Australian Government

Department of the Environment and Heritage
Australian Antarctic Division

Environment Protection and Biodiversity Conservation Act 1999

HEARD ISLAND AND MCDONALD ISLANDS MARINE RESERVE MANAGEMENT PLAN

Australian Antarctic Division

and

Director of National Parks

2005

Federal Register of Legislative Instruments F2005L02346

Draft Heard Island and McDonald Islands Marine Reserve Management Plan
Australian Antarctic Division
ISBN 1 876 93408 5

Photography credits

Front cover

Curved crevasses – Eric Woehler

Antarctic fur seal *Arctocephalus gazella* – Eric Woehler

Subantarctic skua *Catharacta lonnbergi* and chick – Kieran Lawton

Black-browed albatross *Thalassarche melanophrys* – Kieran Lawton

Kelp *Durvillaea antarctica* – Kieran Lawton

Big Ben from Stephenson Lagoon – Kate Kiefer

Back cover

Light-mantled sooty albatross *Phoebetria palepebrata* – Kieran Lawton

Rockhopper penguins *Eudyptes chrysocome* – Eric Woehler

Elephant seal pups *Mirounga leonina* – Kate Kiefer

Heard Island cormorant *Phalacrocorax atriceps* – Kate Kiefer

Callitriche antarctica – Kate Kiefer

Heard Island and McDonald Islands Marine Reserve

Management Vision

The Heard Island and McDonald Islands Marine Reserve is a truly wild and naturally dynamic area of the world.

Spectacular geographical features and natural processes and ecosystems make it a uniquely inspiring place of immense value to current and future generations.

This outstanding place will be accorded the utmost respect and protection and will be managed, on the basis of sound understanding, as a place where humans are thoughtful, responsible and privileged visitors.

Foreword

Isolated in subantarctic waters approximately 4000 km south-west of Perth, Western Australia, the Heard Island and McDonald Islands (HIMI) Marine Reserve is Australia's most remote Commonwealth reserve. Heard Island, the nearby McDonald Islands and the surrounding marine areas of the Reserve have an incredibly dynamic environment dominated by natural processes such as vulcanism, glacial action, major ocean currents and seasonal influxes of abundant wildlife.

The HIMI Territory—comprising the islands, offshore rocks and shoals, and the territorial sea—has been managed as an IUCN category 1a strict nature reserve since 1996, in accordance with the provisions of the *Heard Island Wilderness Reserve Management Plan* made under the Territory's *Environment Protection and Management Ordinance* (the EPMO). In October 2002, the Territory and parts of the surrounding marine area were declared a Commonwealth reserve under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). This meant that those areas—which together now comprise the HIMI Marine Reserve—are to be managed in accordance with the EPBC Act and the regulations made under it. This is not to say that the EPMO will no longer apply. As explained in this Plan, the EPMO will continue to be relied upon as a management and conservation tool to protect the Territory and its values.

The islands provide important breeding locations for seabird and seal species such as the southern giant petrel and southern elephant seal, listed because of their conservation status under the EPBC Act and under international conventions. The surrounding waters provide valuable foraging grounds for land-based marine predators including king penguins, macaroni penguins, black-browed albatross and Antarctic fur seals. The marine areas of the Reserve also contain important benthic habitats and unique and vulnerable marine species that collectively make an outstanding contribution to Australia's National Representative System of Marine Protected Areas.

As well as HIMI's great value to the people of Australia, recognised through the islands' inclusion on the Register of the National Estate in 1983 and through the declaration of the Reserve, Australia also manages the outstanding natural universal values of the Territory on behalf of the global community. In recognition of these values, the Territory was inscribed on the World Heritage List in 1997. Consideration is also being given to nominating the Territory as a wetland of international importance under the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention).

This draft management plan includes measures to ensure that the Reserve's values are identified, protected and communicated to the public, most of whom will never visit this remote, wild and special place. In particular the Plan includes comprehensive measures designed to prevent the introduction of alien species from human activities, to ensure protection of important terrestrial and marine species, habitats and ecosystems, and to interpret the cultural heritage values associated with 19th century sealing activities and the earliest Australian National Antarctic Research Expedition.

This draft plan was prepared by the Australian Antarctic Division (AAD) of the Department of the Environment and Heritage, and takes into account submissions received during an initial public comment period from March to May 2003. The Director of National Parks has delegated his responsibilities under the EPBC Act in respect of the Reserve to the AAD. This is in recognition of the AAD's considerable Antarctic and subantarctic experience and expertise, its lead role in the region's environmental management and conservation to date, and its continuing responsibilities for the administration of the Territory on behalf of the Australian Government.

The extreme isolation and severe climate have meant that human visitation and associated environmental disturbance has been minimal, resulting in the Reserve being one of the most biologically pristine areas in the world. The Australian Government is committed to maintaining this important quality of the Reserve; this draft management plan describes how human activities will be managed over the next seven years with the aim to ensure that it does.

AJ Press
Director, Australian Antarctic Division

Acknowledgments

This Plan was prepared by the Australian Antarctic Division (AAD) of the Department of the Environment and Heritage. The AAD is grateful for the support of many organisations and individuals who provided information and assistance during the preparation of this Plan, including:

Staff of the Australian Antarctic Division, Department of the Environment and Heritage

Staff of the Approvals and Wildlife Division, Department of the Environment and Heritage

Staff of the Heritage Division, Department of the Environment and Heritage

Staff of the Land, Water and Coasts Division, Department of the Environment and Heritage

Staff of Parks Australia, Department of the Environment and Heritage

Members of the Commonwealth Marine Protected Areas Committee

Members of the Subantarctic Fisheries Management Advisory Committee

Prof Steven Chown, Terrestrial Ecologist, Department of Zoology, University of Stellenbosch

Max Downes, Historian

Dr Andrew Forbes, CSIRO Marine Research

Dr Penny Greenslade, Entomologist

Prof Patrick Quilty, University of Tasmania

Dr Jenny Scott, University of Tasmania

Prof Rod Simpson, National Marine Science Centre

Robert Vincent, Cultural Heritage Officer

The submissions received were incorporated into the Plan where appropriate, and AAD also gratefully acknowledges the input from these submissions.

Table of Contents

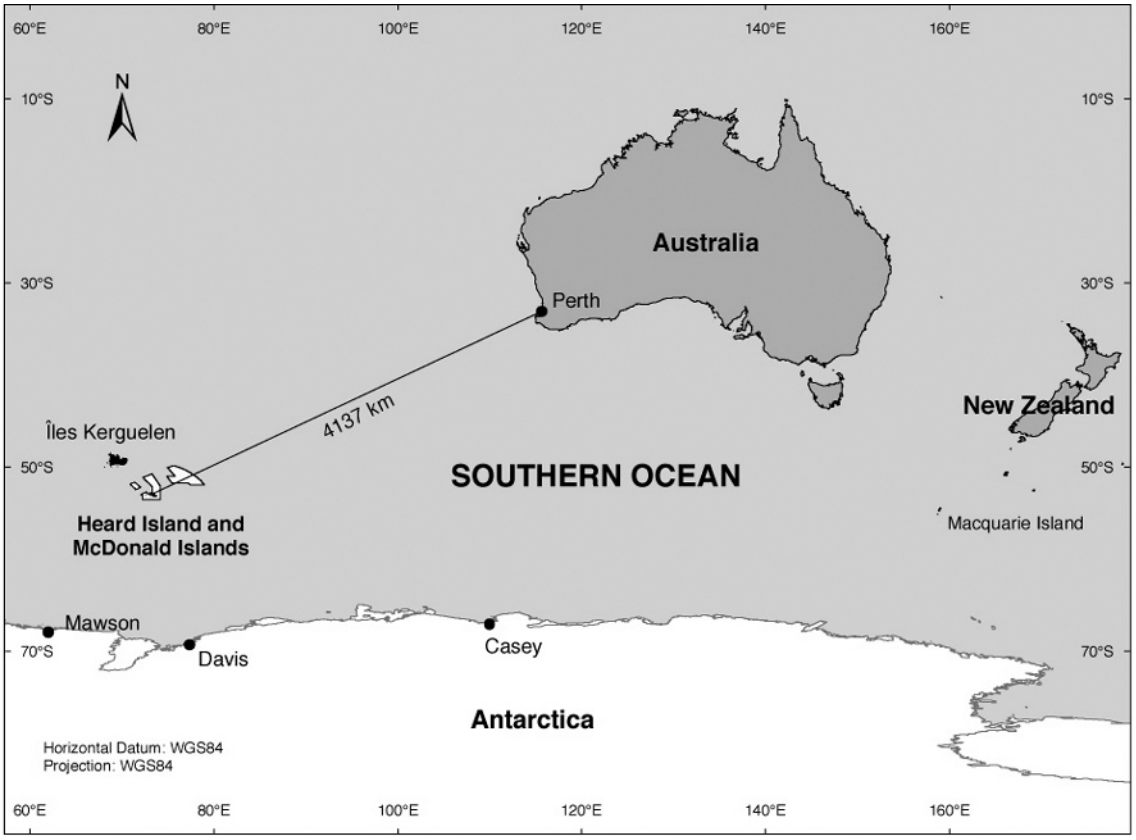
List of Figures

Note: Larger, more detailed versions of the maps include in this Plan are available by contacting the Australian Antarctic Division, or by visiting www.heardisland.aq

List of Tables

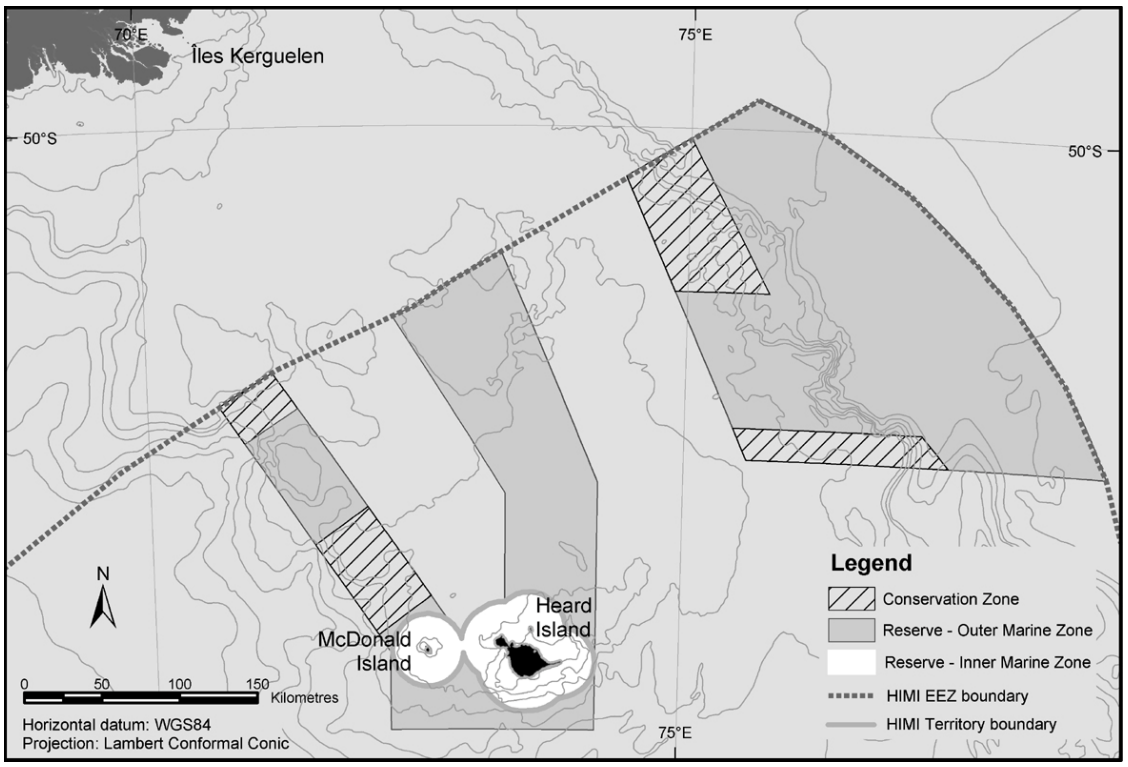
Part 1 Introduction

Figure 1. Location of Heard Island and McDonald Islands



(not to scale)

Figure 2. HIMI Marine Reserve boundaries



1 Introductory Background

1.1 Proclamation of the Reserve

The Heard Island and McDonald Islands Marine Reserve (the Reserve) is a Commonwealth reserve under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Reserve was declared by Proclamation under s.344 of the Act on 16 October 2002 for the purpose of 'protecting the conservation values of Heard Island and McDonald Islands and the adjacent unique and vulnerable marine ecosystems'.

The management objectives for the Reserve outlined in the Reserve proposal were to:

- protect conservation values of Heard Island and McDonald Islands (HIMI), the territorial sea and the adjacent EEZ including:
  - the World Heritage and cultural values of the HIMI Territory;
  - the unique features of the benthic and pelagic environments;
  - representative portions of the different marine habitat types; and
  - marine areas used by land-based marine predators for local foraging activities.
- provide an effective conservation framework which will contribute to the integrated and ecologically sustainable management of the HIMI region as a whole;
- provide a scientific reference area for the study of ecosystem function within the HIMI region; and
- add representative examples of the HIMI EEZ to the National Representative System of Marine Protected Areas.

The Proclamation declaring the Reserve is reproduced at Appendix 1, and includes the Schedule outlining its boundaries.

1.2 Conservation Significance of the Reserve

The area encompassed by the Reserve is of outstanding national and international conservation significance. Declared as Commonwealth reserve assigned to the IUCN category strict nature reserve, and covering an area of 6.5 million hectares (65 000 km^2), the Reserve is the world's second largest marine reserve with full protection from fisheries resource activities (behind the Great Barrier Reef Marine Park which includes 'no take' Green Zones covering approximately 114 500 km^2).

Heard Island and the McDonald Islands is the only major subantarctic island group believed to contain no species directly introduced by humans, making it among the most biologically pristine areas on the planet. Its terrestrial and marine ecology and oceanographic conditions are quite distinct from other Southern Ocean islands, including Australia's other subantarctic island, Macquarie Island.

The islands and surrounding waters provide crucial breeding habitat for a range of birds and marine mammals, including several species listed as threatened and/or migratory under the international conservation agreements and the EPBC Act (see Appendix 2). Two species of bird, the Heard Island sheathbill and the Heard Island cormorant, are endemic to the Reserve.

The terrestrial environment displays distinctive geographical features such as permanent glaciers, Australia's only active volcanoes, and Australia's highest mountain (Mawson Peak 2750 m) outside the Australian Antarctic Territory. Heard Island also contains significant cultural relics and heritage

sites from 19th and early 20th century sealing activities and from the first Australian Antarctic research expeditions.

The marine environment surrounding the islands features diverse and distinctive benthic habitats that support a range of slow growing and vulnerable species including corals, sponges, barnacles and echinoderms. The waters of the Reserve also include prime foraging areas for a number of land-based marine predators, and provide nursery areas for a range of fishes, including commercially harvested fish species. Areas of highly productive nutrient rich waters in the Reserve, created by the confluence of key oceanographic fronts such as the Antarctic Polar Front, are believed to provide suitable feeding grounds for a range of cetaceans.

The key conservation values of the HIMI region were documented in the report *Conservation of marine habitats in the region of Heard Island and McDonald Islands*[1]. The following sections summarise the conservation values of the Reserve, which are variously recognised both nationally and internationally. A more detailed description of the Reserve is given in Part 3.

International Conservation Significance

World Heritage – outstanding universal natural heritage values

The Territory, including the islands, adjacent offshore rocks and shoals and the territorial sea to 12 nm, was inscribed on the World Heritage List during the twenty-first session of the World Heritage Committee in 1997, on the basis of its outstanding natural universal values. The statement of significance given in the World Heritage nomination reads:

> *HIMI is a unique wilderness, a place of spectacular beauty which contains outstanding examples of biological and physical processes continuing in an essentially undisturbed environment. Significant biological processes include colonisation and speciation, while the island group's physical processes provide valuable indicators of the role of crustal plates in the formation of ocean basins and continents and of atmospheric and oceanic warming*[2].

The Committee noted that the site 'is the only volcanically active sub-Antarctic island and illustrates the ongoing geomorphic processes and glacial dynamics in the coastal and submarine environment and sub-Antarctic flora and fauna, with no record of alien species'. The site was considered by the Committee to meet two of the criteria for listing as a natural World Heritage property, as:

i. an outstanding example representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of land forms, or significant geomorphic or physiographic features

Heard Island and McDonald Islands contain outstanding examples of physical and biological processes continuing in an essentially undisturbed environment. The physical processes provide an understanding of the role of crustal plates in the formation of ocean basins and continents and of atmospheric and oceanic warming. Biological processes of significance include colonisation and speciation. Examples of the World Heritage Values are given in Appendix 3.

ii. an outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals

The Heard Island and McDonald Islands group is the only major subantarctic island group free of human-introduced species and with negligible modification by humans. It provides a classic example of a subantarctic island group with low species diversity and large populations of certain species. Examples of the World Heritage Values are given in Appendix 3.

Migratory species

The Reserve provides important habitat for a number of migratory birds and marine mammals. Many of these are listed under international agreements for the protection and conservation of migratory species, including the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA), the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Species and Birds in Danger of Extinction and their Environment (JAMBA), and the Agreement on the Conservation of Albatrosses and Petrels (ACAP).

Migratory bird species recorded as breeding in the Reserve include the wandering albatross, black-browed albatross, southern giant petrel, Wilson's storm petrel and the light-mantled sooty albatross. Several species of cetaceans and non-breeding birds recorded in the Reserve are also listed under these international agreements. A summary of the migratory species recorded in the Reserve and their protection status is given in Appendix 2.

Wetlands – ecological character

Some areas of HIMI exhibit significant wetland features and processes, and provide habitat for a number of wetland species. These are the moist, low-level terrestrial, freshwater and shallow near-shore marine environments.

HIMI was rated as the most important Commonwealth-managed wetland in *A Strategic Assessment of nationally important wetlands management by the Commonwealth*[3], when assessed against criteria for wetlands of international importance as defined under the Ramsar Convention. The Strategic Assessment found the HIMI wetland to satisfy six of the Ramsar criteria for wetlands of international importance.

At the time of preparing this Plan, a draft Ramsar Information Sheet (RIS) has been prepared and consideration is being given to nominating the Territory as a wetland of international importance (see Appendix 4). A summary of the qualities of the proposed wetlands site against the relevant criteria is given below:

Criterion 1 – contains representative, rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

The islands are the only landmasses in the Kerguelen Province, defined using the Interim Marine and Coastal Regionalisation for Australia[4].

Criterion 2 – supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Heard Island's wetlands support substantial populations of three species listed as threatened under the EPBC Act: the southern elephant seal (vulnerable), the southern giant petrel (endangered) and the Heard Island cormorant (vulnerable).

Criterion 3 – supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Heard Island and McDonald Islands are the only land masses within the Kerguelen Province and therefore provide the only habitat for a range of wetland flora and fauna within the bioregion.

Criterion 4 – supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

The HIMI wetland supports large breeding colonies of four species of penguin: macaroni, gentoo, king and southern rockhopper. The king penguin, which suffered major depredations early last

century, is reported to be doubling its numbers on Heard Island every five years[5]. The Heard Island shag and the Heard Island sheathbill (a shorebird) are subspecies endemic to HIMI. Heard Island is also a major moulting area for southern elephant seals.

Criterion 5 – regularly supports 20 000 or more waterbirds.

The HIMI wetland regularly supports more than four million waterbirds, with the majority being penguins. In particular, the macaroni penguin colonies on Heard Island and the McDonald Islands are estimated to total two million birds.

Criterion 6 – regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

The HIMI wetland supports the entire world population of the endemic subspecies of the Heard Island cormorant and the Heard Island sheathbill. The HIMI population remains the only sheathbills of any species unaffected by introduced predators such as cats and rats. Gentoo penguins are believed to be present all year round, and the breeding population on Heard Island in 1987 comprised 16 600 pairs, representing approximately 6% of the global population. The largest two macaroni penguin colonies are estimated to contain 2 million birds each, which represent approximately 21% of the world population.

National Conservation Significance

National Representative System of Marine Protected Areas

The HIMI region overall remains in a close to pristine state due to the only very recent opening of fisheries in waters adjacent to the Reserve and the low level of other human activities, and associated environmental interference, to date. The region was identified in *Australia's Oceans Policy* as one of five priority areas for the declaration of a marine reserve, due to its relatively untouched features and processes, distinctive location in highly productive cold waters south of the Antarctic Polar Front, unique benthic and pelagic environmental features, variety of marine habitat types, and importance as foraging grounds for land-based marine predators from the World Heritage area. The declaration of the Reserve contributes to the protection of Australia's unique marine biodiversity by ensuring that temperate and subantarctic waters are incorporated in the comprehensive and representative national system of marine parks.

Natural and cultural heritage

Register of the National Estate

The islands of the Territory were listed on the Register of the National Estate in 1983. The statement of significance is reproduced at Appendix 5. The heritage amendments to the EPBC Act, which entered into force on 1 January 2004, replaced the previous Commonwealth heritage protection legislation under which the Register of the National Estate was established. The Register will be retained and maintained by the Australian Heritage Council.

Commonwealth Heritage List

The Commonwealth Heritage List, established under the heritage provisions of the EPBC Act, is a list of natural and cultural heritage places owned or controlled by the Australian Government and identified as having Commonwealth heritage values. At the time of preparing this Plan the Territory was noted on the Australian Heritage Database as an 'Indicative Place' to be considered for inclusion on the list.

National Heritage List

This National Heritage List established under the EPBC Act is intended to contain Australian places with outstanding heritage value. At the time of preparing this Plan the Territory has also been noted

on the Australian Heritage Database as an 'Indicative Place' to be considered for inclusion on the list.

Atlas Cove ANARE Station

The *Atlas Cove, Heard Island Cultural Heritage Management Plan*[6] was prepared by the AAD to identify the heritage significance of the Atlas Cove ANARE station site and to guide future management. This document indicates that the Atlas Cove ANARE Station site, and the adjacent foundations of the seismic and absolute magnetic huts are significant because they demonstrate the sheer difficulties, tenacity, ingenuity, remoteness and isolation experienced by the 87 expeditioners based at the station between 1947–55. In particular, the site:

- demonstrates innovative approaches to building technology;
- demonstrates the nature of the experience of expeditioners living in remote and difficult conditions; and
- bears testimony to lessons learnt by expeditioners in establishing Mawson station on the Antarctic mainland and closely parallels Macquarie Island station and its activities.

The Statement of Cultural Significance for the site, comprising an assessment against the National Estate criteria, is given at Appendix 6.

Important Wetlands

The HIMI wetland is listed on the *Directory of Important Wetlands in Australia*[7], a comprehensive inventory of Australia's nationally important wetlands, for meeting the following criteria:

- it is a good example of a wetland type occurring within a biogeographic region in Australia;
- it is a wetland that plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
- it is a wetland that is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail;
- the wetland supports 1% or more of the national populations of any native plant or animal taxa; and
- the wetland supports native plant or animal taxa or communities which are considered important endangered or vulnerable at the national level.

1.3 Previous Management Plan

This is the second management plan for the Territory, and replaces the previous *Heard Island Wilderness Reserve Management Plan*, prepared under the Territory's *Environment Protection and Management Ordinance 1987* (the EPMO), and in force from 14 February 1996. There are no previous management plans covering the marine areas of the Reserve beyond the 12 nm territorial sea.

This management plan, prepared under the EPBC Act, builds on the *Heard Island Wilderness Reserve Management Plan* by:

- providing for the management of a substantial marine protected area component beyond the previous area of application (the Territory);
- addressing the requirements of the current legislative framework for the HIMI region, chiefly arising from the EPBC Act;
- addressing requirements arising from the Territory's inscription on the World Heritage list in 1997 and its possible Ramsar listing; and

- incorporating relevant information and experience gained from a number of AAD and other visits to the HIMI region since 1996.

1.4 Structure of this Management Plan

This management plan has been structured to reflect the Parks Australia Strategic Planning and Performance Assessment Framework. The Framework sets down, within the broader context of the Department of the Environment and Heritage Corporate Plan, a set of outcomes based on government policy, legislative requirements and the management requirements of the protected area estate that is the responsibility of the Director of National Parks (the Director). The outcomes are developed in the following seven Key Result Areas (KRA):

KRA1: Natural Heritage Management

KRA2: Cultural Heritage Management

KRA3: Joint Management

KRA4: Visitor Management and Park Use

KRA5: Stakeholders and Partnerships

KRA6: Business Management

KRA7: Biodiversity Knowledge Management

Note: KRA 3 is not relevant to the Reserve and is not addressed in this Plan.

The Director has developed outcomes for each KRA under the Framework. The outcomes relevant to the Reserve are reproduced at Appendix 7.

Each section of this Plan contains an 'Aim' or list of 'Aims' that describe the desired result of Reserve management activity, and a series of 'Prescriptions' that represent the controls on activities in the Reserve and strategies for managing the Reserve to meet the Aim(s). The aims have been formulated to encapsulate the desired results of management of the Reserve while, at the same time, contributing to the achievement of the outcomes listed above.

In addition to annual reporting on implementation of the prescriptions contained in this Plan, it is proposed that progress against identified aims also be measured periodically, although the remoteness of the Reserve and uncertainty over the timing of Government visits place practical limitations on research and monitoring for performance assessment. This approach will provide a basis for measuring achievement and public accountability and a feedback mechanism that, in line with the principle of adaptive management, will identify areas where management may need to be altered in order to reach the desired aims.

Progress on each aim will be assessed using the appropriate performance indicators included in each section of the Plan. These indicators may be varied in light of experience with their use to ensure that they are the most appropriate or efficient.

2 Introductory Provisions

2.1 Short title

This management plan may be cited as the Heard Island and McDonald Islands Marine Reserve Management Plan.

2.2 Commencement and Termination

This management plan will come into operation following approval under section 370 of the *Environment Protection and Biodiversity Conservation Act 1999* and will cease to have effect seven years after commencement, unless sooner revoked and replaced by a new management plan.

2.3 Interpretation (including Acronyms)

In this Plan unless a contrary intention appears:

AAD means the Australian Antarctic Division of the Department of the Environment and Heritage.

AFMA means the Australian Fisheries Management Authority.

Approved purpose means scientific research, environmental monitoring, Reserve management and other purposes consistent with this Plan and the reserve management principles.

Australian Fishing Zone (AFZ) means the area established by the *Fisheries Management Act 1991* in which Australia exercises jurisdiction over all Australian and foreign fishing. The AFZ comprises waters adjacent to Australia and its external territories (excluding the Torres Strait and the Australian Antarctic Territory) which extend from defined baselines to 200 nautical miles seawards but not including coastal waters or excepted waters under the Act.

Authorised official means:

(a) an authorised officer for the purposes of the EPBC Act;

(b) an inspector appointed under the EPMO;

(c) an inspector for the purposes of the *Antarctic Marine Living Resources Act 1981*;

(d) a constable for the purposes of the Criminal Procedures Ordinance 1993;

(e) an officer for the purposes of the *Fisheries Management Act 1991*; or

(f) a person authorised in writing by the Director for the purposes of this Plan.

CAMBA means Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment.

CCAMLR means the Convention on the Conservation of Antarctic Marine Living Resources.

Commonwealth reserve means a reserve declared under Division 4 of Part 15 of the EPBC Act.

Director means the Director of National Parks as referred to in section 514A of the EPBC Act or a person to whom the Director has delegated all or any of the Director's powers and functions under the EPBC Act in so far as they or their exercise relates to the Reserve.

Ecological character, when used in relation to a wetland, means the sum of the biological, physical, and chemical components of the wetland ecosystem, and their interactions, which maintain the wetland and its products, functions, and attributes.

Environment has the meaning given in section 528 of the EPBC Act, and includes:

(a) ecosystems and their constituent parts, including people and communities;
(b) natural and physical resources;
(c) the qualities and characteristics of locations, places and areas;
(d) heritage values of places; and
(e) the social, economic and cultural aspects of a thing mentioned in (a), (b) or (c).

Environmental damage includes disturbance of wildlife, damage to vegetation, burrows, wallows, nesting areas and wildlife corridors, wetlands, waterbodies and catchments, sensitive geological features, research sites and cultural heritage sites.

EPMO means the *Environment Protection and Management Ordinance 1987* made under the *Heard Island and McDonald Islands Act 1953.*

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999*.

EPBC Regulations means the *Environment Protection and Biodiversity Conservation Regulations 2000*.

Exclusive Economic Zone (EEZ) means the Exclusive Economic Zone declared under the *Seas and Submerged Lands Act 1973*, and in relation to HIMI commences at the outer limit of the territorial sea (12 nautical miles from the territorial sea baselines established under the Act) and extends to 200 nautical miles from the baselines except where it is less to take account of the treaty line defined by the Maritime Delineation Treaty between the Government of Australia and the Government of the French Republic.

Facility means something that is built, installed or established in the Reserve, including structures to be used for accommodation, scientific equipment and communications equipment.

GIS means geographical information system.

Heard Island and McDonald Islands Marine Reserve means the areas declared as a Commonwealth reserve by that name under the EPBC Act on 16 October 2002.

HIMI means Heard Island and the McDonald Islands.

Issuer of a permit means the person deciding whether to issue a permit under the EPBC Regulations or the EPMO.

IUCN means the World Conservation Union.

KRA means Key Result Area, which is explained in section 1.4 of this Plan.

JAMBA means Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment.

MARPOL means the International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978.

NRSMPA means the National Representative System of Marine Protected Areas.

Ramsar Convention means the Convention on Wetlands of International Importance Especially as Waterfowl Habitat.

Reproductive material means: seeds, spores, cuttings or any other part, or product of a plant, from which another plant could be produced; and embryos, eggs, sperm or any other part, or product of an animal, from which another animals could be produced.

Reserve means the Heard Island and McDonald Islands Marine Reserve.

Reserve management principles means the Australian IUCN reserve management principles set out in Schedule 8 of the EPBC Regulations (see Appendix 8).

Territorial sea means the water surrounding Heard Island and McDonald Islands to a distance offshore of 12 nautical miles.

The Territory means the Australian external Territory of Heard Island and McDonald Islands, and the territorial sea around the Territory.

UNCLOS means the United Nations Convention on the Law of the Sea.

Wise use, when used in relation to a wetland, involves maintenance of their ecological character, as a basis not only for nature conservation, but for sustainable development.

World Heritage Convention means the Convention Concerning the Protection of the World Cultural and Natural Heritage

2.4 Legislative Context

The EPBC Act

Proclamation of the Territory and surrounding waters as a Commonwealth reserve under the EPBC Act has had the effect of applying to those areas the provisions of that Act relating to Commonwealth reserves. These and other provisions of the EPBC Act now provide the main legislative framework for the management and conservation of the Territory and other parts of the Reserve.

Provisions relating to management of Commonwealth reserves

The EPBC Act vests general responsibility for the administration and management of Commonwealth reserves in the Director (see s.514B).

The EPBC Act requires the Director to prepare management plans for each reserve which must be approved by the Minister for the Environment and Heritage. A management plan is a 'legislative instrument' for the purposes of the *Legislative Instruments Act 2003* and must be registered under that Act. Following registration the plan is tabled in each House of the Commonwealth Parliament and may be disallowed by either House on a motion moved within 15 sitting days of the House after tabling.

A management plan for a Commonwealth reserve has effect for seven years, subject to being revoked or amended earlier by another management plan for the Reserve.

The Director must give effect to a management plan in operation for a Commonwealth reserve. The Commonwealth and Commonwealth agencies must also not perform functions or exercise powers in relation to the reserve inconsistently with the plan (s.362).

Under the EPBC Act (s.367) a management plan for a Commonwealth reserve must provide for the protection and conservation of the reserve and must assign the reserve to one of the following IUCN categories (which correspond to the six distinct categories of protected areas identified by the IUCN):

- strict nature reserve;
- wilderness area;
- national park;
- natural monument;
- habitat/species management area;
- protected landscape/seascape; or
- managed resource protected area.

In preparing a management plan the EPBC Act (s.368) requires account to be taken of various matters. In relation to the Reserve these matters include:

- the regulation of the use of the Reserve for the purpose for which it was declared;
- the protection of the special features of the Reserve, including objects and sites of biological, historical, palaeontological, archaeological, geological and geographical interest;
- the protection, conservation and management of biodiversity and heritage within the Reserve;

- the protection of the Reserve against damage; and
- Australia's obligations under agreements between Australia and one or more other countries relevant to the protection and conservation of biodiversity and heritage.

Provisions relating to activities within Commonwealth reserves

The EPBC Act (s.354) states that, despite any other law, certain actions can only be undertaken in a Commonwealth reserve if authorised by and undertaken in accordance with a management plan made for that reserve under the EPBC Act. These actions are:

- kill, injure, take, trade, keep or move a member of a native species;
- damage heritage;
- carry on an excavation;
- erect a building or other structure;
- carry out works; or
- take an action for commercial purposes

The EPBC Act also prohibits mining operations in Commonwealth reserves unless they have been authorised in accordance with the EPBC Act and are carried out in accordance with a management plan made under that Act (s.355).

The EPBC Act contains provisions (Part 13) that prohibit and regulate actions taken in Commonwealth areas—such as the Reserve—in relation to listed threatened species and ecological communities, listed migratory species, cetaceans (whales and dolphins) and listed marine species. Appendix 2 to this Plan lists fauna species of significance to the Reserve, including species that are listed under the EPBC Act.

Provisions relating to environmental impact assessment

Under the EPBC Act, actions that are likely to have a significant impact on a matter of national environmental significance are subject to rigorous referral, assessment, and approval processes. An action includes a project, development, undertaking, activity, or series of activities. The EPBC Act currently identifies seven matters of national environmental significance:

- World Heritage properties;
- National Heritage places (from 1 January 2004);
- Ramsar wetlands of international importance;
- listed threatened species and ecological communities;
- listed migratory species;
- the Commonwealth marine area; and
- nuclear actions (including uranium mining).

The EPBC Act's assessment and approval provisions also apply to actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land) and actions taken by the Commonwealth that will have a significant impact on the environment anywhere in the world.

It is important to appreciate that, for the purposes of the above, land within the Reserve constitutes 'Commonwealth land' and the marine component of the Reserve constitutes part of a 'Commonwealth marine area'.

Further information on the EPBC Act's referral, assessment and approval requirements and processes is available from DEH. See also the DEH website at:
http://www.deh.gov.au/epbc/index.html

Civil and criminal penalties may be imposed for breaches of the EPBC Act.

The EPBC Regulations

The EPBC Regulations control, or allow the Director to control, a range of activities in Commonwealth reserves, such as use of vehicles and vessels, littering, commercial activities, commercial fishing, recreational fishing and research. Many of these activities are prohibited unless certain exemptions apply, for example where the Director has issued a permit that authorises the activity, or where a management plan in force for the Commonwealth reserve allows the activity (see r.12.06(1)). The Regulations are applied by the Director subject to, and in accordance with, the EPBC Act and management plans.

The EPMO

Prior to the proclamation of the Reserve under the EPBC Act, the EPMO was the primary legislative instrument for the environmental management and conservation of the Territory, including the territorial sea. This management plan is premised on the continued existence of the EPMO and its application to the Territory, notwithstanding that the Territory now comprises part of a Commonwealth reserve established under the EPBC Act. The EPBC Act expressly allows for continued application of the EPMO (see sections 10 and 356(3)).

There are advantages to the continued application of and reliance on the EPMO as a management and conservation tool in the Reserve. These include the following:

- the provisions of the EPMO apply to and govern a broader range of activities and conduct than the EPBC Act or the EPBC Regulations do. As such, the EPMO can allow for more comprehensive protection of the Reserve and its values. For example, unlike the EPBC Act or EPBC Regulations, the EPMO imposes a broad prohibition on the introduction of any 'organism' (as defined) into the Territory without a permit issued under that Ordinance. It also prohibits entry to the Territory without a permit.
- the EPMO provides greater sanctions than are available under the EPBC Regulations. The EPBC Act provides that the maximum penalty that can be imposed under the EBPC Regulations is 50 penalty units (or $5500) (s.520(2)). In contrast, the sanctions available under the EPMO for similar or the same conduct include the option of imposing significant terms of imprisonment. The continued availability of this sanction or deterrence—through the application of the EPMO—is warranted given the national and international importance of the Reserve.

Parts of the EPBC Regulations also have little relevance to the management of the Reserve. The EPBC Regulations are designed more to provide a regime for the day to day management of activities within Commonwealth reserves generally, many of which have vastly different levels and types of visitation and activities.

For the purposes of this Plan, the EPMO will generally be relied upon or invoked to regulate activities occurring within that part of the Reserve that is comprised of the Territory, whereas the EPBC Regulations will generally be invoked to regulate activities within the other part of the Reserve, namely the Outer Marine Zone (see section 3 Zoning and IUCN Category). Permits or authorisations issued under the EPMO or the Regulations will include conditions requiring compliance with the prescriptions of this Plan.

The EPBC Act and EPBC Regulations will prevail over the EPMO to the extent of any inconsistency (s.10 and 356(3)). As mentioned above, section 354 of the EPBC Act also provides

that certain activities in a reserve can only be carried out if they are authorised by and undertaken in accordance with a management plan made under the EPBC Act for that reserve. This is despite any other inconsistent Commonwealth, State or Territory law—such as the EPMO, the EPBC Regulations and other provisions of the EPBC Act. Similarly, EPBC Regulation 12.06(1)(a) provides that activities otherwise prohibited by those Regulations may be carried on in a reserve if provided for by, and carried out in accordance with, a management plan in force for that reserve.

In view of the above, this Plan includes prescriptions which expressly provide that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or by the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit (see section 4 Environmental Assessment and Approval). As mentioned above, activities in that part of the Reserve that does not form part of the Territory will be regulated through reliance on the EPBC Regulations.

At the time of preparing this Plan it is intended that the EPMO will be examined to determine whether action should be taken to repeal provisions that have been made redundant by the application to the Territory of the EPBC Act provisions concerning Commonwealth reserves (such as those relating to the *Heard Island Wilderness Reserve Management Plan* made under the EPMO).

Delegation of Management Responsibilities Under the EPBC Act to AAD

At the time of preparing this Plan the Reserve is being managed for and on behalf of the Director by the staff of the AAD, and the Director has delegated all of the powers and functions of the Director under the EPBC Act and Regulations in relation to the Reserve to the Director of the AAD and other AAD officers. These arrangements reflect the AAD's continuing role and responsibilities for management and administration of HIMI as a Territory of Australia. They also reflect the AAD's long and significant historic involvement in the HIMI region and in the protection and conservation of its environment.

Accordingly, references to requirements of, or actions by, the Director within this Plan should generally be read as including the staff of the AAD (see the definition of Director in section 2.3 Interpretation (including Acronyms)).

2.5 Purpose and Content of the Management Plan

The purpose of this Plan is to guide the management of the Reserve for the next seven years, in accordance with the EPBC Act. As is the case for most protected areas, it is recognised that knowledge of the Reserve is incomplete. This Plan aims to weigh options in line with current information and best practice approaches, and provide a decision making framework to facilitate the orderly management of sometimes competing interests and a basis to determine resource allocation priorities for management purposes.

Under s.367(1) of the EPBC Act, a management plan for a Commonwealth reserve must provide for the protection and conservation of the reserve. In particular, the plan must:

(a) assign the reserve to an IUCN category (whether or not a proclamation has assigned the reserve or a zone of the reserve to that IUCN category);

(b) state how the reserve, or each zone of the reserve, is to be managed;

(c) state how the natural features of the reserve, or of each zone of the reserve, are to be protected and conserved;

(d) if the Director holds land or seabed included in the reserve under lease, be consistent with the Director's obligations under the lease;

(e) specify any limitation or prohibition on the exercise of a power, or performance of a function, under an Act in or in relation to the reserve:

(f) specify any mining operation, major excavation or other works that maybe carried on in the reserve, and the conditions under which it may be carried on;

(g) specify an operation or activity that may be carried on in the reserve;

(h) indicate generally the activities that are to be prohibited or regulated in the reserve, and the means of prohibiting or regulating them;

(i) indicate how the plan takes account of Australia's obligations under each international agreement with one or more other countries that is relevant to the reserve;

(j) if the reserve includes a National Heritage place:

(i) not be inconsistent with the National Heritage management principles; and

(ii) address any matters prescribed by the EPBC regulations.

(k) if the reserve includes a Commonwealth Heritage place:

(i) not be inconsistent with the Commonwealth Heritage management principles; and

(ii) address any matters prescribed by the EPBC regulations.

A management plan may divide a Commonwealth reserve into zones and assign each zone to an IUCN category. The category to which a zone is assigned may differ from the category to which the reserve is assigned (s.367(2)).

The provisions of a management plan must not be inconsistent with the management principles for the IUCN category to which the reserve or a zone of the reserve is assigned (s.367(3)).

2.6 IUCN Category and Zoning

As outlined in sections 2.4 and 2.5 a management plan for a Commonwealth reserve or a zone within a Commonwealth reserve must be assigned to an IUCN category. This management plan divides the Reserve into seven zones and assigns each zone and the Reserve to the IUCN category strict nature reserve (see section 3 Zoning and IUCN Category).

The EPBC Act (section 347(2)) lists the characteristics for each IUCN category. The characteristics of a strict nature reserve are that it must contain some outstanding or representative ecosystems, geological or physiological features or species.

Appendix 8 to this Plan reproduces the reserve management principles for the IUCN category strict nature reserve, as prescribed in Schedule 8 to the EPBC Regulations.

2.7 Inclusion of Conservation Zone

The EPBC Act (s367) provides that a management plan for a Commonwealth reserve may include provisions relating to an area that is proposed to be included in the Reserve. At the time of preparing this Plan the conservation zone adjacent to the Reserve is undergoing assessment for possible later inclusion in the Reserve. As the conservation zone areas are outside the Territory, and therefore beyond the area of application of the EPMO, any areas of the conservation zone added to the Reserve would be subject to the Commonwealth reserve provisions of the EPBC Act (see section 2.4) and would be managed by application of the EPBC Regulations, with due regard to the Australian IUCN reserve management principles for the category to which those areas were assigned.

2.8 International Agreements

As noted in sections 2.4 and 2.5, this Plan must take account of Australia's obligations under relevant international agreements. The following agreements are relevant to the Reserve.

Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention)

In 1972 the Member States of the United Nations Educational, Scientific & Cultural Organization (UNESCO) adopted the Convention concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention) with the aim of ensuring the proper identification, protection, conservation and presentation of cultural and natural heritage with outstanding universal value to all mankind.

The Convention provides for properties exhibiting cultural and/or natural heritage of 'outstanding universal value' and meeting at least one of a set of World Heritage criteria to be included on the World Heritage List.

The Territory of Heard Island and McDonald Islands was inscribed on the World Heritage List on 3 December 1997 for its outstanding natural universal values (see Appendix 3). Australian World Heritage management principles are prescribed by the EPBC Regulations (Schedule 5). An extract from the principles is at Appendix 9.

Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)

The Ramsar Convention is an international agreement that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The HIMI wetland is listed on the Directory of Important Wetlands in Australia[7] and, in a *Strategic Assessment of nationally important wetlands management by the Commonwealth*, was rated as the most highly ranked Commonwealth-managed wetland for nomination to the Ramsar list of Wetlands of International Importance[3]. The Territory is being considered for nomination to the List of Wetlands of International Importance under the Ramsar Convention and a copy of the required draft Ramsar information sheet is at Appendix 4. Australian Ramsar management principles are prescribed by the EPBC Regulations (Schedule 6). An extract from the principles is at Appendix 10.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

The Bonn Convention aims to conserve terrestrial, marine and avian migratory species throughout their range. Parties to this Convention work together to conserve migratory species and their habitats. Appendix 2 to this Plan lists migratory species recorded from the Reserve that are covered by the Bonn Convention.

Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA)

CAMBA provides for cooperation between China and Australia on the protection of migratory birds listed in the Annex to the Agreement, and their environment, and requires each country to take appropriate measures to preserve and enhance the environment of migratory birds. Appendix 2 to this Plan lists migratory species recorded from the Reserve that are covered by CAMBA.

Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA)

JAMBA provides for cooperation between Japan and Australia on measures for the management and protection of migratory birds, birds in danger of extinction, and the management and protection of their environments, and requires each country to take appropriate measures to preserve and enhance the environment of birds protected under the provisions of the agreement. Appendix 2 to this Plan lists migratory species recorded from the Reserve that are covered by JAMBA.

Treaty between the Government of Australia and the Government of the French Republic on Cooperation in the Maritime Areas Adjacent to the French Southern and Antarctic Territories (TAAF), Heard Island and the McDonald Islands

The Treaty between the Government of Australia and the Government of the French Republic on Cooperation in the Maritime Areas Adjacent to the French Southern and Antarctic Territories (TAAF), Heard Island and the McDonald Islands was signed on 24 November 2003, but has not yet entered into force. The Treaty is intended to facilitate cooperation between Australia and France to tackle illegal, unreported and unregulated (IUU) fishing by establishing a framework for information exchange and cooperative surveillance and research activity by France and Australia in the Area of Cooperation, which includes the HIMI territorial sea and exclusive economic zone and the territorial sea and exclusive economic zone of the French territories of Kerguelen Islands, Crozet Islands, Saint-Paul Island and Amsterdam Island.

Convention on Biological Diversity (the Biodiversity Convention)

Establishment of the Reserve assists Australia in meeting its obligations under the 1992 Convention on Biological Diversity and its commitments under the Jakarta Mandate on the Conservation and Sustainable Use of Marine and Coastal Biological Diversity. The Convention requires parties to pursue the conservation of biological diversity and the sustainable use of its components. A key feature of the Convention is the establishment of a system of protected areas where special measures need to be taken to conserve biological diversity.

Agreement on the Conservation of Albatrosses and Petrels (ACAP)

Australia is a signatory to the Agreement on the Conservation of Albatrosses and Petrels, established under the Convention on the Conservation of Migratory Species of Wild Animals and which entered into force on 1 February 2004. The objective of the Agreement is to achieve and maintain a favourable conservation status of albatrosses and petrels by seeking concerted action by Parties to protect important breeding habitat; control non-native species detrimental to albatrosses and petrels; implement measures to reduce the incidental catch of seabirds in longline fisheries; and support research into the effective conservation of albatrosses and petrels. Appendix 2 to this Plan lists albatross and petrel species recorded from the Reserve.

Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)

The Convention on the Conservation of Antarctic Marine Living Resources was established in 1980 under the Antarctic Treaty system to provide a management regime for conserving the Antarctic marine ecosystem. The Commission for the Conservation of Antarctic Marine Living Resources was established under this convention as a policy and regulatory body to implement the objective of the conservation of Antarctic marine living resources; conservation was defined to include rational use. The Commission determines conservation measures regulating harvesting and associated activities in the pursuit of this objective; such measures may include setting precautionary catch limits, harvesting methods and fishing seasons for species, regulating waste disposal and catch reporting. The HIMI EEZ and the HIMI fishery lie within the Convention area.

International Convention for the Prevention of Pollution from Ships (MARPOL Convention)

The International Convention for the Prevention of Pollution of Ships was adopted on 2 November 1973, and was subsequently modified in 1978 by a Protocol that introduced stricter regulations for the survey and certification of ships. The combined instrument, which entered into force on 2 October 1983, is usually referred to as the MARPOL Convention or MARPOL 73/78 and is the main international convention covering prevention of pollution of the marine environment by ships due to operational or accidental causes. Regulations covering the various sources of ship-generated pollution are contained in six technical Annexes; Annexes I and II, governing oil and chemicals are compulsory but annexes III, IV, V and VI on packaged materials, sewage, garbage and air pollution are optional. Australia has legislated to adopt the Convention and its Technical Annexures I, II, III, IV and V (oil, bulk noxious liquid substances, harmful substances in packaged forms, sewage and garbage, respectively). It is expected legislation to implement MARPOL Annexure VI (control of sewage and air pollution) will be passed in 2005[8].

Convention on the International Trade of Endangered Species (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) entered into force on 1 July 1975, and aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES works by placing controls on international trade in specimens of selected species. Several species of marine mammal found in the Reserve or recorded from waters in the HIMI region are listed under CITES Annex II, including the southern elephant seal, subantarctic fur seal, Antarctic fur seal, strap-toothed beaked whale, Commerson's dolphin, southern bottlenose whale and spectacled porpoise.

