift, while the Antarctic Convergence is situated only a few degrees south of them. Marion Island has an age of about 0,25 million years and has experienced at least two volcanic episodes and three ice ages, which profoundly influenced the biota of the island. The results of pollen analyses suggest that during the last glacial maximum the temperature at sea level decreased by at least 3 °C, which accords with later research on the glacial geology of the island and with the CLIMAP research carried out in the surrounding ocean. This indicates that a slight northward shift of the Antarctic Convergence and/or a minor decrease in temperature caused the nearly complete glaciation of the island. From 12 600 years BP onward the climate apparently resembled present-day conditions.

Because of the island's isolation, its geologically recent origin and rigorous environment, only 38 vascular plant species occur in the island flora. Of these, only six species contribute significantly to the aerial cover and standing crop of the vegetation. Thirteen of the 38 vascular species recorded in the island flora are aliens, introduced by man.

The biogeographical affinities of the marine fauna and flora of the Prince Edward islands lie largely within the sub-Antarctic and, to a lesser degree, within the Antarctic region. The closest relationships are with the Crozet and Kerguelen island groups. The species richness of fish (10 species) and other marine invertebrates appears to be lower than that recorded from around the islands of the Crozet and Kerguelen archipelagos. In deeper offshore waters, down to 600 m, species richness appears to increase. The peculiar species composition of the zooplankton community, which is Antarctic rather than sub-Antarctic in character, is apparently related to the upwelling of cold water in the lee of the islands.

Three species of seals - two fur seals (Arctocephalus tropicalis and A. gazella) and an elephant seal (Mirounga leonina) - breed at the Prince Edward islands, and individuals of at least one other species - the leopard seal (Hydrurga leptonyx) - are occasionally observed. The pinniped fauna is therefore primarily sub-Antarctic, but there is a degree of overlap with a more typically Antarctic fauna. The apparent increase, in recent years, in the occurrence of sub-Antarctic fur and elephant seals along the southern african coastline is an interesting phenomenon and one that is not necessarily related to increasing population sizes at traditional breeding grounds. The dispersal of these species away from their summer breeding grounds during winter and their whereabouts during this period are also matters which, when understood, will shed further light on Southern Ocean pinniped biogeography.

Twenty-seven species of seabirds breed on the Prince Edward islands and the avifauna has most in common with that of the Crozet and Kerguelen archipelagos, which are the two nearest island groups. Thirty-three individuals, belonging to 15 alien species of land birds, have been recorded at the Prince Edward islands. These observations are potentially useful in developing an improved understanding of island biogeography and in studies of the role of birds as transporters of biological propagules, parasites and diseases in the Southern Ocean.

To develop a better understanding of the palaeo-ecology and biogeography of the Southern Hemisphere and the Southern Ocean, questions which need to be addressed at the Prince Edward islands are:

- What is the detailed Quaternary history of the islands with reference to volcanic, glacial and peri-glacial phenomena, including changes in climate and sea level?
- What are the relationships between landscape evolution and soil genesis with respect to the different lava types and their biotic communities; and what is the effect on the freshwater environments and communities?
- How has the palaeo-environment of the islands influenced colonization by plants and animals?
- What are the relationships between species diversity, habitat size and substrate age in the various island communities?
- What special characteristics for dispersal and colonization can be observed in the biota of the islands and how do these relate to colonization success?
- What are the biogeographical relationships of organisms that have colonized the island's freshwater bodies?

(ii) Ecosystem studies

A considerable body of descriptive information on the structure of various terrestrial and freshwater communities has been accumulated since the first biological expedition to the Prince Edward islands.

The first surveys provided general accounts of the principal plant and freshwater communities and a base for the more detailed phyto-sociological and physico-chemical studies initiated subsequently. During the 1970's research was aimed at quantifying the amount of nitrogen and other elements in the biotic and abiotic components of selected study sites as well as the inputs of nutrients by seabirds, precipitation and fixation. Although useful quantitative data were gathered, relatively little progress has been made with synthesizing these data into a simplistic whole-island model, as originally envisaged.

Another attempt at developing a simple, whole-island accounting model is recommended, mainly to provide a better understanding of communities selected for more detailed investigation.