International Convention for the Regulation of Whaling

The International Convention for the Regulation of Whaling, signed in 1946, was initially developed to provide for the proper conservation of whale stocks to make possible the orderly development of the whaling industry. It provides for the complete protection of certain species, for promoting relevant research and for designating specific areas as whale sanctuaries. The Reserve lies within the Indian Ocean Sanctuary, which was established under the Convention in 1979 to provide freedom from disturbance for migrating and breeding great whales in an area where whales were once hunted to the brink of extinction. Australia has declared its entire EEZ, including that around HIMI, as a whale sanctuary under the EPBC Act. Appendix 2 to this Plan lists cetacean species recorded in the Reserve.

United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS was made in 1982 and entered into force for Australia in 1994. It provides a framework to regulate many aspects of the uses of the sea and the conservation of marine environment. UNCLOS provides for the right of innocent passage of foreign ships through the territorial sea.

The right of innocent passage allows foreign ships to pass through the territorial sea, without entering internal waters or calling at a roadstead or port facility outside internal waters, or proceeding to or from internal waters or a call at such roadstead or port facility. Passage must be continuous and expeditious, but includes stopping and anchoring in the course of ordinary navigation, or if it is necessary by *force majeure* or distress or to assist persons, ships or aircraft in danger or distress. Certain activities are specified as not being innocent passage including: launching, landing or taking on board aircraft; wilful and serious pollution contrary to UNCLOS; fishing; research or survey activities; other activities not having a direct bearing on passage.

UNCLOS requires that foreign ships enjoying the right of innocent passage through the territorial sea must comply with laws relating to certain matters, including: conservation of the living resources of the sea; prevention of infringement of fisheries laws; preservation of the environment

and the prevention, reduction and control of pollution of the environment; and, marine scientific research and hydrographic surveys.

2.9 National Agreements and Strategies

Australia's Oceans Policy and National Representative System of Marine Protected Areas

The need to protect marine biodiversity through marine protected areas was reaffirmed in *Australia's Oceans Policy*[9], which made commitments to "accelerate the development of the National Representative System of Marine Protected Areas (NRSMPA)" and to "accelerate declaration and management of marine protected areas in Commonwealth waters including the declaration of new parks… around Macquarie Island and around Australia's subantarctic territory of Heard and McDonald Islands". The declaration of the Macquarie Island Marine Park on 27 October 1999 and the HIMI Marine Reserve on 16 October 2002 has contributed to this policy objective.

The primary goal of the NRSMPA is to establish and manage a comprehensive, adequate and representative system of marine protected areas to contribute to the long-term ecological viability of marine and estuarine systems, to maintain ecological processes and systems and to protect Australia's biological diversity at all levels[10]. Protected areas within the NRSMPA are established especially for the conservation of biological diversity, are classified into one or more IUCN protected area categories, have secure conservation status and contribute to the representativeness, comprehensiveness or adequacy of the national system.

Other goals of the NRSMPA—of relevance to the Reserve— include promoting integrated ecosystem management, providing for the formal management of a range of human activities, providing scientific reference sites, providing for the special needs of rare, threatened and migratory species and the conservation of special groups of organisms, and protecting areas of high conservation value including those containing high species diversity, natural refugia for flora and fauna and centres of endemism.

The Reserve falls within the Kerguelen Province of the Interim Marine and Coastal Regionalisation for Australia (IMCRA) version 3.3. The Kerguelen Province is described as a broad region of the Indian Ocean, including deep submarine ridges and subantarctic islands (Kerguelen, Crozet, Heard and McDonald)[4], which contains widely distributed Antarctic species and a few endemics but lacks cool temperate elements.

Register of the National Estate/National and Commonwealth Heritage Lists

The Register of National Estate is a national inventory of natural and cultural heritage places to be preserved for future generations. The islands and associated rocks of the Territory were listed on the Register in 1983, for their importance (see Appendix 5):

- for association with events, developments or cultural phases which have had a significant role in the human occupation and evolution of the nation, State or community;
- in demonstrating a distinctive way of life, custom process, land-use, function or design no longer practiced, in danger of being lost, or of exceptional interest; and
- for information contributing to a wider understanding of the history of human occupation of Australia.

As noted in section 1.2, the Territory is also listed as an 'Indicative Place', to be considered for entry on both the Commonwealth Heritage List and National Heritage List. Commonwealth Heritage management principles (Schedule 7B) (see Appendix 11) and National Heritage management principles (Schedule 5B) (see Appendix 12) are prescribed by the EPBC Regulations.

Recovery Plans, Action Plans and Threat Abatement Plans

A number of EPBC Act recovery plans and threat abatement plans for listed threatened species, and other national actions plans, are relevant to the protection and management of species found in the Reserve, including:

- Recovery Plan for Albatrosses and Giant Petrels 2001[11]
- Sub-antarctic Fur Seal and Southern Elephant Seal Recovery Plan[12]
- Draft recovery plan for ten species of seabird 2004-2009[13]
- Threat Abatement Plan for the Incidental Catch (or By-catch) of Seabirds During Oceanic Longline Fishing Operations[14]
- Action Plan for Australian Birds 2000[15]
- Action Plan for Australian Cetaceans 1999[16]
- Action Plan for Australian Seals 1999[17]

Other Agreements and Strategies

The Reserve's declaration and ongoing management contribute to meeting the Commonwealth Government's objectives in relation to protected areas and networks of protected areas as stated in the *National Strategy for the Conservation of Australia's Biological Diversity*[18] and the *National Strategy for Ecologically Sustainable Development*[19].

2.10 Other Relevant Legislation

The ***Heard Island and McDonald Islands Act 1953*** (HIMI Act) ratifies Australia's acceptance of sovereignty over the Territory and provides for the Territory's legal regime, including the application to the islands of:

- Commonwealth laws which expressly apply to the Territory and Commonwealth laws specific to the Territory;
- ordinances made specifically for the Territory;
- the laws, other than criminal laws, in force from time to time in the Australian Capital Territory in so far as they are applicable and not inconsistent with an Ordinance in force in the Territory; and
- the criminal laws in force from time to time in the Jervis Bay Territory and not inconsistent with an Ordinance in force in the Territory.

The Act also provides for the Governor-General to make ordinances for administration of the islands.

The **EPMO** provides for protection of the Territory's environment and its indigenous plants and animals. Obligations arising from the Ordinance include:

- the requirement for a permit to enter the Territory; and
- the requirement for a permit to undertake activities in the Territory which may have a damaging effect on the environment or the indigenous plants and animals.

The EPMO also provides for the appointment of inspectors to deal with breaches of the Ordinance.

The **Criminal Procedures Ordinance 1993** provides mechanisms for law enforcement in the Territory, including the designation of special constables, who have powers to deal with persons who have breached the laws of the Territory including those laws that carry criminal sanctions.

The **Weapons Ordinance 2001** provides for the implementation of the National Firearms Agreement in the Territory. The Ordinance restricts the possession and use of weapons to approved scientific projects, with some minor exceptions. Storage and registration of weapons is also provided for and a register must be compiled and kept to enable weapons to be traced.

The ***Protection of the Sea (Prevention of Pollution from Ships) Act 1983***, administered by the Australian Maritime Safety Authority (AMSA), deals with the protection of the marine environment from ship-sourced pollution. The Act implements MARPOL 73/78 and regulates normal operational discharges from ships. MARPOL 73/78 annexes regulate the discharge of oil (Annex I), noxious liquid substances (Annex II), the disposal from ships of sewage (Annex IV) and garbage (Annex V) and prohibit the disposal of harmful substances carried by sea in packaged forms (Annex III).

The ***Environment Protection (Sea Dumping) Act 1981*** regulates the dumping at sea of controlled material (including certain wastes and other matter), the incineration at sea of controlled material, loading for the purpose of dumping or incineration, export for the purpose of dumping or incineration, and the placement of artificial reefs. The Act gives effect to Australia's obligations under the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (thereby also fulfilling Australia's international obligations under the London Dumping Convention). Permits are required for any sea dumping activities. Operational discharges from vessels are not defined as 'dumping' under the 1996 Protocol and are therefore not regulated under the Act.

The ***Fisheries Management Act 1991*** regulates fishing activities (taking etc of fish, including all species of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but not including marine mammals or marine reptiles) in the Australian Fishing Zone (AFZ) which is, generally speaking, the waters adjacent to Australia between three and 200 nautical miles of Australia's territorial sea baselines, the latter figure corresponding to the outer limits of the exclusive economic zone. The Act also regulates fishing by Australians on the high seas, including in the CCAMLR area.

The ***Antarctic Marine Living Resources Conservation Act 1981*** (AMLRC Act) implements Australia's obligations under the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). The Reserve falls within statistical subdivision 58.5.2 of the Convention area; a small part of the EEZ extends into division 58.4.3. The Act is administered by the AAD and provides for a system of permits and inspectors, and allows for the implementation of conservation measures adopted by the CCAMLR Commission. The *Fisheries Management Act 1991* takes precedence over the AMLRC Act in some respects (e.g. managing commercial harvesting).

The ***Historic Shipwrecks Act 1976*** provides for the protection of historic shipwrecks and associated relics, and provides for the establishment of protected zones around historic shipwrecks. All shipwrecks and associated relics more than 75 years old have been protected under the Act by Ministerial declaration. A wreck less than 75 years old may also be protected by a declaration of the Minister. The Act prohibits conduct in relation to historic shipwrecks and relics, including conduct that destroys or causes damage to an historic shipwreck or relic, causes interference with an historic shipwreck or relic, causes the disposal of an historic shipwreck or relic, or causes an historic shipwreck or relic to be removed from Australia.

Part 2 How the Reserve will be Managed

3 Zoning and IUCN Category

Aim: To protect the natural and cultural features of the Reserve by defining suitable areas for the conduct of activities.

Performance indicator

- The sensitive natural and cultural features of the Reserve are protected from human impacts and human activity is confined to sites that can sustain it.

Background

As noted in sections 2.4–2.6 of this Plan, the EPBC Act requires the management plan for a Commonwealth reserve to assign the reserve to an IUCN category and allows the Plan to divide the reserve into zones and to assign each zone to an IUCN category, which may differ from the overall category of the reserve. Zoning and IUCN categorisation by this Plan takes into account relevant provisions of the EPBC Act and the management principles prescribed by the EPBC Regulations.

This Plan divides the Reserve into seven zones in order to facilitate protection of those areas that are susceptible to the impacts of human activities, such as vegetated areas, EPBC Act listed threatened species and sensitive geological features, and to confine human activity to sites that can sustain it. The level and type of protection varies between zones, with activities in the Reserve being restricted to the most appropriate areas and managed to give effect to the protected area management principles for the IUCN category strict nature reserve.

The seven zones comprise a Main Use Zone, a Visitor Access Zone, a Heritage Zone, a Wilderness Zone, a Restricted Zone, an Inner Marine Zone and an Outer Marine Zone (see Figure 2 and Figure 3).

Main Use Zone

Main Use Zone areas are located at Atlas Cove and at Spit Bay, allowing for the conduct and support of activities at the north-west and south-east ends of Heard Island. These areas provide suitable locations in which access and support operations can be conducted, and in which long-term facilities can be located, while confining the potential environmental impacts associated with these activities to areas which have been the focus of most past and current activities on land within the Reserve (see sections 5.1 Access and Transport and 5.2 Management of Facilities). Each of these areas contains sites and/or items of cultural heritage significance.

Visitor Access Zone

Visitor Access Zone areas are located at Atlas Cove at the north-west end of Heard Island, Spit Bay in the south-east and Long Beach in the south. These areas provide for appropriate management of low impact, short-term, land-based visitor activities in the Reserve, and allow for a balance between conservation goals and the desire to maximise the experience and enjoyment of visitors in the brief time they are likely be ashore. As weather conditions usually differ dramatically around the island and tourist ships are usually on tight itineraries, the wide distribution of the three Visitor Access Zone areas improves the chances of visitors being able to get ashore.

The areas within the Visitor Access Zone provide relatively safe landing sites, albeit not in all conditions, and access to a range of attractions within approximately one hour's walk of these landing sites. Attractions within, or visible in close proximity to, these low-lying areas include heritage sites, extensively vegetated areas, wildlife colonies and a range of spectacular landscape features. Only low impact access, such as beach landings by vessels or helicopter landings at designated points, and low-impact activities (such as walking, photography and wildlife observation) will be allowed in the Visitor Access Zone in accordance with the provisions of this

Plan (see sections 5.1 Access and Transport and 5.3 Visitor Management and Commercial Activities).

Heritage Zone

The Heritage Zone, contained within the Atlas Cove Main Use Zone, is an area warranting special protection because of its significance in the early history of ANARE, particularly the occupation of the Atlas Cove Station site from 1947–1955. The Heritage Zone encompasses the culturally significant remains of early and pre-ANARE buildings on the western side of Ephemeral Creek including the buildings or building remains shown on Figure 4 (e.g. Admiralty Hut, Recreation Hut). The Heritage Zone restricts activities that have the potential to destroy or degrade heritage values, such as the construction of new facilities which might impinge on the visual context of the location (see sections 5.2 Management of Facilities and 7 Cultural Heritage Management).

Wilderness Zone

The Wilderness Zone comprises all those land areas in the Reserve not included in the Main Use Zone, Visitor Access Zone, Heritage Zone or Restricted Zone. The Wilderness Zone provides for the management of human activities so as to maintain the relatively undisturbed stated and wilderness qualities of the majority of the terrestrial component of the Reserve. Activities that would result in long-term impacts to the natural qualities of the Reserve, such as the establishment of permanent facilities, will not be permitted in the Wilderness Zone, with access primarily being allowed for scientific research, environmental monitoring and management activities (see sections 5.1 Access and Transport and 5.2 Management of Facilities)

Restricted Zone

The Restricted Zone comprises those areas with environmental values that are highly sensitive to the potential impacts of human activities for which it is particularly desirable to conserve existing minimal levels of human disturbance, or where other concerns such as visitor safety are paramount.

Azorella Peninsula, to the north of the Atlas Cove Main Use Zone and Visitor Access Zone, is a particularly sensitive area containing the only lava tubes recorded in the subantarctic or Antarctic[20] and sinkholes. The entrances to some of these features are highly unstable and erodible, and the roofs of some of the very shallow lava tubes are thin and susceptible to collapse. As well as the safety and conservation issues relating to these volcanic features, the cushion plants and other vegetation on the Peninsula are vulnerable to human impact, and significant numbers of both South Georgian diving petrels and Antarctic prions also nest in the vegetated and non-vegetated parts of the Peninsula respectively. While significant stands of cushion plants, some lava tubes and burrowing bird colonies are found elsewhere on Heard Island, the close proximity of Azorella Peninsula to Atlas Cove, the main area of historic and continuing human activity on the Island, and the difficulty of avoiding significant impacts from a low level of visitation necessitate the imposition of strict restrictions on access to the Peninsula.

The McDonald Island group and other small offshore rocks and shoals have been infrequently, if ever, visited and warrant the highest level of protection to maintain their undisturbed state.

Access to, and activities in, these areas will be restricted and tightly controlled (see sections 5.1 Access and Transport, 5.2 Management of Facilities).

Inner Marine Zone

The Inner Marine Zone provides for the management, and in some cases prohibition, of activities in the nearshore marine areas of the Reserve (< 12 nm), to ensure protection of the coastal environment of the islands, the nearshore foraging areas of wildlife, and the values of that marine area (see the Marine Environment section in Part 3 for a description of the marine component of the Reserve). Transport activities in the Inner Marine Zone, including vessel and small craft use and any discharges, will be regulated to prevent or minimise environmental impacts (see sections 5.1

Access and Transport and 6.3 Waste Management). The outer boundary of the Inner Marine Zone also coincides with the outer boundary of the HIMI Territory and World Heritage Area.

Outer Marine Zone

The Outer Marine Zone provides for the management of activities in the marine areas of the Reserve that extend beyond the Inner Marine Zone (see the Marine Environment section in Part 3 for a description of the marine component of the Reserve). Due to the greater distance separating the Outer Marine Zone from the islands, regulation of human activities in this zone will be less strict than the Inner Marine Zone, while still sufficient to provide for the protection of the values of the Reserve. Entry to, and passage through, the Outer Marine Zone by a vessel will not require a permit (see sections 5.1 Access and Transport and 6.3 Waste Management).

Conservation Zone

As explained in section 2.7 Inclusion of Conservation Zone, areas of the HIMI EEZ have been declared a conservation zone under the EPBC Act and, at the time of preparation of this Plan, are being assessed for possible later inclusion in the Reserve. Activities in any of these areas later included in the Reserve will be subject to the provisions of the EPBC Act and Regulations and the relevant prescriptions of this Plan. Any areas incorporated into the Reserve will be managed in a manner consistent with the Australian IUCN reserve management principles for the category to which those areas are assigned.

Prescriptions

3.1 The Reserve is assigned to the IUCN category strict nature reserve.

3.2 The Reserve is divided into seven zones (see Figure 2 and Figure 3):

(a) a **Main Use Zone (MUZ)**– consisting of the Atlas Cove MUZ and the Spit Bay MUZ.

The Atlas Cove MUZ comprises the land area within the outer boundaries described below, except for the Heritage Zone as defined in (d). Commencing at the sign post at 53°01’10”S, 73°23’42”E, the Atlas Cove MUZ boundary proceeds in a straight line south-west to the low water mark of Atlas Cove (53°01’14”S, 73°23’33”E), follows the high water mark generally northwards to Wharf Point (53°01’11”S, 73°23’26”E) then generally north-east along the south-eastern extent of the vegetation on Azorella Peninsula (the southern boundary of the Restricted Zone) until the point where the vegetation limit intersects the edge of the Azorella Peninsula lava flow (approx. 53°01’01”S, 73°23’41”E), before tending southwards along the western limit of the lava flow to the point of commencement (see Figure 4).

The Spit Bay MUZ comprises all the land area within a 150 m radius centred on the large rock at 53°06’26”S and 73°43’14”E (see Figure 5).

(b) a **Visitor Access Zone (VAZ)**– consisting of the Atlas Cove VAZ, the Spit Bay VAZ and the Long Beach VAZ.

The Atlas Cove VAZ, at the north-western end of Heard Island, comprises the low-lying shingle and sandy areas of The Nullarbor, and is bound to the west by Atlas Cove, to the north by the Azorella Peninsula Restricted Zone and Atlas Cove MUZ, to the east by Corinthian Bay and the base of the Baudissin Glacier moraine, and to the South by the vegetation at the foot of Mount Drygalski. The Atlas Cove VAZ also includes:

- an area of 50 m radius surrounding sealers’ huts and relics on the Azorella Peninsula lava flow adjacent to the north-eastern corner of The Nullarbor (53°01’08”S, 73°24’30”E);

- a coastal walking route extending to the flanks of Mount Aubert de la Rue on the western side of Atlas Cove (53°01'27"S, 73°22'50"E);
- a coastal walking route extending 500 m from Wharf Point north along the western shore of Azorella Peninsula (53°00'56"S, 73°23'14"E) (see Figure 4); and
- an unspecified walking route from the Atlas Cove Main Use Zone to an access area of 10 m radius around the memorial cross at 53°01'05"S, 73°23'29"E, approximately 65 m from the closest point on the north-western boundary of the Atlas Cove Main Use Zone. Such access to the memorial cross will only be allowed if it can be achieved without causing environmental damage, and must be via the most direct suitable route.

The Spit Bay VAZ, at the south-eastern end of Heard Island, comprises an approximately triangular area with sides around two kilometres in length lying between Elephant Spit and the eastern-most part of the island proper, plus two narrow coastal strips of approximately one kilometre in length extending to the north-west and south-west from this triangular area. The north-west coastal strip ends where Stephenson Lagoon meets the sea (approx. 53°06'19"S, 73°43'04"E). The south-west coastal strip runs along Sealers Beach and ends at the coast adjacent to the north-eastern end of the unnamed lagoon to the north-east of Doppler Hill (53°08'00"S, 73°43'51"E). The eastern limit of the Zone, on Elephant Spit, is approximately 2 km from the centre of the Spit Bay MUZ at 73°46'17"E (see Figure 5).

The Long Beach VAZ, on the central southern coast of Heard Island, comprises a narrow coastal strip of beach extending from 50 m west of sealers' hut ruins near Cape Labuan (53°11'40.5"S, 73°29'58.5"E), and extending approximately 2 km east to the end of Long Beach where the beach joins a set of low lava cliffs (53°11'11"S, 73°31'16"E) (see Figure 6).

(c) a **Wilderness Zone** - comprising all those land areas in the Reserve not included in the Main Use Zone, Visitor Access Zone, Heritage Zone or Restricted Zone (see Figure 3).

Note: The term 'wilderness' is used here as a general descriptor and is not intended to refer to the IUCN category of wilderness area. At the time of preparing this Plan all areas of the Reserve are assigned to the highest IUCN category available under the EPBC Act - strict nature reserve (see section 3.3).

(d) a **Heritage Zone** - comprising the area within the Atlas Cove MUZ, but excluded from it, that is the site of the original ANARE Station. The Heritage Zone is bound to the north-west by southern limit of the Azorella Peninsula Restricted Zone, then by a 10 m buffer north-east of the remains of the Seal Pen/Tractor/Clothing Store, east of the remains of Chippy's Church/the Carpenter's Store, south of the remains of the Biology Lab, south-west of the remains of Biology Lab/Meteorology and Wireless Hut, and west of the remains of the Meteorology and Wireless Hut/Dogkeeper and Cosmic Ray Hut (see Figure 4).

(e) a **Restricted Zone** – comprising the whole of Sail Rock, Shag Rock and Drury Rock, all of the McDonald Islands and the area north of the southernmost extent of the vegetation or the lava flow on Azorella Peninsula (the northern boundaries of the Atlas Cove MUZ and the Atlas Cove VAZ) (see Figure 3 and Figure 4).

(f) an **Inner Marine Zone** – comprising the marine waters of the Reserve extending from the high tide mark to the 12 nautical mile boundary of the HIMI territorial sea (see Figure 2).

(g) an **Outer Marine Zone** – comprising all the marine waters of the Reserve not included in the Inner Marine Zone (see Figure 2).

3.3 Each zone is assigned to the IUCN category strict nature reserve.

3.4 Activities in any area added to the Reserve during the life of this Plan will be subject to the Commonwealth reserve provisions of the EPBC Act and Regulations, and will be managed in accordance with the Australian IUCN reserve management principles for the IUCN category to which the area is assigned.

Figure 3. Terrestrial zones in the HIMI Marine Reserve

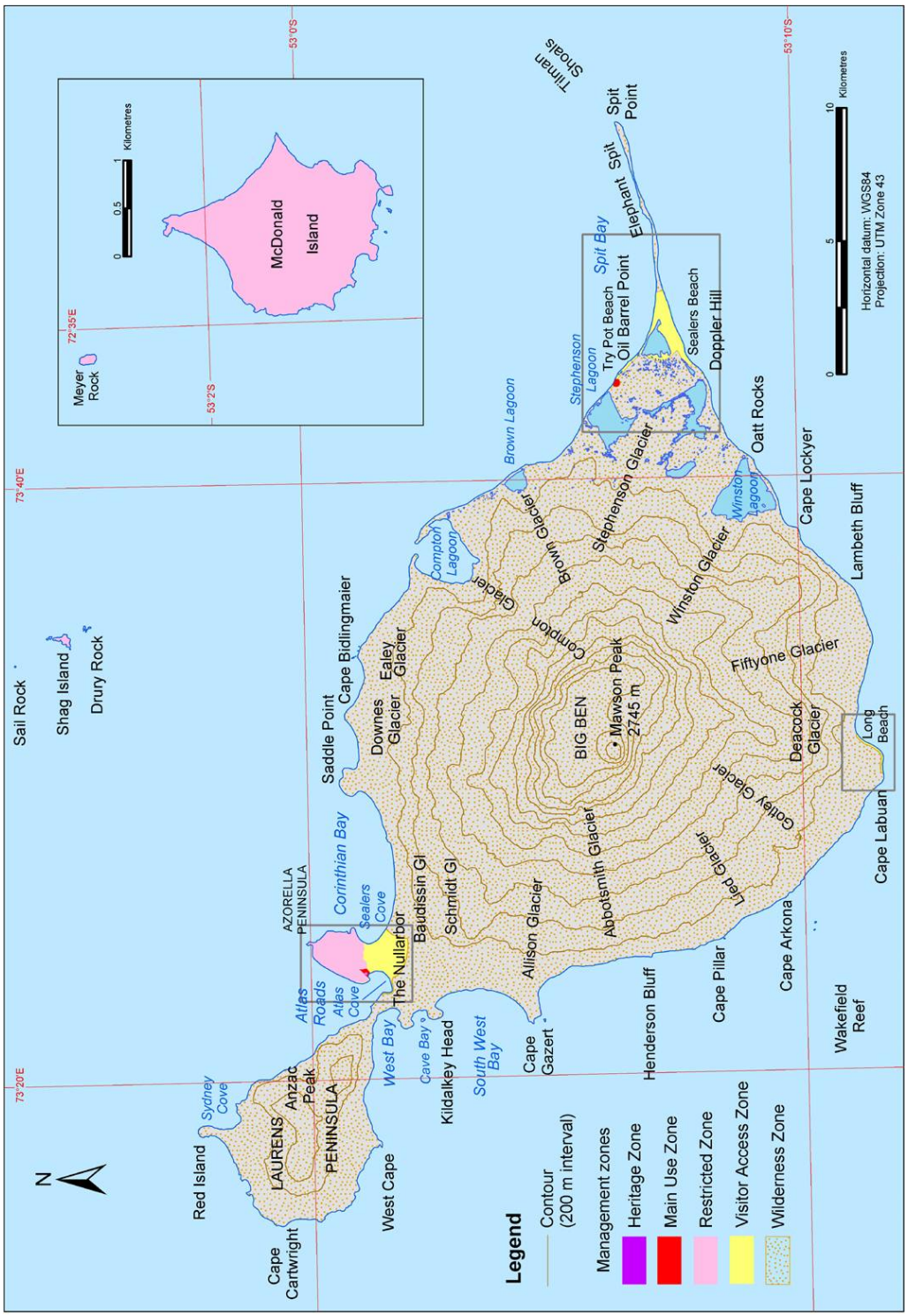


Figure 4. Atlas Cove Zones

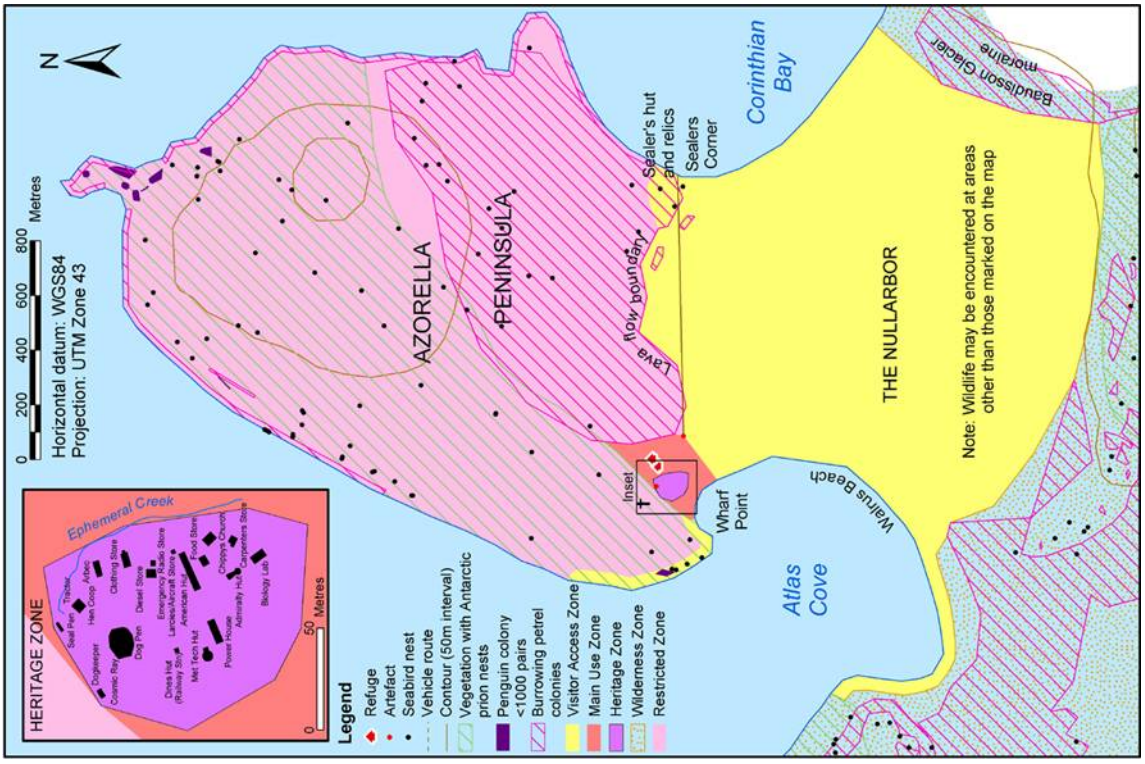


Figure 5. Spit Bay Zones

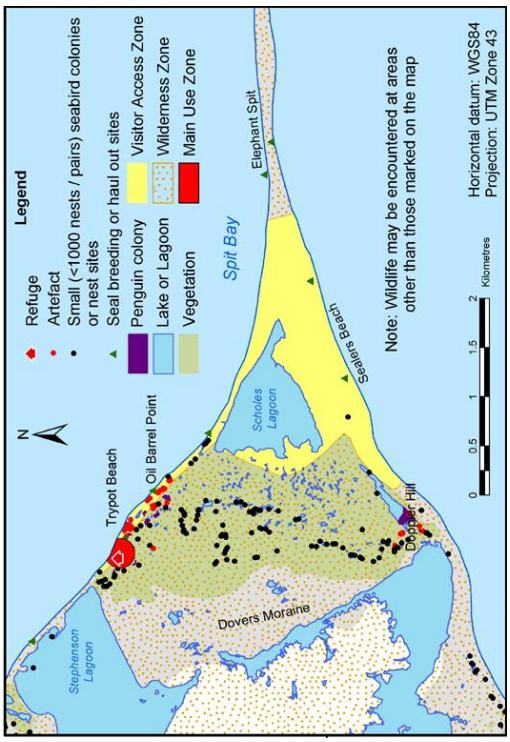
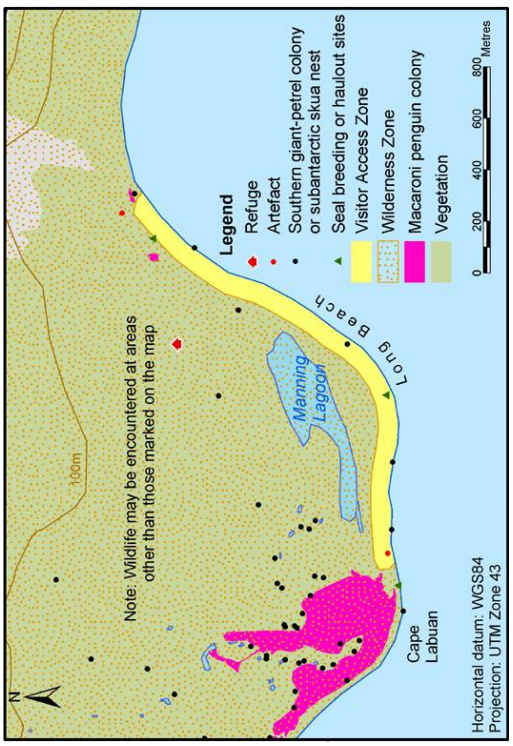


Figure 6. Long Beach Visitor Access Zone



4 Environmental Assessment and Approval

Aims:

To assess to an appropriate degree the potential impacts on the Reserve's values of all proposed activities.

To apply conditions on approved activities, where necessary, to ensure the ongoing protection of the Reserve's values.

Performance indicators

- An environmental impact assessment is undertaken for all proposed activities likely to have more than a negligible impact on the Reserve's values.
- Activities in the Reserve have an acceptable impact on the Reserve's values.
- Permit conditions are applied consistently and are practical and relevant to protecting the values of the Reserve.

Background

Environmental impact assessment (EIA) is a formal process for evaluating the likely environmental effects of a proposed activity, project or program, including consideration of alternatives to the proposal and the application of mitigation measures that may be applied to reduce actual or potential environmental impacts. The EIA process requires the proponent to consider the most environmentally appropriate approach to achieving their intentions from the early planning stages and provides an opportunity for dialogue between the proponent and the assessing authority, with the aim of achieving a suitable outcome for the environment and for the proponent.

Prior to the commencement of this Plan, the *Heard Island Wilderness Reserve Management Plan* required persons wishing to carry out activities in the Territory to prepare and submit an EIA for those activities. The EIA was then taken into account when deciding whether to issue an EPMO permit for the activities in question and what permit conditions ought to be imposed. The administrative guidelines used for this EIA process were modelled on those applied to activities in Antarctica under the *Antarctic Treaty (Environment Protection) Act 1980* (Cth). Activities likely to constitute 'controlled actions' for the purposes of the EPBC Act were referred for assessment in accordance with that Act. It is proposed to continue this arrangement subject to any amendments to the EPMO (see below).

As explained in section 2.4, actions that could have a significant environmental impact on the Reserve may trigger the assessment and approval provisions of the EPBC Act and may be decided by the Minister to be 'controlled actions'. Responsibility for compliance with these provisions of the EPBC Act lies with the persons taking, or proposing to take, the relevant action. A person proposing to take an action that the person thinks may be, or is, a controlled action should refer the proposal to the Minister for the Environment and Heritage for the Minister's decision on whether or not the action is a controlled action. Where the Director considers that a proposed action by another person may be a controlled action in relation to the Reserve, the Director may refer the proposal for the Minister's decision.

At the time of preparing this Plan it is proposed that the EPMO be examined to determine whether amendments should be made to require the proponent of an activity in the Territory to evaluate potential environmental impacts before the activity begins and before a permit is granted under that Ordinance. This EIA process may be broadly modelled on the EIA requirements and thresholds imposed under the *Antarctic Treaty (Environment Protection) Act 1980* (Cth) in respect of proposed activities in Antarctica.

Prescriptions

4.1 Actions that will or are likely to have a significant impact on matters of national environmental significance will be subject to the assessment and approval provisions of Chapters 2 to 4 of the EPBC Act (irrespective of where the action is taken). Matters of national environmental significance are identified in Part 3 of the EPBC Act.

4.2 An activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit.

4.3 In addition to the EPBC Act assessment and approvals process outlined in section 4.1, activities in the Territory are subject to the following environmental impact assessment provisions:

(a) a person proposing to carry on an activity in the Reserve for which a permit is required under the EPMO must provide a written report on the impacts that the activity would be likely to have on the environment of the Reserve; and

(b) no permit will be issued under the EPMO to authorise the activity unless the issuer of the permit is satisfied that:

i. the environmental impacts of the activity have been assessed in accordance with this section; and

ii. the activity, either as proposed or with certain modifications, has been assessed as being consistent with this Plan and the reserve management principles.

4.4 The Director may determine in writing that section 4.3 does not apply to certain proposed activities if the Director is satisfied that, because of their nature, those activities, when conducted in accordance with the requirements of this Plan, are likely to have no more than a negligible impact on the Reserve environment.

Note: Activities likely to have no more than a negligible impact on the Reserve environment may include those constituting routine management operations (see, for example, Appendix 13), or those not requiring the establishment of facilities or access beyond the Main Use Zone, Heritage Zone and Visitor Access Zone, such as day-trips for the purpose of sight-seeing.

4.5 Section 4.3 does not apply to a person or activity that is exempted by this Plan (for example, under 9.4 Emergency Management or 9.2 Compliance and Enforcement) or by the Director under section 4.4.

4.6 The Director will make available information to assist proponents to understand and comply with the environmental impact assessment and permit application processes, and will encourage consultation with proponents at an early stage in the planning of visits to the Reserve.

4.7 Permits issued under the EPMO or the EPBC Regulations will contain conditions requiring compliance with this Plan, and may include additional conditions arising from the EIA process or, where no EIA is required, considered appropriate for protecting the values of the Reserve.

5 Visitor Management and Reserve Use

5.1 Access and Transport

Aim: To provide for safe human access to and within the Reserve that does not adversely impact the Reserve's values.

Performance indicator

- Number and nature of incidents affecting visitor safety or the environment.

Background

The isolation of the Reserve, together with its topography and persistently severe weather imposes substantial restrictions on safe and suitable access to, and travel within, the islands of the Reserve by land, water and air.

There are no harbours, landing facilities, roads or marked walking tracks in the Reserve. Atlas Roads, at the north-west end of Heard Island, is sheltered from the prevailing westerly and south-westerly weather and is the main anchorage point for vessels visiting the island. However, it is not a safe, all-weather anchorage. Personnel and cargo can be transported ashore by small boat or amphibious vehicle, which land in the Main Use Zone on Walrus Beach, or by helicopter using defined approach corridors and landing sites to minimise wildlife disturbance. In some weather conditions, vessels anchor in Corinthian Bay and deploy personnel and cargo to the beach at Sealers Corner. A defined vehicle route, crossing the base of a lava flow that marks the southern boundary of Azorella Peninsula, can be used to access the Atlas Cove Main Use Zone from Corinthian Bay. At the eastern end of the island, vessels generally stand off in Spit Bay, and deploy personnel and cargo to the Spit Bay Main Use Zone at Try Pot Beach by small boat, amphibious vehicle or by helicopter.

Excluding marine debris and waste items ingested and regurgitated by wildlife, human-made items that reach the Reserve overwhelmingly do so initially by ship, and then either by helicopter or small boat (such as inflatable rubber boats (IRBs), barges or amphibious vehicles). As well as providing for the deployment and retrieval of personnel and cargo, these craft (in the broad sense) are all pathways that might potentially introduce alien species and diseases to the Reserve, generate marine and/or terrestrial pollution, and cause disturbance to wildlife, vegetation or the landscape.

Access to other parts of the island by water, air or on foot may be possible in suitable weather and sea conditions but such access may not be appropriate depending on the nature of the area to be visited and the relevant management zoning (see section 3 Zoning and IUCN Category). Low-impact transport options that avoid the need for vehicle use, such as walking from designated campsites or nearby coastal locations, will be required where practical.

Domestic and international shipping is regulated by the Australian Maritime Safety Authority (AMSA). Reserve visitors should have regard to Marine Notices and other requirements or recommendations for vessel operations in subantarctic waters, as specified by AMSA.

Access to and activities within the Reserve (except the Outer Marine Zone) will be managed and regulated in accordance with this Plan primarily through the EPMO. The EPMO provides that a person may only enter the Territory in accordance with a permit issued under that Ordinance, or during the course of an emergency, or in the performance of the duties of that person as an inspector appointed under the EPMO. The EPMO also provides that a person must not land an aircraft, drive a vehicle or sail a vessel in the Territory, except in accordance with a permit.

Activities in the Outer Marine Zone will be managed and regulated in accordance with this Plan primarily through the EPBC Regulations. Entry to that zone does not require a permit under the

EPBC Regulations. However, access to all or part of that zone may be prohibited under EPBC regulation 12.23.

EPBC Regulation 12.23(3) provides that the Director may prohibit or restrict entry to the Reserve at all times, at specified times or for a specified period by persons generally or by a class of persons. Notice of such prohibition or restriction must be published in the *Gazette,* unless the prohibition or restriction deals with an emergency or meteorological conditions that may endanger public safety and were not known in sufficient time for publication. Contravention of a prohibition or restriction is an offence. At the time of preparing this Plan no prohibition or restriction has been imposed under r.12.23 in relation to the Reserve.

EPBC Regulation 12.56 also provides that a person must not use a vessel in a Commonwealth reserve in contravention of a determination issued under that Regulation. No such determination has been made in respect of the Reserve at the time of preparing this Plan.

In relation to the use of aircraft in or over the Reserve, EPBC Regulation 12.36 deems commercial activities carried on in airspace over the Reserve up to 3000 m (about 9850 feet) above mean sea level to be commercial activities carried on in the Reserve, and therefore prohibited unless carried on in accordance with the management plan or a permit issued under the EPBC Regulations (or another exemption in r.12.06(1) applies).

As explained in section 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit. Activities in that part of the Reserve which does not form part of the Territory will be regulated through reliance on the EPBC Regulations.

Consistent with the above, entry to the Territory and the use of aircraft, vehicles and vessels in that part of the Reserve will be regulated by the EPMO and permits issued under that Ordinance in accordance with this Plan.

Nothing in this Plan is intended to interfere with enjoyment of the right of innocent passage of foreign ships through the territorial sea in accordance with UNCLOS (see section 2.8).

Prescriptions

General

5.1.1 An activity that is otherwise prohibited by section 354(1) of the EPBC Act, or by or under the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with a permit issued under the EPMO.

5.1.2 Permits will not be issued under the EPMO to authorise entry to the Territory in contravention of a prohibition or restriction imposed under EPBC regulation 12.23.

5.1.3 Permits authorising aircraft, vehicles and vessels (including small boats such as inflatable rubber boats (IRBs), amphibious craft when in the water, or similar) to enter and be used in the Territory will only be issued for an approved purpose.

5.1.4 Aircraft, vehicle and small boat use in the Territory must be restricted to the minimum reasonably necessary to safely carry out permitted activities.

5.1.5 Persons operating aircraft, vehicles and vessels in the Reserve must take all reasonable steps to minimise, and where possible avoid, environmental damage.

5.1.6 Fuels and lubricants must only be taken ashore for the purpose of refuelling aircraft, vehicles or small boats where:

(a) the refuelling cannot reasonably be carried out on board the support vessel;

(b) the fuels and lubricants taken ashore are transported and stored onshore in secure containers; and

(c) all reasonable precautions are taken to prevent fuels and lubricants being spilled.

If a spill occurs, all reasonable steps must be taken to contain the spill and to minimise environmental damage.

5.1.7 Landings in the Reserve may occur only in the Main Use Zone or Visitor Access Zone, except where landings elsewhere are carried out in accordance with 5.1.10, 5.1.12 or 5.1.18.

> Note: See also prescriptions listed elsewhere in this Plan relating to:
>
> - waste management requirements (see section 6.3 Waste Management)
> - quarantine requirements (see section 6.4 Prevention and Management of Alien Species and Disease)

5.1.8 Australian vessels may traverse the territorial sea (Inner Marine Zone) in a manner consistent with the meaning of innocent passage in UNCLOS (with out a permit).

> Note: Foreign vessels enjoy the right of innocent passage through the territorial sea in accordance with UNCLOS and do not require a permit.

Vehicles

5.1.9 Vehicles may only be used for approved research or management purposes in the Main Use Zone, except where used in accordance with section 5.1.10.

5.1.10 Vehicles (including amphibious craft onshore) may be used outside the Main Use Zone when landing to deploy and retrieve personnel and cargo. In doing so, the vehicle must not proceed beyond the lower limit of vascular vegetation unless doing so is:

(a) reasonably required to ensure human safety; or

(b) expressly authorised by a permit issued under the EPMO.

5.1.11 A permit may only be issued to authorise vehicle use above the lower limit of vascular vegetation outside the Main Use Zone for an approved research or management purpose. When deciding whether to issue a permit, the issuer will consider whether such vehicle use is likely to result in the least environmental impact of the practicable alternative methods of transport.

Vessels

5.1.12 Small boats may be landed on the shore outside the Main Use Zone or Visitor Access Zone to deploy and retrieve personnel and cargo for approved purposes, provided such a landing will not result in environmental damage.

> Note: See sections 5.1.9 to 5.1.11 for prescriptions relating to the use of amphibious craft onshore.

5.1.13 Subject to sections 5.1.1 to 5.1.6, small boats may be used to cruise the coast and open lagoons of Heard Island.

5.1.14 To minimise bird strikes at night, vessels must only use the minimum lights reasonably necessary for safety.

5.1.15 Small boat operations and landings may only occur at the McDonald Islands or other offshore rocks or shoals in the Reserve when essential for the support of approved research or management activities.

5.1.16 The Director will investigate options for additional protection of the Reserve from potential impacts of shipping, such as through marking the Reserve on new edition Marine Charts and in the Australian Annual Notice to Mariners, together with a cautionary note that indicates the need for a permit to enter the Territory and the area's environmental sensitivity.

Aircraft

5.1.17 Permits issued under the EPMO to authorise aircraft use in the Territory may specify flight paths and landing sites with a view to minimising disturbance of flora and fauna. When deciding whether to issue a permit and what conditions to impose, the issuer of the permit will take into account factors assessed in the environmental impact assessment process, including:

(a) alternatives to air transport;

(b) the locations of wildlife concentrations and critical periods in wildlife lifecycles; and

(c) potential overall environmental benefits through the use of aircraft to support the proposed activity.

5.1.18 Landings of aircraft at locations outside the Main Use Zone may only occur where access by land or water would be impractical and aircraft support is reasonably required for carrying personnel or cargo for research or management purposes.

5.1.19 Aircraft refuelling operations on land, if necessary, may only occur in the Main Use Zone.

5.2 Management of Facilities

Aims:

To ensure that facilities are located and managed to prevent or minimise impacts on the Reserve's values.

To ensure that redundant facilities are removed and that sites are rehabilitated to the extent practicable.

Performance indicators

- Estimated total area disturbed by facilities.
- Impacts on Reserve values from facility establishment, use and removal are within acceptable limits.
- Details of all facilities are recorded in the Reserve Management Database.
- Periodic reviews of existing facilities are undertaken and redundant facilities are removed.

Background

The placement or construction of facilities has the potential to detract from the wilderness qualities of the Reserve, as well as to directly impact on the vegetation, wildlife, waterbodies and other values. Facilities should be appropriate for the intended zone of use, and planned to allow safe deployment and retrieval in accordance with the controls that this Plan places on logistical support. As far as possible, all facilities should be light, low-impact and operable with minimal need for major logistical support, and should be easily removable.

The placement of facilities also carries the potential for introduction of alien species. In certain circumstances, where facilities are required at a location for research or management purposes over an extended period, it may be environmentally preferable for the facilities to remain *in situ* for the period of use rather than being repeatedly retrieved and redeployed although facilities left for extended periods will generally need to be more durable, potentially causing more impacts than other facilities.

There are no facilities on the McDonald Islands (or any of the other rocks and shoals) and no permanent facilities on Heard Island. At the time of preparing this Plan, temporary accommodation facilities on Heard Island include:

- several small fibreglass or tank huts in both the Atlas Cove and Spit Bay Main Use Zones;
- a single wooden hut, in a state of some disrepair, from the 1947–1955 ANARE expedition in the Heritage Zone at the Atlas Cove ANARE Station site; and
- small fibreglass or tank huts in the Wilderness Zone near the coast at Long Beach, at Brown Lagoon and at Red Island. These are used in support of approved research and management activities distant from the Main Use Zones.

While all efforts are taken to ensure that any refuges on the island are sufficiently maintained to ensure their continued survival, extreme weather events, combined with the inability to undertake frequent management visits to the island mean that the condition or presence of these facilities cannot be guaranteed (see also section 9.4 Emergency Management). Such considerations are also relevant to decisions about placement of facilities for extended periods.

Section 354 of the EPBC Act and r.12.11 of the EPBC Regulations generally provide that a person must not carry on an excavation, erect a building or other structure or carry out works in the Reserve except in accordance with a management plan.

The EPMO provides that a person must not, except in accordance with a permit:

- engage in conduct that results in death or injury to, or interference with, any organism in the Territory;
- leave any equipment, material or refuse in the Territory;
- engage in conduct that results in interference to any soil or other geological matter in the Territory;
- engage in conduct that results in interference to any buildings, historical relics, equipment, supplies or survey markers; or
- engage in conduct that results in interference to the conduct of a scientific experiment that is the subject of a permit in the Territory.

As explained in section 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit. Activities in that part of the Reserve which does not form part of the Territory will be regulated through reliance on the EPBC Regulations (see reference above to r.12.11).

Consistent with the above, the establishment or alteration of facilities in the Reserve will be regulated by the EPMO and permits issued under that Ordinance in accordance with this Plan.

Prescriptions

5.2.1 The establishment of a new facility in the Territory, or the alteration of an existing facility in the Territory, may only be carried out:

(a) for an approved purpose (see section 2.3);

(b) following the completion of an environmental impact assessment (see section 4 Environmental Assessment and Approval); and

(c) in accordance with an EPMO permit.

5.2.2 The issuer of the permit will have regard to the findings and recommendations arising from the environmental impact assessment process when deciding whether to issue the permit and the conditions to be imposed.

5.2.3 The establishment, alteration, maintenance and removal of a facility in the Territory must be planned and conducted to minimise, and where possible avoid, visual impacts and environmental damage. Where practicable, new facilities will be located at previously used sites.

5.2.4 A permit for the establishment of a facility in the Territory may only be issued where the issuer of the permit is reasonably satisfied that:

(a) establishment of the facility is consistent with the management objectives for the reserve, with this Plan, and with the reserve management principles;

(b) establishment and use of the facility at the proposed location will not result in adverse environmental damage;

(c) the location of a new site for the facility, if used, will be chosen to minimise, and where possible avoid, environmental damage; and

(d) the facility will be sufficiently robust to ensure that it can reasonably be expected to remain intact and in situ for the intended period of use;

(e) logistic capability is likely to be available to remove the facility at the end of the intended deployment or as soon as practical after the facility is no longer required; and

(f) appropriate steps will be taken to rehabilitate the site(s) on removal of the facility.

5.2.5 A permit may only be issued for the establishment of a permanent facility in the Territory if:

(a) establishment of the facility is for compelling research or management purposes; and

(b) the facility will be located in the Main Use Zone; or

(c) compelling circumstances exist which warrant the establishment of the facility in an area other than the Main Use Zone.

5.2.6 No new facility may be established in the Heritage Zone.

5.2.7 A permit may only be issued to authorise the establishment of a facility in the Visitor Access Zone or Wilderness Zone where the issuer of the permit is satisfied that:

(a) the facility will be temporary; and

(b) compelling circumstances exist which warrant the establishment of the facility in the Visitor Access Zone or Wilderness Zone,

and in determining whether such circumstances exist, regard shall be had to whether the facility is required to ensure visitor safety. Visitor or operational convenience alone will not be considered compelling circumstances.

5.2.8 A permit to authorise the placement of a facility in the Wilderness Zone or Visitor Access Zone, or a temporary facility in the Main Use Zone, will indicate when the facility is to be removed.

5.2.9 In considering whether to issue a permit for establishment of a facility in the Territory for an extended period, the issuer will have regard to whether the impacts associated with the use of the facility over the intended period are likely to be less than the impacts associated with regular removal and redeployment of a facility.

5.2.10 A permit to establish a new facility in the Restricted Zone may only be issued where the issuer of the permit is satisfied that:

(a) the facility will be removed on departure; and

(b) compelling circumstances exist which warrant establishment of the facility in the Restricted Zone for research or management purposes,

and in determining whether such circumstances exist, regard shall be given to whether the facility is required to ensure visitor safety.

5.2.11 No wood may be taken ashore unless it has undergone AQIS-recognised quarantine treatment to kill any organisms (including reproductive material) and to prevent fungal growth.

5.2.12 To reduce the risk of bird strike:

(a) masts and guy wires must be appropriately marked to ensure that they are reasonably visible to wildlife;

(b) masts and guy wires must not be illuminated at night; and

(c) lighting at camps must be minimised to the extent practicable.

5.2.13 All fuel taken ashore must be transported and stored in a secure container. When refuelling equipment, appropriate precautions must be taken to minimise the risk of fuel spills (such as the use of funnels and drip mats). Appropriate spill management equipment must be readily available for use in an emergency. If a spill occurs, all reasonable steps must be taken to contain the spill to and to minimise environmental damage.

5.2.14 Where practicable, ground transport of equipment from a landing site to the location where the equipment is to be used should be via a single route and should take all reasonable steps to minimise, and where possible avoid, environmental damage.

5.2.15 Locations and relevant details of all facilities placed in the Reserve must be provided to the Director to facilitate maintenance of the Reserve Management Database (see section 6.5.19).

5.2.16 Where approval has been given for an item to remain ashore in the Reserve, it must be suitably marked to facilitate future identification.

5.2.17 Prior to each management visit the Director will review existing facilities in the Reserve to determine whether their retention is still justified or warranted.

5.3 Visitor Management and Commercial Activities

Aim:

To manage visitor access and commercial operations in the Reserve so as to provide a safe and enjoyable experience without compromising the Reserve's values.

Performance Indicators

- Number and nature of visitor-related incidents affecting visitor safety or the environment.
- Number of entry permits applied for and issued.
- Visitor satisfaction, based on feedback received in post-visit reports.

Background

The majority of land-based activity in the Reserve in recent years has been associated with research- and management-related expeditions of the Australian Antarctic program, supported by the AAD, with only a few visits by private groups and commercial tourist operations. The

Reserve's remoteness from any mainland port, together with the extreme weather conditions, makes access difficult. Getting ashore at some parts of Heard Island, the primary destination within the Reserve for visitors, may also involve hazardous landing conditions.

Despite the physical limitations on visitor access, the natural and cultural attractions of the Reserve are powerful drawcards for visitation by persons willing and able to make the substantial investment of both time and money. Demand for private and commercial visitation is limited and unlikely to increase significantly over the life of this Plan and it is likely that visitation will continue at or around recent levels.

There are no established facilities for recreational visitors and no intention to provide them. This is in order to maintain the Reserve's wilderness qualities and because of the significant costs and logistical requirements for maintaining such facilities. Visiting groups must be fully self-sufficient and aware of the risks associated with visitation (e.g. there is no permanent search and rescue presence and any assistance may be more than two weeks away).

Both the World Heritage Convention and the Australian World Heritage management principles (Appendix 9), call for the presentation of the World Heritage values of the Reserve to the community. It is generally accepted that such presentation should not be to the detriment of the values of the property. In keeping with the Reserve's declaration as a strict nature reserve only controlled, low intensity on-site recreational visitor access will be allowed and off-site presentation methods will be promoted (see section 5.4 Communicating Reserve Values). On-site visitation will be managed in accordance with the reserve management principles (Appendix 8) to conserve and protect the values of the Reserve and to enhance visitor safety.

Commercial tours and other actions for commercial purposes are prohibited in the Reserve by s.354(1) of the EPBC Act unless carried out in accordance with this Plan. Section 354(1) of the Act also prohibits the following actions being taken in the Reserve except in accordance with this Plan:

- kill, injure, take, trade, keep or move a member of a native species;
- damage heritage;
- carry on an excavation;
- erect a building or other structure; and
- carry out works.

The EPBC Regulations also prohibit or regulate other activities in the Reserve, except where taken in accordance with this Plan, including: scientific research (r.12.10); excavating, building and works (r.12.11); damaging, defacing features (r.12.12); damaging heritage (r.12.13); dumping of waste, littering (r.12.14); use of poisonous substances (r.12.15); fossicking, removal of earth materials (r.12.16); use of firearms, nets and other devices (r.12.18); taking animals into a Commonwealth reserve (r.12.19); taking plants into a Commonwealth reserve (r.12.20); capturing images or recording sound (r.12.24); adventurous activities (r.12.26); camping (r.12.28); lighting and use of fires (r.12.30); erection of commemorative markers (r.12.33); commercial fishing (r.12.34); commercial activities (r.12.36); erecting signs (r.12.40); use of vessels (r.12.56); use of aircraft (r.12.58).

The EPMO also regulates activities in that part of the Reserve that comprises the Territory. For example, except where otherwise authorised by or under the EPMO, it is an offence to knowingly or recklessly: enter the Territory; bring into the Territory any organism, poultry or poultry products; take, injure or otherwise interfere with any organism in the Territory; remove an indigenous organism from the Territory; land an aircraft, drive a vehicle, sail a vessel in the Territory; leave any equipment, material or refuse in the Territory; introduce to or remove from the Territory any soil or other geological material; collect any material in the Territory; cause or allow to escape in the Territory an introduced organism; interfere with any building, historical relic, equipment,

supplies or survey marker in the Territory; interfere with the conduct of scientific experiment in the Territory; and contravene a condition of a permit issued under the EPMO.

As explained in section 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit. Activities in that part of the Reserve which does not form part of the Territory will be regulated through reliance on the EPBC Regulations.

Prescriptions

5.3.1 The Director will take reasonable steps to provide organisers of visits to the Reserve (including persons with on-ground responsibility for the visiting group) with appropriate briefings and materials detailing the requirements of this Plan.

5.3.2 Materials provided to visitors may include an *Environmental Code of Conduct for Visitors to Heard Island*, or similar, that outlines principles and guidelines, including wildlife approach guidelines, for minimal impact visitation to the Reserve. A sample *Environmental Code of Conduct* is given at Appendix 14.

5.3.3 Permits may be issued subject to the permit holder entering into an agreement to:

(a) reimburse any costs incurred by the Director or the Commonwealth in relation to the provision of search and rescue or other emergency assistance provided to them or their clients while in, or in transit to or from, the Reserve;

(b) release the Director and the Commonwealth from any claims for loss or injury arising from the conduct of the permitted activities;

(c) have a policy of insurance covering any public liability arising out of the permitted activities; and

(d) indemnify the Director and the Commonwealth against claims brought against the Director and the Commonwealth arising from the conduct of the permitted activities.

5.3.4 The Director may require an authorised official to accompany any visit to the Territory to encourage compliance with legislation, permits and the requirements of this Plan.

5.3.5 Visit organisers must ensure that all visitors to the Reserve for whom they are responsible, including ships' crew, are provided with a copy of the *Environmental Code of Conduct for Visitors to Heard Island* (see 5.3.2) and are aware of and comply with, visitors' individual responsibilities arising from this Plan with particular regard to:

- waste management (see prescriptions in section 6.3 Waste Management);
- quarantine (see prescriptions in section 6.4 Prevention and Management of Alien Species and Disease);
- protection of flora and fauna (see prescriptions in section 6.1 Flora and Fauna); and
- cultural heritage (see prescriptions in section 7 Cultural Heritage Management).

5.3.6 Permit holders must ensure that visitors going ashore are suitably briefed on safety requirements and are appropriately clothed and shod.

5.3.7 Overnight stays will not be allowed on land in the Reserve, other than for approved purposes where the activities in question cannot reasonably be undertaken as a day trip or by using ship-based facilities.

5.3.8 Permits issued for visitor access on land in the Reserve will be limited to foot travel within the Visitor Access Zone, Main Use Zone and Heritage Zone, unless access to other areas

and by other means of transport is authorised by and undertaken in accordance with a permit issued under the EPMO (see also section 5.1 Access and Transport).

5.3.9 No buildings or other structures may be erected in the Reserve to cater for recreational visitor use, other than approved temporary structures which are to be removed on departure (see also section 5.2 Management of Facilities).

5.3.10 The following limits apply unless the Director is reasonably satisfied that exceeding the limits is consistent with achieving the management objectives for the reserve:

(a) the combined maximum number of persons allowed ashore in the Atlas Cove Main Use Zone and/or the Atlas Cove Visitor Access Zone at any one time is 60;

(b) the combined maximum number of persons allowed ashore in the Spit Bay Main Use Zone and/or the Spit Bay Visitor Access Zone at any one time is 30;

(c) the maximum number of persons allowed ashore in the Long Beach Visitor Access Zone at any one time is 30;

(d) the total number of persons allowed in any one group at the locations listed in (a), (b) and (c) is 15, and each group must include at least one guide; and

(e) the combined total number of persons allowed ashore at any one time at locations other those listed in (a), (b) or (c) is 15.

5.3.11 All shore parties must be capable of maintaining two-way radio communication with the vessel providing support while those parties are in the Reserve and away from the vessel.

5.3.12 Firearms, nets and other devices listed in EPBC Regulation 12.18 may only be used in the Outer Marine Zone for approved research or management purposes and in accordance with a permit issued under the EPBC Regulations.

5.3.13 The following commercial activities may be carried on in accordance with a permit issued under the EPMO in respect of activities in the Territory, or under the EPBC Regulations in respect of activities in the Outer Marine Zone:

(a) organised tours (other than fishing tours);

(b) the capture of images (record by artistic representation, or on film, videotape or electronic medium) or recording of sounds; and

(c) other activities considered by the Director to be consistent with the management objectives for the Reserve, with this Plan, and with the reserve management principles.

5.3.14 Permits may only be issued to authorise allowable commercial or other non-government activities if the issuer of the permit is reasonably satisfied:

(a) that the activity will assist in promoting an understanding and appreciation of the Reserve's natural and cultural resources; and

(b) that the activity is consistent with the management principles for the IUCN category strict nature reserve; and

(c) that all safety and public liability issues will be adequately addressed.

5.3.15 Permits relating to allowable commercial and other non-government activities will be managed to:

(a) avoid undesirable conflict or overlap with other permitted activities;

(b) avoid disturbance to research and management activities;

(c) minimise or where possible avoid environmental damage; and

(d) avoid inappropriate or significant demands on the Director's resources.

5.3.16 Permits may be issued under the EPMO so as to restrict onshore visits to no more than one commercial tour group or private visit on any one day.

5.3.17 Permits authorising visits to the Territory will be issued subject to the requirement that a written report on each visit be provided within 60 days of the visit, including the following information:

(a) details of environmental or safety incidents;

(b) details of the location of markers, facilities or equipment used or placed in Reserve;

(c) the number, location, duration and activities of persons ashore at each location visited;

(d) a statement of compliance with permit conditions; and

(e) other information considered necessary to assist with the management of the Reserve.

5.3.18 In addition to post-activity reporting by permit holders, all visitors to the Reserve may be invited to report to the Director details (preferably including photographs and GPS coordinates where appropriate) of any:

(a) sightings of alien species;

(b) details of any bird strikes that occur on land or on the vessel;

(c) evidence of any unusual wildlife mortalities;

(d) evidence of current or recent volcanic activity;

(e) sightings of any other vessels within the Reserve or HIMI EEZ;

(f) signs of recent human activity;

(g) information on sightings of anthropogenic marine debris and wildlife entangled with debris;

(h) other incidents or unusual occurrences; and

(i) recommendations on the management of the Reserve.

5.3.19 During the life of this Plan the Director will undertake a safety audit of Reserve management activities and visitor use of the Reserve, and will investigate ways of reducing risks to visitor safety and to the values of the Reserve.

5.4 Communicating Reserve Values

Aims:

To enhance public awareness and appreciation of the Reserve and its values, and of activities undertaken to manage, protect and conserve the Reserve.

To effectively use off-site measures to present the Reserve to the community.

Performance indicators

- Visitor satisfaction, based on feedback received in post-visit reports and on feedback on off-sit measures.
- A range of interpretive material is periodically updated and publicly available.
- The Reserve is promoted through public forums.

Background

Due to the isolation and extreme weather conditions of the HIMI region and the significant cost and logistical constraints on public visitation, it is unlikely that more than 100 people per annum will visit the Reserve in person. The placement of on-site interpretive materials and facilities to cater for the small number of possible recreational visitors may conflict with the wilderness qualities of the Reserve, and result in unjustified upkeep costs. It is also generally recognised that the likelihood of establishment of alien species is directly proportional to the number of persons who visit a site, so promoting increased access may conflict with the aim of preventing the human introduction into the Reserve of alien species or disease.

As the Territory is a World Heritage Area, there is a formal obligation under the World Heritage Convention to present the site to the community. While on-site access is unlikely, and is largely incompatible with this Plan for the reasons outlined above, there is value for distant communities in knowing that a wild and natural place such as the Reserve exists. This requires a means of bringing the site to the community, which can be achieved by using rapidly improving web and multi-media technology, as well as interpretive materials and displays.

Recognising that some on-site visitation is likely to occur, it is essential that comprehensive information is made available to visitors before their departure for the Reserve, both to increase the quality of their experience and to facilitate compliance with the requirements of this Plan. The Visitor Access Zone described in section 3 Zoning and IUCN Category provides for access to a range of visitor attractions while protecting areas of high environmental sensitivity.

Prescriptions

5.4.1 A website will be established and maintained to provide information about the Reserve, such as:

- this Plan and associated documentation;
- general information about the location, features, values and management of the Reserve;
- maps of the Reserve;
- multi media (e.g. images, virtual panoramas, movie clips, audio clips);
- a bibliography of relevant references;
- scientific information/databases;
- spatial data (GIS datasets);
- historical records (e.g. photos, diaries, logs, oral histories);
- links to information on other Commonwealth reserves, marine protected areas, World Heritage sites, Ramsar sites, Commonwealth Heritage sites and National Heritage sites;
- information relating to the environmental impact assessment and permits processes;
- links to relevant legislation;
- Australian Antarctic program expedition information;
- public notices relating to the Reserve; and
- contact details for queries regarding the Reserve.

5.4.2 Where practical, opportunities will be taken to present the Reserve in appropriate public forums, such as:

- the AAD headquarters public display area;

- exhibitions relating to Australian national parks and reserves, World Heritage areas, Ramsar wetlands, National Heritage places;
- Antarctic exhibitions; and
- other photographic exhibitions.

5.4.3 An interpretation package will be prepared and maintained for use by Reserve management staff in presenting the Reserve at appropriate events, comprising such items as display stands, posters, videos, pamphlets, slide presentations.

5.4.4 Where practical, opportunities will be taken during Australian Antarctic program expeditions to the Reserve to improve the catalogue of images, video footage and other multi-media items available for use in presenting and communicating the Reserve.

5.4.5 The Director will use appropriate media opportunities to raise public awareness of the Reserve through newspapers, radio and television coverage.

5.4.6 Where appropriate, the Director will encourage the inclusion on expeditions to the Reserve of non-science participants who can promote public understanding of the Reserve's values.

5.4.7 The preparation of Reserve-related feature articles for relevant publications, and the presentation of papers and presentations at science and management oriented conferences will be encouraged.

5.4.8 Consultation with, and briefing of, tour operators will be continued to explain how management policies protect the values of the Reserve, to encourage the conduct of interesting and educational visits, and to raise and resolve to the extent possible issues of concern to any parties.

6 Natural Heritage Management

6.1 Flora and Fauna

Aims:

To protect the native flora and fauna of the Reserve by managing human activities to minimise or avoid disturbance.

To ensure that all work involving flora and fauna is undertaken in accordance with the provisions of the EPBC Act and any relevant recovery plans and threat abatement plans.

Performance indicators

- Changes to abundance and distribution of native plant and animal species are not a direct result of activities in the Reserve, other than as a result of activities undertaken in accordance with this Plan.
- All relevant actions required under relevant recovery plans and threat abatement plans are undertaken in a timely and effective manner.

Background

The terrestrial, freshwater and relatively shallow marine areas (<1000 m) of the Reserve provide important habitat for a range of plant and animal species. Several of the seal, seabird and cetacean species found in the Reserve have conservation status under national legislation and international agreements as threatened and/or migratory species (see Appendix 2). The Reserve's largely intact

ecosystems have outstanding conservation value to the Australian and global community (see section 1.2 Conservation Significance of the Reserve) and considerable scientific value as excellent indicators of climate change the impacts of environmental change (see the Scientific Values section in Part 3). The relatively unmodified marine ecosystems contribute to the comprehensiveness, adequacy and representativeness of the NRSMPA, and also potentially provide a reference against which to evaluate the sustainable management of the adjacent HIMI fishery.

The prohibition on extractive resource activities in the Reserve (see section 6.2 Natural Asset Use), along with strict provisions relating to waste and quarantine management (see sections 6.3 Waste Management and 6.4 Prevention and Management of Alien Species and Disease) address the main threats to the marine ecosystems. On the islands, the low-lying coastal areas support the majority of the flora and fauna, while at the same time comprising the main locations of human activity ashore in the Reserve. These areas face additional pressure due to those activities, most notably from the introduction of alien species, the placement of facilities and installations, and from travel between points. In particular, certain vegetation types are susceptible to damage from trampling (such as the cushion plant *Azorella selago*, the megaherb *Pringlea antiscorbutica* and areas of 'moss carpets'). Vegetated areas are also often used as a nesting site for burrowing birds, such as Antarctic prions and common diving petrels. Disturbance of wildlife may cause parents to abandon eggs or young, exposing them to predators.

Under s.354 of the EPBC Act a person must not kill, injure, take, trade, keep or move a member of a native species in the Reserve except in accordance with this Plan.

The EPBC Act also contains provisions (Part 13) that prohibit and regulate actions taken in Commonwealth areas in relation to listed threatened species and ecological communities, listed migratory species, cetaceans (whales and dolphins) and listed marine species. Several breeding species of birds and marine mammals found in the Reserve are designated as listed threatened and/or migratory species under the EPBC Act (see Appendix 2). Section 268 of the Act requires that a Commonwealth agency (such as the Director) not to contravene recovery plans and threat abatement plans for listed threatened species and ecological communities, and section 269 requires the Commonwealth to implement such plans to the extent to which they apply in Commonwealth areas.

Section 229 of the EPBC Act generally provides that it is an offence to kill or injure a cetacean in the Australian Whale Sanctuary, which includes the waters of the Reserve. Part 8 of the EPBC Regulations detail separation distances and guidelines for aircraft and vessels approaching cetaceans. These requirements are elaborated upon in the *Australian National Guidelines for Cetacean Observation.*

The EPMO provides that, unless authorised by a permit, a person must not bring any organism into the Territory, take any organism in the Territory, remove from the Territory any organism indigenous to the Territory, or engage in conduct that results in a living organism that has been introduced to the Territory escaping in the Territory.

As explained in section 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit. Activities in that part of the Reserve which does not form part of the Territory will be regulated through reliance on the EPBC Regulations.

Prescriptions

6.1.1 The Director will include information about the flora and fauna of the Reserve, and associated protective measures, in briefings and materials provided to Reserve visitors (see section 5.3.1).

6.1.2 Activities that involve killing, injuring, taking, trading, keeping or moving a member of a native species of flora or fauna in the Reserve may only be carried on for approved research or management purposes in accordance with a permit issued under the EPMO in respect of activities in the Territory or under the EPBC Regulations in respect of activities in the Outer Marine Zone.

Note: This does not remove the need to obtain a permit for activities covered by Part 13 of the EPBC Act.

6.1.3 Permits to authorise research in the Reserve involving work on living fish, birds and mammals will only be issued where the work will use and comply with humane practices approved by an appropriate animal ethics committee.

6.1.4 Management priorities for the Reserve will include research and monitoring to enable the evaluation of the status of listed threatened species (see prescriptions in section 6.5 Research and Monitoring).

6.1.5 Disturbance to flora and fauna by Reserve visitors will be minimised by maintaining and enforcing strict controls:

- on human access and behaviour (see prescriptions in section 5.1 Access and Transport, section 5.3 Visitor Management and Commercial Activities and section 6.5 Research and Monitoring);
- on the placement and management of such facilities (see prescriptions in section 5.2 Management of Facilities); and
- to prevent deliberate or accidental introductions of alien species or disease by human agency and to manage any such introductions (see prescriptions in section 6.4 Prevention and Management of Alien Species and Disease).

6.1.6 The Director may take actions (including actions covered by section 354(1) of the Act) reasonably required to implement and comply with relevant recovery plans and threat abatement plans to the extent to which they apply in the Reserve, provided that any such actions are undertaken in accordance with this Plan. Notwithstanding any other prescription in this Plan, the Director will not take, or issue permits to take, actions that would contravene a relevant recovery plan or threat abatement plan.

6.1.7 The Director will continue to liaise with the fishing industry and relevant Government agencies to assist the implementation of initiatives to address wildlife conservation issues in the adjacent HIMI fishery (such as the cooperative development of gear technology and techniques to mitigate seabird bycatch).

6.2 Natural Asset Use

Aim: To ensure best practice use of the Reserve's natural assets.

Performance indicators

- Management practices encourage efficient use of assets.
- Natural and cultural values of the Reserve are not degraded through management action or inaction.

Background

In keeping with the Reserve's declaration as a strict nature reserve, extractive activities, including mining operations and non-research- or management-oriented fishing activities are prohibited. The

Reserve's values are principally associated with the presence of largely undisturbed natural and cultural assets which are of existence value to the Australian and global community, to the few on-site recreational visitors, and also to the scientific community. Some fish, though protected from harvesting within the Reserve, are also of economic value in adjacent fishing areas.

Section 301 of the EPBC Act authorises the EPBC Regulations to provide for the control of access to biological resources in Commonwealth areas (the Reserve is a Commonwealth area). At the time of preparing this Plan, regulations were being prepared to control the taking of biological resources of native species for conservation, commercial application or industrial application of, or research on, any genetic resources, or biomolecules, comprising or contained in the biological resources.

Prescriptions

6.2.1 No commercial or recreational fishing will be allowed in the Reserve.

6.2.2 No mining operations, including petroleum or mineral exploration or extraction, will be allowed in the Reserve.

6.2.3 All activities in the Reserve will be managed, in accordance with this Plan, to prevent or minimise the degradation of natural and cultural assets, particularly including:

- access and transport (see prescriptions in section 5.1 Access and Transport);
- facilities and installations (see prescriptions in section 5.2 Management of Facilities);
- visitor access and commercial activities (see prescriptions in section 5.3 Visitor Management and Commercial Activities);
- waste management (see prescriptions in section 6.3 Waste Management);
- quarantine management (see prescriptions in section 6.4 Prevention and Management of Alien Species and Disease); and
- research and monitoring (see prescriptions in section 6.5 Research and Monitoring).

6.2.4 The Director will pursue, in consultation with relevant reserve management agencies, best practice approaches to natural and cultural resource management.

6.2.5 The Director will give preference in Reserve operations to the use of feasible technologies and products that minimise environmental impacts in the Reserve.

6.2.6 Activities that are subject to any Regulations made for the purposes of s.301 of the EPBC Act may be carried on in accordance with those regulations and the prescriptions of this Plan that are applicable to the activity.

6.3 Waste Management

Aim: To prevent or minimise the impacts of wastes generated by human activities on the Reserve's values.

Performance indicators

- All waste created during visits to the Reserve is removed from the Reserve or treated in compliance with the requirements of this Plan.
- Marine debris is removed from the Reserve during visits, where practicable.
- Pre-existing wastes are removed from Heard Island, where practicable.

Background

Visitation to the Reserve will be predicated on a minimal impact and 'leave no trace' approach.

Wastes generated as a result of human activities within and outside the Reserve have the potential to impact on the values of the Reserve, including direct and indirect effects on species, habitats and ecosystems, plus degradation of wilderness and aesthetic values. Of particular concern are impacts on wildlife, such as ingestion of or entanglement in wastes and the possible introduction of disease agents. Marine and coastal species are also susceptible to marine pollution events.

There are no permanent facilities for the treatment or disposal of wastes available in the Reserve. It is imperative that all activities are planned to ensure that items that will become waste in the Reserve (e.g. excess packaging) are minimised and that logistical and support arrangements specifically cater for the management, storage and removal of wastes. Proposed activities that involve the creation of waste that cannot be removed from the Reserve are unlikely to be permitted.

A major clean-up of the Atlas Cove ANARE Station site was undertaken in 2000/01 with most of the remaining structures being dismantled and returned to Australia. Continual erosion and displacement of soil at the site is likely to expose further items over time. Such items may present a hazard to wildlife and human visitors and may degrade the wilderness and aesthetic values of surrounding areas if dispersed by the wind. Some of these items may also have cultural heritage significance and must be assessed and handled in accordance with the cultural heritage provisions of this Plan (see section 7 Cultural Heritage Management).

A preliminary assessment of contamination in the Atlas Cove ANARE Station area also undertaken during 2000/01 indicated that heavy metal contamination is evident but not at levels sufficient to pose a significant potential impact on local ecosystems[21]. Contamination by petroleum hydrocarbons was found to be at a level that may cause a significant impact on the local environment, but further investigation is required. Monitoring of changes at the site over time is desirable and the benefits of any remediation, which could likely only be conducted *in situ*, will need to be balanced against any negative effect on plants and animals that have recolonised the site and on items of heritage significance.

On 13 August 2003, 'Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris' was listed as a key threatening process under the EPBC Act. This listing will lead to the development of a threat abatement plan for the process that may include measures relevant to the Reserve.

Waste disposal in the territorial sea is limited only to the discharge of sewage from land-based parties and from small vessels meeting specified criteria; such waste will be rapidly dispersed by the highly energetic marine environment. Outside the territorial sea, waste management measures are equivalent to those applied in the waters of the Antarctic Treaty area, which is designated as a Special Area under MARPOL. In Australian waters surrounding the Reserve, relevant vessels must comply with the requirements of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and MARPOL.

Under the EPMO a person must not leave any equipment, material or refuse in the Territory, except in accordance with a permit issued under that Ordinance.

EPBC Regulation 12.14 generally provides that it is an offence to discharge, leave or release certain types of minerals, wastes or substances in a Commonwealth reserve. Regulation 12.14 does not apply to such activities which are provided for, and carried out in accordance with, this Plan; or are authorised by a permit issued under those Regulations; or under certain other conditions (regulation 12.06).

As explained in section 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried

on in the Territory if authorised by and undertaken in accordance with an EPMO permit. Activities in that part of the Reserve which does not form part of the Territory will be regulated through reliance on the EPBC Regulations.

Prescriptions

6.3.1 Permits to enter the Territory will require compliance with the waste management requirements of this Plan, and may include additional conditions considered by the issuer of the permit to be reasonably necessary to prevent or minimise the environmental impacts of waste on the Reserve.

6.3.2 The Director will include information about waste management requirements in briefings and materials provided to Reserve visitors (see section 5.3.1).

6.3.3 The amount of plastic and other packaging and wrapping material sent to the Reserve must be kept to a minimum.

6.3.4 The Director will use appropriate opportunities to remove from the Reserve environmentally hazardous or persistent wastes and wastes associated with recent human occupation.

6.3.5 Wastes from early occupation of Heard Island (including sealing era items and early ANARE items) will be assessed and handled in accordance with the Cultural Heritage Management prescriptions of this Plan (see prescriptions in section 7 Cultural Heritage Management). Items dating from this period and assessed as not being of heritage significance may be removed, providing that it is practicable and will not result in greater adverse environmental impact than leaving the items *in situ*.

6.3.6 All wastes generated on land in the Reserve during any visit must be securely stored during the visit and removed on departure, other than the types of wastes referred to in sections 6.3.8–6.3.10.

6.3.7 Persons going ashore for day trips must return all wastes they generate, including solid human wastes, to the vessel providing support.

6.3.8 Persons remaining ashore for an extended period must, where practicable, store and then on departure from the Territory remove, all human wastes they generate ashore during that period. Where removal from the Territory is not practicable, human wastes must be:

(a) incinerated in accordance with section 6.3.10;

(b) disposed of below the high water mark at a site where conditions exist for rapid marine dispersal and which is as far as practicable from wildlife concentrations; or

(c) where disposal below the high water mark is impractical for human wastes generated at inland sites, such wastes must be disposed of in a way that minimises impacts on wildlife, waterbodies and vegetation (e.g. by burial or disposal into a large rapidly flowing stream with unimpeded access to the sea).

6.3.9 Washing water may be disposed of below the high water mark provided reasonable efforts have been made to remove food matter prior to disposal. Such food matter must be handled in accordance with section 6.3.6 or 6.3.10.

6.3.10 Food wastes, human wastes and non-toxic combustibles generated during an extended visit ashore may be incinerated using a secure container that will prevent the dispersal of wastes or ash. All ash and residue of unburnt materials must be collected and removed from the Reserve on departure.

6.3.11 Food and all food wastes stored for removal or incineration must be secured and contained at all times to prevent dispersal or foraging by wildlife and to prevent leakage.

6.3.12 No chemically treated human wastes may be disposed of on land in the Reserve.

6.3.13 Only detergents which are fully biodegradable and low in phosphates may be used in the Reserve.

6.3.14 Polystyrene beads and chips and similar particulate packaging material may not be taken into the Reserve.

6.3.15 A description of the type and amount of any waste, other than human waste and washing water, that cannot be retrieved and removed from land at the end of a visit due to weather conditions or other mitigating circumstances must be recorded and reported to the Director. Any such waste left in the Reserve for later retrieval or disposal must be securely stored and removed at the first opportunity.

6.3.16 No ballast water may be discharged or exchanged in the Inner Marine Zone.

6.3.17 In the Inner Marine Zone the only wastes that may be discharged from a vessel are washing water and human wastes from a vessel that:

(a) is certified to carry ten people or less; and

(b) does not contain a storage tank of a kind designed for storage of sewage.

6.3.18 Oil, oily mixtures, sludge, dirty ballast, or tank washing water must not be discharged from a vessel in the Outer Marine Zone.

6.3.19 In the Outer Marine Zone the only wastes that may be discharged from a vessel are:

(a) sewage from a holding tank discharged at a moderate rate (not instantaneously) while the vessel is underway at a speed of not less than 4 knots;

(b) food scraps which have been comminuted (reduced through grinding or other means) to a size of 25 mm or smaller – such food scraps must not contain plastic; and

(c) liquid substances, chemicals or any other substance in a quantity or concentration that is reasonably unlikely to have a significant adverse impact on the marine environment.

6.3.20 Where practicable, the Director will contribute to and implement initiatives to address the harmful effects of marine debris.

6.4 Prevention and Management of Alien Species and Disease

Aims:

To prevent the human introduction into the Reserve of alien species or disease and to respond to reports of such events to minimise impacts on the Reserve's values.

Performance indicators

- The quarantine requirements of this Plan are implemented for all visits to the Reserve.
- Number of observed or reported breaches of quarantine requirements.
- Number of known alien species, extent of colonisation and results of investigations into the likely cause of introduction.
- Effectiveness management response to alien introductions and disease events.

Background

Consistent with the IUCN approach[22], for the Reserve an alien species is defined as:

A species, subspecies or lower taxon that has been introduced to the HIMI Marine Reserve as a result of human activity in or around the Reserve, or that has arrived in the Reserve by natural means from an area to which it was introduced as a result of human activity.

Alien species can be further classified depending on their persistence and invasive nature as:

- *transient alien*, meaning a species that survives in small populations for a short time period but either dies out naturally or is removed by human intervention;
- *persistent alien*, meaning a species that survives and reproduces for many years in a restricted locality, but does not expand its range from that location; and
- *invasive alien*, meaning a species that spreads into native communities and displaces native species[23,24].

Invasive species are the greatest concern but it is worth noting that a persistent alien may become invasive, particularly under changing environmental conditions, and that this can be difficult to predict[25].

Heard Island has previously been exposed to aliens that have not persisted (e.g. silverfish, house fly, clothes moth, sheep, dogs, cockroaches and a rat). However, the lack of baseline information for smaller organisms (such as micro-organisms and invertebrates) means that the status of some recorded species is unknown. At the time of preparing this Plan there are only four terrestrial species considered to be possible persistent aliens at Heard Island: the vascular plant *Poa annua*; the thrip *Apterothrips apteris*; the mite *Tyrophagus putrescentiae*[24]; and the worm *Dendrodrilus rubidus*[26]. Although no alien species are recorded from McDonald Island[24,27], field observations have not been made on the island since 1980. The McDonald Islands therefore warrant the highest level of protection against the introduction of alien species.

In 2003, the AAD commissioned an independent ecological risk assessment into the probability of introducing alien organisms to the HIMI region by human means. The report, *The Probability of Introduction of Non-indigenous Species to Heard and McDonald Islands: Taxa, Risks, and Mitigation*[27], outlined the following key points regarding the introduction and establishment of alien species in the Reserve:

- a wide range of terrestrial, freshwater and marine species could be introduced to the HIMI region and, although species introductions and invasions are difficult to predict, the impacts on species and ecosystems could be dramatic;
- a species is more likely to establish if the climate at the point of origin is similar to the climate of the HIMI region, and climate warming in the HIMI region is likely to increase the probability of establishment and colonization. Species that are invasive at other sites are likely to also be invasive at HIMI;
- the probability of establishment of alien species is directly related to the number of organisms (including reproductive material) that reach an area and the number of potential introduction events. The likelihood of alien species introductions will increase as visits to the HIMI region increase;
- pathways for the introduction of terrestrial and freshwater species largely involve transport ashore in or on equipment, stores, clothing, containers, wood, vehicles (including land-based and amphibious vehicles, helicopters and vessels) and certain food items, including fresh fruit and vegetables, yeast and meat products, particularly poultry products;
- all items transferred between sites are potential pathways for the translocation of organisms (including reproductive material); and

- the primary routes for the introduction of marine species are hull fouling, small craft and gear that is routinely left in the water, and ballast water and waste water discharge.

To address the second point above, visits to the HIMI Territory from non-Australian ports are strongly discouraged and will be allowed only under exceptional circumstances and where the proponent can provide assurance that the visit will not result in the introduction to HIMI of non-native species or disease.

Human intervention to mitigate the impacts of invasive species, such as cats and rodents, on other subantarctic islands has cost several governments millions of dollars[28]. Preventing the arrival of alien species by closing off the routes by which introductions take place, and rapid action if a new species is discovered are the keys to reducing the likelihood of an alien species becoming established in the Reserve. The key principles for preventing the introduction and spread of alien species are to inform all visitors of quarantine requirements and ensure their compliance by:

- ensuring that all items to be taken ashore or used in the waters of the Reserve are meticulously cleaned and thoroughly inspected for organisms (including reproductive material); and
- thoroughly cleaning all clothing, equipment and vehicles that have been in close contact with vegetation or soil to remove organisms (including reproductive material) before moving to or between major ice-free regions.

While human activities have the potential to increase the rate of new colonisations in the Reserve, and to change the source from which colonising species are drawn, natural background colonisation will also occur. Management of alien species requires the ability to distinguish between these natural colonisation events and human-assisted ones. This management plan is based on maintaining ecological processes. Cessation of natural colonisation would have longer-term impacts on the ecosystems of the Reserve.

A report submitted in 2001 to the international Antarctic Committee on Environmental Protection stated that while no diseases have been demonstrated to have been introduced to Antarctic or subantarctic wildlife or spread among them as a consequence of human activity, disease is suspected to have caused several observed unusual mortality events in Antarctic and subantarctic seal and seabird populations, and humans are recognised as potential disease vectors[29].

The report stated that diseases most likely to be of risk of introduction and spread by humans are those that are well established in the home country of visitors, can survive well without a host, and can infect different hosts, such as Newcastle disease and avian influenza. As discussed above for alien species, diseases transferred from locations with similar environmental conditions are more likely to be viable. The potential pathways for introduction and spread of disease are also similar to the potential pathways for alien species, with additional concern relating to activities that involve close approach to or contact with wildlife, such as scientific observation and scientific manipulation, and the feeding of or access to human food items by wildlife.

The report concluded that, while there is insufficient information to conduct a reliable quantitative risk assessment of disease introduction and spread, nor to identify all diseases with the potential for introduction, the following practical measures are priorities for diminishing risk:

- precautions to prevent scavenging of food items and food wastes;
- actions following the discovery of unusual mortality events;
- strict precautions when close to, or in contact with, wildlife;
- strict controls on the import of food items, particularly poultry products;
- treatment and disposal of sewage; and

- cleanliness of all footwear, equipment and clothing before arrival and before travel to other sites, including wildlife aggregations.

Many of the glaciers on Heard Island extend to the ocean, producing isolated coastal ice-free areas—regions which support discrete ecosystems and can be considered analogous to islands[30]. The transfer of either alien or native species or disease between these sites or to the smaller islands in the Reserve is also of concern.

At the time of preparing this Plan, these areas include:

- South: the Long Beach area, from Gotley Glacier to the western side of Fiftyone Glacier
- East: north-east from the eastern side of Fiftyone Glacier to Elephant Spit, and north-west from there to the eastern side of Ealey Glacier, including Cape Bidlingmaier
- North-west: west from the western side of Downes Glacier, including Azorella Peninsula, Laurens Peninsula and south to the southern end Cape Gazert
- West: each of the ice-free areas at Walsh Bluff, Henderson Bluff, Cape Pillar and Cape Arkona is considered a separate area for quarantine purposes.
- McDonald Islands and all offshore rocks and shoals, each of which is considered a separate area for quarantine purposes.

The risk of introducing alien species through human activities beyond the 12 nm HIMI territorial sea is reduced because the waters are deeper and distant from the islands, and vessels are generally underway when in these areas. The areas of primary concern are the shallower areas comprising the territorial sea, and the islands themselves.

EPBC Regulation 12.19 provides that a person must not cause or allow an animal owned by, or in the charge of, the person, to enter or remain in the Reserve, unless doing so is provided for by, and carried out in accordance with, this Plan; or is authorised by a permit issued under the EPBC Regulations; or under certain other conditions (regulation 12.06).

EPBC Regulation 12.20 provides that a person must not cause or allow a plant to be taken into, or possess a plant in, the Reserve, unless doing so is provided for by, and carried out in accordance with, this Plan; or is authorised by a permit; or under certain other conditions (regulation 12.06).

EPBC Regulation 12.66 provides that if a ranger or warden considers it necessary for the protection and conservation of biodiversity and heritage in the Reserve or a part of the Reserve, the ranger or warden may take any suitable measure to control or remove an organism that is not a member of a native species; or not indigenous to the Reserve or that part of the Reserve.

The EPMO makes it an offence to bring into the Territory any diseased organism or live poultry. The EPMO also states that unless otherwise authorised by a permit issued under that Ordinance, a person must not bring an organism into the Territory, bring any dead poultry or poultry products into the Territory, introduce any soil or other geological matter to the Territory, or engage in conduct that results in a living organism that has been introduced into the Territory escaping in the Territory.

As explained in 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit.

Prescriptions

6.4.1 Permits to authorise entry to the Territory will require compliance with the quarantine provisions of this Plan and may include additional conditions considered reasonably

necessary by the issuer of the permit to prevent or sufficiently reduce the risk of introduction and spread of alien species or disease.

6.4.2 A permit to authorise entry to the Territory will only be granted if the vessel travels direct from an Australian Quarantine Inspection Service (AQIS) controlled port, unless exceptional circumstances means this is not feasible and the Director is satisfied that the entry to the Territory of the vessel presents a sufficiently low risk of the introduction to the Territory of alien species or disease.

6.4.3 The Director may require an authorised official to be present at the departure of any vessel travelling to the Territory to ensure compliance with quarantine requirements.

6.4.4 The Director may require an authorised official to accompany any visit to the Territory to ensure compliance with quarantine requirements.

6.4.5 When considering the quarantine risks associated with a vessel proposing to enter the Territory, and the need to appoint an authorised official to be present at the departure of a vessel travelling to the Territory, or to accompany a visit to the Territory, the Director will take into account factors relevant to the risks of introducing alien species including, but not necessarily limited to:

(a) the intended activities in the Territory;

(b) the vessel operator's previous experience with operating in the HIMI region;

(c) the vessel operator's previous record on quarantine matters;

(d) the vessel's departure port, other recently visited ports and any quarantine concerns associated with those locations;

(e) whether the vessel hull has been treated with anti-fouling or has been recently cleaned or ice-scoured due to travel through ice;

(f) the results of any visual inspections of the vessel hull for fouling communities;

(g) the number of people to go ashore;

(h) the quantity and type of equipment to be taken ashore;

(i) current best practice approaches to preventing the introduction of alien species and disease.

6.4.6 A permit will not be issued to authorise a vessel to enter the Territory, unless it has a valid deratting certificate or deratting exemption certificate recognised by AQIS. Vessels may be inspected on the day of departure to ensure that they are free of rodents and may not be permitted to enter the Territory unless a satisfactory inspection has been undertaken.

6.4.7 All vessels, small craft and ships' equipment routinely in contact with the water (such as mooring lines and anchor chains) to be used in the Territory must be cleaned or treated to minimise the risk of marine introductions from fouling species. All other equipment to be used in the waters of the Territory (such as dry suits, wet suits, scientific or fishing equipment) must be thoroughly cleaned, where practicable by hot-washing, prior to use in the Territory.

6.4.8 To the extent practicable, items to be used ashore or in the waters of the Territory must be transported in clean cargo holds, within clean (hot-washed at a minimum), inspected and sealed containers that contain only cleaned and inspected cargo.

6.4.9 Prior to being loaded on a vessel travelling to the Territory:

(a) the quantity of material to be taken ashore in the Reserve should be minimised to greatest extent practicable;

(b) all items travelling in the vessel's cargo spaces or on deck (such as equipment, stores, field accommodation, vehicles, personal gear shipped as cargo) to be taken ashore in the Territory must be hot-washed, disinfected or fumigated where feasible, and inspected for organisms (including reproductive material), which if found must be removed and destroyed.

(c) all personal luggage and carry-on gear must be cleaned and inspected for organisms (including reproductive material), which if found must be removed and destroyed.

(d) any vehicles or aircraft to be used ashore in the Territory must be hot-washed and inspected for organisms (including reproductive material), which if found must be removed and destroyed.

6.4.10 Live plants, live animals, mushroom kits or soils must not be taken on a vessel travelling to the Territory.

6.4.11 Rodent traps, bait stations and insect traps must be deployed throughout all vessels travelling to the Territory, and monitoring for introduced species must continue regularly while the vessel is underway, with particular attention paid to the deployment/retrieval period for visits ashore in the Territory. Broad-spectrum fumigants and insecticides must be available as an option for dealing with newly detected organisms (such as invertebrates).

6.4.12 All outer clothing to be taken ashore in the Territory must be for dedicated use only at HIMI, and must be new or cleaned and appropriately treated to kill all organisms (including reproductive material) (e.g. with a biocide or similar).

6.4.13 Upon arrival in the Territory, and as late as practicable prior to deployment ashore or in the waters of the Territory:

(a) all clothing, personal gear (such as bags, cameras, back packs) and emergency equipment (such as sleeping bags, ropes) to be taken ashore must be inspected for organisms (including reproductive material), which if found must be removed and destroyed.

(b) footwear to be taken ashore must be thoroughly scrubbed to remove all organisms (including reproductive material) which if found must be destroyed, and must be treated with a biocide;

(c) all other items to be deployed ashore or in the waters of the Territory must be inspected for organisms (including reproductive material), which if found must be removed and destroyed.

6.4.14 To minimise the risk of introducing rodents, vessels (other than small support boats) must not moor directly to the shore.

6.4.15 Rodent traps and baits must be deployed onshore by the first landing party at each location where ship to shore transfers take place, prior to the offloading of cargo. Such baits and traps must be of a kind designed to avoid bycatch of native species. Traps and baits must be removed on departure.

6.4.16 The following food products must not be taken ashore in the Reserve:

(a) brassicas;

(b) fresh fruit or vegetables, except where the Director is satisfied that they have been effectively treated to eliminate the risk of introducing associated alien species and diseases;

(c) poultry or poultry products (other than egg powder, or products containing egg powder, which can be taken ashore if kept in sealed containers and opened only in an enclosed shelter);

(d) other animal products intended for human consumption that have not been inspected for disease causing agents and approved to the standard required for domestic consumption or export, whichever is the higher;

(e) viable seed products (such as sunflower seeds, bean sprouts); and

(f) viable fungal products (including dried mushrooms).

6.4.17 If yeast products are taken ashore:

(a) such products must be kept in secured, sealed containers which must only be opened under enclosed shelter;

(b) all waste or surplus products, including packaging, must be removed from the Territory in a sealed container;

(c) all containers and utensils used with such products must be washed with boiling water and the resulting waste water disposed of in accordance with the prescriptions in section 6.3 Waste Management.

6.4.18 No wood may be taken ashore unless it has undergone AQIS-recognised quarantine treatment to kill any organisms (including reproductive material) and to prevent fungal growth.

6.4.19 All footwear, clothing, equipment or vehicles in close contact with soil, plants or animal faeces must be cleaned to the greatest extent practicable when travelling between major ice-free regions on Heard Island.

6.4.20 Visitors to McDonald Island or any of the other offshore rocks or shoals in the Reserve must comply with any additional quarantine measures as may be determined in writing by the Director on a case-by-case basis.

6.4.21 All equipment to be used with or on birds and marine mammals must be appropriately disinfected prior to use and between use with different individuals.

6.4.22 Entry to or activities in or near areas known or reasonably suspected to support diseased wildlife or human-introduced species will be for management purposes only (including management-related research or monitoring). Equipment taken into such areas must be restricted to the minimum essential. When departing such areas, all footwear, outer clothing, bags and equipment must be thoroughly cleaned and inspected for organisms (including reproductive material), which must be removed before departing the area. To the extent practicable, such equipment should not be used elsewhere in the Reserve.

6.4.23 When practicable, comprehensive surveys of indigenous species for which baseline information is lacking will be undertaken to allow the identification of introduced terrestrial, freshwater and marine species. Surveying usual landing sites and main use areas will be a priority (see also section 6.5 Research and Monitoring).

6.4.24 When practicable, species-specific audits of the presence and spread of known alien species, and site-specific auditing of landing sites and main use areas will be undertaken (see also section 6.5 Research and Monitoring).

6.4.25 Collaborative agreements with molecular biology facilities will be sought by the Director to allow screening of new species detected to determine their origin and whether they are a result of natural or human-induced colonization (see also section 6.5 Research and Monitoring).

6.4.26 A database of invasive alien species with the potential to reach and impact on the Reserve will be developed.

6.4.27 All sightings of new species or disease events in the Reserve, or while on a vessel travelling to or from the Reserve, must be reported to the Director at the first available opportunity.