Four communities considered to be particularly appropriate for more detailed investigations are:

- Cotula/Poa herbfield and tussock and associated seal and penguin colonies;

- Agrostis mire and associated sheathbill (Chionis minor) and invertebrate populations;

- Azorella/Acaena/Blechnum slope complex and associated burrowing petrel populations;

- selected freshwater bodies and associated aquatic and terrestrial communities.

Workers who choose to participate in these studies should concentrate their efforts on the following key questions:

- How does the primary producer component function and what are the inputs into a primary producer sub-model?

- What are the patterns and rates of nutrient utilization, transformation, translocation and accumulation and what are the inputs to a nutrient sub-model?

- How does the consumer component function (eg herbivory, carnivory, migration, physiology, population dynamics), and what are the inputs to a consumer sub-model?

- How does the decomposer component function (invertebrates and micro-organisms) and what are the inputs into a decomposer sub-model?

- What are the important abiotic influences on the above ecosystem functions and what are the inputs for an abiotic sub-model?

(iii) Autecological studies

The fauna, with the exception of the seabirds, and flora of the Prince Edward islands are characterised by a relative paucity of species, with many animal species using the islands primarily as platforms for breeding and moulting, whilst relying on the ocean for their food resources. Thus there is a critical need to examine both the terrestrial and pelagic life cycles of the seabirds and pinnipeds. The need for autecological studies is also implicated in the other main fields of research presented in this document.

Prior to 1973 autecological studies on the fauna consisted mainly of generalised accounts of numbers, density and local distribution. Since then a few more detailed studies on population dynamics, genetics, diet, physiology, growth, social behaviour and reproduction have been undertaken to obtain a better understanding of the species themselves, or their roles in the local communities in which they occur and, in some cases, their interrelationships with other closely related species (eg species pairs). Relatively few detailed plant autecological studies have been undertaken on the islands.

Key questions which need to be addressed in the future research effort at these islands are:

- What are the forces responsible for changes in population parameters and population status of species which play major roles in the important terrestrial, freshwater and local marine communities?

- What environmental and species characteristics allow closely related or ecologically similar species to coexist on the islands?

- What are the energy budgets of the vertebrate and invertibrate species which play major roles in the communities selected for ecosystem studies?

- How do population dynamics (notably predator-prey relationships) influence communities and what is the nature of these interactions?

- What are the photosynthetic and respiratory responses of the islands' algal, bryophyte and vascular plant species to environmental and biotic factors?

- What are the physiological characteristics (in terms of carbon/water/nutrient balances) of the dominant vascular plant species?

(iv) Studies on alien biota

Five cats were introduced to Marion Island in 1949, apparently to control the mouse (*Mus musculus*) problem at the Meteorological Station. The mice appear to have been introduced, possibly on more than one occasion, to Marion Island through the activities of sealers in the nineteenth and early part of the present centuries. Neither mice nor cats have yet been found on Prince Edward Island and there is a need to protect this island from these and other aliens.

Thirteen of the 38 species of vascular plants recorded on the islands are alien. On Marion Island, four of these aliens (*Avena sativa*, *Holcus lanatus*, *Hypochoeris radicata*, *Plantago lanceolata*) are now considered transient aliens, one (*Rumex acetosella*) as a persistent alien and eight as naturalised aliens. Four of the latter (*Agropyron repens*, *Alopecurus australis*, *Festuca rubra*, *Poa pratensis*) show a restricted distribution, while the other four (*Agrostis stolonifera* *Cerastium fontanum*, *Poa annua*, *Sagina apetala*, *Stellaria media*) are widespread. Only one alien (*Poa annua*) is known to occur on Prince Edward Island and is considered to be naturalised. Successive introductions, arising from the activities of sealers and the establishment of the Meteorological Station, are thought to have led to the present situation. The introduction of sheep and domestic fowls to Marion Island, necessitating the supply of stock feeds and fodder from 1950 until 1969, when the practice was terminated and the livestock removed, probably accounts for most of the alien plants found in the vicinity of the Meteorological Station. Apparently willows and pines were once planted near the Meteorological Station on Marion Island, but have not survived.

Trout (Salmo trutta) were introduced, in the late 1960's, into the only perennial stream (Van den Boogaardt river) on Marion Island. They have persisted to the present time, apparently in small numbers in some of the lower lying, more stable portions of this stream.

Of all the alien species, the cats and, to a lesser extent, the mice on Marion Island have been the subjects of most attention. Studies on the alien flora have, up to the present, been largely confined to their identification and distribution. No work has been done on the introduced trout.