6.4.28 If a sighting of a new species or suspected disease event is reported, the Director will, as necessary, seek expert advice to evaluate the report and to develop recommended management responses, taking into account factors including:

- the known status and effects of the identified species elsewhere;
- the level of relevant expertise available on-site for identification and further action;
- the probability that the potential alien species or disease was introduced as a direct result of human activities in or around the Reserve;
- opportunities for monitoring and the collection of further information/monitoring;
- the period of time until the next planned management visit to the Reserve;
- the intended duration of the visit during which the potential alien is reported; and
- the precautionary principle.

6.4.29 The Director will develop a contingency plan for dealing with newly detected alien species or disease. Management responses taken may include, but not necessarily be limited to:

- containment;
- destruction or removal;
- monitoring; and
- collection of a sample for further analysis.

6.4.30 Actions to eradicate or control alien species, or to control disease outbreaks, will only be undertaken where the Director is satisfied that such action is practicable and that the adverse impacts on the Reserve's values reasonably likely to arise from those actions will be less than the potential adverse impacts from the presence of the alien species.

6.4.31 Response to the discovery of unusually high numbers of sick or dead animals, or animals with signs that suggest disease, will be generally in accordance with the AAD *Response Plan for the Discovery of Unusual Animal Deaths*.

6.4.32 Practical guidance on quarantine matters will be provided to all visitors to the Reserve, including information about:

- the potential risks and consequences of introducing alien species or disease;
- the emphasis on preventing the introduction of alien species and disease;
- the measures to be taken to prevent the introduction and spread of alien species and disease;
- how to identify likely alien species or disease events;
- the need to eliminate rodents immediately if observed;
- the need to report any potential aliens or disease events and to act in a timely and appropriate manner to prevent or minimise the impacts of aliens or disease events; and
- to whom, when and how potential alien incursions or disease events should be reported.

6.4.33 The Director may seek to recover any costs associated with management action taken to mitigate or address alien species or disease introduction to the Reserve, from those responsible for the introduction.

6.4.34 An independent audit of the Australian Antarctic program's adherence to the quarantine requirements of this Plan during expeditions to the Reserve will be undertaken during the life of the Plan, as part of the performance assessment framework for the Reserve.

6.5 Research and Monitoring

Aim: To conduct and support research in the Reserve, including that which:

- ***will contribute to the effective management of the Reserve and the surrounding region; and/or***
- ***will contribute to national and international conservation initiatives, including requirements to report on the state of the Reserve; and/or***
- ***is of intrinsic benefit to science and humanity;***

provided it does not adversely impact on, or put at risk, the Reserve's values.

Performance indicators

- Research and monitoring fulfils the requirements of relevant recovery plans and threat abatement plans.
- Results of research and monitoring are used to inform and assess management actions or policies and for state of the environment reporting.

Background

The following extract taken from a report by the Australian Science, Technology and Engineering Council[31], *Environmental Research Ethics - National Principles and Guidelines for the Ethical Conduct of Research in Protected and Environmentally Sensitive Areas*, is relevant to the conduct of research and monitoring activities in the Reserve:

> *Research in protected and environmentally sensitive areas is a legitimate activity, and if we consider understanding these areas important, it is also a duty. However, the responsibility to understand and study protected and environmentally sensitive areas must not take precedence over our primary obligation: to protect and care for them.*

The Director has functions (under s.514B of the EPBC Act) to protect, conserve and manage biodiversity and heritage in Commonwealth reserves and to carry out (alone or in cooperation with other institutions and persons), research and investigations relevant to the establishment and management of Commonwealth reserves. As an IUCN category strict nature reserve, the Reserve will be managed primarily for scientific research and environmental monitoring, consistent with the management principles outlined in the EPBC Regulations (see Appendix 8), to ensure the ongoing protection of the values of the Reserve.

Although many scientific studies have been undertaken at and around Heard Island since the voyage of the *HMS Challenger* in 1874, much baseline information is still required to allow comparisons to be made and then changes and trends to be inferred. Research to improve our understanding of what is there and how it is changing will also facilitate better informed management decisions. Such assessment of the condition of the Reserve also helps fulfil reporting requirements under legislation and national and international agreements, such as annual 'State of the Park' reporting and periodic reporting on the state of the World Heritage values and of the

ecological character of the wetlands of the Territory. Assessment of the condition of wildlife populations such as albatrosses and giant petrels, southern elephant seals and Antarctic fur seals is also required to contribute to the implementation of recovery plans, action plans and threat abatement plans.

Monitoring is required to inform management decisions and responses by increasing knowledge of the effects, or 'pressures' of human activities in the Reserve on the Reserve's values. Examples include recording the number of vessels and people visiting, determining the impact of human activities through the presence of facilities, equipment, sampling sites or spills sites, and recording wildlife deaths resulting from collisions with vessels, guy wires or scientific studies.

Research within the Reserve is required to contribute to the integrated and ecologically sustainable management of the HIMI region as a whole. Studies into the condition of fish stocks, the foraging ranges and diets of land-based marine predators, and the composition and condition of benthic communities are essential if informed decisions are to be made for the adjacent HIMI fishery and the CCAMLR region in which the Reserve is located.

At the time of preparing this Plan, work has commenced on developing a strategic monitoring approach for Australia's subantarctic marine protected areas—the Reserve and the Macquarie Island Marine Park. The strategy will guide the implementation of research and monitoring activities to provide information on the ecosystem health and management effectiveness of these areas, and will also assist with the evaluation of management performance across all the Commonwealth marine protected areas. Table 1 indicates the types of research and monitoring activities that are likely to be pursued as a priority to assist in the meeting Reserve management requirements and obligations, as discussed above, and gives an indication of the management drivers for these activities.

While research and monitoring is essential to the effective management of the Reserve, it is acknowledged that the Reserve's unique location, its relatively undisturbed condition and its unique, unusual and dynamic features provide exceptional opportunities to undertake compelling research that is of global benefit to science and to humanity and cannot reasonably be undertaken elsewhere. In particular, research in the Reserve may contribute to a greater understanding of global questions relating to the impacts of climate change on biodiversity.

Table 1. HIMI Marine Reserve research and monitoring priorities

Driver ⇨ Research or monitoring requirement ⇩	Legal or other requirement	Key management issue	Baseline information	Long-term monitoring (SoE)	Management of human pressures
Research that contributes to increased understanding of the values of the Reserve and that provides for ongoing reporting of the condition of the values of the Reserve, as required under legislation and national and international agreements, such as:					
Continuing population counts and monitoring of threatened species (see Appendix 2) to assist in the implementation of the *Sub-antarctic Fur Seal and Southern Elephant Seal Recovery Plan, Recovery Plan for Albatrosses and Giant Petrels* and *Draft Recovery Plan for 10 Species of Seabird 2004-2009*	✓ **EPBC, RP, WH, Ramsar, SoP**			✓	
Research and monitoring to contribute to the development and implementation of other recovery plans, action plans and threat abatement plans	✓ **EPBC, TAP, AP, RP**			✓	
Comprehensive surveys of indigenous species to provide baseline information against which to compare human-introduced or otherwise newly colonised terrestrial, freshwater and marine species		✓ **CC, AS**	✓		✓
Regular surveys to determine the presence and extent of any new species and to monitor the behaviour and further spread of established alien species, such as *Poa annua*	✓ **WH, Ramsar, SoP**	✓ **AS**	✓	✓	✓
Monitoring the spatial extent and character of human disturbance or 'footprint' (such as the total area	✓ **WH, Ramsar,**			✓	✓

Driver ⇨ / Research or monitoring requirement ⇩	Legal or other requirement	Key management issue	Baseline information	Long-term monitoring (SoE)	Management of human pressures
impacted by facilities, debris, historic sites, sampling sites, tracks etc)	**SoP**				
Monitoring the area and extent of newly deglaciated land/decrease in ice-covered land	✓ **WH, Ramsar**	✓ **CC**		✓	
Monitoring the colonisation of newly deglaciated land by plants and animals	✓ **WH, Ramsar**	✓ **CC, AS**	✓	✓	
Long-term whole-of-Reserve and colony-specific monitoring to provide fundamental data on the distribution, abundance and population trends of seal and seabird species, with particular emphasis on listed threatened species (see Appendix 2)	✓ **WH, SoP**		✓	✓	
Monitoring the presence or absence of large breeding populations of penguins (such as representative macaroni and other penguin colonies)	✓ **WH, Ramsar**			✓	
Surveys to increase knowledge of the biodiversity of the Reserve, and its response to current conditions and climate change	✓ **WH, Ramsar**	✓ **CC**	✓	✓	
Monitoring changes in composition and extent of vegetation communities		✓ **CC, AS**	✓	✓	
Long-term climate monitoring		✓ **CC**		✓	
Monitoring of changes to the coastline, glacial landscape and other and features of the Reserve	✓ **WH, Ramsar**	✓ **CC**		✓	
Research into the location, condition and significance of heritage sites and items, including those items that become exposed through natural or human actions	✓ **SoP**		✓	✓	✓
Hydrographic surveys for producing and updating of marine charts			✓		
Systematic geological mapping			✓		
Monitoring of volcanic activity	✓ **WH**			✓	
Studies to evaluate the ecological character of wetland areas	✓ **SoP, Ramsar**			✓	
Quantitative baseline biological studies of coastal marine ecosystems			✓		
Opportunistic monitoring of the distribution of cetaceans during AAD expeditions, fishing vessels, ocean-going yachts, tourist vessels, merchant vessels, spotter aircraft	✓ **EPBC, AP**		✓	✓	
Research into oceanographic features and processes that strongly influence the distribution of marine species and seabirds		✓ **ESD**	✓	✓	
Where practical, remote sensing of vegetation, glacial retreat, benthic communities and habitats and other characteristics	✓ **WH, Ramsar, SoP**	✓ **CC**	✓	✓	
Research to determine whether the current Reserve area provides sufficient representation of the marine habitats in the HIMI region and is effective in achieving the purposes for which it was declared, such as:					
Acoustic mapping of the substratum	✓ **SoP**	✓ **ESD**	✓		
Stratified random sampling of the benthos, particularly habitat-forming benthos such as sponges and corals, to determine the extent of differences in the assemblages and habitats between the biophysical units used to develop the Reserve	✓ **SoP**	✓ **ESD**	✓		
Studies to determine whether the land-based marine predator foraging locations in the Reserve are sufficient for the conservation of those species	✓ **SoP**	✓ **ESD**	✓		
Stratified random sampling of benthos within and outside the Reserve, to determine how well the Reserve configuration protects the features it was designed to protect.	✓ **SoP**	✓ **ESD**	✓		
Stratified random sampling within and outside the Reserve of target species in the HIMI fishery.	✓ **SoP**	✓ **ESD**	✓		
Research and monitoring to further understand of the impacts of human activities in and around the Reserve on the values of the Reserve, and to					

Driver ⇨ / Research or monitoring requirement ⇩	Legal or other requirement	Key management issue	Baseline information	Long-term monitoring (SoE)	Management of human pressures
contribute to developing management strategies that will prevent or minimise those impacts, such as:					
Monitoring of contamination by petroleum hydrocarbons and heavy metals at the Atlas Cove ANARE Station site and sites of more recent contamination.	✓ **WH, Ramsar**			✓	✓
Site-specific auditing of anchorages, landing sites and main use areas for the presence of alien species	✓ **WH, Ramsar, SoP**	✓ **AS**		✓	✓
Identifying the pathways for and consequences of introducing alien species		✓ **AS**			✓
Research into the impacts of commercial fishing in adjacent waters on the Reserve and/or its key components (e.g. protected species)	✓ **WH, Ramsar**	✓ **ESD**		✓	✓
Monitoring changes in the degree to which anthropogenic threats affect threatened animal species (e.g. interactions with fishers, marine pollution, disease outbreaks, direct disturbance)	✓ **WH, Ramsar, SoP**	✓ **AS, ESD**		✓	✓
Investigating the cumulative impacts of research programs and other activities on threatened species or species and their habitats that are vulnerable to human disturbance	✓ **RP, WH, Ramsar, SoP**			✓	✓
Research to contribute to the integrated and ecologically sustainable management of the HIMI region as a whole, such as:					
Studies to allow better understanding of the HIMI food web, such as: – quantifying the foraging areas and diet of key land-based marine predators – modelling of the potential interactions (direct and indirect) between marine mammal and seabird predators and HIMI fisheries (trawl fisheries for toothfish and icefish, and long-line fishery for toothfish)		✓ **ESD**	✓	✓	✓
Fish stock assessments	✓ **CCAMLR**	✓ **ESD**		✓	✓
Research and monitoring that will assist in addressing emerging Reserve management issues consistent with the provisions of this Plan.					

EPBC – Requirement of the EPBC Act; WH – World Heritage reporting requirement; SoP – State of the Parks reporting requirement; TAP – threat abatement plan; AP – action plan; RP – recovery plan; CC – Climate Change effects; AS – Alien Species; ESD – Ecologically Sustainable Development of the HIMI Region

Research for management purposes and other compelling research in the Reserve need not be mutually exclusive and some research projects will fit into both categories. Using the Australian Antarctic Science process, preference will be given to research that contributes to the management objectives for the reserve and that is aligned with the objectives of the Australian Antarctic Science Strategic Plan.

Like other types of activities, research is restricted by the Reserve's remoteness and the consequent resource-intensive support and logistical requirements. The AAD currently intends to support summer visits by the Australian Antarctic program to the HIMI region approximately every three years over the next decade. The triennial cycle is partly due to the significant costs of such expeditions and also the time required for research results to be analysed and duly considered in planning for subsequent visits. Opportunities may also exist for research to be undertaken in the interim years, through cooperation with other visitors to the region, such as with fishing vessels, surveillance vessels and tourist or private groups, and with research programs from other countries.

The AAD maintains, via the Internet, the System for Indicator Management and Reporting (SIMR), a State of the Environment reporting system that provides for the management and evaluation of information relating to environmental condition, pressure and response indicators[32]. There are several indicators relevant to the Reserve, and additional indicators will be developed to facilitate Reserve management and reporting requirements.

Research in the Reserve is prohibited by r.12.10 of the EPBC Regulations unless authorised by this Plan or a permit issued by the Director (or unless one of the other exceptions prescribed by r.12.06 of the EPBC Regulations applies). Research which involves taking, keeping, killing, injuring, trading, or moving, native species or is undertaken for commercial purposes is prohibited by s.354(1) of the EPBC Act except in accordance with this Plan. Research that affects listed threatened species or ecological communities, listed migratory species, cetaceans or listed marine species, is also regulated under Part 13 of the Act.

Section 301 of the EPBC Act authorises the EPBC Regulations to provide for the control of access to biological resources in Commonwealth areas (the Reserve is a Commonwealth area). Regulations are being prepared to control the taking of biological resources of native species for conservation, commercial application or industrial application of, or research on, any genetic resources, or biomolecules, comprising or contained in the biological resources.

Under s.8 of the *Antarctic Marine Living Resources Act 1981* a person must not cause the harvesting of any marine organisms or carry out research with respect to any marine organisms in the Reserve unless done in accordance with a permit granted under s.9 that Act. An exemption is provided for activities authorized under another Commonwealth law, such as an activity authorised by or under the EPBC Act.

Under the EPMO a person must not enter the Territory, engage in conduct that results in death or injury to, or interference with, any organism in the Territory, remove from the Territory any organism indigenous to the Territory, remove any soil or other geological matter from Territory, engage in conduct that results in interference to any soil or other geological matter in the Territory, or collect any material in the Territory, except in accordance with a permit issued under that Ordinance. The EPMO authorises the issuer of the permit to impose such conditions as he or she thinks fit.

The use and possession of weapons in the Territory is governed by the Weapons Ordinance 2001. For the purposes of the Ordinance, 'weapon' is defined to include a firearm, a tranquilliser gun or a crossbow as well as certain items listed in the *Customs (Prohibited Imports) Regulations 1956* (Cth)

As explained in section 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit. Activities in that part of the Reserve which does not form part of the Territory – including research activities – will be regulated through reliance on the EPBC Regulations (see reference above to EPBC Regulation 12.10).

Prescriptions

6.5.1 Research in the Territory may only be carried out by persons other than the Director in accordance with a permit issued under the EPMO.

6.5.2 Research in the Outer Marine Zone may only be carried out by persons other than the Director in accordance with:

(a) a permit issued under the EPBC Regulations; or

(b) a scientific permit issued under the *Fisheries Management Act 1991*, the conditions of which must be consistent with relevant provisions of this Plan.

6.5.3 Research and monitoring activities in the Reserve will be carried on in accordance with the requirements of this Plan and, where relevant, in accordance with identified research and monitoring priorities, such as those identified in Table 1.

6.5.4 The Director will develop and implement for the Reserve, as part of a broader strategy for Australia's subantarctic marine protected areas, a research and monitoring program aimed at providing information on ecosystem health and management effectiveness.

6.5.5 The research and monitoring program will consider identified local, regional and global threats to the values of the Reserve and will seek to identify who will conduct the required research.

6.5.6 Research and monitoring priorities for the Reserve will give due consideration to the Australian Antarctic science program Strategic Science Priorities and the priorities outlined in Table 1.

6.5.7 The Director will use the Antarctic Research Assessment Committee or a similar body to facilitate the merit assessment and conduct of government-managed research and monitoring required to meet the management objectives of this Plan. The Director may conduct, commission or support research and management activities for the purposes of this Plan outside that process.

6.5.8 Public expressions of interest in conducting research and monitoring activities in the Reserve will be sought prior to each Australian Antarctic program expedition to the Reserve. Public expressions of interest in conducting related off-site research and monitoring may be called for each year.

6.5.9 Permits may be issued under the EPMO in respect of activities in the Territory or under the EPBC Regulations in respect of activities in the Outer Marine Zone to authorise research in the Reserve where the issuer of the permit is reasonably satisfied that the proposed research:

(a) is consistent with the management principles for the zone of the Reserve where the research is proposed to be carried out;

(b) will be conducted by a researcher with appropriate credentials and experience;

(c) gives due consideration to the likely impact on the conservation status of any species of flora or fauna;

(d) will not adversely affect the natural or cultural heritage values of the Reserve;

(e) cannot reasonably be undertaken outside the Reserve;

(f) will comply with the provisions of this Plan; and

(g) if unrelated to the management objectives for the reserve, the justification for undertaking that research in the Reserve is compelling.

6.5.10 Permits authorising research in the Reserve will be issued and managed to:

(a) avoid conflict or duplication of research activities;

(b) ensure minimal disturbance to the Reserve and Reserve operations;

(c) avoid or minimise adverse impacts on the Reserve;

(d) ensure that, where appropriate, any benefits derived from research, whether financial or non financial, are shared with the Commonwealth, acting through the Director; and

(e) avoid inappropriate or significant demands on AAD resources.

6.5.11 Permits authorising research in the Reserve will be subject to conditions, including conditions requiring permit holders to:

(a) provide research results and a plain English summary of the research results promptly to the Director;

(b) not pass data acquired as a result of research to third parties unless authorised by the permit or otherwise with the written consent of the Director;

(c) provide to the Director as part of the post-visit report (see section 5.3.17) details of the location of samples taken in the Reserve, or equipment and markers deployed for entry in the Reserve Management Database (see section 6.5.19); and

(d) enter into an agreement with the Australian Government in respect of the equitable sharing of any benefits, whether financial or non-financial, arising from the research.

6.5.12 In general terms, researchers will be subject to the same conditions that apply to other Reserve visitors, except to the extent that the issuer of the permit is reasonably satisfied some or all of these conditions should not apply or would unduly detract from the proposed research.

6.5.13 Organisations and individuals seeking to obtain a permit under the EPMO or under the EPBC Regulations to conduct research in the Reserve will be required to:

(a) explain how the proposed research activities are consistent with this Plan and with the Reserve Management Research and Monitoring Priorities, such as those outlined in Table 1;

(b) provide a brief plain English summary to be made publicly available via the internet; and

(c) indicate whether the applicants consider that any biological material to be collected as a result of the proposed research, any data derived from such material, and any other data acquired as a result of the proposed research, has the potential to be exploited commercially, or whether such material is intended to be passed on to other organisations for any purpose (see also section 6.2.6)

6.5.14 Where practical, the Director will pursue the research and monitoring activities listed in Table 1 as priorities to contribute to the management of the Reserve.

6.5.15 In respect of the use and possession of weapons in the Territory, an activity that is otherwise prohibited by the EPBC Regulations may be carried on in the Territory if authorised by or under the Weapons Ordinance 2001.

6.5.16 The lava tubes and caves within the Azorella Peninsula Restricted Zone may only be accessed for research or management purposes in accordance with a permit issued under the EPMO that specifically authorises that access and use.

6.5.17 Researchers must provide written reports on their research activities and findings to the Director within a reasonable timeframe. Reports must include a plain English summary and will be made available on the Internet. A public summary of each Australian Antarctic program expedition to the Reserve will also be published on the internet.

6.5.18 The Director will establish and maintain on the internet a publicly accessible register of research reports, a database of scientific collections and a citations database that are as up to date as practicable.

6.5.19 A Reserve Management Database, and associated geographic information system (GIS), will be established and maintained to store and manage research and monitoring data, including information about field sites.

6.5.20 Where practical, global positioning systems (GPS), or other non-intrusive means of identifying field locations in the Reserve should be used in preference to markers.

6.5.21 Where approval has been given for research and monitoring equipment or markers deployed in the Reserve to be left in place following departure, they must be suitably marked, and GPS details recorded where practical, to facilitate future location and identification.

6.5.22 The Director will promote the development of further environmental indicators for research and monitoring conducted in the Reserve. These will be made publicly available as part of the AAD's System for Indicator Management and Reporting.

6.5.23 The Director will promote the review of existing Reserve research and monitoring data during the life of this Plan, in order to increase baseline information and to facilitate the evaluation of trends.

6.5.24 The Director will seek to develop cooperative arrangements with other agencies and visitors to the Reserve to facilitate the conduct of research and monitoring outside Australian Antarctic Program visits (see prescriptions in section 8 Stakeholders and Partnerships).

6.5.25 The Director will seek to establish cooperative research and monitoring arrangements with other management authorities and research institutions with responsibilities for, and operations in, other marine protected areas and other locations in the subantarctic region (see prescriptions in section 8 Stakeholders and Partnerships).

7 Cultural Heritage Management

Aim: To identify, protect, conserve and present the cultural heritage values of the Reserve.

Performance indicators

- The Reserve's cultural heritage is conserved through a process of managed decay.
- Cultural heritage guidelines prepared for cultural heritage sites outside the Atlas Cove ANARE station area.
- Information about the cultural heritage values of the Reserve is provided to all visitors and is available to the public.

Background

The cultural heritage of the Reserve, like the natural heritage, has remained largely undisturbed by recent human activities, but is susceptible to loss over time through natural processes of decay such as coastal erosion, dispersal by wind and trampling by wildlife, and through human actions such as souveniring or damage associated with access or the placement of facilities (see section 1.2 Conservation Significance of the Reserve).

The previous management plan for the Territory (the *Heard Island Wilderness Reserve Management Plan*, s.6.66e) included a requirement for the preparation of a conservation plan for the cultural heritage of the Territory. To this end, the AAD commissioned a heritage expert to prepare the *Atlas Cove ANARE Station, Heard Island Cultural Heritage Management Plan*[6], which analysed the historical background to the Atlas Cove station and the remaining evidence of the station, and provided recommendations for its future management (see extract at Appendix 6). This plan concluded that the station remains significant because:

- it demonstrates innovative approaches to building technology;
- it demonstrates the nature of the experience of expeditioners living in remote and difficult conditions; and

- it bears testimony to lessons learnt by expeditioners, applied in establishing Mawson station on the Antarctic mainland and there is a close parallel with Macquarie Island station and its activities.

No cultural heritage management plan has yet been prepared for cultural heritage sites outside the Atlas Cove ANARE station, but this remains a priority due to the threat of loss of cultural heritage values through natural processes or human activities.

Ownership of the cultural heritage sites and associated artefacts within the Reserve rests with the Commonwealth, represented by the AAD.

EPBC Regulation 12.13 provides that a person must not, in a Commonwealth reserve, damage, deface, move, possess or interfere with heritage, unless it is provided for, and carried out in accordance with, a management plan in force for the Reserve; or is authorised by a permit; or under certain other conditions (regulation 12.06).

All shipwrecks over 75 years of age, and their associated relics, are protected under the Commonwealth *Historic Shipwrecks Act 1976*, pursuant to a declaration made under that Act. A number of such shipwrecks are likely to be found in the Reserve, as at least fourteen ships are believed to have been wrecked or lost at Heard Island during the mid-late 19th century, including the *Alfred*, *E.R. Sawyer*, *Exile*, *Frank*, *Mary Powell*, *Pacific* and the *Trinity*[33]. Under section 13 of the Act, it is an offence for any person to damage, interfere with, dispose of or remove any part of a historic shipwreck, or associated relic, without a permit under section 15 of that Act.

The EPMO provides that a person must not engage in conduct that results in interference to any buildings, historical relics, equipment, supplies or survey markers in the Territory, except in accordance with a permit issued under that Ordinance.

As explained in section 2.4 Legislative Context, this Plan expressly provides that an activity that is otherwise prohibited by section 354(1) of the EPBC Act, or the EPBC Regulations, may be carried on in the Territory if authorised by and undertaken in accordance with an EPMO permit.

Prescriptions

7.1 The Director will comply with the heritage provisions of the EPBC Act so far as applicable to the Reserve.

7.2 The AAD's cultural heritage policies and guidelines will apply to management of the Reserve's cultural heritage.

7.3 Environmental impact assessments undertaken in respect of proposed activities in the Reserve will include an assessment of potential impacts on cultural heritage and of measures to mitigate or avoid any adverse impacts (see prescriptions in section 4 Environmental Assessment and Approval).

7.4 A permit will only be issued under the EPMO to authorise a person to damage, deface, move, possess or interfere with cultural heritage in the Territory if the issuer of the permit is reasonably satisfied that such actions are necessary for research or management purposes.

> Note: This does not remove the need to obtain a permit for activities covered by the *Historic Shipwrecks Act 1976*.

7.5 Permits issued under the EPMO to damage, deface, move, possess or interfere with cultural heritage in the Territory will contain appropriate conditions to minimise impacts on cultural heritage values, including a requirement that cultural heritage activities be undertaken by or under the supervision of suitably qualified persons.

7.6 Details of the cultural heritage of the Reserve will be recorded on the AAD Antarctic Heritage Register and linked to the Reserve Management Database and GIS (see section

6.5.19). This register will assist management in identifying cultural heritage sites when planning or assessing proposed activities in the Reserve, and in preparing cultural heritage management plans.

7.7 Conservation and management of the Atlas Cove ANARE Station area (within the Heritage Zone – see section 3 Zoning and IUCN Category) will have regard to the *Atlas Cove, Heard Island Cultural Heritage Management Plan*[6].

7.8 The Director will prepare cultural heritage guidelines for sites associated with the sealing era and other heritage sites beyond the Atlas Cove ANARE station area. Such sites will be managed in accordance with any guidelines so prepared.

7.9 Visitors and the public will be informed of the importance of protecting the cultural heritage of the Reserve and restrictions applying to cultural heritage items, including by incorporating information about cultural heritage into a range of public education and interpretive material to be prepared for the Reserve (see prescriptions in section 5.4 Communicating Reserve Values).

7.10 The Director will liaise with the relevant management authority concerning applications for permits to recover any relics under section 15 of the *Historic Shipwrecks Act 1976*.

8 Stakeholders and Partnerships

Aim: To work cooperatively and productively with stakeholders and partners to achieve the management objectives for the Reserve.

Performance indicators

- Effective stakeholder participation in Reserve management.
- Working relationships with partners are effective.

Background

There is no resident local or indigenous community within, or in close proximity to, the Reserve. Most activities are conducted by the Australian Antarctic science program and supported by the AAD. The AAD has responsibility for administering and managing the Territory and (under delegation from the Director) the Reserve, and for supporting the activities of the Australian Antarctic science program to achieve the Australian Government's Antarctic goals and the goals of the Australian Antarctic Science Strategic Plan.

Other groups with an intermittent presence in the Reserve include border protection (fisheries surveillance and enforcement) vessels and commercial tourist/private recreational groups. Off-site stakeholders with an interest in the management of the Reserve include Australian commercial fishers, the science community, government and non-government conservation organisations and, by virtue of the Reserve's national and international conservation significance, both the Australian and global public. While most of these stakeholders or interest groups are unlikely to be on-site visitors to the Reserve, each is interested in being assured that the Reserve is managed to maintain the aspects in which their stake lies. It is therefore essential that information about the Reserve is readily available and that decision-making processes are transparent.

Due to low level of visitation to the Reserve and the associated significant cost and logistical restrictions, access by both visitors and managers is impractical, and arguably unnecessary, to

maintain a permanent or frequent on-site management presence. Current intentions are for AAD to support expeditions of the Australian Antarctic program to the Reserve only every few years as resources allow, so it is crucial for effective implementation of this Plan that the Director, through the AAD, maintains effective partnerships with others with operational presence, or responsibility for activities, in the region. Such partners include Customs, AFMA, AMSA, AQIS, Defence, licensed commercial fishers, tourist and recreational visitors, and the administrators of the Îles Kerguelen and the French EEZ adjoining the HIMI EEZ. Partnerships with French authorities will be primarily achieved through cooperative measures in accordance with the *Treaty Between the Government of Australian and the Government of the French Republic on Cooperation in the Maritime Areas Adjacent to the French Southern and Antarctic Territories (TAAF), Heard Island and the McDonald Islands*.

To achieve the aims of the research and monitoring prescriptions of this Plan, it is also essential that good relationships are maintained with the science community. Expert scientific advice, beyond that available within the AAD, may also be required to inform management actions, such as appropriate responses to known or suspected alien introductions.

Prescriptions

8.1 The Director will promote stakeholder involvement in the management of the Reserve by a variety of actions, such as:

- making information about the Reserve publicly available, such as via the Internet, including information about planned and current Australian Antarctic program expeditions, and summary reports of such expeditions (see section 5.4 Communicating Reserve Values);
- conducting a planning workshop and calling for public expressions of interest to conduct research in the Reserve when planning each major Australian Antarctic program expedition to the HIMI region (see section 6.5 Research and Monitoring);
- investigating the development of a register of interested parties to facilitate consultation and exchange of information about proposed and approved activities in the Reserve; and
- inviting all Reserve visitors to make management recommendations as part of their post-visit report (see section 5.3 Visitor Management and Commercial Activities).

8.2 The Director will seek to establish and maintain effective cooperative management initiatives with:

- Government agencies with responsibility for activities in the region, such as Customs, AFMA, AMSA, AQIS, Defence;
- other groups with operational presence in the region, such as the administrators of the French EEZ surrounding the Îles Kerguelen, licensed commercial fishers and recreational visitors; and
- other parties involved or interested in the Reserve's management.

9 Business Management

9.1 Operational Management

Aims:

To manage the Reserve in an effective and efficient manner in accordance with the obligations contained in legislation and this Plan.

Performance indicators

- Compliance with the legal obligations of the Director under the EPBC Act.
- Post-visit reports received as requested.
- Management strategies are adjusted in response to new information and feedback.

Background

It is the function of the Director under the EPBC Act (s.514B) to 'administer, manage and control' Commonwealth reserves (see section 2.9 National Agreements and Strategies). As mentioned in section 2.4, the Director's powers and functions under the Act for administering the Reserve have been delegated to the Director and relevant officers of the AAD.

On-site management opportunities are limited by infrequent visits and the implementation of this Plan is subject to operational and financial constraints. It is essential that information on the status of the Reserve is obtained at every opportunity, including from non-AAD visits.

The isolation of the Reserve and the frequent, persistent severe weather and sea conditions increase the risk to persons conducting on-site management activities. AAD staff and participants in Australian Antarctic program expeditions to the Reserve undertake many and varied on- and off-site Reserve administration and management-related activities, as outlined in Appendix 13.

In fulfilling these Reserve management responsibilities, the Director draws directly on the skills and knowledge of many staff, including those from AAD policy, planning, environmental, legal, scientific, operational and public relations sections, as well as staff from a range of other agencies.

Prescriptions

9.1.1 An implementation schedule and performance report will be developed in respect of the prescriptions of this Plan and any other actions that may be identified from time to time to address risks. The implementation schedule and performance report will be used to formulate annual priorities and work plans in respect of the Reserve.

9.1.2 The implementation schedule will include off-site measures and on-site management activities to be conducted by each Australian Antarctic program expedition to the Reserve, taking account of information gained from previous visits and apparent or emerging issues.

9.1.3 The Director will periodically assess risks to the values and effective management of the Reserve and may adjust management responses if there is a significant change to a risk ranking.

9.1.4 The Director will seek opportunities to undertake cooperative management activities with other groups operating in the Reserve and other relevant government and non-government agencies.

9.1.5 The Director may develop, review or update operational plans and management strategies for carrying out prescriptions in the Plan dealing with Reserve management issues, such as management of flora and fauna (including native and introduced species), cultural heritage items, visitor access and transport operations and unplanned or unforeseen events or actions that arise during the life of the Plan.

9.2 Compliance and Enforcement

Aim: To ensure that activities in the Reserve are conducted in accordance with this Plan, the EPBC Act and other legislation.

Performance indicators

- Number of infringements detected or suspected, and severity of any associated environmental impacts.
- Compliance and enforcement plan for the Reserve implemented and regularly reviewed and revised where necessary to reflect compliance risks.
- Database developed to record and assist investigation of alleged infringements.

Background

The primary goals of the *Department of the Environment and Heritage Compliance and Enforcement Policy* are to encourage a high level of public awareness and support the values of parks and reserves, maximise compliance with the relevant parts of the EPBC Act and Regulations and management plans, and enforce legislation transparently, lawfully, equitably and fairly. These goals are directly relevant to compliance and enforcement activities for the Reserve.

The remoteness of the Reserve and the prohibitive costs of maintaining a full-time on-site enforcement capability mean that emphasis must be given to encouraging compliance through education and self-regulation. That is, by educating visitors in the importance of protecting the Reserve environment and the environmental consequences likely to arise from any breaches. A key goal is to instil in visitors the notion that visiting the Reserve is a rare privilege, carrying with it an important obligation to protect the environment. Nonetheless, an important element of the compliance and enforcement activities is to facilitate a management presence in the Reserve, including regular patrols, and to further develop surveillance, compliance and enforcement services by building on current cooperative approaches with relevant Commonwealth agencies (including Customs, Defence and AFMA). Foreign governments also operating in the eastern Antarctic and subantarctic, particularly French authorities, also play an important part of a comprehensive surveillance and enforcement network for the region.

Members of Australian Antarctic program expeditions to the Reserve typically have a range of relevant experience and understanding of environmental issues and management practices. Voyage Leaders and Field Leaders are appointed as authorised officials under relevant legislation, with statutory powers to stop, search and arrest. All are thoroughly briefed to ensure understanding of both compliance requirements and operational matters. All Australian Antarctic program expedition personnel must attend environmental and operational briefings and training prior to departure, on board the ship and again at pre-disembarkation.

Access to the Territory is controlled through an entry permit system. This system seeks to ensure all visitors, including non-governmental visitors, consult extensively with the AAD and are provided with comprehensive information to ensure that compliance requirements are understood.

Non-compliance by transiting or unauthorised groups, taking the form of illegal fishing activities or marine pollution events, could have serious environmental consequences. As these are not Reserve-specific issues, they must be effectively managed as part of broader governmental efforts to address such activities throughout the Australian EEZ around HIMI.

Prescriptions

9.2.1 Compliance and enforcement activities for the Reserve will be detailed in a *Heard Island and McDonald Islands Marine Reserve Compliance and Enforcement Plan* developed in accordance with the *Department of the Environment and Heritage Compliance and Enforcement Policy* and the Parks Australia Compliance and Enforcement Manual.

9.2.2 The *Heard Island and McDonald Islands Marine Reserve Compliance and Enforcement Plan* will outline compliance and enforcement priorities that reflect identified risks. The plan will be reviewed annually and amended as appropriate.

9.2.3 All key Australian Antarctic program expedition staff, including voyage and field leaders, will be appropriately trained and some will be appointed as authorised officials under relevant legislation and will undertake regular compliance checks in the Reserve.

9.2.4 The Director will pursue arrangements to authorise officers of other Commonwealth agencies to conduct compliance and enforcement activities in the Reserve.

9.2.5 The Director will seek to initiate a Territory Watch program to report suspicious activities in the HIMI region, involving non-government expeditions, commercial fishers, transiting vessels, overflying aircraft and others. A database will be developed to record and investigate alleged infringements.

9.2.6 The Director will seek to ensure that copies of this Plan and relevant supporting documentation, including information about the legal requirements relating to activities in the Reserve, are made available to the public and provided to all persons intending to visit the Reserve (see prescriptions in section 5.4 Communicating Reserve Values).

9.2.7 Where practicable, permits to enter and undertake activities in the Reserve will be accompanied by explanatory notes indicating the environmental reasons for any conditions imposed.

9.2.8 Permits to enter and undertake activities in the Reserve will require permit holders to provide a report on their visit, giving details of any non-compliance on their part, or evidence of non-compliance by others (see prescriptions in section 6.5 Research and Monitoring).

9.2.9 The Director will seek to develop cooperative arrangements, including with the French Administrators of Îles Kerguelen, so that:

(a) visitors to Îles Kerguelen with intentions of travelling to the Reserve are informed of the management arrangements and contact details for the Reserve; and

(b) information about visitors to Îles Kerguelen, who intend to travel to the Reserve, is provided to the Director.

9.2.10 The Director will liaise with the Australian Federal Police, Director of Public Prosecutions, Customs, AFMA, DAFF, AMSA, Defence and other relevant law enforcement agencies in relation to compliance and enforcement issues in and around the Reserve (see prescriptions in section 8 Stakeholders and Partnerships).

9.2.11 Where appropriate, the Director will contribute to Government initiatives involving relevant Commonwealth agencies and Foreign Governments, particularly French authorities, in relation to compliance and enforcement activities in the HIMI region.

9.2.12 This Plan does not restrict authorised officials in the performance of their duties. The activities of authorised officials directly related to the performance of their duties as authorised officials are approved and authorised for the purposes of this Plan. However, authorised officials in the Reserve must abide by any instructions that may be issued by the Director in respect of their activities in the Reserve. A full report on their activities in the Reserve, including details of the environmental impact of any actions taken, must also be provided to the Director by the officials or agencies concerned at the earliest reasonable opportunity.

9.2.13 An assessment of the effectiveness of compliance and enforcement provisions for the Reserve will be undertaken as part of the performance assessment framework for the Reserve (see prescriptions in section 10 Performance Assessment).

9.3 Financial Management

Aim: Adequate funds are available and appropriately allocated to implement the prescriptions of this Plan so that the aims of the Plan are met.

Performance indicators

- Effective implementation of this Plan.
- Timely and accurate reporting on the financial aspects of Reserve management.
- Compliance with Chief Executive Instructions.

Background

Responsibility for effective and efficient Reserve administration and management lies with the AAD Director, under delegation from the Director of National Parks. Management and administration funds for the Reserve are drawn from the Australian Government's appropriation to the Department of the Environment and Heritage's Antarctic Outcome. These funds are administered by the AAD Director in accordance with statutory and administrative requirements for Commonwealth government agencies.

As there are no permanent residents or occupants in the Reserve, and commercial visits to the Reserve are infrequent, financial management for the Reserve is largely related to the planning and conduct of Australian Antarctic science program expeditions (which facilitate the conduct of science and non-science Reserve management activities), providing information and advice, processing environmental impact assessments and permits for visitors to the Reserve, and coordinating the implementation of the prescriptions of the plan.

At the time of preparing this Plan no fees are prescribed by the EPBC Regulations in relation to permits for activities in the Reserve, nor has the Director determined and imposed charges under s.356A of the EPBC Act in relation to entering and using the Reserve. If visitation to the Reserve increases significantly during the life of this Plan, the government may consider the introduction of permit fees and the Director may consider entry and use charges to assist in meeting the administrative costs of Reserve management.

Like all government agencies, both the Director and the AAD are subject to Government decision and must work within the Government's financial and policy priorities and appropriations. The AAD is responsible for management of resources used to implement the Reserve's management plan, subject to government purchasing and financial guidelines and statutory requirements. Accounts are maintained on an accrual accounting basis. Due to the substantial logistical and personnel costs associated with planning and conducting AAD-supported expeditions to the Reserve, expenditure relating to on-site Reserve management will vary greatly over a three year cycle.

As an authority for the purposes of the *Commonwealth Authorities and Companies Act 1997* (Cth), the Director is also subject to the requirements of that Act.

Prescriptions

9.3.1 Implementation of the prescriptions in this Plan is subject to the availability of funding and other required resources.

9.3.2 The Reserve budget will be managed in accordance with Commonwealth statutory requirements, taking account of the requirements of this Plan.

9.3.3 Management systems will provide the ability to account for the overall expenditure against this Plan.

9.3.4 The AAD will report annually to the Director on the financial management of the Reserve.

9.4 Emergency Management

Aims:

Emergency situations in the Reserve are prevented through comprehensive planning and the implementation of appropriate precautions.

Response to emergency situations gives first priority to the safety of human life and then the environment of the Reserve.

Organisers of activities in the Reserve are self-sufficient.

Performance indicators

- Emergency response plans are in place for all visits to the Reserve.
- All visitors are informed of the risks associated with visiting the Reserve and are suitably briefed and equipped to minimise the risks of emergencies arising.
- Emergency situations are managed efficiently and effectively.
- Number of incidents resulting in requests for emergency assistance from AAD or other organisations.

Background

The Reserve is an inherently dangerous place to visit: weather conditions at sea and on land can change extremely rapidly; terrain is difficult throughout much of the terrestrial area; there is intermittent volcanic activity; and there are other natural hazards such as calving glaciers and extreme sea conditions. The Reserve is also remote and lacks any permanent infrastructure or capacity for prompt external response to emergency situations. The consequence of this is that all visitors to the Reserve must take all appropriate precautions in the planning and conduct of their visit to reduce the risks of emergency situations occurring.

Emergencies in the Reserve and necessary response actions can affect the values of the Reserve. For example, an oil spill may directly cause significant environmental damage and the deaths of seabirds or marine mammals, while the use of helicopters to retrieve injured persons or a trapped field party may disturb wildlife. The Reserve is about two weeks passage by ship from Australia, so a rapid response to an incident is unlikely unless a suitably equipped vessel happens to be in the area.

The AAD usually maintains refuges with basic survival gear in the Atlas Cove and Spit Bay Main Use Zones (see Figure 4, Figure 5 and Figure 7). The condition of these refuges can be known only for the time of the most recent condition report, which may be infrequent, and the presence or condition of these refuges must not be relied upon.

Vessels may seek the safety offered by HIMI for a safe anchorage or to access a place of refuge in circumstances involving a maritime casualty, force majeure or distress, or other operational, logistical or medical situations. Australian Search and Rescue (AusSAR), a division of AMSA, provides a maritime search and rescue coordination service that covers the waters in the HIMI region. A vessel seeking access to such an area may contact AAD directly or AusSAR, which would consult on access with the AAD. Visitors to the HIMI region are encouraged to contact AMSA to discuss registering their vessel for the Australian Ship Reporting System (AUSREP). Ships participating in AUSREP are provided with an active search and rescue watch by AusSAR.

The EPMO provides that a person must not enter or sail a vessel in the Territory except in accordance with a permit issued under that Ordinance. The EPMO directs the issuer of the permit, when deciding whether to issue a permit and what permit conditions to impose, to have due regard to both the need to protect the environment of the Territory as well as the safety of persons, aircraft, vehicles and vessels in the Territory. A permit may be issued subject to conditions.

Prescriptions

9.4.1 Any activities directly associated with an emergency involving possible loss of human life or injury to persons (including search and rescue activities), risk to the safety of significant property (such as an aircraft, a vehicle or a vessel), or to prevent an immediate and significant threat to the environment, are approved for the purposes of this Plan.

9.4.2 A full report of activities conducted during an emergency, including details of the environmental impact of any actions taken and details of any facilities or supplies used, must be provided to the Director at the earliest reasonable opportunity.

9.4.3 The Director will take all reasonable efforts to inform persons intending to visit the Reserve of the need for self-sufficiency, relevant precautions, and the procedure for reporting any emergencies. Relevant precautions include:

(a) fully enclosed and operational vessel's lifeboats/life rafts;

(b) the provision of sufficient thermal protective survival suits for all on board;

(c) contingency plans for medical emergencies that may arise in the course of the voyage;

(d) carriage of sufficient reserves of food, fresh water, fuel and spares for critical equipment to provide for unforeseen delays; and

(e) a Shipboard Oil Pollution Emergency Plan (SOPEP) and marine pollution mitigation arrangements to manage a fuel or waste spill from the vessel.

9.4.4 All groups that go ashore in the Reserve must take sufficient emergency equipment and supplies to shelter and sustain the maximum number of people ashore at any one time.

9.4.5 Permit notes or other information provided to visitors will include contact details for emergencies.

9.4.6 Emergency situations will be managed generally in accordance with the provisions of the *AAD Crisis Management Recovery Manual*, to ensure that the safety of human life and protection of the Reserve environment are given foremost attention. Where practicable, HIMI-related scenarios will also be used in training programs and tests of the AAD crisis management and response system.

9.4.7 Emergency response to reports of new alien species or disease events must be in accordance with section 6.4 Prevention and Management of Alien Species and Disease.

9.4.8 The Director will maintain close relationships with AMSA for the reporting of, and response to, emergencies involving vessels in the HIMI region.

10 Performance Assessment

Aim: To regularly evaluate progress in implementing this Plan and to conduct a technical audit of the implementation of the Plan as part of its review.

Performance indicators

- Prescriptions in this Plan are implemented and regularly reported on.
- Annual reporting is timely, accurate and meaningful.
- The implementation and effectiveness of the Plan's prescriptions are reviewed in time for the preparation of the next management plan.

Background

This management plan has been developed on the basis of present best knowledge of financial and staff resources and circumstances. Management techniques currently considered appropriate may change as knowledge improves and pressures on the Reserve change over the anticipated seven year period of this Plan. Monitoring implementation of this Plan will ensure prescriptions are carried out and provide information for developing the next plan for the Reserve.

In order to adequately assess protected area management, the Director of National Parks has developed a reserve management performance assessment framework. This identifies clear outcomes for management of Commonwealth reserves and, consequently, guides the aims of individual Commonwealth reserves. Prescriptions are based on, amongst other things, Government policy, the requirements of legislation including the EPBC Act, and on the particular attributes and management issues of the Reserve.

Prescriptions

10.1 The Director will prepare an annual report on the implementation of the prescriptions in this Plan, assessed against the performance indicators.