Key questions which need to be addressed in the future research effort are:

- What are the interactions between the alien species and indigenous prey, predator and competitive species?

- What alien invertebrate species (terrestrial and water), if any, occur on the islands and is there any competition with indigenous species?

- What parasites and diseases have been introduced by alien species, and what influence, if any, do these have on the native fauna and flora?

(v) Monitoring studies

Monitoring of indicator species on the Prince Edward islands could contribute towards evaluating the impact of man's activities on the Southern Ocean ecosystem and the occurrence of heavy metals, organo-chlorines and other persistent chemicals. Invasive alien plants and animals on the islands also need to be monitored for local terrestrial conservation and management purposes.

Some general prerequisites must apply to monitoring programmes on the islands, before this type of work can be undertaken. It is necessary to integrate monitoring programmes with those established by other nations through efforts such as BIOMASS and GEMS, and to develop a sound insight into the biology of the species selected for monitoring. Ideally, monitoring systems should be simple to implement, with a large degree of standardisation in terms of time and space. The design of these systems should be such as to minimize manpower requirements, by the maximum use of advanced technology, within the constraints of available funds. Future proposals for the implementation of monitoring will need to address specifically the experimental design of the exercise so that it will over the long-term provide the data being sought.

The key questions in regard to the development of monitoring activities are:

- What is the nature of the change(s) that might be expected to become evident during the monitoring programme?

- What species and/or sites, as well as techniques, will be suited to monitoring such change(s)?

- What particular characteristics of the selected species should be monitored (for example diet, breeding success, numbers)?

- What sampling intensity, frequency and duration would be required to indicate significant and meaningful fluctuations and trends in the selected species and/or sites?

- What procedures are required to verify that the monitoring design applied is being effective?

- What are the environmental variables which influence the species and/or site(s) selected for monitoring which could complicate the interpretation of findings about man's impact on the environment, and how are these variables monitored?

(vi) Priorities

Proposals directly relevant to any of the five components will be considered by SASCAR, on the basis of scientific merit, appropriateness, and their financial and logistical implications. However, proposals relevant to the ecosystem and autecological components will be given priority consideration. Support for proposals not falling within these two priority components will be dependent upon the availability of funds not allocated to ecosystem and autecological studies.

ORGANIZATION AND ADMINISTRATION OF THE RESEARCH PROGRAMME

Research in the Antarctic is coordinated internationally through the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions (ICSU). The Council for Scientific and Industrial Research (CSIR) adheres to SCAR on behalf of South Africa and coordinates the South African Antarctic research programme through the South African Scientific Committee for Antarctic Research (SASCAR).

The SASCAR sub-Committee on Biological Sciences coordinates the biological research programme. It comprises the directors of the various research institutions which conduct the research, a number of other experts in the fields of research being undertaken, representatives of the Department of Transport (Antarctic Section) and the Scientific Coordinator and Secretary (Cooperative Scientific Programmes, CSIR). Financial and logistical support are provided by the Department of Transport, on the advice of SASCAR.

Scientific Coordination

The overall research programme is managed by a Scientific Coordinator at the Cooperative Scientific Programmes (CSP) of the CSIR. The institutions which participate in the programme are responsible for the internal administration of their research personnel and allocated funds.

Participants in the SASCAR biological research programme are expected to maintain close liaison with other researchers involved in the same programme. Laboratory and domestic facilities, available at Marion and Gough islands, at Sanae and aboard the *SA Agulhas*, are shared by all participants.

Maintenance of the standard of research is largely the responsibility of the project leaders. However, SASCAR as well as its sub-committees are also responsible for ensuring that high standards of research are maintained.

Project proposals are reviewed in the light of progress made, workshops and symposia on selected topics are arranged, programme participants are sent to international SCAR or SCAR-related workshops, symposia and conferences when appropriate, and when possible experts are sent to visit researchers in the field or at their home bases.

Participation in the Programme

Participation in the National Antarctic Programme is not confined to particular research groups only. Individuals or groups of researchers from any research organization in South Africa are free to submit research proposals. These are considered by the relevant SASCAR sub-committee in free and fair competition with each other. If approved, projects are funded for fixed periods - normally three years in the biological sciences programme - provided satisfactory progress is maintained.