10.2 In time to contribute to the development of the next management plan, the Director will commission a technical audit of this Plan with the following terms of reference:

(a) consider each prescription and determine whether or not it was carried out satisfactorily;

(b) evaluate the performance of each prescription in relation to its intended aim(s);

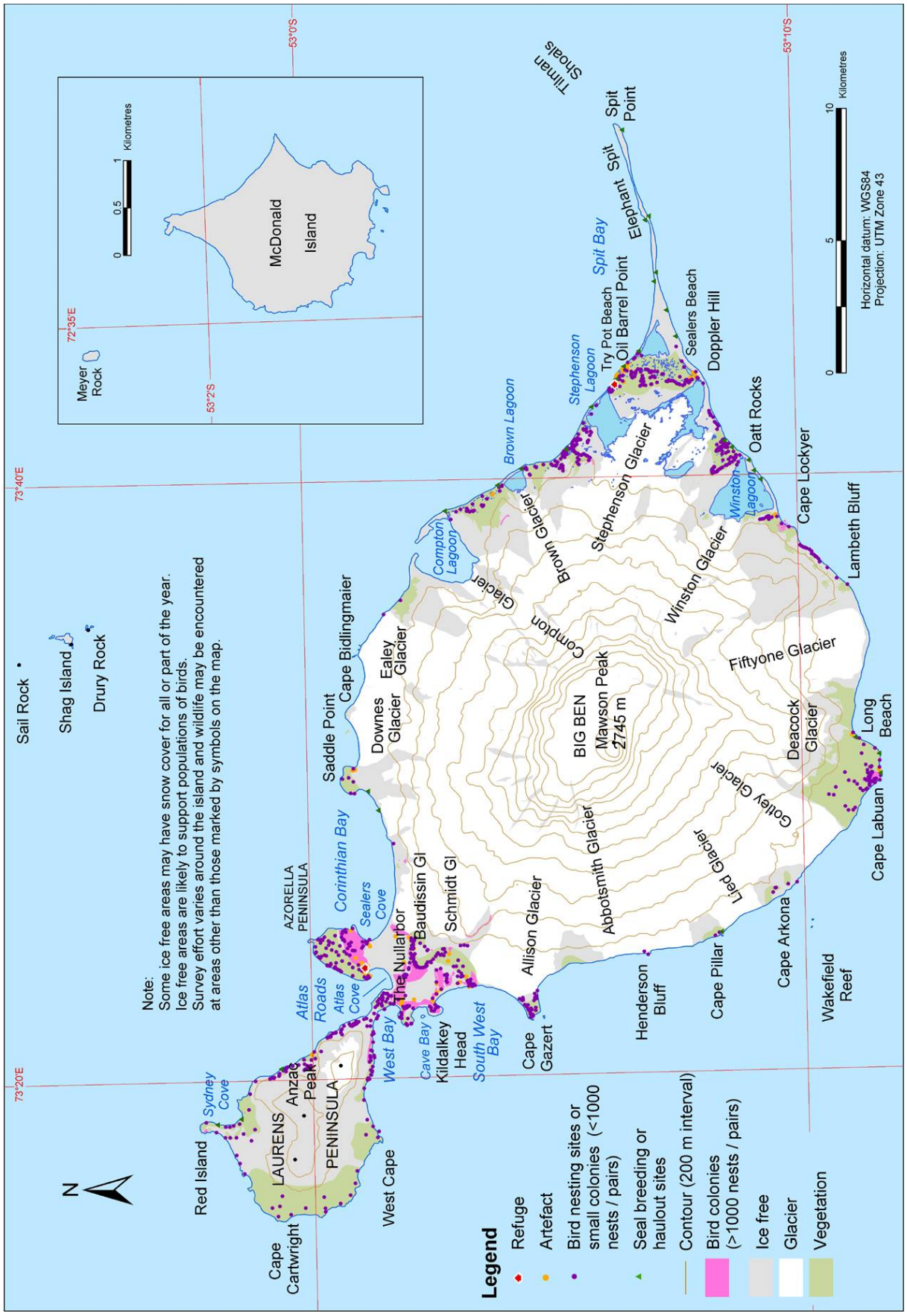
(c) if any prescription was not implemented, or failed to achieve its aim(s), determine the cause;

(d) report the results of the audit and an overall assessment of the performance of the Plan against its objectives to the Director; and

(e) in the light of this Plan's performance, recommend to the Director any changes to the objectives and prescribed actions to be considered during the preparation of the next plan.

Part 3 A Description of the Heard Island and McDonald Islands Marine Reserve

Figure 7. General map of Heard Island and the McDonald Islands



Heard Island and McDonald Islands Region

Heard Island (53°06'S, 73°32'E) and the nearby McDonald Islands are located in the Indian Ocean sector of the Southern Ocean, approximately 4000 km south-west of Australia and 1000 km north of the Antarctic continent (see Figure 1). The nearest land is the Kerguelen group of islands (Îles Kerguelen) 440 km to the north-west which, with the Heard-McDonald group, form the only exposed parts of the submerged Kerguelen Plateau.

Heard Island is approximately 43 km long, stretching from Laurens Peninsula in the north-west to the end of Elephant Spit in the south-east, with a land area of 368 km^2. The majority of this area comprises Big Ben, a heavily glaciated and roughly circular volcano of around 18-20 km in diameter. Recent and possibly ongoing volcanic activity has changed the size and shape of the McDonald Island group; a comparison of satellite images taken in 1980 and 2003 indicates that McDonald Island itself has doubled in size and is now connected to the previously separate Flat Island by a low isthmus (see Geology and Geomorphology below). A low-lying spit and reef also extend over a kilometre to the east of McDonald Island. The McDonald Island group, including Meyer Rock one kilometre to the north, now covers an area of approximately 2.45 km^2. Other islets include Sail Rock, Shag Rock and Drury Rock which lie approximately 10 km north of Heard Island (see Figure 7).

The islands, plus several offshore rocks and shoals and the 12 nm territorial sea, collectively comprise the Territory of Heard Island and McDonald Islands (the Territory), which is the most isolated territory of Australia and one of the most isolated locations on Earth. The seas surrounding Heard Island and McDonald Islands (HIMI) form part of Australia's exclusive economic zone (EEZ), which extends to a distance offshore of 200 nm, with the exception of an area to the north-west where Australia has an agreement with France on the delimitation of the EEZ boundary between HIMI and the Îles Kerguelen (see Figure 2).

The following sections give a brief description of the history and characteristics of the HIMI region, with particular emphasis on the areas contained within the HIMI Marine Reserve. More information about the HIMI region and Reserve is available from the references listed in the bibliography at the end of this Plan, and from the Australian Antarctic Division (AAD) website at **www.aad.gov.au**

History

Although the nearby Îles Kerguelen were frequently visited by sealing vessels from the 1770s and there was shipping activity in the southern Indian Ocean since before 1800, Heard Island and the McDonald Islands remained unknown until the mid-1800s[34]. Captain Peter Kemp of the sealing vessel *Magnet* may have sighted land in the vicinity of Heard Island in 1833, and the captain of another sealing vessel, the *Charles Carrol*, reported sighting land south of the Îles Kerguelen in 1849[35]. However, the discovery of Heard Island is attributed to Captain John Heard on the merchant vessel *Oriental*. Captain Heard made a confirmed sighting of the island on 25 November 1853 when travelling from Boston to Melbourne on a newly recommended, more southerly, 'great circle' route[33]. The McDonald Islands were discovered on 4 January 1854 by Captain W. McDonald on the *Samarang*[33].

Within a few years of discovery, sealing operations had commenced at numerous locations around the Heard Island coast. The first landing was by a sealing expedition at Try Pot Beach on 15 February 1855 during a visit by the American whaler *Corinthian*, under the command of Captain Erasmus D. Rogers. The first party to overwinter comprised crew from the brig *Zoe*, who remained ashore undertaking sealing operations from March to October 1856[33]. In December that year the schooner *Alfred* was driven ashore at Spit Bay, becoming the first of at least 14 vessels to be wrecked on or near the island[33].

More than 40 vessels made over 100 voyages to Heard Island seeking 'sea-elephant' (southern elephant seal – *Mirounga leonina*) oil in the three decades following the island's discovery[34]. The highest level of human activity ever at the island occurred during the sealing period from 1855–1882, with production of seal oil and visitation peaking in 1857–1859 and declining thereafter. Few details are known of the brief, sporadic visits by sealers and whalers during the early 20th century.

Five scientific visits are known from the late 19th and early 20th centuries, with brief visits by the *Challenger* and the *Arkona* in 1874, the German South Polar Expedition in 1902, and in 1929 by a French mineral-prospecting expedition and the British, Australian and New Zealand Antarctic Research Expedition (BANZARE) led by Douglas Mawson. The latter group travelled on to Antarctica to undertake activities that form part of the foundation for Australia's claim to a substantial part of the Antarctic continent.

No further visits to Heard Island are known until the establishment of the Australian National Antarctic Research Expedition (ANARE) station at Atlas Cove in December 1947. The station was occupied between December 1947 and March 1955, providing a base for extensive scientific activities on the island throughout that period.

Several summer visits by the Australian Antarctic program and several private expeditions, including an overwintering American expedition (1969) and a French expedition (1971), were conducted between 1955 and the late 1970s. The first recorded landing on the McDonald Islands occurred by helicopter in 1971[36], with the second almost a decade later in 1980[37].

A resurgence in Australian Antarctic program activities on Heard Island commenced in the mid-1980s, with three successive summer expeditions between 1985 and 1989, a brief midwinter visit in 1990, an overwinter expedition in 1992, and summer expeditions in 2000/01 and 2003/04.

Several brief landings were also made by personnel involved in fisheries surveillance patrols conducted between 1997 and 2004, which used both civilian and Australian Defence Force vessels. Shore parties from some patrols undertook small scale cleanup and reconnaissance tasks in preparation for later Australian Antarctic program expeditions[38].

Heard Island and McDonald Islands Marine Reserve

The United Kingdom formally established its claim to Heard Island in 1910, marked by the raising of the Union Jack and the erection of a beacon by Captain Evensen, master of the *Mangoro.* Effective government, administration and control of Heard Island and the McDonald Islands was transferred to the Australian Government on 26 December 1947 at the commencement of the first Australian National Antarctic Research Expedition (ANARE) to Heard Island, with a formal declaration that took place at Atlas Cove. The transfer was confirmed by an exchange of letters between the two governments on 19 December 1950.

The conservation values of the HIMI region have long been appreciated. The need for formal protection of the natural values of the Territory was formally acknowledged with the approval by the Australian Parliament of the *Heard Island and McDonald Islands Act 1953* (HIMI Act) which, among other things, made provisions for the protection of wildlife and the making of ordinances for the administration of the islands.

The islands of the Territory were listed on the Register of the National Estate in 1983 for their significant natural and cultural features (see section 1.2 Conservation Significance of the Reserve and Appendix 5). The value of these features was further recognised and protected through the *Environment Protection and Management Ordinance 1987* (the EPMO), made under the HIMI Act. The EPMO provided a legal regime for the protection of the Territory's indigenous plants and animals, including the obligation to prepare a management plan for the Territory and the requirement for a permit to enter or undertake activities in the Territory.

In 1990 the Australian Government nominated the Territory for inclusion on the World Heritage list, citing the islands' outstanding natural processes, the undisturbed environment and important ecosystems, the range of landform features and their aesthetic qualities. The nomination was deferred by the World Heritage Bureau, which requested further information on the Territory's conservation values, legal status, proposed boundaries and management plan for the site.

The *Heard Island Wilderness Reserve Management Plan*, made under the EPMO, came into effect on 14 February 1996. The plan provided priorities for decisions that would affect the Territory, defined appropriate uses and activities, outlined management areas and contained management strategies for protecting the Territory's values.

Later in 1996 Australia submitted the additional information requested by the World Heritage Bureau in a second nomination. This nomination was accepted, and the Territory was inscribed on the World Heritage list on 3 December 1997 for its outstanding natural universal values. The World Heritage Committee noted that the site 'is the only volcanically active subantarctic island and illustrates the ongoing geomorphic processes and glacial dynamics in the coastal and submarine environment and subantarctic flora and fauna, with no record of alien species'.

In 1998 the HIMI region was identified in Australia's Oceans Policy as one of five areas where the Australian Government would preferentially pursue a marine park, to ensure Australia's temperate and subantarctic waters were incorporated in the comprehensive and representative system of marine protected areas and to help protect Australia's unique marine biodiversity.

A subsequent report, *Conservation of marine habitats in the region of Heard Island and McDonald Islands*[1], documented the conservation values of the HIMI region and, using the Australian and New Zealand Environment and Conservation Council (ANZECC) criteria for the identification and selection of marine protected areas under the National Representative System of Marine Protected Areas (NRSMPA), proposed boundaries for a marine reserve to provide ongoing protection of these values.

In January 2001 the Government announced the initial proposal to declare a Commonwealth reserve (Marine Reserve) under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) in the HIMI EEZ. Following extensive consultation with key stakeholders from industry, conservation groups and government, the proposal was revised and released in May 2002, with some of the initially proposed areas declared as a conservation zone under the Act (see Figure 2). It was agreed that the conservation zone areas would undergo further assessment to determine their conservation values and fisheries resource potential before again being considered for incorporation in the Reserve.

Stakeholders were supportive of the revised proposal and on 16 October 2002 the Heard Island and McDonald Islands Marine Reserve (the Reserve) was proclaimed under section 344 of the EPBC Act as a Commonwealth reserve, for the purpose of protecting the conservation value of the Heard and McDonald Islands and the adjacent unique and vulnerable marine ecosystems.

In summary, the Reserve covers an area of approximately 6.5 million hectares (65 000 km^2), including:

- Heard Island and the McDonald Islands and the associated territorial sea;
- the central portion of the plateau area to the north of the territorial sea extending out to the Australian EEZ boundary;
- a portion of the western plateau around Coral Bank;
- a small area to the south of the territorial sea; and
- a portion at the north-east of the plateau area, including areas over and around Shell Bank and part of the north-eastern plateau out to the limits of the EEZ.

In addition to the land and waters within these areas, the Reserve also includes the seabed and subsoil to a depth of 1000 m.

At the time of preparing this Plan, the conservation zone assessment program is still underway.

The location of the Reserve is represented in Figure 1 and the boundaries of the Reserve are represented in Figure 2. The boundaries of the Reserve are outlined in the Schedule to the Proclamation document, which is reproduced at Appendix 1.

Climate

The large-scale climate of the HIMI region is strongly influenced by its mid-latitude location in the Southern Ocean, south of the Antarctic Polar Front (the meeting point of subantarctic surface waters and colder Antarctic surface waters) and in a zone of strong and persistent westerly winds (the 'furious 50s') associated with deep low-pressure systems. The maritime setting of the islands leads to low seasonal and daily temperature ranges, persistent and generally low cloud cover, frequent precipitation and strong winds. The local climate on Heard Island is significantly influenced by the island's perennial ice cover and mountainous nature, particularly the orographic effects of Big Ben on precipitation, snow accumulation, winds and cloud cover[39]. The relatively low-lying McDonald Islands are free of permanent ice and, while windy, do not experience the highly changeable conditions of Heard Island.

Due to intermittent human occupation, meteorological observations at Heard Island are incomplete, although there are good records for the periods 1947–1954 (manual measurements from Atlas Cove) and 1997–2004 (data from automatic weather stations at Atlas Cove and Spit Bay). Monthly average temperatures at Atlas Cove range from 0.0^{o} to 4.2^{o}C, with an average daily range of 3.7 to 5.2^{o}C in summer and -0.8 to 0.3^{o}C in winter. The highest recorded temperature at Atlas Cove was 15.8^{o}C in February 2001. Air temperatures at Spit Bay, only 25 km to the east can be remarkably different, with monthly mean temperatures being as much as 1.3°C higher. Spit Bay also experienced an extreme monthly maximum temperature of 21.6^{o}C in April 1992, which is 10.8^{o}C higher than for the April record at Atlas Cove[39].

Winds at Heard Island are predominantly westerly, although the direction of local winds is greatly influenced by surrounding topography. At Atlas Cove, monthly average wind speeds range from a low in December and January of 7.2 m/s (around 26 km/h) to a high of around 9.3m/s (around 33.5 km/h). A maximum daily wind gust of greater than 50m/s (180 km/h) has been recorded on several occasions. Wind records from other parts of the island are less comprehensive, with observations also being influenced by local topography, although it is known that wind speed generally increases with elevation and that violent, localised wind storms are common[39]. Strong, dry, gusty and warm Föhn winds, which develop on the lee side of Big Ben, are an important element of the climatic conditions for some parts of Heard Island and lead to higher average monthly temperatures and more frequent high temperature events at Spit Bay compared with Atlas Cove[39].

Observations at Atlas Cove and Spit Bay indicate that annual precipitation at sea level on Heard Island is in the order of 1.3–1.9 m (water equivalent)[40], with precipitation occurring on 75% of days during the 1948–1954 period at Atlas Cove[39].

The high relative humidity at Heard Island (mean >80% year-round) together with the mountainous topography and strong winds, result in persistent cloud cover and often-spectacular cloud formulations, such as cap, lenticular and rotor (collectively 'wave' clouds) commonly observed over and downwind of Big Ben and to a lesser extent Laurens Peninsula[39]. Atlas Cove, at the western end of the island, experiences significantly greater cloud cover (average 7.3 octas, where an octa equals one eighth of the celestial dome) than Spit Bay at the eastern end, in the lee of Big Ben.

There is considerable evidence that the climate of Heard Island is changing, with observations at Atlas Cove indicating an increase in average annual air temperature of almost 1°C between the periods 1948–1954 and 1997–2001[39]. This mirrors similar changes interpreted from observations at nearby Îles Kerguelen and elsewhere in the southern Indian Ocean. These increased temperatures are having a significant effect on the Heard Island environment, with glacial retreat leading to the formation of lagoons and freshwater lakes, and exposing new land for colonisation by plants and animals.

Terrestrial Environment

Geology and Geomorphology

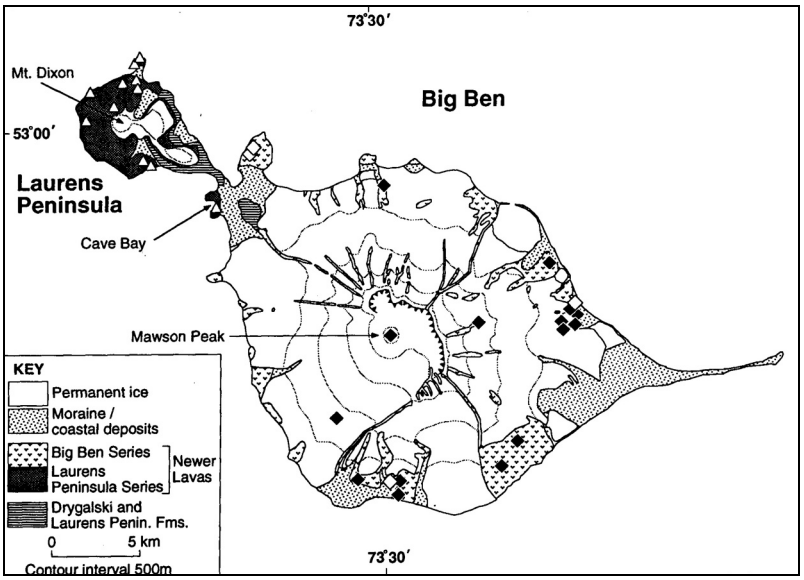
Heard Island and the McDonald Islands are located on the relatively shallow (<1000 m deep) central part of the submarine Kerguelen Plateau. The islands collectively comprise one of two (with Îles Kerguelen) surface exposures of the Plateau which, with an area of approximately two million square kilometres, is one of the largest submarine plateaus on Earth. The Kerguelen Plateau began to form approximately 115 million years ago (mya). Recent geological investigations suggest a formative period extending over 80 million years[41], with the formation of Heard Island commencing approximately 45–50 mya and continuing to this day.

Heard Island essentially consists of two oval-shaped regions connected by an extensive, low gravel isthmus near Atlas Cove (The Nullarbor) (see Figure 7). The main part of the island is dominated by Big Ben, a massive volcanic cone between 18 and 20 km in diameter that rises to a height of 2745 m at Mawson Peak, and sits approximately 400 m above a large ice-covered plateau to its north, east and south-east[42,43]. The smaller oval of Laurens Peninsula (about 8 km long and 6 km wide) rises to 715 m at Anzac Peak and contains three main snow- or ice-capped peaks, the northernmost of which, Mt Dixon, is a volcanic dome that has probably been active in the last few hundred years[43]. The eastern end of the island terminates in Elephant Spit, a changeable sand and gravel feature affected by the prevailing easterly ocean currents, which extends offshore for approximately 10 km.

The geology of Heard Island is the result of three distinct phases, as evidenced by three main stratigraphic formations presently recognised on the island: the Laurens Peninsula Limestones (mid-Eocene ~44 mya to mid-Oligocene ~29 mya), the Drygalski Formation (late Miocene to early Pliocene ~5.3 mya) and the Young Lavas (Quaternary ~1.8 mya to today)[41,43] (see Figure 8). The Laurens Peninsula Limestones contain calcareous nanofossils and foraminiferids and are observed as extensive outcrops on the southern and north-eastern sides of Laurens Peninsula, although it is thought that they occur as a basement under much of the island[43].

The Drygalski Formation overlies the Laurens Peninsula Limestone (see Figure 8) and is readily identified on Laurens Peninsula and under Mt Drygalski as sedimentary rocks, some possibly glacial, with interbedded basaltic flows and intrusions. It occurs on much of the island as solid, cliff-forming strata 300–350 m in thickness[43]. The Drygalski Formation is in turn overlain by the Young Lavas, which give Heard Island its shape and consist of the youngest rocks on the island. Two lava series are recognised: the Laurens Peninsula series, which forms much of the Laurens Peninsula and magmatic rocks from Cave Bay, and the Big Ben series which forms much of the remainder of the island. These two series have differing petrographic characters, indicating contrasting magma plumbing systems[43]. Elemental and isotopic geochemical properties also differ between the two series.

Figure 8. Geological sketch map of Heard Island



(adapted from Barling, Goldstein & Nicholls 1994[44])

McDonald Island appears to be an uplifted and eroded portion of a shallow submarine volcano and is composed of phonolitic lava, very different from that which characterises Heard Island. Shag Island, Sail Rock and Drury Rock are emergent outcrops that have not been studied[42].

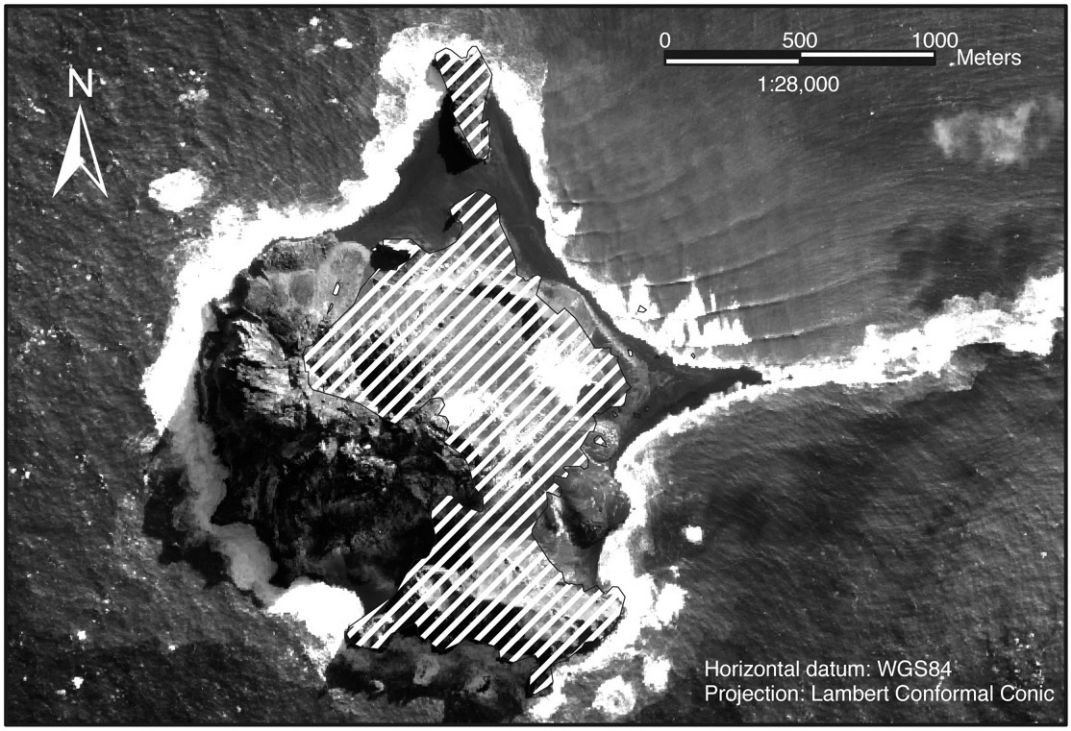
The geomorphology of HIMI is the product of close interaction between volcanism, glaciation, and vigorous marine processes[45]. Both Heard Island and the McDonald Islands are volcanically active. Eruptions have been observed regularly on Big Ben[42] and recent satellite imagery of McDonald Island clearly shows its altered coastline and topography as a result of vulcanism (see Figure 9). There are numerous records of pumice being washed ashore around Heard Island in the last 100 years – it is now believed that some of it originated from the McDonald Islands. Volcanic activity on McDonald Island has been observed during visits to the islands since 1997 and observations of sporadic volcanic activity on Heard Island have been reported over the past twenty years[42].

The most obvious volcanic feature is Big Ben, but other volcanic landforms, including scoria and cinder cones, craters, domes, open vertical volcanic conduits, lava flows and lava tubes, are found throughout Heard Island, with concentrations on Laurens and Azorella Peninsula [45]. Azorella Peninsula, in particular, contains a diverse range of volcanic landforms and near-pristine systems that display unique interactions between local physical, climatic and biological elements. Importantly, the Peninsula also contains the only lava tubes recorded from the Antarctic or subantarctic regions[20].

The substantial glaciation of Heard Island and periods of glacial advance and retreat, in keeping with climate change, have resulted in the occurrence of widespread erosional and depositional landforms. Erosional features include glacial valleys, ice-abraded bedrock surfaces, trough heads, rock bars, cirques, arêtes, cols and horns. Glacial processes have also produced depositional features such as lateral, medial, hummocky and end moraines, the most prominent of which occur in the Dovers Moraine complex, deposited by the Stephenson Glacier. Other prominent depositional features are alluvial and beach deposits, such as those which form The Nullarbor between Laurens Peninsula and the main part of the island.

The islands are constantly exposed to vigorous westerly ocean waves generated by the ‘furious fifties’, resulting in the presence of wide-spread erosional and depositional coastal landforms. Persistent wave-action has produced the steep cliffs found around much of Heard Island, with the coastline in some areas punctuated by steep beaches of sand, shingle, cobbles and boulders, as well as bars and spits resulting from the drift alongshore of substantial quantities of glacial and volcanic sediment[45].

Figure 9. Satellite image of McDonald Island taken in 2004 overlaid with a shaded area indicating the island's extent in 1980



Glaciology

Heard Island has extensive ice cover, with glaciers covering 70% (257 km^2) of the island and permanent snow covering a further 2%[40]. Steep glaciers descend radially and rapidly from the summit of Big Ben towards the coast. It is thought that the age of the oldest ice may be around 100 years[42]. Some of these glaciers currently terminate in the sea, while others terminate inland as a result of glacial retreat, which has led to the formation of widespread glacial lakes and lagoons. There are extensive snowfields on Laurens Peninsula, and several smaller glaciers that descend from the summits of Mt Dixon, Mt Anzac and Mt Olsen.

This extensive glaciation of Heard Island results from the island's high altitude and its position south of the Antarctic Polar Front. There are twelve major glaciers and numerous minor glaciers that radiate outwards from the summit of Big Ben or from the peaks of Laurens Peninsula, flowing towards the coast[40]. The largest of these is the Gotley Glacier, which descends for over 13 km from the island's highest point (2745 m at Mawson Peak) to the coast west of Cape Labuan, covering an area of 27.4 km^2 with an estimated mean thickness of 59 m[40]. There are no glaciers at the McDonald Islands.

Since the earliest visits to Heard Island in the mid 19th century numerous maps, drawings, photographs and satellite images have recorded the extent of ice-free land. This shows that the glaciers on Heard Island changed little between 1860 and 1929[46]. Many glaciers on the eastern and northern sides of the island receded slightly between 1929 and 1955, more widely between 1955 and 1963, (some) advanced between 1963 and 1971, and receded extensively since then. Major glacial retreats have typically been restricted to the glaciers that begin below 1500 m above sea level (asl)[46]. The glaciers with a larger elevation range and high mass turnover, such as the Gotley Glacier, lose much of their ice through calving into the sea rather than surface melt[40].

Climate change appears to have been responsible for dramatic changes to the glaciers on Heard Island between 1947 and 1988, when the total ice area decreased from 288 km^2 (79% of the island) to 257 km^2 (70% of the island). This recession, and the intermittent advances in the glaciers,

correlate strongly with increases and decreases in regional sea surface and air temperatures[39,40]. The contribution of volcanic activity to these changes in glacial extent is considered negligible[39,47].

The extent of glaciers on Heard Island is currently decreasing, with a corresponding development and expansion of pro-glacial water bodies, and increased bare ground available for colonisation by plants and animals. Preliminary results of field work at Brown Glacier in 2003/04 indicate that the glacier has retreated by approximately fifty metres since 2000/01, and has lost as much as eleven metres in thickness on the lower slopes[48]. A correlating reduction in glaciers on Îles Kerguelen, approximately 300 km to the north-west, and north of the Antarctic Polar Front, shows that the warming at Heard Island is characteristic of regional trends[39].

Terrestrial and Coastal Flora

Low-growing herbaceous flowering plants and bryophytes are the major components of vegetation on HIMI. The vascular flora at HIMI is comprised of the smallest number of species of any major subantarctic island group, reflecting its isolation, small ice-free area and severe climate[49]. Twelve vascular species are known from Heard Island, of which five have also been recorded on McDonald Island[50-53] (see Appendix 15). Bryophytes (mosses and liverworts) and lichen contribute substantially to overall biodiversity of Heard Island with 62 bryophyte species and 71 lichen species recorded at the time of preparing this Plan[49]. The 1980 survey of McDonald Island[52] found lower diversity than that on Heard Island. Recent volcanic activity will have altered the distribution and abundance of the vegetation dramatically.

The low plant diversity of HIMI most likely reflects the islands' isolation, small size, severe climate, the short, cool growing season and, for Heard Island, substantial permanent ice cover. The vascular flora covers a range of environments and, although only six species are currently widespread, glacial retreat and the consequent connection of previously separate ice-free areas is providing opportunities for further distribution of vegetation into adjacent areas. None of the vascular species is endemic to HIMI, although *Pringlea antiscorbutica*, *Colobanthus kergulensis*, and *Poa kerguelensis* occur only on subantarctic islands in the southern Indian Ocean.

The recorded terrestrial flora of HIMI is typically subantarctic, but with a higher abundance of the cushion plant *Azorella selago* than other subantarctic islands. Heard Island is also the largest subantarctic island with no known human-introduced plants.

Areas available for plant colonisation on Heard Island are generally the result of retreating glaciers or new ice-free land created by lava flows[30]. Today, substantial vegetation covers over 20 km^2 of Heard Island, and is best developed on coastal areas at elevations below 250 m[49,54] (see Figure 7).

Bryophytes are present in most of the major vegetation communities and often occupy habitats unsuitable for vascular plants, such as cliff faces. A total of 43 moss species and 19 liverwort species have been recorded at the time of preparing this Plan[49] (see Appendix 16). Lichens are common on exposed rock and dominate the vegetation in some areas[49]. Seventy one species have been recorded on Heard Island, including several soil and moss-inhabiting species. Four mosses, eight lichens and a number of algal and fungal species are also recorded from McDonald Island[52].

At least 100 species of terrestrial algae are known from Heard Island, commonly in permanently moist and ephemeral habitats[55]. Forests of the giant Antarctic kelp *Durvillaea antarctica* occur at a number of sites around Heard Island[2] and at least 17 other species of marine macro-algae (seaweeds) are known, with more to be added following the identification of recent collections (see Appendix 17). The low diversity in marine macro-algae is due to the island's isolation from other land masses, unsuitable beach habitat, constant abrasion by waves, tides and small stones, and the extension of glaciers into the sea in many areas.

Evidence from microfossil records indicates that ferns and woody plants were present on Heard Island during the Tertiary (a period with a cool and moist climate)[56]. Neither group of plants is

present today, although potential Tertiary survivors include the vascular plant *Pringlea antiscorbutica* and six moss species[49,57].

The main environmental determinants of vegetation on subantarctic islands, including HIMI, are wind exposure, water availability, parent soil composition, salt spray exposure, nutrient availability, disturbance by trampling (from seabirds and seals) and possibly altitude[49]. At Heard Island, exposure to salt spray and the presence of breeding and moulting seabirds and seals are particularly strong influences on vegetation composition and structure in coastal areas.

Heard Island has a range of terrestrial environments in which vegetation occurs. Seven general vegetation communities are currently recognised, although vegetation composition is considered more of a continuum than discrete units[49,58]:

Open cushionfield vegetation is the most widespread and abundant vegetation type on Heard Island. It is characterised by *Azorella selago* cushions interspersed with bryophytes, small vascular species and bare ground with 20–75% cover, and found mainly at altitudes between 30–70 m asl.

Fellfield describes vegetation with abundant bare ground and less than 50% plant cover. Fellfield may occur as a result of harsh climatic and/or edaphic factors, or recent deglaciation which has exposed bare ground.

Mossy fellfield is a community with high species richness and consists of bryophytes and small *Azorella selago* cushions. It is found at altitudes between 30–150 m asl in areas with intermediate exposure.

Wet mixed herbfield occurs on moist substrate, mostly on moraines and moist lee slopes (often in association with burrowing petrels colonies) at low altitude (<40 m asl) where the water table is at or close to the surface. Species richness is highest here of all the communities, with dominant species being *Poa cookii, Azorella selago, Pringlea antiscorbutica, Acaena magellanica,* and *Deschampsia antarctica*.

Coastal biotic vegetation is dominated by *Poa cookii* and *Azorella selago*, and occurs mainly on coastal sites of moderate exposure and in areas subject to significant influence from seals and seabirds.

Saltspray vegetation is dominated by the salt-tolerant moss *Muelleriella crassifolia* and limited in extent, being found at 5 m asl on lavas in exposed coastal sites.

Closed cushionfield is found on moraines and sand at altitudes mostly below 60 m asl. Dominated almost entirely by *Azorella selago* cushions that often grow together to form continuous carpets and can be subject to some burrowing by seabirds.

Other vascular plant species and vegetation communities and species—found on other subantarctic islands north of the Antarctic Polar Frontal Zone—are missing from the Heard Island flora, although it is possible that some species may colonise the island if climate change produces more favourable conditions[58].

One of the most rapidly changing physical settings in the subantarctic has been produced on Heard Island by a combination of rapid glacial recession and climate warming. The consequent increase in habitat available for plant colonisation, plus the coalescing of previously discrete ice-free areas, has lead to marked changes in the vegetation of Heard Island in the last 20 years or so. Some plant species are spreading and modifying the structure and composition of communities, some of which are also increasing in distribution[49]. It is likely that further changes will occur, and possibly at an accelerated rate. Changes in population numbers of seal and seabird species are also expected to affect the vegetation by changing nutrient availability and disturbance through trampling.

At the time of preparing this Plan there is one plant species on Heard Island considered to be an alien, *Poa annua*, a cosmopolitan grass native to Europe. It is thought to have been naturally introduced, probably by skuas from Îles Kerguelen where it is widespread, because the grass was initially recorded in 1987 in two recently deglaciated areas of Heard Island not previously exposed to human visitation, while at the same time being absent from known sites of past human habitation[59]. Since 1987 *Poa annua* populations have increased markedly in density and abundance within the original areas and have expanded beyond these areas[49,60]. Expeditioner boot traffic during the Australian Antarctic program expedition in 1987 may be at least partially responsible for the spread of the grass beyond the initial two deglaciated areas but it is probably mainly due to dispersal by wind and the movement of seabirds and seals facilitating further spread around the island[60]. Genetic studies of the different populations on Heard Island are currently in progress and may provide insights into the origin and spread of the species on the island.

The potential for introducing additional plant species (including invasive species not previously found on subantarctic islands) by both natural and human-induced means is high[61]. This is due to the combination of low species diversity and climatic amelioration. During the 2003/04 summer a new plant species for Heard Island, currently identified as *Leptinella plumosa*, was recorded. Only one small specimen was found growing on a coastal river terrace that had experienced substantial development and expansion of vegetation over the past decade[62]. The species has a circumantarctic distribution and occurs on many subantarctic islands[63]. It will be of great interest to monitor its future distribution on Heard Island.

Wetlands

Heard Island has a number of small wetland sites scattered around its coastal perimeter, including areas of wetland vegetation, lagoons or lagoon complexes, rocky shores and sandy shores, including the Elephant Spit. (Further information about the wetland areas is given in Appendix 4, which includes a map at Attachment B). Many of these wetland areas are separated by active glaciers. There are also several short glacier-fed streams and glacial pools. Some wetland areas have been recorded on McDonald Island but, due to substantial volcanic activity since the last landing was made in 1980, their present extent is unknown.

The HIMI wetland is listed on the *Directory of Important Wetlands in Australia*[7] and, in a recent analysis of Commonwealth-managed wetlands, was ranked highest for nomination under the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention) as an internationally important wetland[3]. A draft of the Ramsar Information Sheet required for nomination of the wetland is included in Appendix 4.

Six wetland types have been identified from HIMI covering approximately 1860 ha: coastal ‘pool complex’ (237 ha); inland ‘pool complex’ (105 ha); vegetated seeps mostly on recent glaciated areas (18 ha); glacial lagoons (1103 ha); non-glacial lagoons (97ha); Elephant Spit (300 ha) plus some coastal areas (Scott 1999). On Heard Island, the majority of these types suites are found below 150 m asl[58]. The wetland vegetation occurs in the ‘wet mixed herbfield’ and ‘coastal biotic vegetation’ communities described above.

The wetlands provide important breeding and feeding habitat for a number of Antarctic and subantarctic wetland animals. These include the southern elephant seal and macaroni, gentoo, king and southern rockhopper penguins, considered to be wetland species under the Ramsar Convention. Non-wetland vegetated parts of the islands also support penguin and other seabird colonies.

Terrestrial, Freshwater and Coastal Invertebrates

Heard Island supports a relatively low number of terrestrial invertebrate species compared to other Southern Ocean islands, in parallel with the low species richness in the flora—that is, the island’s isolation and limited ice-free area[64]. Endemism is also generally low and the invertebrate fauna is

exceptionally pristine with few, if any, (successful) human-induced introductions of alien species[24]. Two species, including the thrip *Apterothrips apteris* and the mite *Tyrophagus putrescentiae* are thought to be recent, possibly natural, introductions[64]. An exotic species of earthworm *Dendrodrilus rubidus* was also collected in 1929 from a dump near Atlas Cove[65], and has recently been collected from a variety of habitats including wallows, streams and lakes on Heard Island[26]. A list of the terrestrial invertebrates presently known from Heard Island is given in Appendix 18.

The arthropods of Heard Island are comparatively well known with 54 species of mite and tick, one spider and eight springtails recorded. A study over summer at Atlas Cove in 1987/88 showed overall densities of up to 60 000 individual springtails per square metre in soil under stands of *Pringlea antiscorbutica*. Despite a few recent surveys, the non-arthropod invertebrate fauna of Heard Island remain poorly known[64].

Beetles and flies dominate Heard Island's known insect fauna, which comprises up to 21 species of ectoparasite (associated with birds and seals) and up to 13 free-living species. Approximately half of the free-living insects are habitat-specific, while the remainder are generalists found in a variety of habitats, being associated with either supralittoral or intertidal zones, *Poa cookii* and *Pringlea antiscorbutica* stands, bryophytes, lichen-covered rocks, exposed rock faces or the underside of rocks[64]. There is a pronounced seasonality to the insect fauna, with densities in winter months dropping to a small percentage (between 0.7–5%) of the summer maximum[66]. Distinct differences in relative abundances of species between habitats has also been shown, including a negative relationship between altitude and body size for Heard Island weevils[64].

The fauna of the freshwater pools, lakes, streams and mires found in the coastal areas of Heard Island are broadly similar to those on other subantarctic islands of the southern Indian Ocean. Many species reported from Heard Island are found elsewhere. Some sampling of freshwater fauna has been undertaken during recent expeditions and records to date indicate that the freshwater fauna includes a species of Protista, a gastrotrich, two species of tardigrade, at least four species of nematode, 26 species of rotifer, six species of annelid and 14 species of arthropod[67].

As with the other shore biota, the marine macro-invertebrate fauna of Heard Island is similar in composition and local distribution to other subantarctic islands[68], although relatively little is known about the Heard Island communities compared with the well-studied fauna of some other locations in the subantarctic region, such as Macquarie Island and Îles Kerguelen.

Despite Heard Island's isolation, species richness is considered to be moderate, rather than depauperate, although the number of endemic species reported is low[69]. The large macro-alga *Durvillaea antarctica* supports a diverse array of invertebrate taxa[70] and may play an important role in transporting some of this fauna to Heard Island[69].

The rocky shores of Heard Island exhibit a clear demarcation between fauna of the lower kelp holdfast zone and the upper shore zone community, probably due to effects of desiccation, predation and freezing in the higher areas. The limpet *Nacella kerguelensis* is abundant in the lower part of the shore, being found on rock surfaces and on kelp holdfasts. Other common but less abundant species in this habitat include the chiton *Hemiarthrum setulosum* and the starfish *Anasterias mawsoni*. The amphipod *Hyale* sp. and the isopod *Cassidinopsis* sp. are closely associated with the kelp. Above the kelp holdfast zone, the littornid *Laevilitorina (Corneolitorina) heardensis* and the bivalve mollusc *Kidderia bicolor* are found in well-sheltered situations, and another bivalve *Gaimardia trapesina trapesina* has been recorded from immediately above the holdfast zone. Oligochaetes are also abundant in areas supporting porous and spongy layers of algal mat[71,72].

Birds

Heard Island and the McDonald Islands are free from introduced predators and provide crucial breeding habitat in the middle of the vast Southern Ocean for a range of birds (see Figure 7 and

Appendix 19, which gives scientific names for the species mentioned below). The surrounding waters are important feeding areas for birds and some scavenging species also derive sustenance from their co-habitants on the islands.

Nineteen species of birds have been recorded as breeding on Heard Island and the McDonald Islands[73], although recent volcanic activity at the McDonald Islands in the last decade is likely to have reduced vegetated and un-vegetated nesting areas[74]. Current estimates of breeding populations, population trends and approximate breeding schedules are given in Appendix 19.

Penguins are by far the most abundant birds on the islands, with four breeding species present, comprising king, gentoo, macaroni and rockhopper penguins. The penguins mostly colonise the coastal tussock and grasslands of Heard Island, and have previously been recorded as occupying the flats and gullies on McDonald Island.

Other seabirds recorded as breeding at Heard Island include three species of albatross (wandering, black-browed and light-mantled sooty), southern giant petrels, cape petrels, four species of burrowing petrels (Antarctic and fulmar prions, common and South Georgian diving petrels), Wilson's storm petrels, kelp gulls, subantarctic skuas, Antarctic terns and the Heard Island cormorant [74]. Although not a true seabird, the Heard Island sheathbill also breeds on the island. Both the cormorant and the sheathbill are endemic to Heard Island.

A further 28 seabird species are recorded as non-breeding visitors or from at-sea surveys[74]. Appendix 2 lists the non-breeding species, and indicates the conservation status of each breeding and non-breeding species listed under the EPBC Act. Figure 7 indicates the locations of recorded nesting sites and colonies.

All recorded breeding species, other than the Heard Island sheathbill, are listed marine species under the EPBC Act, four are listed threatened species (endangered—southern giant petrel; vulnerable—wandering albatross, Heard Island cormorant and Antarctic tern), and five are listed migratory species (wandering albatross, black-browed albatross, light-mantled sooty albatross, southern giant petrel and Wilson's storm petrel).

Under the EPBC Act a recovery plan has been made for albatrosses and giant petrels, which calls for ongoing population monitoring of the species found at HIMI, and at the time of preparing this Plan a draft recovery plan has also been made for the Heard Island cormorant and Antarctic tern.

The recorded populations of some seabird species found in the Reserve have shown marked change. The king penguin population is the best studied seabird species on Heard Island and has shown a dramatic increase since first recorded in 1947/48, with the population doubling every five years or so for more than 50 years[74]. A paper reviewing population data for black-browed albatrosses between 1947 and 2000/01 suggested that the breeding population had increased to approximately three times that present in the late 1940s[75], although a CCAMLR Working Group was cautious about the interpretation of the increasing trend given the disparate nature of the data[76], as discussed in the paper. The discovery of a large, previously unknown, colony of Heard Island cormorants in 2000/01 at Cape Pillar raised the known breeding population from approximately 200 pairs to in excess of 1000 pairs[74]. On the other hand, the breeding population of southern giant petrels decreased by more than 50% between the early 1950s and the late 1980s.

Research undertaken in 2003/04 into the feeding habits and foraging range of several bird species, using satellite trackers, data loggers and close to real-time sampling of prey species will contribute to the further understanding of the Heard Island food web and to the sustainable management of the commercial fishery adjacent to the Reserve.

Seals

There are three breeding species of seal at HIMI, the Antarctic *Arctocephalus gazella* and subantarctic *A. tropicalis* fur seals and the southern elephant seal *Mirounga leonina*. Four other

species of Southern Ocean seal have been recorded from Heard Island: Ross *Ommatophoca rossii*, crabeater *Lobodon carcinophagus*, leopard *Hydrurga leptonyx* and Weddell *Leptonychotes weddellii* seals. Each of these seal species is a listed marine species under the EPBC Act, and the southern elephant seal and subantarctic fur seal, for which a recovery plan has been made, are listed as threatened species (vulnerable) (see Appendix 2).

The breeding population of Antarctic fur seals at Heard Island has increased dramatically[77]. The most recent survey in 2000/01recorded a fourfold increase since 1987/88[77]. The non-breeding population, which is made up of immigrants from Îles Kerguelen and South Atlantic Ocean populations[78], far exceeds the breeding population with the total island population exceeding 29 000 individuals[77]. The predominant item in their diet is fish, primarily pelagic myctophids, with mackerel icefish *Champsocephalus gunnari* also being taken in high numbers[79]. Studies undertaken in 1992/93 indicated that female fur seals forage to the north-east of Heard Island, whereas males ranged around the shelf and forage in deep water south of Heard Island. The extent of competition, if any, between seals and commercial fishing operations in the region is presently undetermined due to the absence of long-term data. It is expected that recent research will define food web linkages of fur seals, and other important foragers and help ensure that fisheries in the region are ecologically sustainable.

Southern elephant seals are the largest seals in the world; males can weigh 4000 kg while females may reach 900 kg, and their life expectancy may exceed 20 years[80]. They are by far the most abundant seal on Heard Island, coming ashore to breed and moult. Extensive sealing at Heard Island greatly reduced the population during the 19th century. The breeding population at Heard Island has decreased, with a birth rate in 1985 40% below that of 1948[1]. Breeding occurs through the spring, with pups born in September and October. The diet of southern elephant seals at Heard Island is predominantly fish and squid, with adult females mainly foraging along the south-east edge of the Kerguelen Plateau in summer and close to the Antarctic continental shelf in winter[81-83], adult males foraging closer to the Antarctic continental shelf in winter[84] and juveniles spending most time on or at the edge of the Kerguelen Plateau[81]. Resightings of individuals marked at Heard Island have been made from as far away as Australia's Casey station, over 3000 km away.

Subantarctic fur seals are an uncommon species at HIMI[77,85], as are Weddell, crabeater and Ross seals[80].

Leopard seals are the most commonly occurring, non-breeding seal species visiting Heard Island, which serves as a major wintering area for the species[86]. Haul-out locations vary depending on weather conditions, but the preferred sites are Corinthian Bay, Atlas Cove, South West Bay and West Bay[87]. It has been suggested that leopard seals may be seen in greater numbers at Heard Island than anywhere else in the world[86]. It is possible that climatic changes mean that fewer leopards seals now visit in winter, as may the other vagrants[88].

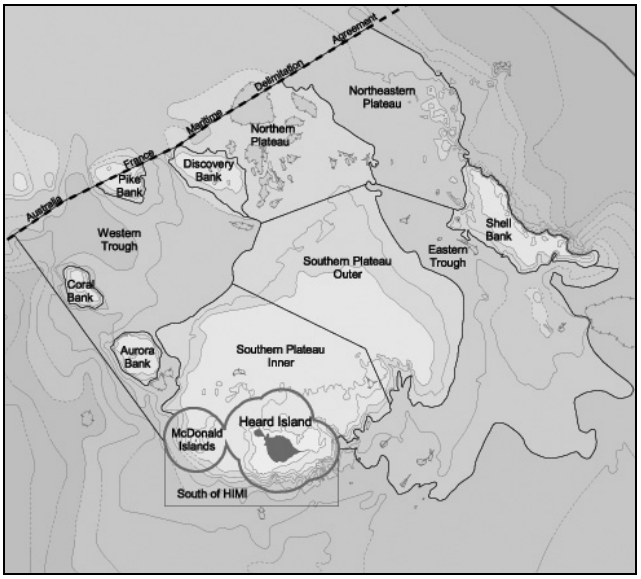
Marine Environment

Heard Island and the McDonald Islands are surface exposures of the surrounding submarine Kerguelen Plateau, the largest oceanic plateau in the world. The confluence of major east-moving oceanographic currents in the region, as well as small-scale upwelling, eddies and gyres caused by varied submarine topography, appear to create a variety of benthic and pelagic habitats[1].

Samples taken in the HIMI region, as part of the global Ocean Drilling Program, indicate that primary surface sediments in the region comprise siliceous diatom mud or ooze, with some areas containing quantities of calcareous sediments and foraminifera[89]. Qualitative analysis of benthic invertebrates taken as by-catch during benthic trawls in the region indicated that a range of species are present, with echinoderm species being the most prevalent[1], including seven species that are possibly endemic to the Heard Island region.

An analysis by Meyer et al. (2000) of the available information about benthic assemblages, substratum and the physical characteristics of the marine environment surrounding HIMI indicates that the areas of the EEZ shallower than 1000 m can be potentially divided into 13 different biophysical local units[1] (see Figure 10). Of these biophysical units, nine are represented in the marine areas within the Reserve (see Appendix 20).

Figure 10. Biophysical local units around HIMI



(adapted from Meyer et al. 2000[1])

The marine areas can be more broadly classified into five as the western, central, southern and north-eastern areas, plus the territorial sea. Collectively these areas contain:

- unique features of the benthic environment surrounding HIMI;
- representative portions of the different habitat types in the region; and
- the pelagic area where land-based marine predators concentrate their local foraging activities.

The territorial sea supports nearshore marine species and is a foraging area for many flying birds based on the islands. The southern area is likely to be highly productive, with a diverse range of benthic assemblages in depths of 500–1000 m. The western area, including Coral Bank, displays diverse assemblages of benthic invertebrates, particularly gorgonian corals and barnacles. The central area, including Discovery Bank and portions of the northern and southern plateaux, is habitat for long-lived glass and other erect sponges, and a nursery area for commercial fish species. In the north-eastern area, Shell Bank supports a separate stock of mackerel icefish, small aggregations of a variety of other fish species, a diverse echinoderm assemblage and a unique shell-grit habitat different from the surface sediments found elsewhere in the region. This north-eastern area, including areas of the north-eastern plateau, is also an important foraging area for land-based marine predators in the HIMI region. A summary of the physical and biological characteristics of the individual biophysical units is given in Appendix 20.

Oceanography

The remote location of the Reserve has made oceanographic study difficult and infrequent, although three comprehensive physical surveys were carried out in conjunction with marine biology in the region during the 1990s[1].

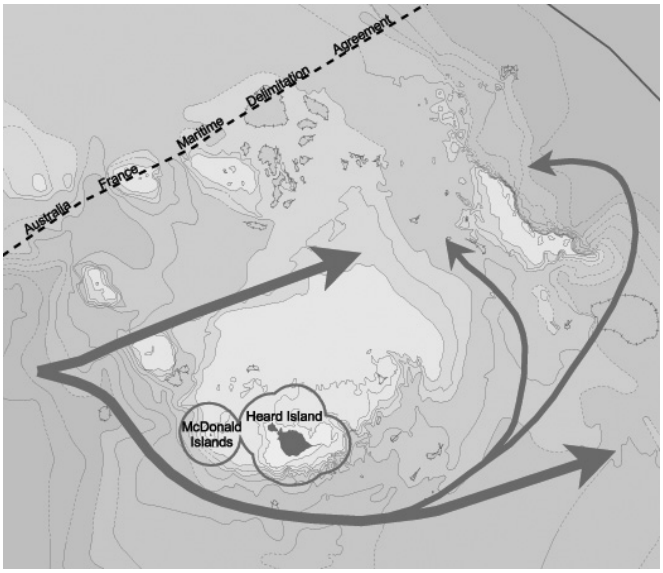
The Kerguelen Plateau is surrounded by deep ocean basins. To the north-west is the Crozet Basin, to the north-east is the Australian-Antarctic Basin, to the east is the Labuan Basin, to the south is the 3500 m deep Princess Elizabeth Trough, and to the south-west is the Enderby Basin[89]. The

northern and central parts of the Kerguelen Plateau have shallow water depths (<1000 m) and contain a major sedimentary basin (the Kerguelen–Heard Basin). The southern plateau is characterised by deep water, from 1500 to 2500 m[89].

The Kerguelen Plateau is a major topographic barrier to the easterly flow of the deep-reaching waters of the Antarctic Circumpolar Current (ACC). The ACC links all the major oceans and is driven by the world's strongest westerly winds, found between about 45ºS and 55ºS[90].

Most of the ACC is thought to be deflected in a north-easterly direction and to travel over the shallow section of the plateau, north of Îles Kerguelen[91]. The ACC then travels down the eastern side of the plateau[91], where a relatively warm inflow of bottom water occurs between the Plateau and the mid-ocean ridge[92]. In the Heard Island region, most water is thought to flow in an easterly direction both to the north and south of the island, although there is a stream of water that moves in a north-westerly direction through the trough between the relatively shallow central plateau and west of Shell Bank. Water is also known to eddy around the east of Shell Bank in an anticlockwise direction (see Figure 11).

Figure 11. Surface currents in the HIMI region



(adapted from Meyer et al. 2000[1])

Several frontal systems exist in the southern Indian Ocean, identified by sharp boundaries of temperature, salinity and density between different water masses, especially in the upper few hundred metres. The most important front in the HIMI region is the Antarctic Polar Front, which is typically defined as the northern limit of a temperature minimum of 2ºC at the 100 to 300 m depth range[93-95]. The Polar Front is oriented in a north, north-easterly direction as it passes around the south of Îles Kerguelen up to latitude 48ºS. From there it curves in a south-easterly direction back down to about 50ºS. Directly north of Heard Island it is estimated to be between 48ºS and 49ºS[93].

The most biologically productive area of the HIMI EEZ is the 200–500 m deep undulating plateau that lies mostly to the north and east of Heard Island[96]. This area comprises the most important foraging areas for land-based marine predators in the HIMI region[1].

Fish

There have been no systematic studies of the fish fauna surrounding HIMI and the current state of knowledge is based on sporadic records, incidental catches and beach-washed specimens[97]. However, the nearshore fish community (within 12 nautical miles of the coast) around HIMI is known to be similar to those at other subantarctic islands, with the families Nototheniidae

(Antarctic cods) and Channichthyidae (icefishes) dominating in numbers of species and in abundance[97,98]. The list of species recorded from the nearshore waters is given in Appendix 21.

In general, the fish fauna is distributed widely across the plateau around HIMI, with noticeable variation from shallow to deep water, and between Shell Bank in the east and the remainder of the banks and plateau areas[1]. It is believed that the Kerguelen–Heard region is a single unit with regard to the fish, and four species are endemic to the region (*Lepidonotothen mizops, Gobionotothen acuta, Notothenia cyanobrancha,* and *Channichthys rhinoceratus*)[99].

Most of the inshore species also occur on the wider Heard Island Plateau[100] although, as would be expected, the number of inshore species is lower than on the plateau. Two species, *N. cyanobrancha* and *Paranototheni magellanica,* have been found only in the inshore waters, as with other subantarctic islands[97]. The inshore species can be divided into five groups according to their use of the area:

- species that are restricted to close inshore waters of depths less than about 30 m for their entire life, e.g. *N. cyanobrancha, P. magellanica, Harpagifer spinosus;*
- species that spend their juvenile stages close inshore but are widespread on the plateau as adults (*Notothenia rossii*);
- species where a part of the adult population inhabits the close inshore area while the remainder of the population inhabits deeper water, both within and outside the territorial sea (*C. rhinoceratus* and *Notothenia coriiceps*);
- species that are widespread on the Heard Island Plateau in depths of 100–500 m including equivalent parts of the territorial sea (*Bathyraja* spp., *Muraenolepis orangiensis, Zanclorhynchus spinifer, Dissostichus eleginoides* juveniles, *G. acuta,* and *Champsocephalus gunnari*); and
- vagrants from the mesopelagic zone in deep water at the margins of the plateau (*Krefftichthys anderssoni, Paradiplospinus gracilis*).

In the deeper waters on the marginal slope and beyond of the Kerguelen Plateau (greater than 500m deep), the dominant species or groups are the toothfish, macrourids and skates. Beyond the plateau in the oceanic waters pelagic groups such as the myctophids dominate the fish fauna.

Australian commercial fishers have operated in the HIMI AFZ since 1997 and have targeted Patagonian toothfish (*Dissostichus eleginoides*) and mackerel icefish (*Champsocephalus gunnari*). Prior to the commencement of the Australian commercial fishery the only recorded fishing activity in the HIMI region is some exploratory Polish fishing in 1975 and the Soviet catch of mackerel icefish in the early 1970s[100], each occurring prior to the establishment of the AFZ and the entry into force of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). In recent years, Patagonian toothfish has also been poached by illegal fishers in areas of the AFZ, mainly to the east and north of HIMI.

Cetaceans

Cetacean records for the HIMI region are sparse due to lack of survey effort, but the waters around HIMI and the Kerguelen Plateau are recognised in *The Action Plan for Australian Cetaceans* as offshore locations of high productivity and importance for cetaceans[16]. The remains of seven species of cetacean have been found washed ashore at Heard Island, including skulls of pilot whales *Globicephala melaena,* strap-toothed beaked whales *Mesoplodon layardi,* spectacled porpoises *Phocaena dioptirca,* Minke whales *Balaenoptera acutorostrata,* hourglass dolphins *Lagenorhynchus cruciger,* and southern bottlenose whales *Hyperoodon planifrons*[80]—an adult female of this species was also found stranded on Heard Island[101]. Shaugnessy (2000) records sperm whale bones and two dolphin heads found on Heard Island in 1929[102].

Species observed at sea in the HIMI or Kerguelen Plateau region include the blue whale *Balaenoptera musculus* and fin whale *Balaenoptera physalus*[102,103], killer whale *Orcinus orca*[16,80,103], hourglass dolphin[16,103,104], strap-toothed beaked whale[16], spectacled porpoise[16,103], humpback whale *Megaptera novaeangliae*[103,105], sperm whale *Physeter macrocephalus*, Minke whale[103,105], long-finned pilot whale *Globicephala melas*[16,103], southern bottlenose whale[103], Commerson's dolphin *Cephalorhynchus commersoni*, dusky dolphin *Lagenorhynchus obscurus*, Arnoux's beaked whale *Berardius arnouxii* and southern right whale *Balaena australis*[103]. As with all areas of the Australian EEZ, the HIMI EEZ forms part of the Australian Whale Sanctuary established under the EPBC Act. It is an offence to kill, injure, take, trade, keep, move, interfere with or treat a cetacean within the Australian Whale Sanctuary, except under certain circumstances. Each of the above species is a listed cetacean under the EPBC Act and several are listed as threatened and/or migratory species (see Appendix 2). Under the EPBC Act recovery plans are in preparation for several cetacean species recorded in the HIMI region, including blue, fin, humpback and southern right whales.

Cultural attributes

Sealing Sites

Evidence of sealing activities on Heard Island is still present at several coastal sites (see Figure 7). These sealing sites comprise stone platforms, hut footings or ruins, occupied caves, barrels, and graves[106]. Stone platforms, comprised of large beach cobbles formed into subcircular mounds raised above the general level of surrounding seal wallows, and used as platforms for working activities, are recorded from Long Beach, Spit Bay North, Try Pot Beach and Lavett Bluff. The ruins of a variety of huts used for domestic and/or industrial purposes, and built from a range of materials, are found on virtually all the sealing beaches. These huts sites—one of which is located in the shelter of an overhang, and two others are located in small lava-cave sites at Red Island and Long Beach—show evidence of occupation. Barrels and barrel pieces are widespread across the beaches, and two barrel caches are known from Oil Barrel Point and Red Island.

The significance of these sealing sites, which are relatively rare and almost untouched by human agency since their use, is recognised in HIMI's listing on the Register of the National Estate.

Shipwrecks

Over 100 visits to Heard Island by over 40 whaling ships and other vessels are known to have occurred in the sealing period[107]. Ships rarely planned to anchor at the island for any length of time, generally only making brief visits to deploy and retrieve seal gangs who would work the beaches while the ship returned to Îles Kerguelen or went whaling[106]. Of those ships at least 14 are recorded as having been lost and some of these were wrecked or lost at the island during the mid-late 19th century[107], including the *Mary Powell*, thought to have been driven into ice cliffs at Brown Glacier in 1858/59[108], and the *Trinity*, which was wrecked at Spit Bay in October 1880 leaving its crew stranded on the island until January 1882[109,110]. No specific locations of wrecked ships are known but shipwreck material has been recorded at Walrus Beach, Skua Beach and along the northern beach at Spit Bay[106]. These remains and any others from shipwrecks over years 75 old are automatically classified as historic shipwrecks under the *Historic Shipwrecks Act 1976*.

Atlas Cove ANARE Station

Remains of Australian National Antarctic Research Expeditions (ANARE) from 1947–1955, and expeditions by other countries including the UK, USA and France, are present at Atlas Cove. The ANARE station at Atlas Cove was the first permanent ANARE base established in the Southern Ocean, and was continually occupied by between 10 and 15 people each year between 11 December

1947 and 9 March 1955. The station, which consisted of a variety of huts and facilities, supported research in the fields of geology, geophysics, meteorology, upper atmospheric physics and biology. Along with the Macquarie Island station, Atlas Cove provided opportunities to test structures and operations in high southern latitudes, which lead to the successful establishment of Mawson station, the first permanent Australian station on the Antarctic mainland, in 1954.

In 2000/01 several parts of the Atlas Cove station were removed as they were in an advanced state of decay and were both an environmental and safety hazard. Aside from building foundations, machinery and scattered artefacts, there is only one building that remains standing and largely intact; the 1950 ANARE recreation hut. Adjacent to the station site, within the vegetated area of Azorella Peninsula, there is a cross that commemorates the deaths in 1952 of two ANARE personnel, Richard Hoseason and Alistair Forbes. Some apparatus used for collecting water for the station remains in the moraine adjacent to the Baudissin Glacier, which is now several hundred metres from the glacier itself. Remains of other structures used during the ANARE period, including the Absolute Magnetic Hut and Magnetograph Hut on the western edge of The Nullarbor at 'Windy City', and the Seismic Hut several hundred metres north-east of the Station Area, are also present. These remnants collectively provide a clear 'footprint' of the original station and are recognised for their historical significance and importance in the study of the colonisation of the subantarctic by humans in HIMI's listing on the Register of the National Estate (see Appendix 5).

Scientific Values

The subantarctic zone in general is a region of immense importance to a full understanding of how the Antarctic system exerts its effects on the rest of the planet. It is a region where the nutrient-rich Antarctic waters meet the nutrient-impoverished sub-Tropical waters and where there is significant transport of nutrients carried by the Antarctic Circumpolar Current (ACC). It is one of the regions where, both in the sea and on land, the consequences of atmospheric warming can be clearly seen. The Reserve constitutes a uniquely appropriate location for conducting of scientific research into global warming, environmental change and its consequences, due to a combination of the islands' position south of the Antarctic Polar Frontal Zone (APFZ), the presence of permanent ice caps and retreating glaciers, the simple vascular flora, and vegetation communities free from confounding influences of introduced herbivores. The terrestrial fauna of the islands is a sensitive indicator of marine change and is of significance with respect to Australia's sustainable management of the HIMI fishery.

The key drivers for scientific work in the Reserve can be broadly classified as:

Management: Science assists the achievement of management objectives for the Reserve, including meeting requirements under legislation and national and international agreements.

Location: The Reserve is located in an isolated and unique geographical location of the subantarctic, south of the APFZ and in the flow of the ACC.

Content: The Reserve contains unusual, unique and highly dynamic features, physical and biological systems and natural processes.

Condition: The Reserve shows very little evidence of anthropogenic influence and consequently displays features, physical and biological systems and natural processes in a relatively undisturbed condition.

Of these drivers, the latter three promote the conduct of scientific research in the HIMI region that cannot adequately be undertaken elsewhere. Examples of the key scientific values of the region, arising from these drivers, are given in Table 2.

Table 2. Key scientific values and drivers for research in the HIMI region

Key Scientific Value	Driver(s)
The natural, undisturbed communities of the HIMI region are excellent indicators of environmental change and impacts of environmental change.	**Condition** (undisturbed terrestrial and marine ecosystems)
Heard Island provides a unique opportunity to measure the rate of glacial retreat, as an indicator of climate change.	**Location** (south of the APFZ) **Content** (presence of permanent glaciers)
The islands are still forming, giving a unique opportunity to gain an understanding of island and plateau formation.	**Content** (presence of exposed geological features and processes)
Heard Island provides opportunities to obtain records of past climate from a temperate latitude.	**Location** (subantarctic, south of APFZ) **Content** (glacial ice, peat/sediment records)
The islands are an appropriate site for studying the development of marine plateaux.	**Content** (surface exposure of Kerguelen plateau)
Big Ben provides unique opportunities for studying deep-earth magmatic processes.	**Content** (presence of volcano and active vulcanism)
As an ecosystem so far largely unaffected by human impact, Heard Island is a unique site for measuring physical processes and addressing fundamental biological problems, testing ecological theory and assessing and modelling the dynamics of environmental change and associated biological responses.	**Location** (in flow of ACC) **Content** (unique, unusual and dynamic processes, biologically and trophically simple ecosystems) **Condition** (little-disturbed ecosystems processes)
The HIMI region is one where effects of climate change on the marine environment can be clearly seen.	**Location** (in the Sub-Antarctic zone, where much oceanic thermal exchange takes place)
The islands provide a significant site for understanding how, and from where, colonisation of recently exposed land occurs in areas undisturbed by human activities. Low species numbers provide an opportunity to investigate their interactions with relatively reduced complexity.	**Content** (recently deglaciated land, new land from active vulcanism) **Condition** (undisturbed ecosystems)
Heard Island is a critical site for recording biotas along an Antarctic terrestrial transect, This provides a means to identify and monitor the effects of climate change in the region.	**Location** (isolated location, subantarctic, south of AFPZ) **Content** (biologically and trophically simple terrestrial ecosystems, rapid climate warming) **Condition** (relatively pristine biota)
Possibilities for direct examination and understanding of the early geological history and geological evolution of this region of the Southern Ocean.	**Location** (subantarctic, Kerguelen Plateau) **Content** (exposed stratified rocks and geological formations)
The Reserve provides a scientific reference area for the study of ecosystem function within the HIMI region.	**Location** (HIMI region) **Condition** (undisturbed marine ecosystems)
Heard Island is one of few stable platforms in the Southern Ocean for the establishment of observatories (geophysics, meteorology).	**Location** (Southern Ocean) **Content** (terrestrial areas)

Table 1 in section 6.5 indicates the research and monitoring activities that are proposed to be pursued to meet Reserve management requirements and obligations, and elaborates on their management drivers.

Uses of the Reserve

Due to its isolation and persistently severe weather and sea conditions, human use of the Reserve has been, and remains, limited. Since the first landing on Heard Island in 1855, there have been only approximately 240 shore-based visits to the island, initially for the purposes of wildlife resource exploitation and then for research, management, tourism, recreation and surveillance purposes. There have been only two known landings on McDonald Island. Terrestrial and marine research, as part of the Australian Antarctic science program, is currently the main human use of the Reserve, and Australian commercial fishing in the adjacent HIMI fishery is the most frequent activity in the region.

Scientific Research, Monitoring and Reserve Management

Although hindered by the extreme isolation and unfavourable working conditions, scientific studies have been carried out on Heard Island since 1874, when scientists from *HMS Challenger* made geological and botanical collections during a three hour visit to Corinthian Bay[111]. The first substantial information about the island's geology, flora and fauna was collected during a one day visit by the German South Polar Expedition led by Baron E. von Drygalski on board the *Gauss* in 1902. Visits in 1929 by Aubert de la Rue and Mawson, who led the BANZARE group bound for Antarctica, were the only other scientific visits prior to the establishment of the ANARE station in 1947. The period of occupation from 1947–1954 marked the beginning of sporadic but ongoing expeditions by the Australian Antarctic program, which continue to the present day.

Following the Australian occupation of the ANARE Station at Atlas Cove from 1947–1955, scientists from France and the U.S.A. made regular visits to Heard Island between 1968 and 1971. Only occasional visits were then made until the mid 1980s, when interest again increased. The AAD has undertaken approximately 33 visits to the HIMI region to conduct science in the terrestrial and marine areas and to conduct environmental management activities, such as the removal of waste material from the Atlas Cove area. Research has involved a broad range of terrestrial and marine science disciplines, including geology, geomorphology, vulcanology, meteorology, terrestrial and marine ecology, glaciology, oceanography and cultural heritage study.

Recent scientific programs at Heard Island have focussed on understanding the effects of climate change on the biodiversity and function of terrestrial and lake ecosystems; studying the glacial systems of Heard Island as an indicator of climate change and variability; monitoring long-term trends in seabird populations; and examining the interactions between key land-based marine predators and their interactions with prey, the ocean and benthic environment and commercial fisheries.

Recent Australian Antarctic program expeditions to Heard Island have generally been multi-disciplinary research programs, with shore parties of mostly scientists, with logistical support crew, field training officers and a doctor. They usually split into project-specific groups, accommodated in huts or tents at Spit Bay, Atlas Cove and other minor camps distributed across the island. Some programs have needed wide-ranging working and living sites.

Research expeditions generally involve stays on the island of a few weeks or months with consequent deployment and retrieval of a large quantity of equipment—including huts, building materials, stores and scientific equipment—making such visits very different from the very short duration (usually only hours) visits by tourists or fisheries patrols. Power is supplied by small diesel generators, solar cells and wind generators. Wastes are stored for return to Australia, incinerated (where combustible and non-toxic) or, in the case of human wastes and washing water, disposed of into the ocean.

Extensive marine biological and oceanographic research has also been conducted in the HIMI EEZ since 1990. The AAD coordinates scientific research programs in the HIMI region that address sustainable use of resources and ecosystem dynamics and that contribute directly to management measures developed under CCAMLR. Ship-based marine science research is undertaken on an irregular basis and has included fish stock assessment surveys and studies of the foraging activity of land-based predators. Commercial operators in the HIMI fishery are required, as a condition of their authorisation to fish, to contribute vessel time and services to facilitate an annual fisheries research program in the HIMI region.

The Australian Antarctic science program is seeking to increase its subantarctic research in the HIMI region to reflect the increasing interest in and importance of the region from a scientific and marine resources perspective. Current intentions are for the AAD to support Australian Antarctic program summer visits to the region approximately every three years over the next decade. These

visits would provide opportunities to undertake research, monitoring, and any required on-site management activities. These visits would also provide opportunities to implement a strategic monitoring approach for the Commonwealth subantarctic marine protected areas (the Reserve and the Macquarie Island Marine Park) which is currently under development.

Private Expeditions

The wildlife, vegetation, cultural heritage, spectacular landscape and remoteness of HIMI are major attractions for private recreational and tourist visits. However, due to the large distance from major ports, the persistently rough seas and associated uncertainties in landing or conducting activities upon arrival, there have been few privately-organised visits to the islands since the cessation of sealing and whaling activities in the early 1900s. Landings and activities during each of these private visits have focused on Heard Island.

A small number of private yachts and commercial tourist vessels have visited Heard Island, although few successful landings have been made due to poor weather. Other private expeditions include brief visits by ham radio enthusiasts, private scientific groups and mountaineering parties. Successful ascents of Big Ben have been made on three occasions: by members of the Southern Indian Ocean Expedition in 1965, by members of the *Anaconda* expedition in 1983 and by members of the Australian Army Alpine Association in 1999/2000.

Although the number of private visits per decade to the HIMI region shows little or no sign of increasing in the foreseeable future, tourism to the Antarctic, particularly the Peninsula area, has been growing steadily since the early 1990s, with many voyages including visits to several subantarctic or Antarctic sites[27]. Future increases in recreational and tourism activities, if any, could be expected to be concentrated ashore at Heard Island and within the territorial sea.

Surveillance Activities

Surveillance patrols in the HIMI region are by civilian and Australian Defence Force vessels and are principally aimed at enforcing fisheries legislation and detecting and deterring illegal foreign fishing activities within the HIMI AFZ. These patrols also provide opportunities for the surveillance of other illegal activities in the Reserve. Details of the frequency and duration of these patrols and the areas visited are confidential. However, surveillance patrols cover the waters of the Reserve, making landings at Heard Island to check for evidence of illegal activities and to undertake limited, opportunistic management tasks.

A treaty signed by Australia and France in 2003 also provides for cooperative surveillance activities in the adjacent EEZs surrounding HIMI and Îles Kerguelen (see section 2.8 International Agreements). Under that treaty it is possible that French vessels may undertake surveillance patrols in the HIMI EEZ, including within the Reserve.

Shipping

The HIMI region is remote from any major population centres and conventional shipping routes but does receive visits from vessels involved in scientific research, fishing, fisheries surveillance and occasionally from tourist and other private vessels. The ports from which these vessels have departed in recent years include Hobart, Fremantle, Albany, Esperance, Port Louis (Mauritius), Durban (South Africa), several ports in New Zealand and a variety of locations in Antarctica. Consideration needs to be given to the potential impacts of such traffic, particularly if it increases in the future.

Refuge/Shelter

Seas in the HIMI region are normally rough, and occasionally become sufficiently severe that vessels in the area seek a place of refuge in the lee of Heard Island. Such vessels would normally

contact the AAD or Australian Search and Rescue (AusSAR). The AAD generally maintains one or two refuges on Heard Island which are equipped with basic provisions but because their presence and ability to be maintained varies with AAD's operational requirements they should not be relied upon for shelter.

Fisheries

Due to its remoteness and lack of permanent population, there is no indigenous or recreational fishing activity in the HIMI region. Australian commercial fishing within the HIMI EEZ occurs outside a 1 nm buffer around the 12 nm territorial sea and began in April 1997. It targets mackerel icefish *Champsocephalus gunnari* and Patagonian toothfish *Dissostichus eleginoides*. Fishing is concentrated in a few main locations and fishing vessels may cross the Reserve to reach fishing grounds. Consistent with the Reserve being assigned to the IUCN category strict nature reserve, commercial and recreational fishing in the Reserve is prohibited.

The HIMI fishery falls within the area of application of CCAMLR, statistical division 58.5.2. It is managed under the provisions of the *Fisheries Management Act 1991* and the *Heard Island and McDonald Islands Fishery Management Plan 2002* by the Australian Fisheries Management Authority (AFMA) in a manner that complies with or exceeds the standards required by the CAMLR Commission. Management provisions for fishing in the region include precautionary catch limits for both target and bycatch species, that take account of predator-prey relationships; independent scientific observers on all voyages; collection and analysis of a wide range of catch data and samples; restrictions to minimise non-target species interactions, and ongoing research on the ecological sustainability of targeted and bycatch fish stocks.

The Australian Fisheries Management Authority, in consultation with AAD and fishing industry representatives, maintains a rolling five year Strategic Research Plan for the HIMI fishery, which also contributes information to understanding the environmental impacts of fishing in the HIMI region. Holders of Statutory Fishing Rights in the fishery contribute resources to, and assist in the conduct of, an annual fisheries research program to assess the status of fish stocks and other issues related to the presence of a commercial fishery, as stipulated in the management plan for the fishery. Some of this research is undertaken in areas within the Reserve under strict permit conditions. This research typically includes an annual survey designed to obtain reliable estimates of recruitment for each target species and other work to assist in monitoring of the potential impacts of the fishery on non-target species and the ecosystems of the HIMI region.

Illegal Fishing

Illegal foreign fishing is considered not to target the Reserve and to occur in the same locations as the legal fishing. Such fishing therefore primarily threatens the fish targeted by the licensed fishery. Australia is committed to combating illegal fishing in the EEZ around HIMI, and the region is the focus of growing national and international efforts to combat illegal fishing. A voluntary *International Plan of Action for Illegal, Unreported and Unregulated (IUU) Fishing* has been developed through the Food and Agriculture Organisation of the United Nations, within the framework of the Code of Conduct for Responsible Fisheries, and further measures may be adopted by CCAMLR. Australia's compliance and response actions are primarily the responsibility of AFMA and the Department of Agriculture Fisheries and Forestry (DAFF), in close consultation with the AAD, Attorney General's Department, Department of Foreign Affairs and Trade, Department of Defence and Australian Customs Service.

Mineral/Petroleum Exploration and Extraction

The definition of 'mining operations' in the EPBC Act includes all activities associated with petroleum and mineral exploration and recovery. The Act prohibits mining operations in

Commonwealth reserves unless they have been authorised in accordance with the EPBC Act and are carried out in accordance with a management plan made under that Act (s.355).

There is currently no exploration or extraction of minerals or petroleum resources in the HIMI region, which is part of the remote frontier region of the Kerguelen Plateau. While some areas in the Kerguelen Plateau region may have potential petroleum prospectivity, given the speculative nature of mineral or petroleum exploration in deep ocean basins it is unlikely that the HIMI region will provide opportunities for commercial or petroleum activities in the foreseeable future. This management plan does not allow mining operations in the Reserve. Future reviews of the management plan for the Reserve will reconsider this issue taking account of any new developments in exploration and environmental protection technologies.

Pressures on the Conservation Values of the Heard Island and McDonald Islands Marine Reserve

The islands and surrounding waters of the Reserve are an excellent example of a relatively untouched subantarctic environment. This is due to the absence of a local human population, the low frequency of human visitation and the minimal amount of commercial resource activity in the region to date. This situation is not static and there are many actual and potential pressures on the values of the Reserve. Most of these pressures are human-related and can be managed with varying degrees of intervention and effort. Others are natural pressures largely beyond human control. The following sections provide a general outline of the pressures on the values of the Reserve and Table 3 gives a summary of which aspects are relevant to the uses described in the previous section. Appendix 22 also lists some of the main conservation-related risks in the Reserve and cross-references relevant descriptions and prescriptions within this Plan.

Natural Processes

The Reserve environment is naturally highly dynamic. The present condition of the environment may be affected by a range of natural processes, including volcanism, coastal erosion, glacial retreat or advance, severe storms, natural arrival and establishment of new species and increasing, decreasing or relocated wildlife populations.

Natural disturbance to ice-free areas, and the creation of new ice-free areas, through landslips, glacial retreat or wildlife trampling, favours the establishment of new species, including alien species[27]. The effects of moisture, wind, wind blown sand and debris and direct disturbance by elephant seals and other wildlife may result in the loss or degradation of cultural heritage items. Coastal erosion also threatens cultural heritage sites, particularly those remaining from the sealing era, many of which were located close to the beaches to be near seal colonies.

It has been suggested that the number of fur seals at Heard Island will continue to expand until either food availability or breeding space limit pup production , which could potentially result in a total resident population of approximately 304 000 within 20 years[77]. Such an increase in fur seal numbers may lead to trampling of vegetation, eutrophication of waterbodies, competition with other wildlife for breeding sites, disturbance to seabird nesting sites and impacts on the surrounding marine ecosystem through increased competition for food sources, as has been recorded at other subantarctic islands. Rapidly increasing king penguin numbers may have similar effects.

Active volcanism at the McDonald Islands has recently had a dramatic influence on the environment, resulting in the coalescing of the previously separate McDonald Island and Flat Island, and affecting local wildlife colonies, vegetation and ecosystems to an as yet unknown extent. Volcanic activity at Heard Island could produce similar effects and may also affect the benthic habitats adjacent to the islands through landslides and deposition[1].

Introduction and Spread of Alien Species and Disease

The human introduction and spread of invasive species is now recognised as one of the most significant threats to biodiversity[112,113], particularly at islands, being capable of causing major alterations to the structure and function of both marine and terrestrial ecosystems, including the extinction of local and global populations[114-119].

At the time of preparing this Plan there are no known alien species on McDonald Island and only four terrestrial species considered as aliens on Heard Island: the vascular plant *Poa annua*; the thrip *Apterothrips apteris*; the mite *Tyrophagus putrescentiae*[24]; and the worm *Dendrodrilus rubidus*[26], making these islands one of the least biologically-disturbed regions on the planet[27].

While the likelihood of species introductions and invasions are difficult to predict, there is a possibility that a wide variety of terrestrial, freshwater and marine taxa could be introduced to the Reserve, potentially resulting in substantial alteration of ecosystem functioning and local extirpation of many different species[27]. Climate warming, as has been observed in the HIMI region, is likely to increase the probability of alien species becoming established and may also enhance the impacts of alien species that become established[27,61].

The impacts of biological invasions on other Southern Ocean islands have been significant, with a range of species including reindeer, cats, rabbits, plants, insects and rodents having devastated seabird breeding populations, modified plant communities and landforms, changed invertebrate communities, reduced biodiversity and contributed to local extinctions[24]. On Macquarie Island a five year effort was required to eradicate cats and action is still required to rid the islands of rabbits and rats which are having a heavy impact on the vegetation and nesting habitat of burrowing petrels and albatrosses.

The major risk to the biosecurity of the Reserve is the introduction of rodents, which have had huge impact on the biota and ecosystems of many other subantarctic islands and which, if introduced to the islands, would almost certainly have a similarly effect. Invasive vascular plants have considerable consequences for the local diversity of both of plants and invertebrates. The cosmopolitan grass *Poa annua*, already found on Heard Island, could be the first vascular plant to colonise McDonald Island. Flies, beetles and bugs are the most likely invertebrate invaders with potentially significant effects on prey or host plants and local ecosystems.

Humans have a direct role in such invasions, with the likelihood of alien establishment closely related to the number of individuals introduced and the number of introduction events. Human activity in the Reserve is expected to continue to slowly increase in line with interest in the region for science, tourism and fisheries. The management goal must be to prevent the introduction of alien species by minimising the risk of introductions occurring.

Human-induced Wildlife Disturbance

Human activities can disturb seabird and seal breeding colonies, and may decrease juvenile recruitment into the population or increase adult mortality, resulting in the decrease or loss of breeding colonies, populations or even entire species. Breeding failure as a result of natural processes is inevitable from time to time and most species are adapted to recover from such losses. However, disturbance arising from human activities may contribute to decreases in breeding success[120]. The extent of such disturbance to the seal and seabird populations at HIMI is currently unknown but is considered likely to be minimal, due to the low levels of human visitation and the enforcement of precautionary wildlife approach guidelines.

Wildlife colonies in the Reserve are concentrated in the ice-free coastal areas which are also the main areas of human activity on land. A variety of activities in the Reserve may disturb individuals, including through the intentional catching and manipulation of animals for research purposes. Other unintentional, but potentially significant localised disturbance may occur when habitat is altered or

destroyed. Excavations and the placement of facilities or equipment can collapse or contaminate burrows, and birds can strike structures and guy wires. Approach by people on foot or in vehicles, vessels or aircraft can also significantly disturb wildlife. Marine mammals and seabirds are at risk of colliding with vessels while foraging or migrating in open waters, particularly if vessel sounds and lights attracts the animals or masks important natural signals and communications.

Species differ in their sensitivity to human presence and associated activities and responses may vary by location and by the time of year or stage of breeding cycle. However, all animals can be disturbed and will react in such ways as changing breeding habitat, refraining from breeding and deserting colonies or nests. Disturbance can increase the mortality of young from predation, exposure, trampling or disorientation, which reinforces the need to apply caution at all times when around animals.

Although not targeted in the Reserve, illegal fishing is known to impact the HIMI region through direct taking of fish; bycatch of fish, seabirds and seals; loss of fishing equipment and damage to benthic species and habitat. Legal fishing operations in the fishery adjacent to the Reserve, while strictly regulated, also contribute to pressure on the region's biodiversity.

Human-induced Physical Disturbance

Most of the Reserve is free from persistent or obvious signs of human disturbance, which is rare among subantarctic islands and is one of HIMI's greatest values. Physical disturbance could degrade this value, detracting from the natural visual and wilderness qualities of the environment and having direct adverse effects on features, species, habitats and ecosystems. People moving by foot or vehicle through terrestrial areas, particularly coastal ice-free areas, can cause localised effects such as compaction of soil, damage to vegetation cover and suppression of its re-establishment; damage to sensitive geological features; disturbance and damage to cultural heritage sites; and destruction of invertebrates and their habitat. Disturbance can be exacerbated by the inappropriate placement of refuges, camping sites, monitoring equipment, survey markers and other facilities. Souveniring may be an additional pressure, particularly relevant to cultural heritage.

Scientific research sometimes requires the taking or disturbance of animals and plants, or destroying their habitats, to further understand them. Sampling vegetation, soils and other geological features may result in environmental damage which, individually may be negligible but may result in more substantial cumulative impacts over time. In the marine areas of the Reserve, benthic sampling may also result in long-lasting effects on benthic species and habitats, such as sponges, corals and bryozoan assemblages.

Terrestrial and Marine Pollution

Marine pollution is a potential pressure associated with shipping activities in the HIMI region and takes the form of fuel or oil spills, sewage or waste water discharge and the introduction of anthropogenic marine debris. Major fuel or oil spills would affect water quality and may cause extensive mortality to marine animals and land-based marine predators and damage to important habitats on a large scale. In the unlikely event of a major spill there would be limited capacity to respond except by the vessel causing the incident or another vessel if one is in the area. A response through the *National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances* would be difficult, because of HIMI's remoteness and the absence of any permanent station. It is unlikely that most vessels could mount effective response action because of limited resources and hostile sea and weather conditions.

Floating debris is a major hazard for marine mammals and seabirds that may be attracted to the debris and become entangled, causing restricted mobility, starvation, infection, amputation, drowning or smothering. Five entangled seals were discovered and disentangled at Heard Island during the 2003/04 Australian Antarctic program expedition[88]. The significance of such hazards was

recognised with the listing of *Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris* as a key threatening process under the EPBC Act on 13 August 2003. A threat abatement plan to address the issue is under preparation. Under Australian law, all shipping is regulated to minimise impacts from the discharge of wastes, flotsam and oil spills. Nevertheless, the potential threat remains, because debris from other parts of the Southern Ocean may drift into the HIMI region. Consideration needs to be given to the potential impacts of shipping activities, particularly if this traffic increases in the future.

Terrestrial pollution can also greatly affect the values of the Reserve, detracting from natural scenic and wilderness qualities and potentially adversely affecting species, habitats and ecosystems. Disposal of human waste and grey water may temporarily change the local nutrient regime and ecosystem functioning. Although this is likely to be minimal compared with that from the abundant wildlife[49], it may represent a disease risk. Contamination by hazardous liquids, including fuels (through spills from storage vessels or when refuelling) and chemicals, can cause localised but long-lasting soil contamination, degradation of vegetation and invertebrates and may damage wildlife it eaten[21]. Wind-blown debris from unsecured wastes or stores degrades scenic landscape values and, particularly in the case of plastics, may injure, infect or even kill wildlife through ingestion or, in the case of food scraps, the introduction of disease agents. Apart from their climate change effects, atmospheric emissions from other parts of the world are likely to have negligible environmental impact on the Reserve when compared to the local volcanic emissions.

Table 3. Summary of potential impacts from human activities in the Reserve

Activity/Use	Terrestrial environment	Marine environment
Scientific research, monitoring & area management	– localised damage to vegetation and invertebrate/burrowing bird habitat through trampling, vehicle use, aircraft landings and installations – localised and/or wider disturbance of seals and seabirds by persons on foot, or by the use of vehicles, vessels or aircraft – seabird collision with installations – introduction and spread of terrestrial and freshwater alien species via footwear, clothing, equipment, vehicles, vessels and aircraft – localised disturbance of wildlife through animal handling and manipulation, under permit – localised landscape and soil contamination through leak/spill/discharge of hazardous chemicals/materials and wastes – loss or degradation of cultural heritage items through damage, disturbance or souveniring – damage to coastal habitats, ecosystems and species from marine pollution – loss or degradation of wilderness and aesthetic values from installations, track formation, landscape disturbance – removal of samples	– damage to benthic communities and seabed from trawling and anchoring – taking and/or by-catch of fish species, seabirds and marine mammals through trawling or long-lining – introduction and spread of marine alien species via vessels, small craft and other equipment used in the water – vessel collision with marine mammals and seabirds – ingestion of, or entanglement in, floating debris by marine mammals and seabirds – disturbance of marine mammals from vessel noise – oil/chemical spills
Tourism and recreation	– localised damage to vegetation and invertebrate/burrowing bird habitat through trampling and aircraft landings – localised and/or wider disturbance of seals and seabirds by persons on foot or by the use of vessels or aircraft – introduction and spread of terrestrial and freshwater alien species via footwear,	– introduction and spread of marine alien species via vessels, small craft and other equipment used in the water – vessel collision with marine mammals and seabirds – ingestion or entanglement in floating debris by marine mammals and seabirds – disturbance of marine mammals from

Activity/Use	Terrestrial environment	Marine environment
	clothing, equipment, vessels and aircraft – loss or degradation of cultural heritage items through damage, disturbance or souveniring – damage to coastal and near-shore habitats, ecosystems and species from marine pollution	vessel noise – oil/chemical spills
Surveillance activities	– localised damage to vegetation and invertebrate/burrowing bird habitat through trampling and aircraft landings – localised and/or wider disturbance of seals and seabirds by persons on foot or by the use of vessels or aircraft – introduction and spread of terrestrial and freshwater alien species via footwear, clothing, equipment, vessels and aircraft – loss or degradation of cultural heritage items through damage, disturbance or souveniring – damage to coastal and near-shore habitats, ecosystems and species from marine pollution	– introduction and spread of marine alien species via vessels, small craft and other equipment used in the water – vessel collision with marine mammals and seabirds – ingestion or entanglement in floating debris by marine mammals and seabirds – disturbance of marine mammals from vessel noise – oil/chemical spills
Shipping	– damage to coastal habitats, ecosystems and species from marine pollution	– damage to near-shore habitats, ecosystems and species from marine pollution – introduction and spread of marine alien species via vessels, small craft and other equipment used in the water – vessel collision with marine mammals and seabirds – ingestion or entanglement in floating debris by marine mammals and seabirds – disturbance of marine mammals from vessel noise – oil/chemical spills
Refuge/shelter	– introduction and spread of terrestrial and freshwater alien species via footwear, clothing, equipment, vessels or aircraft – localised and/or wider disturbance of seals and seabirds by persons on foot or by the use of vessels or aircraft – damage, disturbance or collection of cultural heritage items – damage to coastal and near-shore habitats, ecosystems and species from marine pollution	– introduction and spread of marine alien species via vessels, small craft and other equipment used in the water – vessel collision with marine mammals and seabirds – ingestion or entanglement in floating debris by marine mammals and seabirds – oil/chemical spills

Part 4 Appendices

Appendix 1. Proclamation of Heard Island and McDonald Islands Marine Reserve

2730 *Government Departments*

Commonwealth of Australia Gazette
No. GN 41, 16 October 2002

PROCLAMATION

Environment Protection and Biodiversity Conservation Act 1999

I, PETER JOHN HOLLINGWORTH, Governor-General of the Commonwealth of Australia, acting with the advice of the Federal Executive Council and under subsection 344(1) of the *Environment Protection and Biodiversity Conservation Act 1999*:

(a) declare the area specified in the Schedule to be a Commonwealth reserve for the purpose of protecting the conservation values of Heard and McDonald Islands and the adjacent unique and vulnerable marine ecosystems; and

(b) assign to the reserve the name "Heard Island and McDonald Islands Marine Reserve"; and

(c) specify that the land and seabed to a depth of 1000 metres within the declared area is within the reserve; and

(d) assign the reserve to the World Conservation Union (IUCN) category of strict nature reserve.

Signed and sealed with the Great Seal of Australia

L.S.

on -3 OCT 2002 2002

PETER HOLLINGWORTH
Governor-General

By His Excellency's Command

David Kemp

David Alistair Kemp
Minister for the Environment and Heritage

Commonwealth of Australia Gazette
No. GN 41, 16 October 2002

Schedule

Heard Island and McDonald Islands Marine Reserve

All of those areas of land and sea in the Southern Ocean contained within and bounded as follows*:

(a) the area bounded by the line:

(i) commencing at the point of latitude 51 degrees 50 minutes south. longitude 70 degrees 54 minutes east;
(ii) then along the geodesic in a generally south easterly direction to the point of latitude 52 degrees 25 minutes 30 seconds south, longitude 71 degrees 32 minutes 30 seconds east;
(iii) then along the geodesic in a generally north easterly direction to the point of latitude 52 degrees 12 minutes 30 seconds south, longitude 72 degrees 02 minutes 30 seconds east;
(iv) then along the geodesic in a generally north westerly direction to the point of latitude 51 degrees 38 minutes south, longitude 71 degrees 24 minutes east; and
(v) then along the geodesic in a generally south westerly direction to the point of commencement.

(b) the area bounded by the line:

(i) commencing at the point of latitude 52 degrees 57 minutes south, longitude 72 degrees 08 minutes east;
(ii) then along the geodesic in a generally south easterly direction to the point of latitude 53 degrees 03 minutes south, longitude 72 degrees 14 minutes 30 seconds east;
(iii) then south along the meridian of longitude 72 degrees 14 minutes 30 seconds east to its intersection with the parallel of latitude 53 degrees 30 minutes south;
(iv) then east along the parallel of latitude 53 degrees 30 minutes south to its intersection with the meridian of longitude 74 degrees 12 minutes east;
(v) then north along the meridian of longitude 74 degrees 12 minutes east to its intersection with the parallel of latitude 52 degrees 04 minutes south;
(vi) then along the geodesic in a generally north westerly direction to the point of intersection between the meridian of longitude 73 degrees 17 minutes east and the treaty line defined by Article 2 of the Maritime Delimitation Treaty agreed between the Government of Australia and the Government of the French Republic in January 1982 (the Treaty boundary);
(vii) then along the Treaty boundary in a generally south westerly direction to its intersection with the meridian of longitude 72 degrees 17 minutes east;
(viii) then along the geodesic in a generally south easterly direction to the point of latitude 52 degrees 08 minutes south, longitude 73 degrees 20 minutes east;
(ix) then south along the meridian of longitude 73 degrees 20 minutes east to its intersection with the northern limit of the territorial sea (TS**) adjacent to Heard Island;
(x) then along the northern limits of the TS adjacent to Heard Island and McDonald Islands in a generally westerly direction to its intersection with the meridian of longitude 72 degrees 48 minutes east;
(xi) then along the geodesic in a generally north westerly direction to the point of latitude 52 degrees 43 minutes 30 seconds south, longitude 72 degrees 38 minutes east; and
(xii) then along the geodesic in a generally south westerly direction to the point of commencement.

(c) the area bounded by the line:

(i) commencing at the point of latitude 51 degrees 44 minutes south, longitude 75 degrees 27 minutes east;
(ii) then east along the parallel of latitude 51 degrees 44 minute south to its intersection with the meridian of longitude 77 degrees 13' minutes east;

(iii) then along the geodesic in a generally south easterly direction to the point of latitude 51 degrees 55 minutes south, longitude 77 degrees 29 minutes east;
(iv) then east along the parallel of latitude 51 degrees 55 minute south to its intersection with the outer edge of the exclusive economic zone (EEZ***);
(v) then along the EEZ boundary in a generally north westerly direction to its intersection with the Treaty boundary;
(vi) then along the Treaty boundary in a generally south westerly direction to its intersection with the meridian of longitude 75 degrees east;
(vii) then along the geodesic in a generally south easterly direction to the point of latitude 50 degrees 57 minutes south, longitude 75 degrees 45 minutes east;
(viii) then west along the parallel of latitude 50 degrees 57 minute south to its intersection with the meridian of longitude 74 degrees 53 minutes east; and
(ix) then along the geodesic in a generally south easterly direction to the point of commencement.

* All geographic coordinates are expressed in terms of the World Geodetic System 1984 ("WGS84").
** The "TS" is the territorial sea of Australia and its external territories established under the *Seas and Submerged Lands Act 1973* in accordance with Articles 3 and 4 of the 1982 United Nations Convention on the Law of the Sea. Australia has declared a 12 nautical mile wide territorial sea under the Act (by Proclamation which entered into force on 20 November 1990 and published in the Commonwealth of Australia Gazette No. S297 on 13 November 1990). The outer limit of the territorial sea is 12 nautical miles seaward from the territorial sea baselines established under the Act (Proclamations published in the Commonwealth of Australia Gazette No. S29 on 9 February 1983 and No. S57 on 31 March 1987).
*** The "EEZ" is the exclusive economic zone declared in relation to Australia and its external territories under the *Seas and Submerged Lands Act 1973* (Proclamation dated 26 July 1994 published in the Commonwealth of Australia Gazette No. S290 on 29 July 1994). It commences at the outer limit of the territorial sea (12 nautical miles from the territorial sea baselines established under the Act) and extends generally to 200 nautical miles from the baselines. In relation to Heard Island and McDonald Islands it is in part less than 200 nautical miles to take account of the treaty line defined by Article 2 of the Maritime Delimitation Treaty agreed between the Government of Australia and the Government of the French Republic in January 1982 (entry into force 10 January 1983).