New projects are incorporated into the programme as and when funds become available. Usually, this occurs when current projects are brought to completion. New projects that are proposed are expected to be directly relevant to the programme outlined in this document.

Research proposals are submitted annually to CSP through the proposer's own research administration, by 30 June. The proposal is prepared on the CSP NP10 form, obtainable from the scientific coordinator or from university registrars. Proposals take two forms - the first and original "project proposal", describing the objectives, intended duration, techniques to be used, cost analysis, motivation and work plan of the project, and "follow-up proposals" submitted in each subsequent year of the project's duration.

Proposals and progress reports are sent out for review, adjusted accordingly by the proposer(s) if necessary and then considered by the SASCAR Sub-committee on Biological Sciences, usually about September each year, for consideration. The recommendations of this sub-committee are then referred to SASCAR which meets anually, usually in October/November, for approval.

Applicants are subsequently informed of the amounts they have been awarded for their projects, if any, usually in November/December.

These funds are obtained from the Department of Transport. Funding is based on the financial year 1 April to 31 March. New or follow-up proposals submitted in June are therefore considered for funding from 1 April the following year to 31 March the year after. Funds are allocated on a yearly basis.

Proper preparation of new and follow-up proposals is essential. Participants are advised to consult with the scientific coordinator prior to their preparation, particularly with regard to the preparation of budgets. Proposals that indicate insufficient familiarity with past and current work, and a lack of attention to experimental design, key questions, duration and costing will not be accepted for consideration.

A handbook, known as the "Antarctic Programme Manual", detailing procedures to be followed by project leaders with respect to the appointment of research staff, salary scales, payment of bonuses and daily allowances, and general financial administration is available from the General (Antarctic) Section of the Department of Transport. This manual is updated periodically as procedures change and salary scales are reviewed. Project leaders of SASCAR-funded activities are expected to operate according to these procedures.

Progress Reports

Progress reports are required with each follow-up proposal. They provide a means to assess scientific progress over the previous year and are therefore important supporting documents. A set of guidelines for the preparation of these reports is available from the scientific coordinator.

All progress reports submitted to SASCAR are distributed to participants in the South African Antarctic research programme and to members of SASCAR and its sub-committees, in the form of an annual volume of "Progress Reports to SASCAR". These volumes provide participants with an insight into all research projects in the National Antarctic Programme.

Logistics

The General (Antarctic) Section of the Department of Transport provides and coordinates the logistical support for the national Antarctic research effort, and is responsible for the accommodation, domestic supplies, transport and field facilities required by the research programmes at the various stations. Provision and maintenance of laboratory equipment and special supplies are the responsibility of the participating researchers.

The South African Antarctic research/supply ship, the *MV SA Agulhas*, based in Cape Town, usually visits Marion Island (46° 52'S, 37° 51'E) twice annually. The first and longest visit, usually lasting three to six weeks, takes place in autumn (April/May) and is the annual relief voyage. The second visit, generally of much shorter duration usually takes place in spring (August/September) or summer (November/December). Biologists and their field assistants may travel to and from the island on the voyage(s) of their choice. The ship visits Gough Island (40° 21'S, 9° 53'W) once annually for the relief exercise, usually in early summer (October/November) and the visit lasts three to six weeks. In December/January each year it sails to Antarctica for the annual relief of the Sanae station (70° 18'S, 2° 24'W) on the Fimbul Ice Shelf, Queen Maud Land. It returns to Cape Town in February/March. Following the off-loading of expedition personnel, building personnel, visitors and supplies, the ship normally proceeds with oceanographic research conducted by ship-based scientists. On completion of this work, it returns to collect homeward bound personnel, and then proceeds back to Cape Town. The outward and inward voyages between the research stations and Cape Town, as well as the intervening oceanographic cruises are in themselves valuable opportunities for field-work. The *SA Agulhas* is the only platform regularly available to South Africans interested in Southern Ocean oceanography.

Researchers and field assistants intending to stay at the stations between relief voyages are required to undergo medical examination and aptitude and adaptibility tests before their appointment can be confirmed. They are also required to attend an orientation course prior to departure. These courses take place in February/March (for Marion Island), August/September (for Gough Island) and November/

December (for Sanae). The Department of Transport organizes the examinations and orientation courses. Those visiting the stations for the duration of the relief periods only are not normally required to undergo these.

SASCAR and SANCOR

Since no single institution in South Africa is responsible for polar research and two national committees - SASCAR and SANCOR (South African National Committee for Oceanographic Research) - fund research in the Antarctic and sub-Antarctic regions, it has been necessary to arbitrarily partition the "jurisdiction" of these two committees. Work conducted on land or from one of the research stations (eg Marion Island) where the researchers are based, is funded by SASCAR. Work conducted in the Southern Ocean itself, in the main part off a research ship (eg *SA Agulhas)*, is funded by SANCOR. A SANCOR sub-committee, known as the Southern Ocean Committee, sponsors this work from SANCOR funds and reports to both SANCOR and SASCAR.

LIST OF CURRENT PROJECTS IN THE SASCAR BIOLOGICAL SCIENCES RESEARCH PROGRAMME

Mammal Research Institute (MRI), University of Pretoria, Pretoria

- Ecology of the house mouse *Mus musculus* at Marion Island, ending December 1981.

- Influence of southern elephant seals *M. leonina* on the coastal ecology of Marion Island, ending March 1983.

- Ecological and genetic relationships between two species of fur seal *A. tropicalis* and *A. gazella* at Marion Island, ending March 1983.

- Spatial and temporal distribution of pinnipeds in the Southern Ocean (Marion, Gough, Kerguelen and Crozet islands), ending March 1983.

Percy FitzPatrick Institute of African Ornithology (PFIAO), University of Cape Town, Cape Town

- Population dynamics and biology of selected species of seabirds on Marion Island, with particular reference to their energy and mineral contributions to the terrestrial ecosystem, ending March 1984.

- Relationships between the population dynamics of selected species of seabirds (chiefly penguins) and their prey (chiefly krill) at the Prince Edward and Gough islands, ending March 1983.

School of Environmental Studies (SES), University of Cape Town, Cape Town

- Intertidal community structure of Marion Island, ending March 1982.

- Biology of the marine flora of Tristan da Cunha, Gough and Marion islands, ending March 1982.

- Biology of *Durvillae antarctica* and other algae at Marion Island, ending March 1982.

Institute for Environmental Sciences (IES), University of the Orange Free State, Bloemfontein

- Palynology and long distance dispersal at Southern Islands, ending March 1983.

- Nitrogen cycling on Marion Island, ending March 1984.

- Plant ecology of Marion Island, ending March 1982.

- Decomposition studies on Marion Island, ending March 1985.

LIST OF STATIONS

Distances to Cape Town in kilometers

		Lat	Long
Gough Island to Cape Town	2 610		
SANAE to Cape Town	4 260	70,31	357,64
Marion Island to Cape Town	2 110	46,85	37,87
Hermanus		34,42	19,22
Grahamstown		33,28	26,48
Potchefstroom		26,66	27,08
Johannesburg		26,20	28,03

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This bibliography was compiled at the request of the SASCAR Sub-Committee on Biological Sciences. It covers the bulk of the literature published before and during 1980. It was compiled to give readers of this report an insight into the work that has already been conducted at the Prince Edward islands and by participants in the South African Antarctic biological sciences research programme.