Appendix 2. Native Fauna of the HIMI Marine Reserve Listed Under the EPBC Act

Scientific Name	Common Name						
Birds recorded as breeding							
Aptenodytes patagonicus	king penguin		S				
Catharacta lonnbergi	subantarctic skua		S				
Daption capense	cape petrel		S				
Diomeda exulans	wandering albatross	V	S	M	B	J	A
Diomeda melanophrys	black-browed albatross		S	M	B		A
Eudyptes chrysocome	southern rockhopper penguin		S				
Eudyptes chrysolophus	macaroni penguin		S				
Larus dominicanus	kelp gull		S				
Macronectes giganteus	southern giant petrel	E	S	M	B		A
Oceanites oceanicus	Wilson's storm petrel		S	M		J	
Pachyptila crassirostris	fulmar prion		S				
Pachyptila desolata	Antarctic prion		S				
Pelecanoides georgicus	South Georgian diving petrel		S				
Pelecanoides urinatrix	common diving petrel		S				
Phalacrocorax atriceps (e)	Heard Island cormorant	V	S				
Phoebetria palpebrata	light mantled sooty albatross		S	M	B		A
Pygoscelis papua	gentoo penguin		S				
Sterna vittata	Antarctic tern	V	S				
Non-breeding birds							
Catharacta maccormicki	south polar skua		S	M		J	
Diomedea epomophora	southern royal albatross	V	S	M	B		A
Fregetta grallaria	white-bellied storm petrel		S				
Fregetta tropica	black-bellied storm petrel		S				
Fulmarus glacialoides	southern fulmar		S				
Garrodia nereis	grey-backed storm petrel		S				
Halobaena caerulea	blue petrel	V	S				
Macronectes halli	northern giant petrel	V	S	M	B		A
Pachyptila belcheri	narrow-billed petrel		S				
Pachyptila vittata	broad-billed petrel		S				
Pagodroma nivea	snow petrel		S				
Phoebetria fusca	sooty albatross	V	S	M	B		A
Procellaria aequinoctialis	white chinned petrel		S	M	B		A
Procellaria cinerea	grey petrel		S	M	B		
Pterodroma baraui	Barau's petrel		S				
Pterodroma brevirostris	Kerguelen petrel		S				
Pterodroma inexpectata	mottled petrel		S				
Pterodroma lessonii	white-headed petrel		S				
Pterodroma macroptera	great-winged petrel		S				
Pterodroma mollis	soft-plumaged petrel	V	S				
Pygoscelis adeliae	Adelie penguin		S				
Pygoscelis antarctica	chinstrap penguin		S				
Sterna paradisaea	Arctic tern		S				
Thalassarche chlororhynchos	yellow-nosed albatross		S	M	B		
Thalassarche chrysostoma	grey-headed albatross	V	S	M	B		

Scientific Name	Common Name						
Thalassoica antarctica	Antarctic petrel		S				
Tringa nebularia	greenshank		S	M	B	J	C
Seals							
Arctocephalus gazella	Antarctic fur seal		S				
Arctocephalus tropicalis	subantarctic fur seal	V	S				
Hydrurga leptonyx	leopard seal		S				
Leptonychotes weddelli	Weddell seal		S				
Lobodon carcinophagus	crabeater seal		S				
Mirounga leonina	southern elephant seal	V	S				
Ommatophoca rossi	Ross seal		S				
Cetaceans							
Balaena australis	southern right whale	E	W	M	B		
Balaenoptera acutorostrata	Minke whale		W				
Balaenoptera bonaerensis	Antarctic Minke whale		W				
Balaenoptera borealis	Sei whale	V	W				
Balaenoptera musculus	blue whale	E	W	M	B		
Balaenoptera physalus	fin whale	V	W				
Berardius arnuxii	Arnoux's beaked whale		W				
Globicephala melas	long-finned pilot whale		W				
Hyperoodon planifrons	southern bottlenose whale		W	M	B		
Lagenorhynchus cruciger	hourglass dolphin		W				
Lagenorhynchus obscurus	dusky dolphin		W	M	B		
Megaptera noveangliae	humpback whale	V	W	M	B		
Mesoplodon layardii	strap-toothed beaked whale		W				
Orcinas orca	killer whale		W	M	B		
Phocoena dioptrica	spectacled porpoise		W	M	B		
Physeter macrocephalus	sperm whale		W				

Key to codes

(e) Taxon endemic to the HIMI
A Listed under ACAP
B Species listed under the Bonn Convention
C Listed under CAMBA
E Listed under the EPBC Act as endangered
F In a family listed under the Bonn Convention
J Listed under JAMBA
M Listed under the EPBC Act as migratory species (listed under the Bonn Convention, and/or CAMBA and/or JAMBA)
S Listed marine species under the EPBC Act
V Listed under the EPBC Act as vulnerable
W Whales and other cetaceans under the EPBC Act

Appendix 3. HIMI World Heritage Values

The HIMI Territory was inscribed on the World Heritage List during the twenty-first session of the World Heritage Committee in 1997, on the basis of its outstanding natural universal values. In inscribing HIMI on the World Heritage list, the Committee noted that the site is the only volcanically active sub-Antarctic island and illustrates the ongoing geomorphic processes and glacial dynamics in the coastal and submarine environment and subantarctic flora and fauna, with no record of alien species. The site was considered to meet two of the criteria for listing as a natural World Heritage:

i. an outstanding example representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of land forms, or significant geomorphic or physiographic features

Heard Island and McDonald Islands contains outstanding examples of physical and biological processes continuing in an essentially undisturbed environment, particularly physical processes which provide an understanding of the role of crustal plates in the formation of ocean basins and continents and of atmospheric and oceanic warming, and biological processes including colonisation and speciation. Examples of these World Heritage values include:

- an active example of plume volcanism, and direct geological evidence of the action of the longest operational plume system known (plumes are the unseen, upward movements of relatively warm parts of the earth's mantle);
- geological evidence of plume interaction with overlying crustal plates;
- a uniquely wide range of isotopic compositions of elements in volcanic rocks, providing insight into mantle plume composition;
- the only known continuously active volcano on a subantarctic island;
- fast-flowing glaciers that retreat and advance quickly in response to changes in temperature and precipitation;
- evidence of dramatic fluctuation in glacier extent in recent decades, and consequent changes in the total glaciated area; and
- formation of newly deglaciated areas.

ii. an outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals

Heard Island and McDonald Islands, the only subantarctic islands free of introduced species and with negligible modification by humans, provide a classic example of a subantarctic island group with low species diversity and large populations of certain species. Examples of the World Heritage values include:

- the unmodified status of the Islands and intact ecosystems, providing opportunities for ecological research investigating population dynamics, species interactions, propagule immigration, plant colonisation, species recolonisation, and monitoring of the health and stability of the larger Southern Ocean ecosystem;
- crucial habitat and breeding grounds for large numbers of marine birds and mammals;
- areas of newly deglaciated land providing habitat for plants and animals and an outstanding location for researching plant colonisation;
- ice-free areas of land isolated from each other by glaciers which provide unparalleled opportunities for study of dispersal and establishment of plants;

- absence of human disturbance, providing unique opportunities for research into population dynamics of plant and animal species;
- important breeding location for burrowing birds due to the absence of introduced mammals;
- large breeding populations of flying birds and penguins;
- species of conservation significance (such as the endemic Heard shag *Phalacrocorax nivalis* and the endemic sub-species Heard Island sheathbill *Chionis minor nasicornis*);
- bird predator populations unaffected by the presence of introduced predators;
- populations of invertebrate species, some endemic to Heard and McDonald Islands, and some endemic to the Heard and McDonald Islands/Kerguelen region;
- populations of seal species, including breeding southern elephant seals, Antarctic fur seals, and subantarctic fur seals; and
- the diversity of plant and animal species.

Appendix 4. Extract from Draft HIMI Ramsar Information Sheet

5. Map of site included:

a) hard copy: Preliminary map included - see Attachment A (see Figure 2) and Attachment B

b) digital (electronic) format: Preliminary map included - see Attachment A (see Figure 2) and Attachment B

9. Area:

The Heard Island and McDonald Islands Ramsar site is composed of the islands, the offshore rocks and shoals and the territorial sea extending to 12 nautical miles offshore (see Figure 2). The site boundary corresponds to that of the Australian Territory of Heard Island and McDonald Islands, which is also the boundary for the Heard Island and McDonald Islands World Heritage Property. The site area totals 636 400 ha, with Heard Island comprising 36 800 ha and McDonald Islands approximately 245 ha. The wetlands on Heard Island are comprised of approximately 1103 ha of glacial lagoons, 97 ha of non-glacial lagoons[5], and 360 hectares of vegetated landscape[49,58,121]. The size of the wetland areas on McDonald Islands is not clear. The areal estimates above were made from the late 1980s and early 1990s satellite imagery and are likely to need periodic revision due to ongoing environmental changes such as deglaciation, climatic warming and volcanic activity.

10. Overview:

Heard Island and McDonald Islands provide important breeding and feeding habitat for a number of Antarctic and subantarctic wetland animals. These include the southern elephant seal *Mirounga leonina* and a number of penguin species, considered to be wetland species under the Ramsar Convention. Unlike other subantarctic island groups, the site exhibits largely intact ecosystems with negligible modification by humans and only four known alien species (Section 18). Heard Island has a number of small wetland sites scattered around its coastal perimeter, many separated by active glaciers. Included are 15 areas of wetland vegetation, 10 lagoons or lagoon complexes, and a sand spit approximately 10 km in length. There are also several short, glacier-fed streams and glacial lakes and pools, all of which may change or become intermittent as conditions within the glaciers change. In addition, some wetland areas have been recorded on McDonald Island but it is not clear to what extent they occur. Vegetated parts of both islands, including the wetland vegetation, support penguin and other seabird colonies.

11. Ramsar Criteria:

1	**2**	**3**	**4**	**5**	**6**	7	8

12. Justification for the application of each Criterion listed in 11. above:

Criterion 1. Using the Interim Marine and Coastal Regionalisation for Australia[4] Heard Island and McDonald Islands fall within the Kerguelen Province. The regionalisation is restricted to Australian Territorial Waters. These islands are the only landmasses in the Province and as such the site contains all of the wetlands within the region. The wetlands present are described in more detail under item 18.

Criterion 2. Heard Island's wetlands support substantial populations of three species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The southern elephant seal *Mirounga leonina*, listed as vulnerable, uses the wetlands as moulting areas over the summer period and as an important breeding ground. The southern elephant seal is also protected under the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) to which Australia is a signatory. The southern giant petrel *Macronectes giganteus*, listed as endangered, breeds on Heard and McDonald Islands and is known to build nests

in the pool complexes[122]. The imperial shag (Heard Island) *Leucocarbo atriceps nivalis*, a subspecies endemic to Heard Island[15], is listed as vulnerable.

Criterion 3. Heard Island and McDonald Islands are the only land masses within the bioregion[4]. As such, they provide the only habitat for a range of wetland flora and fauna within the bioregion. The flora and fauna of Heard Island and McDonald Islands share some affiliations with their nearest neighbour, the Îles Kerguelen, plus other subantarctic islands[49,64,67,74,80]. These islands, however, occur outside the Kerguelen Province bioregion.

Criterion 4. The site supports large breeding colonies of four species of penguin; macaroni *Eudyptes chrysolophus*, gentoo *Pygoscelis papua*, king *Aptenodytes patagonicus* and southern rockhopper *Eudyptes chrysocome filholi* (Sphenisciformes, the penguins, are considered to be wetland species under the Ramsar Convention). The king penguin, which suffered major depredations early last century, is reported to be doubling its numbers on Heard Island every five years[74]. The imperial shag (Heard Island) and the Black-faced sheathbill (Heard Island) *Chionis minor nasicornis* (a shorebird) are subspecies endemic to Heard and McDonald Islands and thus their breeding is confined to the site. Heard Island is also a major breeding and moulting area for southern elephant seals.

Criterion 5. The site is believed to regularly support more than 4 million waterbirds, with the majority being penguins. The macaroni penguin colonies on Heard Island and McDonald Islands are estimated at 2 million birds each, which together represent approximately 21% of the world population[73]. The penguins come ashore during the summer months to breed, and forage offshore around Heard and McDonald Islands for krill and fish[1]. Surveys in the summer of 2000/01 suggest that numbers of macaroni penguins may be decreasing, however, the breeding season on Heard Island was considered poor and a current assessment of the population status was not possible[74].

Criterion 6. The site supports the entire world population of the endemic subspecies of imperial shag (Heard Island) and the Black-faced sheathbill (Heard Island). Four breeding sites of imperial shag are known and the total breeding population is estimated at 1000 pairs[74]. The Black-faced sheathbill (Heard Island) is a ground-dwelling shorebird species and the Heard and McDonald Islands population remains the only sheathbill population unaffected by introduced predators such as cats and rats. There are at least 1000 sheathbills found at the site[5]. Gentoo penguins are believed to be present on Heard Island and McDonald Islands all year round. The current breeding population on Heard Island has increased from approximately 10 000 pairs in the 1950s to 16 600 pairs in 1987, which represents approximately 6% of the global population[123]. Survey data from 2000/01, however, suggest a lower breeding population of gentoo penguins[74] but still above 1% of the total population. The macaroni penguin colonies on Heard and McDonald Islands are estimated to contain 2 million birds each, which represent approximately 21% of the world population [73].

13. Biogeography:

a) biogeographic region:

Kerguelen Province

b) biogeographic regionalisation scheme:

Interim Marine and Coastal Regionalisation for Australia Technical Working Group (1998), Interim Marine and Coastal Regionalisation for Australia. Version 3.3. Environment Australia, Canberra.

15. Physical features of the catchment area:
The catchment area is wholly contained within the Ramsar site.

16. Hydrological values:
Glaciers cover approximately 70% of Heard Island[40]. They are relatively fast flowing, moving at around 250 m a year[5], with an average thickness of 55 m[40]. The glaciers are a driving force behind the hydrological values and, consequently, a number of the wetland suites. The glacial lagoons,

rivers and streams, for example, are dynamic and may change shape and size or course respectively as a result of ongoing glacial retreat. Although not always directly affected by glacial retreat, the Wet Mixed Herbfield vegetation community (which contains inland 'pool complex' and 'vegetated seepage area' - see Item 18) includes habitat where the water table is at or close to the surface. This includes sites of late snow-lie, depressions around springs and drainage lines and moist slopes subject to continual seepage from above[49]. Vegetated seepage areas, mostly consisting of bryophytes, are particularly distinctive features of recently deglaciated land[59] and due to the active glacial retreat in the eastern part of the island, these habitats are increasing in size and frequency. The glaciers also influence landforms such as karst features in the limestone areas[5,40].

The coastal 'pool complex' vegetation[49,122] is used intensively by gentoo penguins for breeding colonies and southern elephant seals for seasonal moulting grounds. The higher inland pools are used by southern giant petrels and subantarctic skuas *Catharacta lonnbergi*, though not at the same level of intensity as the lowland areas. Such use brings with it nutrients in forms such as excrement and carcasses and it is thought that this, combined with the varied topography, plays a vital role in some areas in influencing peat development and consequently the varying vegetation communities present[58,122]. Peat depth varies from <1 cm to 1 m and the maximum depth of pools measured at the north end of the island was 30 cm[122], with greater pool depths recorded in the south-east part of the island in the extensive 'pool complex' areas near Spit Bay[53]. It is believed that peat formation mainly occurs below 60 m asl[58,122].

Little is known about the marine wetlands of Heard Island and McDonald Islands due to their remoteness and the difficulties that exposed areas present for conducting research[5].

17. Wetland Types

a) presence:

Marine/coastal:

A	**B**	C	**D**	**E**	F	G	H	I	**J**	**K**	Zk(a)

Inland:

L	**M**	N	**O**	**P**	Q	R	Sp	Ss	**Tp**	Ts	**U**	Va	**Vt**	W	Xf	Xp	**Y**	Zg	**Zk(b)**

Human-made: n/a

b) dominance:
J E Tp Vt U O K P D A B M Y Zkb

18. General ecological features:
Six wetland suites have been identified from Heard Island and McDonald Islands covering approximately 1860 ha: the coastal 'pool complex' vegetation (237 ha), inland 'pool complex', mire and meadow vegetation (105 ha), vegetated seepage areas mostly on recent glaciated areas (18 ha), glacial lagoons the largest of which are open to the sea (1103 ha), non-glacial lagoons (97 ha), and coastal areas consisting of narrow beaches and the large sandy expanse of Elephant Spit (300 ha)[7]. On Heard Island, the majority of these suites are found below altitude 150 m asl[58].

The vascular and bryophyte floras of Heard Island occur in seven main vegetation complexes: Open Cushionfield, Coastal Biotic Vegetation, Fellfield, Wet Mixed Herbfield, Mossy Fellfield, Saltspray Vegetation and Closed Cushionfield[49]. These are broadscale community categories which are currently being refined, and further detail is expected after the 2003-04 field season[53]. Wetland values occur mainly in the Coastal Biotic Vegetation and Wet Mixed Herbfield categories[49]. Coastal Biotic Vegetation includes the coastal 'pool complex' vegetation, while Wet Mixed Herbfield includes inland 'pool complex' vegetation, vegetated seepage areas mostly on recently deglaciated

areas, and mires, flushes and wet meadows on inland slopes and flats where the water table is at or close to the surface[49].

The glaciers, which cover approximately 70% of Heard Island, are relatively fast flowing and shallow. The glaciers act as barriers, isolating different plant communities and limiting plant colonisation. As the glaciers retreat it enables these species-poor vegetation communities to expand and diversify. This is a notable feature of the Heard Island vegetation as a large range of habitats and conditions are occupied by a small number of species[58,59]. There are no confirmed human-introduced flora or fauna on Heard Island, a feature that makes this subantarctic island group unique. There is, however, one species of grass, *Poa annua*, a thrip, *Apterothrips apteris*, a mite, *Tyrophagus putrescentiae*, and a worm *Dendrodrilus rubidus*, that are considered alien species as they are not native to the HIMI region and appear to have recently become established by natural means[24].

The coastal 'pool complex' vegetation on Heard Island is inhabited seasonally by southern elephant seals and it is believed that this wetland suite depends partially on these animals for its maintenance[49,59]. The seals' wallowing and moulting activities appear to deepen and widen the pools and reduce drainage[122] by depositing an impervious layer of skin, hair and nutrients[58]. The role played by elephant seals in creating this wetland suite, and the extent to which it has been developed, makes it unique among similar landforms described from temperate and boreal regions[7,49,122].

The vegetation classification system for McDonald Island is essentially the same as that used for Heard Island [49,52]. Prior to recent volcanic activity, vegetation comprising grassland and cushion carpet herbfields covered about one-third of McDonald Island although it was not clear how much of this area contained wetland values. Elsewhere, vegetation is absent mainly due to exposure, lack of substrate stability and the influence of high numbers of seabirds[52]. These factors may have altered or disappeared due to recent volcanic activity on the island.

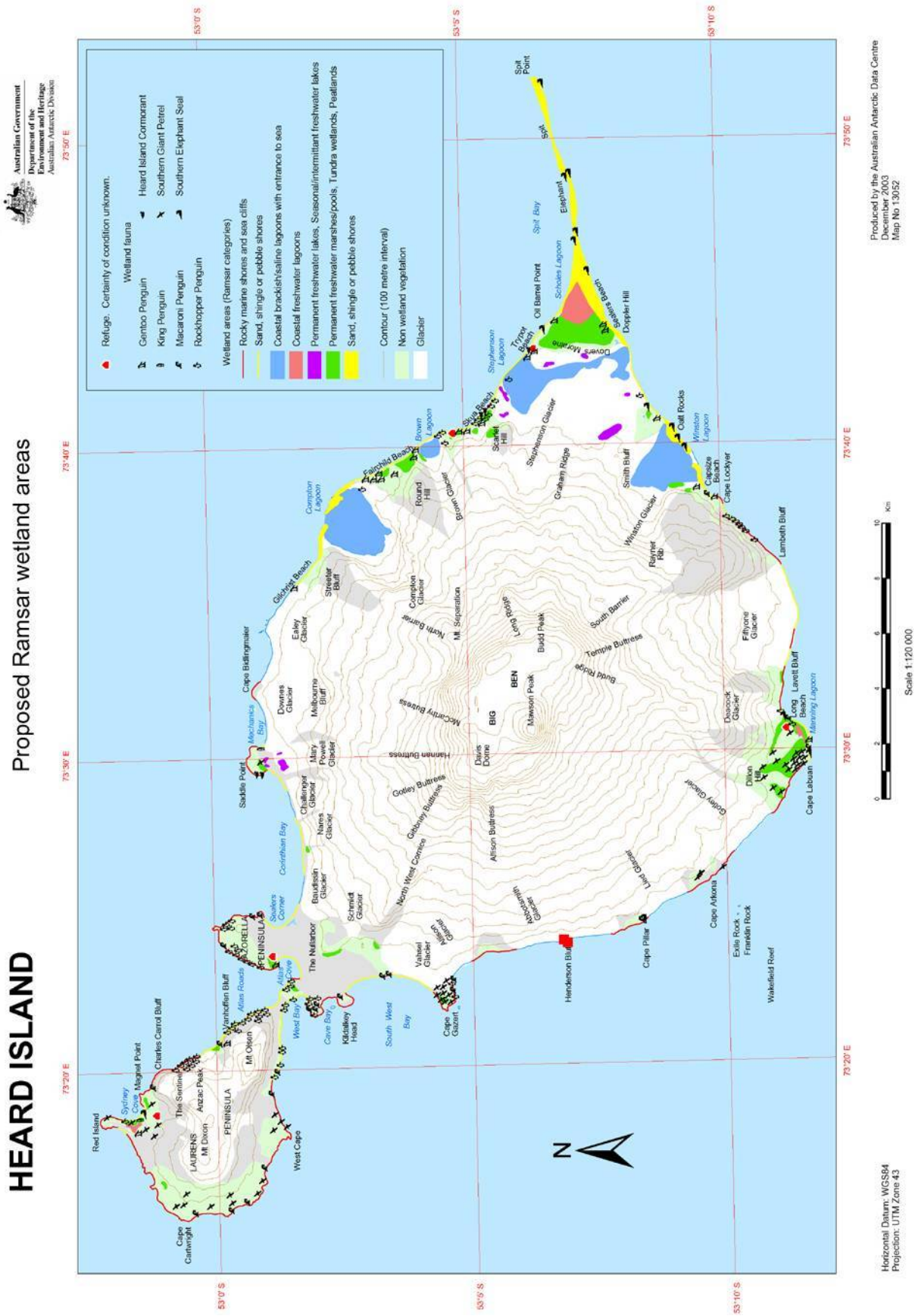
19. Noteworthy flora:

The combination of small area, glaciation and harsh climate on Heard Island and McDonald Islands has resulted in a reduced variety of vascular plants in comparison to other islands north of the Antarctic Polar Front Zone[58]. Some of these plants share affiliations with their nearest neighbour, Îles Kerguelen, however none of the terrestrial flora on Heard Island appear to be endemic[49]. On Heard Island the small vascular plant *Ranunculus crassipes*, a common subantarctic species, is only found at one site, a series of sloping spring-fed mires on bluffs at Skua Beach on the north-east coast. This wetland habitat, included in the Wet Mixed Herbfield complex, is unusual for Heard Island.

Attachment A: Proposed Boundary for Heard Island and McDonald Islands Ramsar Site

- see Figure 2

Attachment B: Wetland Areas of Proposed HIMI Ramsar Site



Appendix 5. HIMI Register of the National Estate Place Details

(extract from the Australian Heritage Database)

Class: Natural

Legal Status: Registered (01/11/1983)

Place ID: 13656

Place File No: 9/02/001/0001

Statement of Significance:

The Island group is the only unmodified example of a sub-Antarctic Island ecosystem in the world and remains in stark contrast with the effects of man on other sub-Antarctic Islands. They are of great scientific value for the study into the effects of geographical isolation and climate on the divergent development of species. The glaciers are amongst the most dynamic in the world whilst Heard Island is the only active volcano in Australian territory. Other significant elements on Heard Island are the remains of numerous sealer's huts and try-works sites, almost untouched by human agency since their use. Such sites are relatively rare and present a major opportunity for further research (Criteria B.2 and C.2). The remains of the first Australian National Antarctic Research Expeditions (ANARE) Base at Atlas Cove 1947-55 are also significant historically. These remains are important in the study of the colonisation of the sub-Antarctic by man and present a rare opportunity to study such relatively undisturbed sites (Criteria A.4, B.2 and C.2).

Description:

A sub-Antarctic island group consisting of three islands and a number of rock outcrops, which lie on the Kerguelen-Heard submarine plateau. Heard Island is the largest island of the group and is heavily glaciated and dominated by Big Ben, an active volcano. The sub- Antarctic climate, particularly precipitation, is greatly influenced by the topography and its position south of the Antarctic Convergence. The flora of the islands is impoverished, whilst the fauna is mainly marine mammals and seabirds, many species of which breed on the islands. Heard island is historically significant due to the presence of sealer's hut sites and try-works, dating from the 1850 to 1920s period. Atlas Cove has substantial remains and huts from the first Australian National Antarctic Research Expeditions (ANARE) Base occupied 1947-55.

History: Not Available

Condition and Integrity: Not Available

Location:

About 38 000 ha, comprising all islands and rocks lying within the area bounded by parallels 52deg 50' and 53deg 15'S latitude and meridians 72deg 30' and 74degE longitude.

Appendix 6. Statement of Cultural Significance for Atlas Cove ANARE Station

(extract from Vincent in press[6])

Assessment Against National Estate Criteria

The following section evaluates the old ANARE Station at Atlas Cove against the criteria for the Register of the National Estate.

Criterion A

Its importance in the course, or pattern, of Australia's natural or cultural history.

Importance for association with events, developments or cultural phases which have had a significant role in the human occupation and evolution of the nation, state, region or community.

There is an important association with the Heard Island sealing industry, which was carried on between 1854 and 1881. Atlas Cove was the destination of at least three scientific visits between 1876 and 1929 prior to ANARE's occupation. Sealers constructed Admiralty Hut on behalf of the British Admiralty (in 1929 or possibly 1927) to provide shelter for shipwrecked sailors.

Atlas Cove Station is important to Australia as the seminal station for ANARE. It was a testing ground to prepare for later expeditions to the Antarctic Continent. The station on Heard Island was also important in learning about group dynamics, supply, logistics and the difficulties of working in remote locations for extended periods of time under arduous circumstances. It also allowed for the most severe testing of equipment and lessons in station management. The baseline science program for Antarctic research was initiated and established at Heard Island along with the parallel program on Macquarie Island.

Criterion B

Its possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.

Importance in demonstrating a distinctive way of life, customs, process, land use, function or design no longer practised, in danger of being lost, or of exceptional interest.

The Atlas Cove Station demonstrates a way of life that was totally isolated from the remainder of the world except by the annual changeover visits and by radio connection. Macquarie Island Station was similar, although it was not nearly as remote in the event of a crisis. New customs were established particularly an ANARE brand of humour and an activity known as end of week 'ding' (the main social/drinking event for the week).

This type and form of station is no longer used by ANARE. The buildings were arranged with centralised living, sleeping and recreational areas with closely located stores. The scientific functions were zoned in different areas depending on their special requirements for isolation or lack of disturbance. The buildings were separated so that a fire would not spread or take out the back-up or emergency supplies. In later years some of the buildings were linked. Fire extinguishers were located both inside and outside huts and there was one incident of fire that was kept under control. Cold porches were initially added to most of the buildings. The experience of Heard and Macquarie islands resulted in a series of specially-designed prefabricated demountable huts specifically built for ANARE in 1950. These were known as Mark I huts and were quickly followed in 1951 by other prefabricated purpose-built designs, in particular the magnetic research huts.

Criterion C

Its potential to yield information that will contribute to an understanding of Australia's natural or cultural history.

Importance for information contributing to a wider understanding of the history of human occupation of Australia.

The work conducted on Heard Island was baseline post-World War II research into the fields of physical and biological sciences. It involved cosmic ray research, seismology, glaciology, vulcanology, geology, meteorology and magnetic variation as well as botany and zoology underpinning current ecological work.

Criterion D

Its importance in demonstrating the principal characteristics of a class of Australia's natural or cultural places.

Importance in demonstrating the principal characteristics of the range of human activities in the Australian environment, including way of life, customs, process, land use, function, design technique.

The arrangement of the buildings illustrates the accommodation necessary for surviving in the subantarctic and the supporting infrastructure necessary to carry out research into cosmic ray science, magnetic fields, meteorology, biology and ecology. The communications, power generation, mess, kitchen and supply of daily services all supported this research. There was a constant concern about fire since the loss of essential supplies would be serious because of the delay in resupplying in such a remote location.

Criterion E

Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.

Importance for a community for aesthetic characteristics held in high esteem or otherwise valued by the community.

The style of the station probably has its closest parallel in the outbuildings associated with a large rural farming operation or a temporary wartime installation. There is no particular formal style but an association with practical buildings.

Criterion F

Its importance in demonstrating a high degree of creative or technical achievement at a particular period.

Importance for its technical, creative, design or artistic excellence, innovation or achievement.

The construction of buildings and aerials on the station was initially a matter of making do with what could be scrounged in a post-war period when building materials were scarce. But by 1950 specific demountable buildings were developed for ANARE's use in the field. These buildings evolved from the experience of the Alaskan huts and the performance of RAAF buildings. The criteria for the buildings were:

- good insulation and draft proof properties;
- limited shipping space;
- compact carrying capacity for unloading via the DUKWs;
- limited and largely unskilled labour for erection;
- the need for very rapid assembly due to destruction by wind during erection;
- the need to withstand severe weather conditions, once erected; and
- easy to maintain.

Some of these initial buildings are still in use at other stations having been relocated from Heard Island. These buildings were at the forefront of prefabricated plywood, stress skin, insulated panel construction techniques.

Criterion G

Its strong or special associations with a particular community or cultural group for social, cultural or spiritual reasons.

Importance as a place highly valued by a community for reasons of religious, spiritual, cultural, educational, or social associations.

Atlas Cove was especially important for expeditioners from ANARE who would have lived there under extremely testing conditions. It was also important as a trying station during the sealing activity in the second half of the nineteenth century.

Criterion H

Its special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.

Importance for close associations with individuals whose activities have been of significance within the history of the nation, state or region.

The place is associated with Dr Phillip Law, Director of ANARE 1949-64, and the 93 ANARE personnel who wintered there between 1947 and 1955. Alastair (Jock) Forbes and Richard (Dick) Hoseason, who died on Heard Island on 26 May 1952, will always be particularly strongly associated with the place.

Appendix 7. Parks Australia Planning and Performance Assessment (extract)

The following outcomes developed by the Director of National Parks under the Framework are relevant to the Heard Island and McDonald Islands Marine Reserve.

Key Result Area 1

1.1 Natural values for which Commonwealth reserves were declared and/or recognised have been maintained.

1.2 Populations of EPBC listed threatened species and their habitats have been conserved.

Key Result Area 2

2.1 Cultural heritage values, both indigenous and non-indigenous, for which the reserves were declared and are recognised have been protected and conserved.

2.3 The impacts of threats to cultural values have been minimised.

Key Result Area 4

4.1 Visitors to Commonwealth reserves enjoy inspirational, satisfying and safe experiences.

4.2 Visitor impacts (on reserve management, values, the environment and other visitors) are within acceptable levels.

4.3 Public awareness and appreciation of the values of Commonwealth reserves has been enhanced.

4.4 Commercial operators provide a high quality service to reserve visitors.

Key Result Area 5:

5.2 Stakeholders, eg. neighbours, State agencies and park user groups, are involved in, and contribute effectively to, reserve management activities.

5.3 Commercial and other partnership opportunities are encouraged and evaluated.

Key Result Area 6:

6.1 Planning and decision-making is based on best available information; legislative obligations; Parks Australia policy and social justice principles.

6.2 Financial and business management is based on better practice and Government requirements.

6.3 High levels of staff expertise and performance is recognised and valued.

6.4 Obligations under the EPBC Act and Regulations relating to management of Commonwealth reserves are complied with.

6.5 Ministerial directions and other obligations are complied with.

Key Result Area 7:

7.1 High quality, comprehensive and current information is available to the Australian community to facilitate and foster understanding, appreciation, sound conservation and appropriate use of Australian biodiversity.

7.2 Effective programs are in place to develop, collate, manage and disseminate taxonomic, occurrence and distribution information on Australian biodiversity.

Appendix 8. Australian IUCN Reserve Management Principles

(*Environment Protection and Biodiversity Conservation Regulations 2000* Schedule 8)

Part 1 General administrative principles

1 Community participation

Management arrangements should, to the extent practicable, provide for broad and meaningful participation by the community, public organisations and private interests in designing and carrying out the functions of the reserve or zone.

2 Effective and adaptive management

Management arrangements should be effective and appropriate to the biodiversity objectives and the socio-economic context of the reserve or zone. They should be adaptive in character to ensure a capacity to respond to uncertainty and change.

3 Precautionary principle

A lack of full scientific certainty should not be used as a reason for postponing measures to prevent degradation of the natural and cultural heritage of a reserve or zone where there is a threat of serious or irreversible damage.

4 Minimum impact

The integrity of a reserve or zone is best conserved by protecting it from disturbance and threatening processes. Potential adverse impacts on the natural, cultural and social environment and surrounding communities should be minimised as far as practicable.

5 Ecologically sustainable use

If resource use is consistent with the management principles that apply to a reserve or zone, it should (if it is carried out) be based on the principle (the principle of *ecologically sustainable use*) that:

(a) natural resources should only be used within their capacity to sustain natural processes while maintaining the life-support systems of nature; and

(b) the benefit of the use to the present generation should not diminish the potential of the reserve or zone to meet the needs and aspirations of future generations.

6 Transparency of decision-making

The framework and processes for decision-making for management of the reserve or zone should be transparent. The reasons for making decisions should be publicly available, except to the extent that information, including information that is culturally sensitive or commercial-in-confidence, needs to be treated as confidential.

7 Joint management

If the reserve or zone is wholly or partly owned, by Aboriginal people, continuing traditional use of the reserve or zone by resident indigenous people, including the protection and maintenance of cultural heritage, should be recognised.

Part 2 Principles for IUCN categories

1 Strict nature reserve

Note This category corresponds to the International Union for the Conservation of Nature (***IUCN***) protected area management category 1a.

1.01 The reserve or zone should be managed primarily for scientific research or environmental monitoring based on the following principles.

1.02 Habitats, ecosystems and native species should be preserved in as undisturbed a state as possible.

1.03 Genetic resources should be maintained in a dynamic and evolutionary state.

1.04 Established ecological processes should be maintained.

1.05 Structural landscape features or rock exposures should be safeguarded.

1.06 Examples of the natural environment should be secured for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded.

1.07 Disturbance should be minimised by careful planning and execution of research and other approved activities.

1.08 Public access should be limited to the extent it is consistent with these principles.

Appendix 9. Australian World Heritage Management Principles

(*Environment Protection and Biodiversity Conservation Regulations 2000* Schedule 5)

1 General principles

1.01 The primary purpose of management of natural heritage and cultural heritage of a declared World Heritage property must be, in accordance with Australia's obligations under the World Heritage Convention, to identify, protect, conserve, present, transmit to future generations and, if appropriate, rehabilitate the World Heritage values of the property.

1.02 The management should provide for public consultation on decisions and actions that may have a significant impact on the property.

1.03 The management should make special provision, if appropriate, for the involvement in managing the property of people who:

(a) have a particular interest in the property; and

(b) may be affected by the management of the property.

1.04 The management should provide for continuing community and technical input in managing the property.

2 Management planning

2.01 At least 1 management plan should be prepared for each declared World Heritage property.

2.02 A management plan for a declared World Heritage property should:

(a) state the World Heritage values of the property for which it is prepared; and

(b) include adequate processes for public consultation on proposed elements of the plan; and

(c) state what must be done to ensure that the World Heritage values of the property are identified, conserved, protected, presented, transmitted to future generations and, if appropriate, rehabilitated; and

(d) state mechanisms to deal with the impacts of actions that individually or cumulatively degrade, or threaten to degrade, the World Heritage values of the property; and

(e) provide that management actions for values, that are not World Heritage values, are consistent with the management of the World Heritage values of the property; and

(f) promote the integration of Commonwealth, State or Territory and local government responsibilities for the property; and

(g) provide for continuing monitoring and reporting on the state of the World Heritage values of the property; and

(h) be reviewed at intervals of not more than 7 years.

3 Environmental impact assessment and approval

3.01 This principle applies to the assessment of an action that is likely to have a significant impact on the World Heritage values of a property (whether the action is to occur inside the property or not).

3.02 Before the action is taken, the likely impact of the action on the World Heritage values of the property should be assessed under a statutory environmental impact assessment and approval process.

3.03 The assessment process should:

(a) identify the World Heritage values of the property that are likely to be affected by the action; and

(b) examine how the World Heritage values of the property might be affected; and

(c) provide for adequate opportunity for public consultation.

3.04 An action should not be approved if it would be inconsistent with the protection, conservation, presentation or transmission to future generations of the World Heritage values of the property.

3.05 Approval of the action should be subject to conditions that are necessary to ensure protection, conservation, presentation or transmission to future generations of the World Heritage values of the property.

3.06 The action should be monitored by the authority responsible for giving the approval (or another appropriate authority) and, if necessary, enforcement action should be taken to ensure compliance with the conditions of the approval.

Appendix 10. Australian Ramsar Management Principles

(*Environment Protection and Biodiversity Conservation Regulations 2000* Schedule 6)

1 General Principles

1.0.1 The primary purpose of management of a declared Ramsar wetland must be, in accordance with the Ramsar convention:

a. to describe and maintain the ecological character of the wetland; and

b. to formulate and implement planning that promotes;

i. conservation of the wetland; and

ii. wise and sustainable use of the wetland for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem.

1.0.2 Wetland management should provide for public consultation on decisions and actions that may have a significant impact on the wetland

1.0.3 Wetland management should make special provision, if appropriate, for the involvement of people who;

a. have a particular interest in the wetland; and

b. may be affected by the management of the wetland

1.0.4 Wetland management should provide for continuing community and technical input

2 Management planning

2.0.1 At least one management plan shall be prepared for each declared Ramsar wetland

2.0.2 A management plan for a declared wetland should:

(a) describe its ecological character; and

(b) state the characteristics that make it a wetland of international importance under the Ramsar Convention; and

(c) state what must be done to maintain its ecological character; and

(d) promote its conservation and sustainable use for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem; and

(e) state mechanisms to deal with the impacts of actions that individually or cumulatively endanger its ecological character, including risks arising from:

i. physical loss, modification or encroachment on the wetland; or

ii. loss of biodiversity; or

iii. pollution and nutrient input; or

iv. changes to water regimes; or

v. utilisation of resources; or

vi. introduction of invasive species; and

(f) state whether the wetland needs restoration or rehabilitation; and

(g) if restoration or rehabilitation is needed-explain how the plan provides for restoration or rehabilitation; and

(h) provide for continuing monitoring and reporting on the state of its ecological character; and

(i) be based on an integrated catchment management approach; and

(j) include adequate processes for public consultation on the elements of the plan; and

(k) be reviewed at intervals of not more than 7 years.

3 Environmental impact assessment and approval

3.0.1 This principle applies to the assessment of an action that is likely to have a significant impact on the ecological character of a Ramsar wetland (whether the action is to occur inside the wetland or not.

3.0.2 Before the action is taken, the likely environmental impact of the action on the wetland's ecological character should be assessed under a statutory environmental impact assessment and approval process.

3.0.3 The assessment process should:

a. identify any part of the ecological character of the wetland that is likely to be affected by the action; and

b. examine how the ecological character of the wetland might be affected; and

c. provide adequate opportunity for public consultation.

3.0.4 An action should not be approved if it would be inconsistent with:

d. maintaining the ecological character of the wetland; or

e. providing for the conservation and sustainable use of the wetland.

3.0.5 Approval of the action should be subject to conditions, if necessary, to ensure that the ecological character of the wetland is maintained.

3.0.6 The action should be monitored by the authority responsible for giving the approval (or another appropriate authority) and, if necessary, enforcement action should be taken to ensure compliance with the conditions.

Appendix 11. Commonwealth Heritage Management Principles

(*Environment Protection and Biodiversity Conservation Regulations 2000* Schedule 7B)

1. The objective in managing Commonwealth Heritage places is to identify, protect, conserve, present and transmit, to all generations, their Commonwealth Heritage values.
2. The management of Commonwealth Heritage places should use the best available knowledge, skills and standards for those places, and include ongoing technical and community input to decisions and actions that may have a significant impact on their Commonwealth Heritage values.
3. The management of Commonwealth Heritage places should respect all heritage values of the place and seek to integrate, where appropriate, any Commonwealth, State, Territory and local government responsibilities for those places.
4. The management of Commonwealth Heritage places should ensure that their use and presentation is consistent with the conservation of their Commonwealth Heritage values.
5. The management of Commonwealth Heritage places should make timely and appropriate provision for community involvement, especially by people who:
    a. have a particular interest in, or associations with, the place; and
    b. may be affected by the management of the place.
6. Indigenous people are the primary source of information on the value of their heritage and that the active participation of indigenous people in identification, assessment and management is integral to the effective protection of indigenous heritage values.
7. The management of Commonwealth Heritage places should provide for regular monitoring, review and reporting on the conservation of Commonwealth Heritage values.

Appendix 12. National Heritage Management Principles

(*Environment Protection and Biodiversity Conservation Regulations 2000* Schedule 5B)

1. The objective in managing National Heritage places is to identify, protect, conserve, present and transmit, to all generations, their National Heritage values.
2. The management of National Heritage places should use the best available knowledge, skills and standards for those places, and include ongoing technical and community input to decisions and actions that may have a significant impact on their National Heritage values.
3. The management of National Heritage places should respect all heritage values of the place and seek to integrate, where appropriate, any Commonwealth, State, Territory and local government responsibilities for those places.
4. The management of National Heritage places should ensure that their use and presentation is consistent with the conservation of their National Heritage values.
5. The management of National Heritage places should make timely and appropriate provision for community involvement, especially by people who:
    a. have a particular interest in, or association with, the place; and
    b. may be affected by the management of the place.
6. Indigenous people are the primary source of information on the value of their heritage and the active participation of indigenous people in identification, assessment and management is integral to the effective protection of indigenous heritage values.
7. The management of National Heritage places should provide for regular monitoring, review and reporting on the conservation of National Heritage values.

Appendix 13. Routine Operations

3. Zoning and IUCN Category	– manage the Reserve in accordance with the zone categories
4. Natural Heritage Management	– terrestrial and marine monitoring – monitor species of special conservation status – wildlife observations – monitor alien species – conduct biological surveys – take water samples – take marine samples
5. Cultural Heritage Management	– survey and record sites – maintain and restore sites
6. Visitor Management and Reserve Use	– maintain counts of Reserve visitors – provide information about Reserve regulations – brief intending visitors – develop interpretive and educational materials – answer enquiries – undertake photography and filming for interpretive purposes – liaise with tour operators – monitor visitor activity
7. Stakeholders and Partnerships	– liaise with other Government agencies, fishing industry, French administrators, tourist operators and researchers
8. Business Management	– maintain refuges, facilities and installations – waste collection and removal – conduct marine surveillance patrols – deal with infringements – where possible assist with search and rescue operations – maintain an implementation schedule and performance report for the prescriptions of this Plan; – making this Plan and associated documents available to interested parties and the public; – respond to correspondence and queries relating to the Reserve; – represent the interests of the Reserve in matters relating to Commonwealth reserves, marine protected areas, World Heritage areas, and Ramsar sites; – consult with other authorities/agencies/organisations on matters affecting or applicable to management of the Reserve; – periodically review, and revise where necessary, the compliance and enforcement plan for the Reserve; – fulfil reporting requirements, including annual State of the Parks reporting, and periodic World Heritage and Ramsar reporting; – coordinate and contribute to emergency response in the Reserve (safety, pollution events, alien introductions, unusual wildlife mortalities); – administer Australian Antarctic program expeditions to the Reserve; – maintain a website and making other materials used for communicating the values of the Reserve available to the community; – assess, and where appropriate approve, proposed activities in the Reserve; – brief visitors to the Reserve on the requirements of this Plan; – maintain a register of research papers arising from HIMI research; and – coordinate the establishment and maintenance of a Reserve Management Database.
9. Performance assessment	– evaluate the success of the implementation of the management plan

Appendix 14. Environmental Code of Conduct for Visitors to Heard Island

Introduction

Heard Island is special. It is one of the few remaining truly wild areas in the world, and a place where humans are respectful and privileged visitors.

The isolation and harsh climatic conditions of Heard Island mean that the organisms and communities present are living on the edge. Even seemingly minor pressures associated with human activities can lead to major and long-lasting environmental impacts, particularly with regard to the potential introduction of alien species and their effects on the ecosystem.

Heard Island can, however, be visited without damaging those things that make it special. Your actions can contribute significantly to its protection. This *Environmental Code of Conduct* provides general guidelines to help prevent or minimise impacts during your visit.

Heard Island has isolated and distinctive ecosystems. In addition, major areas around the island are physically separated by active glaciers, creating discrete systems (analogous to islands).

This *Environmental Code of Conduct* cannot be expected to cover every situation. You should act on the advice and instructions of group leaders and always seek to minimise your impact on the Heard Island environment in all aspects of your visit.

Before you get there

- Protecting Heard Island begins at home. Read this *Code* before you depart for the island and start planning early how to minimise your impact.
- Get to know the island and its environment. Learn about the values and locations of areas that have been afforded special protection and observe all restrictions.
- Obtain any permits necessary for your proposed activities.
- Think of the vessel transporting you to Heard Island as a part of the island itself. In terms of quarantine, don't take aboard any living organisms or items that might harbour organisms that could impact on the fragile ecosystems (e.g. plants, animals, soil). Remove unnecessary packaging before you get on the ship, and again before going ashore (e.g. film boxes, bubble wrap, plastic bags).
- Ensure everything to be taken ashore is meticulously cleaned (e.g. scrub boots, pick velcro, vacuum pockets, clean camera tripods and bags, tents, scientific equipment). Where possible take new clothing and equipment. Extend your scrutiny to gear that is not your own.
- Remember, the marine environment is part of the Heard Island and McDonald Islands Marine Reserve too – keep it clean and throw nothing overboard (e.g. food scraps, plastics, cigarette butts).
- To minimise human waste on the island, go to the toilet on the ship before going ashore.

When you're there

- **Tread lightly**.
- Document your visit (e.g. where you've gone, what you've done). Where possible, include GPS coordinates in your record of these details (eg. location of field camps, marine debris observed, sampling locations).
- Report all unusual occurrences and environmental incidents to your leaders (e.g. presence of rodents, fuel or chemical spills, entanglement of wildlife, volcanic activity).

Managing wastes and equipment

- The goal is to remove all human wastes (including faeces, urine and washing water) from the island. In particular, day trips must endeavour to return all wastes to the ship, or alternatively, discharge into the ocean below high water mark in an area of rapid marine dispersal. If this is not practical, human waste must be buried at sites away from vegetation, waterbodies and wildlife.
- Do not swim, or wash yourself or your equipment in fresh water streams or waterbodies.
- Always secure equipment, stores and wastes to prevent foraging by wildlife and scattering by high winds. Unsecured items can also be a safety hazard.
- Manage fuel and hazardous liquids to prevent leaks or spillage. Store such liquids in air-tight containers and routinely inspect for damage or leaks. Avoid refuelling or changing oil in windy conditions or in areas that might direct accidental spillage into sensitive areas (e.g. lakes, vegetation, wildlife colonies). Use funnels and a drip tray and have spill equipment available.
- Do not interfere with any buildings, equipment, supplies, study sites or markers.
- Do not collect anything (e.g. souvenirs, rocks, bones, specimens, historic relics).

Travel, wildlife and vegetation

- Take care around wildlife and vegetation.
- Trampling of vegetated areas can result in long-term plant damage or death. Many vegetated areas are also extensively used as nesting sites by burrowing birds.
- Think about your choice of route and select a path to minimise your impact (e.g. avoid wildlife colonies, burrows, unstable ground, soft vegetation).
- Do not disturb plants or animals to get better pictures.
- Do not feed the wildlife or leave food or food scraps lying around.
- Breeding may fail if animals are disturbed. Changes in wildlife behaviour (e.g. changes in posture or vocalisation) indicate disturbance - back off immediately.
- Approaching wildlife too closely may cause parents to abandon eggs or young, exposing them to predators.
- Be quiet when around wildlife, move slowly, stay low to the ground and adopt the recommended minimum approach distances (see table following) - the wildlife can interact with you if it chooses to.
- Remain together as a group when viewing wildlife. Do not surround individual seabirds or seals or a colony.
- Most ice-free areas on the island are used for nesting by burrowing birds. Burrows extend beyond the entrance hole by about one metre in any direction and will collapse if tread upon.
- Always give animals the right of way and do not block their access routes.

When you leave

- Leave no signs of your visit.
- Remove everything you take onto Heard Island, particularly rubbish, which endangers wildlife and spoils the natural appearance of the island.
- Take nothing with you but photos and memories.