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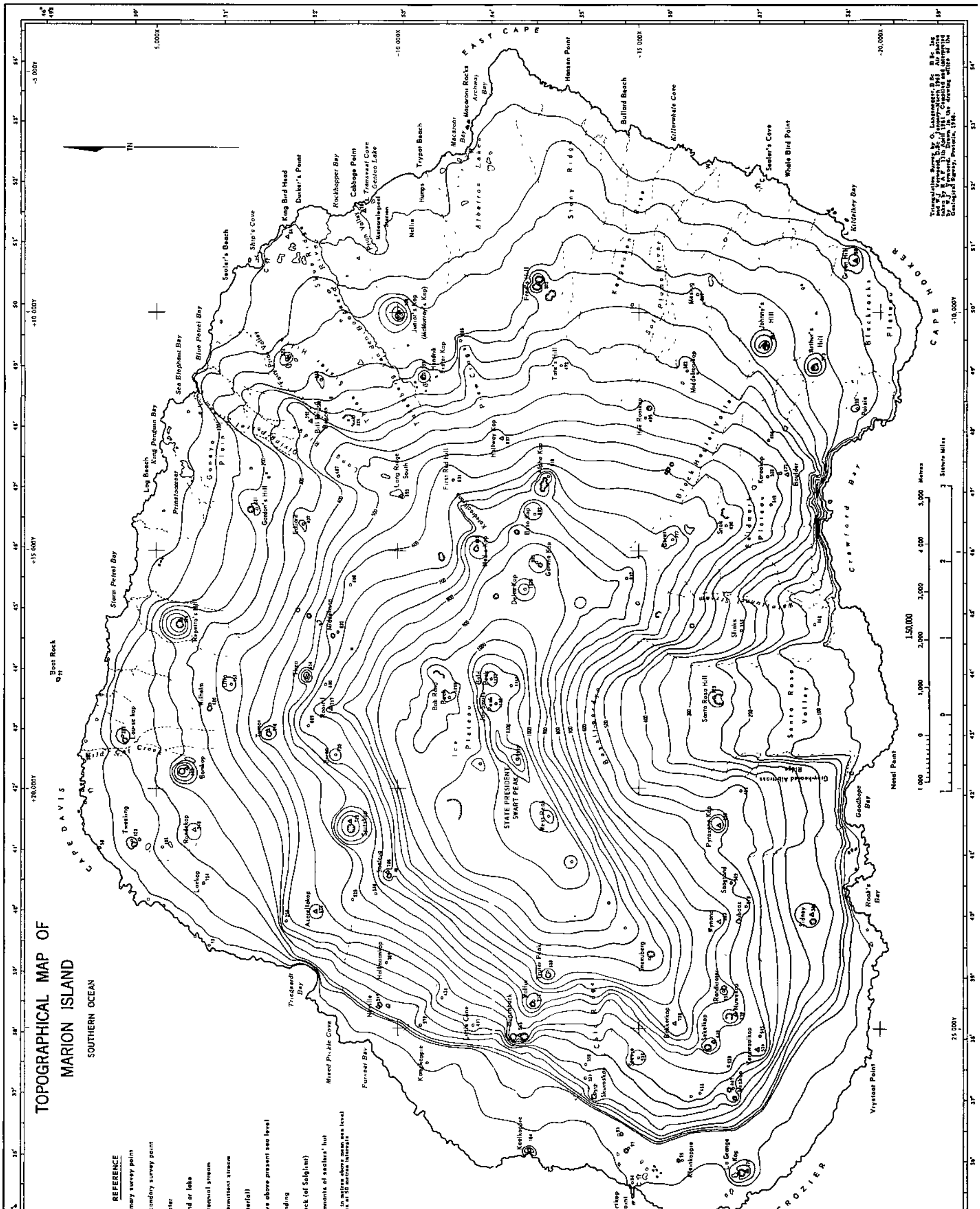
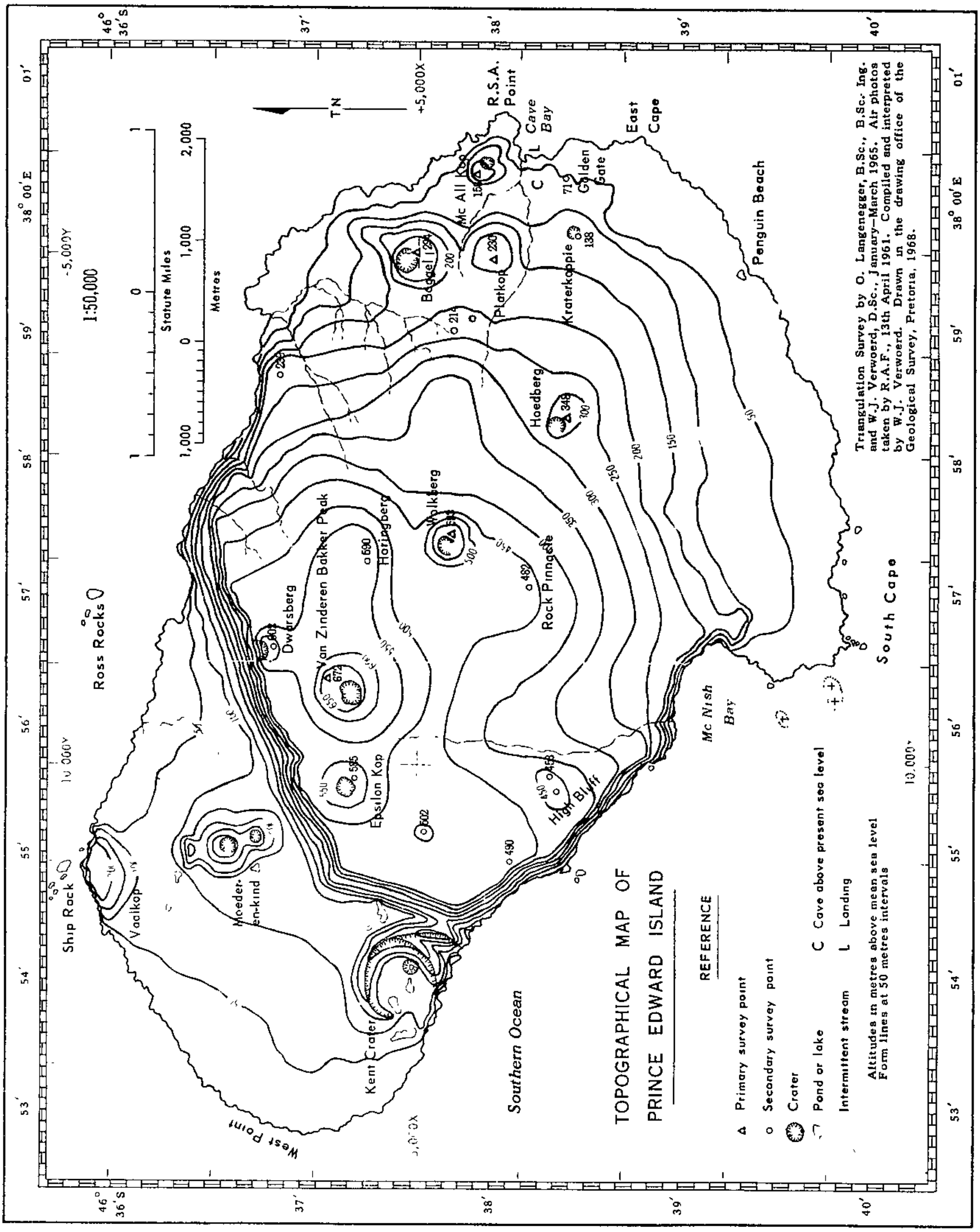
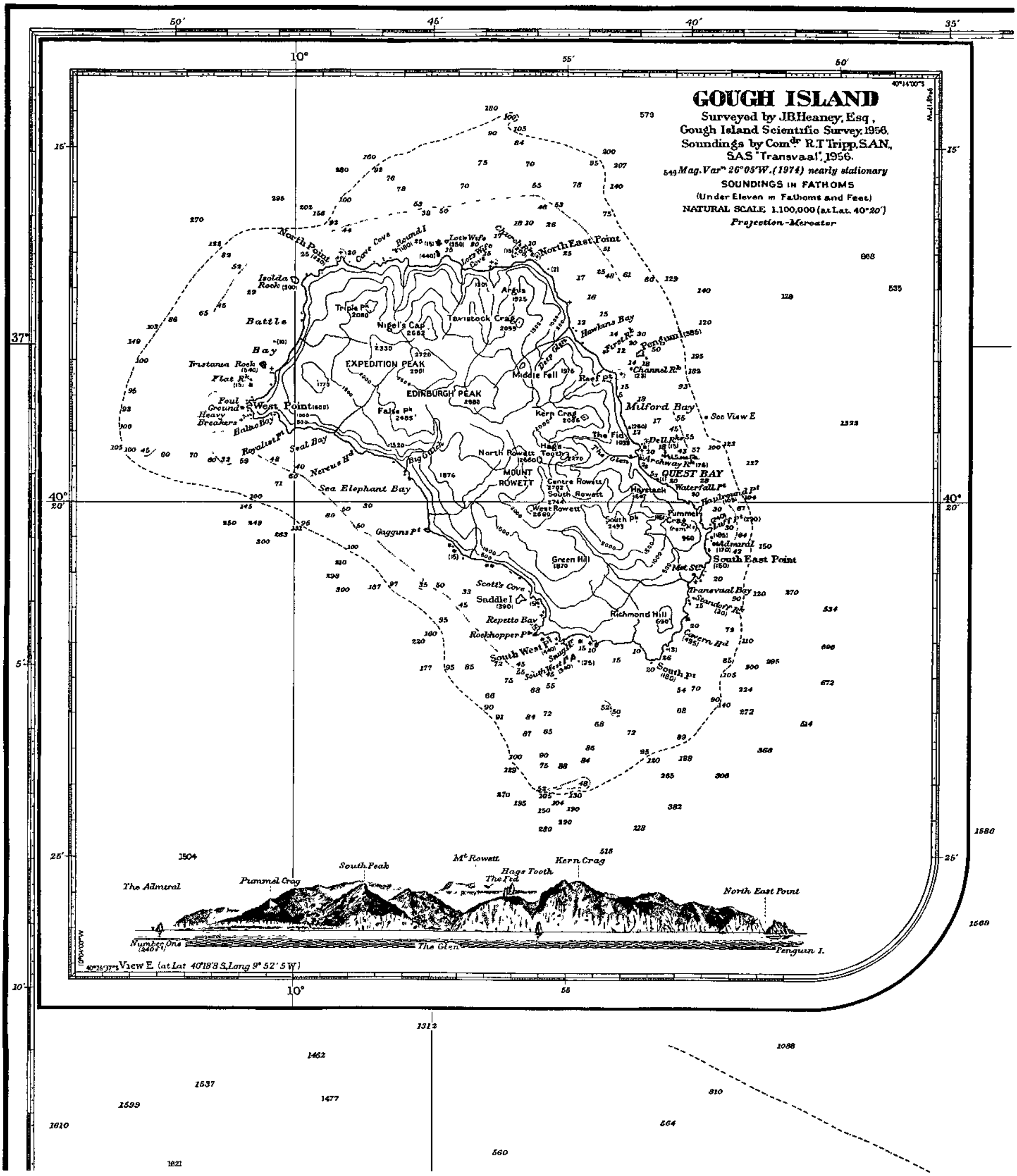

TOPOGRAPHICAL MAP OF
MARION ISLAND
SOUTHERN OCEAN
REFERENCE
Primary survey point
Secondary survey point
Crater
Pond or lake
Perennial stream
Intermittent stream
Waterfall
Cave above present sea level
Landing
Wreck (of Solglimt)
Remnants of sealers' hut
Altitudes in metres above mean sea level
Form lines at 50 metres intervals
STATE PRESIDENT SWART PEAK
EAST CAPE
CAPE HOOKER
CAPE CROZIER
CAPE DAVIS
Ice Plateau
Crawford Bay
Santa Rosa Valley
Boot Rock
Swartkop Point
Storm Petrel Bay
Sealer's Beach
Ship's Cove
King Bird Head
Macaroni Bay
Archway Bay
Hansen Point
Bullard Beach
Killerwhale Cove
Sealer's Cove
Whale Bird Point
Kildalkey Bay
Goodhope Bay
Rook's Bay
Vrystaat Point
Nattal Point
Trollgaard Bay
Mixed Pickle Cove
Funkel Bay
Sea Elephant Bay
Blue Petrel Bay
King Penguin Bay
Log Beach
1:50,000


TOPOGRAPHICAL MAP OF
PRINCE EDWARD ISLAND
REFERENCE
Primary survey point
Secondary survey point
Crater
Pond or lake
Intermittent stream
C Cave above present sea level
L Landing
Altitudes in metres above mean sea level
Form lines at 50 metres intervals
Triangulation Survey by O. Langenegger, B.Sc., B.Sc. Ing. and W.J. Verwoerd, D.Sc., January–March 1965. Air photos taken by R.A.F., 13th April 1961. Compiled and interpreted by W.J. Verwoerd. Drawn in the drawing office of the Geological Survey, Pretoria, 1968.
1:50,000
Statute Miles
Metres
T N
Southern Ocean
Ross Rocks
Ship Rack
Vaalkop
West Point
Moeder-en-kind
Kent Crater
Epsilon Kop
Van Zinderen Bakker Peak
Dwarsberg
Horingberg
Wolkberg
Rock Pinnacle
High Bluff
Hoedberg
Kraterkoppie
Platkop
Boggel
Mc All Kop
R.S.A. Point
Cave Bay
East Cape
Golden Gate
Penguin Beach
South Cape
Mc Nish Bay
46° 36′ S
37′
38′
39′
40′
53′
54′
55′
56′
57′
58′
59′
38° 00′ E
01′

1769 *Underlined figures express in Feet Drying Heights above Chart Datum*
All other Heights are expressed in Feet above Mean High Water Springs
For Symbols and Abbreviations see Admiralty Chart 5011.



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