Minimum distances to maintain when approaching wildlife on foot[^]

Species	Distance[#]
Wandering albatross, southern giant petrel, Heard Island cormorant (shag), Antarctic tern	100m
Other albatrosses, breeding seabirds	50m
Breeding and moulting penguins	30m
Petrels and Prions[*] Heard Island sheathbill Breeding seals and pups	15m
Non-breeding seals and other non-breeding seabirds	5m

[^]Separate guidelines provide for the operation of small boats, vehicles and helicopters.
[#] These distances are only a guide and should you find your activities cause disturbance, greater distances should be maintained.
[*] Includes cape petrels, Wilson's storm petrels, Antarctic prions, fulmar prions, common diving petrels, South Georgian diving petrels.

Notes:

1. The *Code* does not supersede or replace the legal requirements and management provisions outlined in the *Heard Island and McDonald Islands Marine Reserve Management Plan*.
2. Some prohibited activities described above may be allowed in accordance with the relevant permit (e.g. scientific collections, leaving of equipment).

For more information regarding the *Code* or activities in the Heard Island and McDonald Islands Marine Reserve go to **http://www.aad.gov.au** or contact the Australian Antarctic Division at **himi@aad.gov.au**

Appendix 15. Vascular Plants Recorded at Heard Island

Apiaceae
- * *Azorella selago* Hook. f.

Asteracae
- *Leptinella plumosa* Hook. f.

Brassicaceae
- * *Pringlea antiscorbutica* R.Br.ex Hook. f.

Caryophyllaceae
- * *Colobanthus kerguelensis* Hook. f.

Callitrichaceae
- **Callitriche antarctica* Engelm. ex Hegelm.

Poaceae
- *Deschampsia antarctica* Desv.
- *Poa annua* L.
- **Poa cookii* Hook. f.
- *Poa kerguelensis* Steud.

Portulacaceae
- *Montia fontana* L.

Ranunculaceae
- *Ranunculus crassipes* Hook. f.

Rosaceae
- *Acaena magellanica* (Lam.) Vahl.

* denotes recorded from McDonald Island

(adapted from George, Orchard & Hewson, 1993[63], Turner, Scott & Rozefelds, in press[62])

Appendix 16. Bryophyte Species Recorded from Heard Island

MUSCI - Mosses

Andreaeales
- Andreaeaceae
  - *Andreaea acuminata* William Mitten
  - *Andreaea mutabilis* J.D. Hooker & William M. Wilson

Fissidentales
- Fissidentaceae
  - *Fissidens* sp Johann Hedwig

Dicranales
- Ditrichaceae
  - *Ceratodon purpureus* (Johann Hedwig) Samuel Élisée von Bridel
  - *Ditrichum conicum* (Jean Pierre François Camille Montagne) Mitten
  - *Ditrichum immersum* Bennard Otto van Zanten
  - *Ditrichum subaustrale* Viktor Ferdinand Brotherus
- Dicranaceae
  - *Dicranella cardotii* (Robert, of NZ Brown) Hugh Neville Dixon
  - *Dicranella* sp. (Johann Karl August Müller) Wilhelm Philipp Schimper
  - *Dicranoloma billardieri* (Samuel Élisée von Bridel) Jean Édouard Gabriel Narcisse Paris (Basionym: *Dicranum billardieri* Samuel Élisée von Bridel)
  - *Dicranoweisia antarctica* (Johann Karl August (Friedrich Wilhelm) Müller) Jean Édouard Gabriel Narcisse Paris
  - *Dicranoweisia brevipes* (Johann Karl August Müller) Jules Cardot
  - *Dicranoweisia breviseta* Jules Cardot

Seligeriales
- Seligeriaceae
  - *Blindia contecta* (J.D. Hooker & William M. Wilson) Johann Karl August Müller
  - *Blindia robusta* Georg Ernst Ludwig Hampe
  - *Verrucidens microcarpus* (William M. Mitten) Bennard Otto van Zanten
  - *Verrucidens tortifolius* (J.D. Hooker & William M. Wilson) Reimers

Pottiales
- Pottiaceae
  - *Henediella heimii* (Johann Hedwig) R.H.Zander (Basionym: *Pottia heimii* (Johann Hedwig) Georg Ernst Ludwig Hampe (Reference: Streimann and Klazenga 2001)
  - *Syntrichia anderssonii* (Johan Ångström) R.H. Zander (Basionym: Tortula anderssonii Johan Ångström)
  - *Syntrichia geheebiaeopsis* (Johann Karl August Müller) R.H. Zander (Basionym: Tortula geheebiaeopsis (Johann Karl August Müller) Viktor Ferdinand Brotherus)
  - *Trichostomum* sp. Philipp Bruch

Grimmiales
- Grimmiaceae
  - *Grimmia immersoleucophaea* (Johann Karl August Müller) Jean Édouard Gabriel Narcisse Paris
  - *Grimmia* sp. Johann Hedwig
  - *Racomitrium crispulum* (J.D. Hooker & William M. Wilson) J.D. Hooker & William M. Wilson var *crispulum*
  - *Racomitrium lanuginosum* (Johann Hedwig) Samuel Élisée von Bridel
  - *Schistidium apocarpum* (Johann Hedwig) Philipp Bruch & Wilhelm Philipp Schimper
  - *Schistidium falcatum* (J.D. Hooker & William M. Wilson) B. Bremer

Bryales
- Bryaceae
  - *Bryum dichotomum* Johann Hedwig
  - *Bryum pseudotriquetrum* (Johann Hedwig) P. Gaertner, Bernhard Meyer & Johannes Scherbius
  - *Bryum* sp. Johann Hedwig
  - *Pohlia wahlenbergii* (F. Weber & D. Mohr) A.L. Andrews
  - *Pohlia* sp. Johann Hedwig
- Bartramiaceae
  - *Bartramia patens* Samuel Élisée von Bridel
  - *Philonotis* cf. *angustifolia* Baard Bastian Larsen Kaalaas

Orthotrichales
- Orthotrichaceae
  - *Muelleriella crassifolia var. acuta* (Johann Karl August Müller) D.H. Vitt

Hypnales
- Amblystegiaceae
  - *Amblystegium serpens* (Johann Hedwig) Wilhelm Philipp Schimper
  - *Sanionia uncinata* (Johann Hedwig) Leopold Loeske
- Brachytheciaceae
  - *Brachythecium austrosalebrosum* (Johann Karl August Müller) Jean Édouard Gabriel Narcisse Paris
  - *Brachythecium paradoxum* (J.D. Hooker & William M. Wilson) A. Jaeger

Polytrichales
- Polytrichaceae
  - *Polytrichastrum alpinum* (Johann Hedwig) Gary Lane Smith (Basionym: *Polytrichum alpinum* Johann Hedwig)
  - *Polytrichum piliferum* Johann Hedwig
  - Polytrichaceae sp Christian Friedrich Schwägrichen
  - *Notoligotrichum australe* (J.D. Hooker & William M. Wilson) Gary Lane Smith (Basionym: *Polytrichum australe* J.D. Hooker & William M. Wilson)

HEPATICAE - Liverworts

Jungermanniales
- Cephaloziellaceae
  - *Cephalozia badia* (Carl Moritz Gottsche) Franz Stephani
  - *Cephaloziella varians* (Carl Moritz Gottsche) Franz Stephani
- Jungermanniaceae
  - *Anastrophyllum auritum* (Johann Georg Christian Lehmann) Franz Stephani
  - *Cryptochila grandiflora* (Johann Bernhard Wilhelm Lindenberg & Carl Moritz Gottsche) Riclef Grolle
  - *Jungermannia coniflora* Victor Félix Schiffner
  - *Lophozia leucorhiza* (William Mitten) R. M. Schuster
- Gymnomitriaceae

Herzogobryum atrocapillum (J.D. Hooker & Thomas Taylor) Riclef Grolle
Herzogobryum vermiculare (Victor Félix Schiffner) Riclef Grolle
Blepharidophyllaceae
Blepharidophyllum densifolium (W. J. Hooker) Johan Ångström ex C. Massal.
Geocalycaceae
Chiloscyphus coadunatus (Olavo Swartz) J.J. Engel & R. M. Schuster
Chiloscyphus gremmenii Váňa spec. nova
Clasmatocolea rigens (J.D. Hooker & Thomas Taylor) J.J. Engel
Pachyglossa fissa (William Mitten) Theodor Carl Julius Herzog & Riclef Grolle
Pachyglossa grolleana Váňa, spec. Nova
Pedinophyllopsis abdita (William Starling Sullivant) R.M. Schuster & Hiroshi Inoue
Metzgeriales
Fossombroniaceae
*Austrofossombronia australi*s (William Mitten) R.M.Schuster (Basionym: *Fossombronia australis* Mitt.)
Marchantiales
Aneuraceae
Riccardia georgiensis (Franz Stephani) Gabriela G. Hässel subsp. *sympodea* R. M. Schuster (new for Heard Island)
Riccardia sp. Gray
Marchantiaceae
Marchantia berteroana Johann Georg Christian Lehmann & Johann Bernhard Wilhelm Lindenberg

(from Scott & Bergstrom, in press[49])

Appendix 17. Marine Macro-algae Recorded at Heard Island

CHLOROPHYTA (Green algae)

Chaetophorales
- Chaetophoraceae
  - *Endophyton atroviridis* O'Kelly sp.ined.

Acrosiphoniales
- Acrosiphoniaceae
  - *Acrosiphonia pacifica* (Montagne) J. Agardh
- Codiolaceae
  - *Urospora penicilliformis* (Roth) Areschoug

Cladophorales
- Cladophoraceae
  - *Rhizoclonium ambiguum* (Hooker f. & Harvey) Kützing

PHAEOPHYTA (Brown algae including giant kelps)

Desmarestiales
- Desmarestiaceae
  - *Desmarestia chordalis* Hooker f. & Harvey

Durvillaeales
- Durvillaeaceae
  - *Durvillaea antarctica* (Chamisso) Hariot

RHODOPHYTA (Red algae)

Bangiales
- Bangiaceae
  - *Porphyra columbina* Montagne

Bonnemaisoniales
- Bonnemaisoniaceae
  - *Delisea pulchra* (Greville) Montagne

Nemaliales
- Chaetangiaceae
  - *Chaetangium fastigiatum* (Bory de Saint-Vincent) J. Agardh

Gigartinales
- Gigartinaceae
  - *Iridaea cordata* (Turner) Bory de Saint-Vincent
- Plocamiaceae
  - *Plocamium hookeri* Harvey

Palmariales
- Palmariaceae
  - *Palmaria decipiens* (Reinsch) R. W. Ricker comb. nov.
  - *Palmaria georgica* (Reinsch) R. W. Ricker comb. nov.

Ceramiales
- Ceramiaceae
  - *Ballia callitricha* (C. Agardh) Kützing
  - *Plumariopsis eatoni* (Dickie) De Toni
- Delesseriaceae
  - *Schizoseris condensata* (Reinsch) R. W. Ricker comb. nov.
- Rhodomelaceae
  - *Bostrychia vaga* Hooker f. & Harvey
  - *Lophurella hookeriana* (J. Agardh) Falkenberg

(adapted from Ricker 1987[124])

Appendix 18. Terrestrial Invertebrates Recorded at Heard Island

PROTISTA
Rhizopoda
Arcella sp.
Arcella vulgaris Ehrenberg
Difflugia constricta Ehrenberg
Difflugia globulosa Dujardin
Difflugia piriformis Perty
Euglypha seminulum Ehrenberg
Nebella collaris Ehrenberg
Ciliata
nr. *Paramecium* sp.
ACOELOMATA
Platyhelminthes
GASTROTRICHA
Chaetonotus sp.
TARDIGRADA
Acutuncus antarcticus Richters
Dactylobiotus sp.
Echiniscus sp.
Hypsibius dujardini Doy
Hypsibius sp. nov.
Macrobiotus oberhauseri Doy
Macrobiotus sp.
NEMATODA
Mononchidae
Coomansis gerlachei de Man
Dorylaimidae
Mesodorylaimus sp. n.
Endorylaimus sp. n.
Desmodoridae
Eubostrichus guerni Certes
Monhysteridae
Monhystera sp.
ROTIFERA
Adineta sp.
Adineta vaga Davis
Bdelloidea unidentified
Callidina sp. 2 Richters
Callidina sp. 5 Richters
Cephalodella gibba Ehrenberg
Cephalodella sterea Gosse
Cephalodella ventripes Dixon-Nuttall
Collotheca ornata cornuta Dobie
Colurella colurus compressa Lucks
Dicranophorus sp.
Encentrum heardensis Dartnall
Encentrum mustela Milne
Encentrum unicatum Milne
Epiphanes senta O.F. Muller
Euchlanis sp.
Habrotrocha constricta Dujardin
Habrotrocha sp.
Lepadella patella Muller
Lepadella triptera Ehrenberg
Lindia torulosa Dujardin
Notholca hollowdayi Dartnall
Notholoca sp.
Notommata glyphura Wilfert
Ptygura sp.
Resticula gelida Harring and Myers
Rhinoglena frontalis Ehrenberg
Rotatoria rotatoria Pallas
Trichocerca brachyura Gosse
ANNELIDA
OLIGOCHAETA
Megascolecidae
Microscolex kerguelarum Grube
Lumbricidae
Dendrodrilus rubidus^ Savigny
Enchytraeidae
Lumbricillus macquariensis Benham
Lumbricillus lineatus Muller
Lumbricillus maximus Michaelsen
Lumbricillus sp.
ARTHROPODA
CRUSTACEA
Brachipoda
Cladocera
Alona weinecki Studer
Pleuroxus wittsteini Studer
Macrothrix hirsuticornis Norman & Brady
Daphniopsis studeri Ruhe
Copepoda
Calanoida
Boeckella brevicaudata Brady
Harpacticoida
Canthocamptus sp. 1 Richters
Epactophanes richardi Richters
Ostracoda
COLLEMBOLA
Arthropleona
Neanuridae
Friesea tilbrooki Wise
Friesea bispinosa Deharveng
Onychiuridae
Tullbergia bisetosa Börner
Tullbergia templei Wise
Isotomidae
Cryptopygus antarcticus Wilhelm
Cryptopygus caecus Wilhelm
Cryptopygus tricuspis Enderlein
Folsomotoma punctata Wahlgren
Isotoma sp.
Archisotoma brucei? Carpenter
INSECTA
Thysanoptera
Thripidae
Apterothrips apteris^ Daniel
Coleoptera
Hydraenidae
Meropathus chuni Enderlein
Curculionidae
Canonopsis sericeus C.O. Waterhouse
Palirhoeus eatoni C.O. Waterhouse
Bothrometopus gracilipes C.O. Waterhouse
Bothrometopus brevis C.O. Waterhouse
Ectemnorhinus viridis G.R. Waterhouse

Diptera
- Chironomidae
  - *Tematogeton sp.*
- Micropezidae
  - *Calycopteryx moseleyi* Eaton
- Sphaeroceridae
  - *Anatalanta aptera* Eaton
- Ephydridae
  - *Amalopteryx maritima* Eaton

Siphonaptera
- Rhopalopsyllidae
  - *Parapsyllus magellanicus* Jordan
- Pygiopsyllidae
  - *Notiopsylla kerguelensis* Taschenberg

Mallophaga
- Echinophthiridae
  - *Lepidophthirus macrorhini* Enderlein
- Menoponidae
  - *Actornithophilus pauliani* Seguy
  - *Austromenopon fuscofasciatum* group
- Philopteridae
  - *Austrogoniodes macquariensis* Harrison
  - *Austrogoniodes concii* von Kéler
  - *Austrogoniodes cristati* von Kéler
  - *Austrogoniodes bicornutus* von Kéler
  - *Haffneria grandis* Piaget
  - *Naubates prioni* Enderlein
  - *Naubates clypeatus* Giebel
  - *Pelmatocerandra enderleini* Eichler
  - *Pelmatocerandra setosa* Giebel
  - *Quadraceps vaginalis* Timmermann
  - *Saemundssonia pterodromae* Timmermann
  - *Saemundssonia australis* Timmermann
  - *Saemundssonia euryrhyncha* Giebel
  - *Saemundssonia lari* O. Fabricius
  - *Saemundssonia lockleyi* Clay

Lepidoptera
- Yponomeutidae
  - *Embryonopsis halticella* Eaton

ACARINA

Ixodida
- Ixodidae
  - *Ixodes kerguelenensis* Andre
  - Ixodes uriae White

Mesostigmata
- Veigaidae
  - *Cyrthydrolaelaps watsoni* Hirschmann
- Ologamasidae
  - *Parasitiphis jeanneli* André
  - *Parasitiphis* sp.
  - *Athiasella* sp.
  - *Ologamasid* spp. (3)
  - *Litogamasus* sp.
  - *Acugamasus* sp.
- Davacaridae
  - *Davacarus gressitti* Hunter
- Laelapidae
  - *Androlaelaps pachyptilae* Zumpt & Till
  - *Stevacarus evansi* Hunter
  - *Stevacarus claggi* Hunter
- Digamasellidae
  - *Digamasellus templei* Hunter

Prostigmata
- Pygmephoridae
  - gen. species
- Scutacaridae
  - *Disparipes antarcticus* Richters
- Nanorchestidae
  - *Nanorchestes antarcticus* Womersley & Strandtmann
  - *Nanorchestes* sp.
- Eupodidae
  - Eupodes sp. 1
- Halacaridae
  - *Isobactrus magnus* Lohmann
  - *Rhombognathus auster* Bartsch
  - *Rhombognathus apsteini* Lohmann
  - *Lohmannella falcata* Hodge
  - *Wertella tera* Bartsch
- Tydeidae
  - *Tydeus* sp. 1
- Bdellidae
  - *Bdellodes* sp.

Oribatida
- Crotonioidea
  - indet. species
- Brachychthonidae
  - *Liochthonius australis* Covarrubias
- Metrioppidae
  - *Macquarioppia striata* Wallwork
- Oppiidae
  - *Globoppia intermedia longiseta* Wallwork
  - *Globoppia loxolineata* Wallwork
  - *Austroppia crozetensis* Richters
- Ameronothridae
  - *Halozetes marinus* Lohmann
  - *Halozetes belgicae belgicae* Michael
  - *Halozetes belgicae brevipilis* Wallwork
  - *Halozetes marionensis* Engelbrecht
  - *Halozetes intermedius* Wallwork
  - *Halozetes crozetensis* Richters
  - *Halozetes* sp. nov.
  - *Alaskosetes antarcticus antarcticus* Michael
  - *Alaskozetes antarcticus grandjeani* Dalenius
  - *Alaskozetes sp.*
  - *Podacarus auberti auberti* Grandjean
  - *Podacarus auberti occidentalis* Wallwork

Astigmata
- Acaridae
  - *Tyrophagus putrescentiae*^ Schrank
- Algophagidae
  - *Algophagus antarcticus* Hughes
  - *Algophagus semicollaris* Fain
- Hyadesiidae
  - *Hyadesia kerguelenensis* Lohmann
  - *Hyadesia halophila* Fain
  - *Hyadesia subantarctica* Fain
- Winterschmidtidae

Neocalvolia sp. nov.
Neocalvolia kerguelenensis Fain
Histiostomatidae
Austranoetus kerguelenensis Fain
Pterolichidae
Thecarthra theca Megnin & Trouessart
Analgesidae
Alloptes aschizurus Gaud
Alloptes chionis Atyeo & Peterson
Avenzoaridae
Laronyssus marinus Trouessart
Laronyssus martini Trouessart
Proctophyllodidae
Microspalax manicata Megnin & Trouessart
Oxyalges cardiurus Gaud & Atyeo
Oxyalges incertus Gaud
ARANEIDA
Desidae
Myro kerguelensis Cambridge
MOLLUSCA
Charopidae
Notodiscus hookeri Reeve

(The main source of this data is a list compiled by P. Greenslade. The mite list was compiled by D.J. Marshall, and the insects updated by S.L. Chown – adapted from Chown, Greenslade and Marshall in press[64]. ^ denotes alien species recorded at Heard Island).

Appendix 19. Breeding Birds of Heard Island and the McDonald Islands

Adapted from Woehler in press[74]. Current estimates of breeding populations, approximate breeding schedules and current population trends are given where known.

Common name	Scientific name	Breeding population (pairs)	Breeding population trend	Arrival	Onset of laying	Onset of hatching	Fledge/departure
king penguin	*Aptenodytes patagonicus*	40 000	Increasing	YR	Mid Nov	Mid Jan	Late Dec-Jan
gentoo penguin	*Pygoscelis papua*	16 000	Decreasing?	YR	Mid-late Oct	Mid-late Nov	Late Feb-Mar
macaroni penguin	*Eudyptes chrysolophus*	1 000 000	No data	Late Oct – early Nov	Mid Nov	Dec	Mar
rockhopper penguin	*Eudyptes chrysocome*	10 000	No data	Early Nov	Mid-late Dec	Jan	Late Mar
wandering albatross[#]	*Diomedea exulans*	1	May be attempting to colonise?	Nov	Mid Dec-Jan	Mid Mar	Mid-Nov
black-browed albatross	*Thalassarche melanophrys*	≥ 600	Increasing?	Mid Sep	Mid Oct	Mid-late Dec	Apr
light-mantled sooty albatross	*Phoebetria palepebrata*	~ 500	Increasing?	Early Oct	Late Oct	Late Dec	May
southern giant petrel[*]	*Macronectes giganteus*	3000	Increasing?	Sep	Late Oct	Late Dec	May
cape petrel	*Daption capense*	1000 – 2500	No data	Early Sep	Late Nov	Early Jan	Mar
Antarctic prion	*Pachyptila desolata*	≥ 100 000	No data	Early Nov	Late Dec	Jan	Late Mar
fulmar prion	*Pachyptila crassirostris*	≥ 10 000	No data	Sep	Mid Nov	Mid Jan	Mid-late Feb
Wilson's storm petrel	*Oceanites oceanicus*	B	No data	Late Nov	Early Jan	Feb	Mar/Apr
common diving petrel	*Pelecanoides urinatrix*	1000 – 10 000	No data	Late Aug	Early Dec	Mid Jan	Apr
South Georgian diving petrel	*Pelecanoides georgicus*	10 000 – 100 000	No data	Late Oct	Early Dec	Late Jan-Feb	Apr
Heard Island sheathbill	*Chionis minor nasicornis*	< 1 000	No data	YR	Late Dec	Late Jan	Late Mar
kelp gull	*Larus dominicanus*	100 – 200	No data	YR	Mid Nov	Early Dec	Feb
subantarctic skua	*Catharacta lonnbergi*	500	No data	YR	Mid Nov	Mid Dec	Late Feb
Antarctic tern	*Sterna vittata*	100 – 200	No data	Late Oct	Mid Jan	Feb	Apr
Heard Island cormorant	*Phalacrocorax atriceps*	1000	No data	YR	Mid-late Oct	Early-mid Nov	Jan

YR indicates some or all of the population is present on Heard Island throughout the year. B indicates breeding reported but no estimate of breeding population size is available.

B indicates breeding reported but no estimate of breeding population size is available.

A single successful wandering albatross breeding event was observed at Cape Gazert in 1980[37] but there are no subsequent breeding records.

*The breeding southern giant petrel population on Heard Island may be increasing through displacement of breeding birds from the McDonald Islands.

Appendix 20. Physical/Biological Characteristics of Local Units in the HIMI Marine Reserve

Local Unit	Physical Characteristics	Biological Characteristics
Coral Bank	– mesa-like bank rising steeply from deep water – flat but rugged top with pinnacles, boulders and sand – 300 – 500 m deep – locally highly productive in relatively warm, nutrient-rich waters as it is influenced by relatively warm water of the ACC	– rich benthic fauna, including slow-growing gorgonian corals – affinity with Aurora Bank – stalked barnacles only found here – the echinoid *Eurocidaris nutrix* only found here and on the other banks* – localised distribution of the ophiuroid *Astrotoma agassizii* – productive area for meso-pelagic fish – habitat for juvenile *D. eleginoides* and skates – similar fish fauna to Aurora, Discovery and Pike Banks
Discovery Bank	– whale-backed bank rising from the northern plateau – reasonably flat with basaltic sand, but can be pebbly and craggy in places – about 300 – 400 m deep – influenced by relatively warm water of the ACC	– epibenthic fauna consists primarily of anemones, sponges and asteroids – tall erect glass sponges found here and at Shell Bank, north-eastern plateau and eastern trough – the echinoid *Eurocidaris nutrix* only found here and on the other banks* – localised distribution of the echinoid, *Ctenocidaris longispina** – habitat for juvenile *D. eleginoides* and skates – similar fish fauna to Aurora, Coral and Pike Banks
Shell Bank (representative portions)	– isolated mesa-like bank with a flat, even top – steep craggy slopes with a craggy rim – only area with a distinctly different substratum - white sand and uniquely covered with a thick deposit of shell grit – 180 - 350 m deep – cool water – influenced by an eddy of productive water	– rich benthic fauna with high diversity of echinoderms – tall erect glass sponges here and Discovery Bank, north-eastern plateau and eastern trough – only record of a new species of asteroid, *Astropectin* sp. – localised distribution of the asteroid *Rhopiella hirsuta* – the echinoid *Eurocidaris nutrix* only found here and on the other banks* – localised distribution of the holothurian *Cucumaria godeffroyi* – a morphotype of Valvifera isopods of the Family Idoteidae is local to this area, the north-eastern plateau and the eastern trough – distinct population of *C. gunnari* – habitat for juvenile *D. eleginoides* – population of *L. squamifrons* on south edge – part of the main foraging area, including area to the north and east, for many land-based marine predators
Territorial Sea	– substratum is mostly smooth, medium-grain black basaltic sand, with basaltic cobbles and boulders common in the nearshore area – 0 - 300 m deep – substratum disturbed by wave action in water shallower than 200 m, particularly in the north, north-east and eastern areas – southern margins are steep slopes descending to 1000 m deep	– diverse benthic fauna near to the island with affinities to inner southern plateau – a new species of sea cucumber, *Pseudocnus* sp. found here, in the southern plateau inner and the banks – localised distribution of the asteroid *Cycethra verrucosa* – localised distribution of the echinoid *Ctenodaris nutrix* – localised distribution of the holothurians Cucumaria kerguelensis, Cucumaria serrata, Trachythyone lecheri, Psolus ephippifer – localised distribution of the ophiuroids Opiacantha imago, Opiacantha vivipara, Ophiura ambigua – an asteroid morphotype and the ophiuroid, *Ophiacantha vivipara*, are local to this area – foraging area for nearshore flying birds, such as the endemic Heard Island cormorant
Southern Plateau Inner (representative portions)	– broad, flat, hard and even substratum – west, south and east margins are generally steep and undulating to craggy slopes – ground is mostly smooth, medium-grain black basaltic sand and grey silt – 200 – 500 m deep – influenced by relatively warm water of the ACC	– rich benthic fauna with affinities to nearshore areas in the territorial sea – asteroid *Briaster kerguelensis* only found in southern plateau (inner and outer) * – localised distribution of the holothurian *Psolidum incertum* – a new species of holothuroid, *Pseudocnus* sp. found here, in the territorial sea and the banks – very young mackerel icefish have been found here – *D. eleginoides* is widespread with mostly juveniles on the plateau surface – a principal habitat for skates, *C. rhinoceratus* and a variety of less common nototheniids
Southern Plateau Outer (representative portions)	– broad, flat and even substratum – east and west margins generally steep and undulating to craggy slopes – ground is mostly smooth, medium-grain black basaltic sand and grey silt – 300 – 500 m deep – influenced by cooler water from the eastern trough	– rich benthic fauna with affinities to the eastern trough, such as prawns, shrimps and isopods – variety of asteroids and the polychaetes from the Family Aphroditidae are local to this area – the asteroid *Briaster kerguelensis* only found in the southern plateau (inner and outer) * – localised distribution of the asteroid *Smilasterias triremis*

Local Unit	Physical Characteristics	Biological Characteristics
	and the relatively warm water of the ACC in the west and north of this unit	– the asteroid *Bathydiaster loripes obesus* only found here and in the northern plateau* – the ophiuroid *Ophiura* sp.2 only found here and in the northern plateau – soft coral only found here – contains a separate stock of *C. gunnari*, concentrating in the shallow water in the eastern half of the unit – *D. eleginoides* is widespread, but there are mostly juveniles on the plateau surface, with larger fish generally on the slopes – principal habitat for skates, *C. rhinoceratus* and a variety of less common nototheniids
Northern Plateau (representative portions)	– relatively narrow region of the main plateau – very uneven topography – hard substratum of basaltic cobbles, small pinnacles, shell grit, black sand and grey silt – deeper than the southern plateau, averaging about 500 m depth – influenced by cooler water from the eastern trough and the relatively warm water of the ACC in the west and central areas of this unit	– similar benthic fauna to Discovery Bank and the north-eastern plateau – the asteroid *Bathydiaster loripes obesus* only found here and in the southern plateau outer* – *Ophiura* sp.2 only found here and in the southern plateau outer – fewer *D. eleginoides* and skates and a less abundant and diverse fish fauna generally
North-eastern Plateau (representative portions)	– hard substratum with cobbles, yellow sand and grey silt – 500 – 700 m deep which slopes into deeper water in the east	– similar benthic fauna to Shell Bank – tall erect glass sponges found here and at Discovery Bank, Shell Bank, and eastern trough – a morphotype of Valvifera isopods of the Family Idoteidae is unique to this area, Shell Bank and the eastern trough – only record of a new species of holothurian, *Psolus* sp. – only records of three new species of ophiuroid, *Amphiura* sp., *Ophiacantha* sp. and *Ophiomitrella* sp. – localised distribution of the ophiuroid *Asteronyx loveni* – only known location within the HIMI region where Lucifer Sharks (*Etmopterus granulosus*) have been recorded – fish fauna comprising mainly *D. eleginoides* and deeper water species such as the Macrouridae and Moridae – part of the main foraging area, including area to the north and east, for many land-based marine predators
South of HIMI (local unit is only a small portion of AEEZ to south of HIMI)	– relatively warmer water of the ACC moving over the southern parts of the plateau	– no information is available to describe this area except that a number of land-based marine predators forage to the south of the island

*South Australia Museum identification needs to be confirmed

(adapted from Meyer, Constable & Williams 2000[1])

Appendix 21. Nearshore Fishes recorded at HIMI

Class Chondrichthyes

Order Rajiformes

Family Rajidae (Skates)

Bathyraja murrayi Gunther

Bathyraja eatonii Gunther

Bathyraja irrasa Hureau & Ozouf-Costaz

Order Lamniformes

Lamna nasus Bonnaterre

Order Squaliformes

Etmopterus sp

Somniosus pacificus Stevens

Class Actinopterygii

Order Aulopiformes

Family Paralepididae (Barracudinas)

Notolepis coatsi Dollo

Order Myctophiformes

Family Myctophidae (Lantern Fish)

Krefftichthys anderssoni Lönnberg

Protomyctophum bolini Fraser-Brunner

Electrona antarctica Gunther

Gymnoscopelus bolini Andriashev

Gymnoscopelus nicholsi Gilbert

Gymnoscopelus frasaeri Fraser-Brunner

Gymnoscopelus braueri Lönnberg

Order Gadiformes

Family Muraenolepididae (Eel Cods)

Muraenolepis orangiensis Vaillant

Family Macrouridae (Rat Tails, Grenadiers)

Cynomacrourus pirei Dollo

Macrourus whitsoni Regan

Macrourus carinatus Gunther

Family Zoarcidae

Melanostigma gelatinosum Gunther

Order Scorpaeniformes

Family Congiopodidae (Horse fishes)

Zanclorhynchus spinifer Gunther

Order Perciformes

Suborder Notothenioidei

Family Nototheniidae (Antarctic Cods)

Dissostichus eleginoides Smitt

Gobionotothen acuta Gunther

Lepidonotothen (Lepidonotothen squamifrons) Gunther

Lepidonotothen (Lindbergichthys) mizops Gunther

Notothenia (Indonotothenia) cyanobrancha Richardson

Notothenia (Notothenia) coriiceps Richardson

Notothenia (Notothenia) rossii Richardson

Paranotothenia magellanica Forster

Family Harpagiferidae (Plunder Fishes)

Harpagifer spinosus Hureau, Louis, Tomo and Ozouf

Family Channichthyidae (Icefishes)

Champsocephalus gunnari Lönnberg

Channichthys rhinoceratus Richardson

Family Bathydraconidae

Bathydraco cf. *marri* DeWitt

Suborder Scombroidei

Family Gempylidae (Snake Mackerels)

Paradiplospinus gracilis Brauer

Order Pleuronectiformes

Suborder Pleuronectoidei

Family Achiropsettidae (Southern Flounders)

Mancopsetta maculata Gunther

(adapted from Williams in press[97])

Appendix 22. Risks and Prescriptions

This Appendix lists some of the main risks relating to human health and safety, conservation, community and government relations, legal compliance and law enforcement and finances and administration that have been considered relevant to the HIMI Marine Reserve at the time of preparing this Plan, plus some of the most relevant prescriptions that address these risks. The list is not exhaustive and further information on the management of a range of risks in the Reserve is given throughout the Plan.

Type of risk	Cause	Relevant Section(s)
Safety		
Death or injury of AAD staff, Australian Antarctic program participants, or other visitors to the Reserve	– Technical terrain – Exposure to severe climate/weather conditions – LARC/IRB operations (particularly landings) – Helicopter operations – Wind-blown debris from ANARE Station site – Confrontation with wildlife	3, 5.1, 5.3, 4, 6.1, 9.4
Conservation		
Major alterations to the structure and functioning of terrestrial ecosystems through the introduction and spread of alien species	– Unclean small craft taken ashore – Unclean helicopters taken ashore – Unclean vehicles taken ashore – Unclean footwear/clothing taken ashore – Unclean equipment/stores taken ashore – Fresh fruit or vegetables taken ashore – Unclean footwear/clothing/equipment moved between major ice-free regions	3, 5.1, 5.2, 5.3, 4, 6.3, 6.4, 6.5, 8, 9.2, 9.4
Major alterations to the structure and functioning of marine ecosystems through the introduction of alien species	– Hull fouling of vessels and small craft – Fouling of equipment used in the water – Ballast water discharged or exchanged in the Territory – Waste water discharged in the Territory – Wastes discharged in the Inner Marine Zone	3, 5.1, 5.2, 5.3, 4, 6.3, 6.4, 6.5, 8, 9.2, 9.4
Death, disturbance or decreased breeding success of wildlife through disturbance associated with human activities in the Reserve	– Approach by persons on foot – Approach by vehicles (including ground vehicles, vessels, and helicopters) – Handling and manipulation of wildlife for approved research purposes, under permit – Bird strike on guys wires/antennae – Bird strike on vessels – Marine pollution from shipping activities – Marine debris	3, 5.1, 5.2, 5.3, 4, 6.1, 6.2, 6.3, 6.4, 8, 9.2,
Landscape and vegetation disturbance associated with human activities in the Reserve	– Trampling by persons on foot – Damage/compaction by vehicles – Damage/compaction by helicopters – Disturbance from facilities or installations – Contamination from waste discharge – Contamination from oil/fuel spills	3, 5.1, 5.2, 5.3, 4, 6.1, 6.2, 6.3, 6.4, 8, 9.2,
Loss or degradation of cultural heritage associated with human activities in the Reserve	– Damage by vehicle use – Souveniring – Disturbance by facilities/installations	3, 5.1, 5.2, 5.3, 4, 7, 8, 9.2,
Loss or degradation of wilderness and aesthetic values associated with human activities in the Reserve	– Placement of facilities/installations – Track formation – Landscape disturbance by vehicles	3, 5.1, 5.2, 5.3, 4, 6.2, 6.3, 8, 9.2,
Loss or degradation of conservation values due to natural processes	– Volcanic activity – Severe storms	5.3, 6.1, 6.5, 8, 9.2, 9.4

Type of risk	Cause	Relevant Section(s)
	– Glacial action – Coastal erosion – Wildlife trampling – Natural introduction of species	
Death of marine resources, bycatch of marine species (including seabirds) and destruction of benthic habitat	– Illegal fishing – Marine pollution from shipping activities – Marine research and monitoring	5.1, 5.3, 4, 6.1, 6.2, 6.3, 6.5, 8, 9.2,
Community and government relations		
Failure to achieve the aims of the Plan or effectively manage the Reserve	– Lack of community support from other agencies and visitors in the region	5.3, 5.4, 4, 8
Poor public perception of AAD as administrator and prime user of Reserve.	– Lack of transparency in decision making Lack of consultation on administration and management of the Reserve – Information about the Reserve and its values is not available to the public	5.3, 5.4, 4, 8
Legal compliance and law enforcement		
Non-compliance by Government and non-government visitors with applicable Australian legislation or provisions of the Plan	– Lack of knowledge, information or awareness of compliance requirements by visitors – Lack of training/briefing – Lack of knowledge, information or awareness of compliance requirements by reserve managers – Insufficient resources to enforce requirements of legislation and plan – Lack of support from other agencies and visitors in the region	5.3, 5.4, 9.2
Non-compliance by transiting or third party visitors to the Reserve with applicable Australian legislation or provisions of the Plan	– Lack of knowledge, information or awareness of compliance requirements by visitors – Lack of training/briefing – Lack of knowledge, information or awareness of compliance requirements by reserve managers – Insufficient resources to enforce requirements of legislation and plan – Lack of support from other agencies and visitors in the region	5.3, 5.4, 8, 9.2
Finances and administration		
Failure to achieve the aims of the Plan or effectively manage the Reserve	– Inadequate resources available in AAD's appropriation from Government – Inadequate allocation of AAD funds to effectively implement the prescriptions – Lack of operational planning required to effectively implement the prescriptions – Isolation/low frequency of visits – Lack of administrative support required to maintain implementation schedule – Lack of logistical/technical support required to facilitate management actions – Lack of relevant scientific and monitoring information	6.5, 9.1, 9.3
Requirement to employ significant funds to eradicate or control alien species	– Non-compliance with quarantine requirements – Lack of enforcement of quarantine requirements	5.3, 5.4, 6.4, 9.2

Bibliography and Further Reading

1. Meyer, L., Constable, A. & Williams, R. 2000. *Conservation of marine habitats in the region of Heard Island and the McDonald Islands*. Australian Antarctic Division, Department of the Environment and Heritage, Kingston.
2. Department of the Environment Sport and Territories 1996. *Heard Island and McDonald Islands - Nomination by the Government of Australia for Inscription on the World Heritage List*. Department of the Environment, Sport and Territories.
3. Watkins, D. & Jaensch, R. 2003. *A strategic assessment of nationally important wetlands managed by the Commonwealth in relation to the listing of Wetlands of International Importance*. Environment Australia, Canberra.
4. IMCRA Technical Group 1998. *Interim Marine and Coastal Regionalisation for Australia* [http://www.deh.gov.au/coasts/mpa/nrsmpa/imcra.html], cited 3 February 2004
5. AAD 1995. *Heard Island Wilderness Reserve: Management Plan*. Australian Antarctic Division, Department of Environment, Sports and Territories, Kingston.
6. Vincent, R. in press. *Atlas Cove, Heard Island Cultural Heritage Management Plan.* Australian Antarctic Division, Department of the Environment and Heritage, Kingston.
7. Environment Australia 2002. *A Directory of Important Wetlands in Australia, third edition* [http://www.deh.gov.au/water/wetlands/database/directory/index.html], cited 14 April 2004
8. AMSA 2004. *Australian Maritime Safety Authority website* [http://www.amsa.gov.au], cited 11 March 2004
9. Environment Australia 1998. *Australia's Oceans Policy*. Environment Australia, Canberra.
10. ANZECC Taskforce of Marine Protected Areas 1999. *Strategic Plan of Action for the National Representative System of Marine Protected Areas*. Environment Australia, Canberra.
11. Environment Australia 2001. *Recovery Plan for Albatrosses and Giant Petrels*. Environment Australia, Canberra.
12. DEH 2004. *Sub-antarctic Fur Seal and Southern Elephant Seal Recovery Plan*. Department of the Environment and Heritage, Canberra.
13. DEH 2004. *Draft recovery plan for ten species of seabird 2004-2009.* Department of the Environment and Heritage, Canberra.
14. Environment Australia 1998. *Threat Abatement Plan for the Incidental catch (or by-catch) of seabirds during oceanic longline fishing operations.* Environment Australia, Canberra.
15. Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia, Canberra.
16. Bannister, J.L., Kemper, C.M. & Warneke, R.M. 1996. *The Action Plan for Australian Cetaceans*. Environment Australia, Canberra.
17. Shaugnessy, P.D. 1999. *The Action Plan for Australian Seals*. Environment Australia, Canberra.
18. Department of the Environment Sport and Territories 1996. *National Strategy for the Conservation of Australia's Biological Diversity*. Department of the Environment, Sport and Territories.
19. Ecologically Sustainable Development Steering Committee 1992. 'National Strategy for Ecologically Sustainable Development'.
20. Kiernan, K., McConnell, A. & Yates, T. 1998. 'Tube-fed pahoehoe lava-flow features of Azorella Peninsula, Heard Island, spither Indian Ocean'. *Polar Record*, **340**(190): 225-236.
21. Stark, S.C., Gardner, D., Snape, I. & McIvor, E. 2003. 'Assessment Of Contamination By Heavy Metals and Petroleum Hydrocarbons at Atlas Cove Station, Heard Island'. *Polar Record*, **39**(4): 397-414.
22. IUCN 2000. *IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species* [www.iucn.org], cited 8 October 2003.
23. Richardson, D.M., Pysek, P., Rejmanek, M., Barbour, M.G., Panetta, F.D. & West, C.J. 2000. 'Naturalization and invasion of alien plants: concepts and definitions.' *Diversity and Distributions*, **6**: 93-107.
24. Frenot, Y., Chown, S.L., Whinam, J., Selkirk, P.M., Convey, P., Skotnicki, M. & Bergstrom, D.M. 2005. 'Biological invasions in the Antarctic: extent, impacts and implications'. *Biological Reviews*, **80**: 45-72.
25. Low, T. 1999. *Feral Future*. Penguin Books, Victoria.
26. Dartnall, H.J.G. 2003. 'Additions to the freshwater fauna of Heard Island'. *Papers and Proceedings of the Royal Society of Tasmania*, **135**: 75-79.
27. Chown, S.L. 2003. *The probability of introduction of non-indigenous species to Heard and McDonald Islands: Taxa, Risks and Mitigation.* Australian Antarctic Division, Department of the Environment and Heritage, Kingston.
28. Bester, M.N., Bloomer, J.P., Van Aarde, R.J., Arasmus, B.H., Van Rensburg, P.J.J., Skinner, J.D., Howell, P.G. & Naude, T.W. 2002. 'A review of the successful eradication of feral cats from sub-Antarctic Marion Island, Southern Indian Ocean'. *South African Journal of Wildlife Research*, **32**: 65-73.
29. Australia 2001. *Report on the open-ended intersessional contact group on diseases of Antarctic wildlife: Report 1 - Review and risk assessment.* Working Paper submitted to Committee for Environmental Protection Meeting IV.
30. Bergstrom, D. & Selkirk, P. 1997. 'Distribution of bryophytes on subantarctic Heard Island'. *Bryologist*, **100**(3): 349-355.
31. ASTEC 1998. *Environmental Research Ethics - National Principles and Guidelines for the Ethical Conduct of Research in Protected and Environmentally Sensitive Areas*. Australian Science, Technology and Engineering Council, Canberra.

32. Belbin, L., Gibson, J.A.E., Davis, C., Watts, D. & McIvor, E. 2003. 'State Of The Environment Reporting: An Antarctic Case Study'. *Polar Record,* **39**(3): 193-201.
33. Downes, M. 2002. *First Visitors to Heard Island.* ANARE Research Notes. Australian Antarctic Division, Department of the Environment and Heritage.
34. Downes, M. & Downes, E. in press. 'Sealing at Heard Island in the nineteenth century', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beattie.
35. Roberts, B.B. 1950. 'Historical notes on Heard and McDonald Islands.' *Polar Record,* **5**(40): 580-584.
36. Budd, G.M. 1972. *ANARE 1971 expedition to Heard Island.* Antarctic Division Technical Memorandum 17. Australian Antarctic Division, Department of External Affairs, Melbourne.
37. Veenstra, C. & Manning, J. 1982. *Expedition to the Australian Territory of Heard Island and McDonald Islands 1980*. Technical report 31. Department of National Development and Energy, Division of National Mapping, Canberra.
38. Hay 2004. Hay, I., Australian Antarctic Division, Personal Communication.
39. Thost, D. & Allison, I. in press. 'The Climate of Heard Island', in *Heard Island: Southern Ocean Sentinel.* ed. Green, K. & Woehler, E. Surry Beatty.
40. Ruddell, A. in press. 'An inventory of present glaciers on Heard Island and their historical variations', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beatty.
41. Quilty, P.G. in press. 'Heard Island and the McDonald Islands: built on the Kerguelen Plateau foundation', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beatty.
42. Quilty, P.G. & Wheller, G. 2000. 'Heard Island and the McDonald Islands: a window into the Kerguelen Plateau'. *Pap. Proc. R. Soc. Tasm.,* **133**(3): 1-12.
43. Stephenson, J., Barling, J., Wheller, G. & Clarke, I. in press. 'The geology and volcanic geomorphology of Heard Island', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beatty.
44. Barling, J., Goldstein, S.L. & Nicholls, I.A. 1994. 'Geochemistry of Heard Island (southern Indian Ocean): characterization of an enriched mantle component and implications for enrichment of the sub-Indian Ocean mantle'. *Journal of Petrology,* **35**(4): 1017-1053.
45. Kiernan, K. & McConnell, A. 1999. 'Geomorphology of the Sub-Antarctic Australian Territory of Heard Island-McDonald Island'. *Australian Geographer,* **30**(2): 159-195.
46. Ruddell, A. & Allison, I. 1998. 'The sensitivity of glaciers at Heard Island to climate change, and their recent response', in *Heard Island Wilderness Reserve: reports on natural science and cultural heritage research*, ANARE Research Notes. 101. ed. Selkirk, P.M. Australian Antarctic Division, Department of the Environment and Heritage, Kingston. pp 32.
47. Williams, G.D. 1998. *Numerical modelling of the response of Heard Island Glaciers to climate.* Unpublished Ph.D. thesis. Institute of Antarctic and Southern Ocean Studies, University of Tasmania, Hobart.
48. Thost 2004. Thost, D., Glaciologist, Australian Antarctic Division, Department of the Environment and Heritage, Personal Communication.
49. Scott, J.J. & Bergstrom, D.M. in press. 'Vegetation of Heard Island and the McDonald Islands', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beatty.
50. Hughes, J.M.R. 1987. 'The distribution and composition of vascular plant communities on Heard Island'. *Polar Biology,* **7**(3): 153-162.
51. Scott, J.J. 1989. 'New records of vascular plants from Heard Island'. *Polar Record,* **25**(152): 37-42.
52. Jenkin, J.F. 1997. 'Vegetation of the McDonald Islands, sub-Antarctic'. *Polar Biology,* **18**: 260-272.
53. Scott 2004. Scott, J., Botanist, University of Tasmania, Personal Communication.
54. Scott, J.J. & Ryan, U. 2004. *Heard Island vegetation mapping from orthophotos derived from non-metric photography, Australian Antarctic Data Centre - SnoWhite Metadata* [http://www.aad.gov.au/default.asp?casid=3802], cited 25 May 2005
55. Ling 2004. Ling, H., Australian Antarctic Division, Personal Communication.
56. Quilty, P.G., Shafik, S., McMinn, A., Brady, H. & Clarke, I. 1983. 'Microfossil evidence for the age and environment of deposition of sediments of Heard and McDonald Islands'. *Antarctic earth science; fourth international symposium*, Cambridge University Press.
57. Bergstrom, D.M. & Seppelt, R.D. 1988. 'The moss flora of Heard Island: revised checklist, annotations and phytogographical considerations'. *Lindbergia,* **14**: 184-190.
58. Bergstrom, D.M., Whinam, J. & Belbin, L. 2002. 'A classification of subantarctic Heard Island vegetation'. *Arctic, Antarctic and Alpine Research,* **34**: 169-177.
59. Scott, J.J. & Knowles, R. 1990. 'Changes in vegetation on Heard Island 1947--1987', in *Antarctic ecosystems, Ecological Change and Conservation*. ed. Kerry, K.R. & Hempel, G. Springer-Verlag, Berlin. pp 61-76.
60. Scott, J.J. & Kirkpatrick, J.B. in press. 'Changes in Subantarctic Heard Island vegetation at sites occupied by *Poa annua*, 1987-2000'. *Arctic and Antarctic Alpine Research.*
61. Bergstrom, D.M. & Chown, S.L. 1999. 'Life at the front: history, ecology and change in southern ocean islands'. *Trends in Ecology and Evolution,* **14**(12): 472-477.
62. Turner, P.A.M.T., Scott, J.J. & Rozefelds, A.C. in press. 'Probable long distance dispersal of *Leptinella plumosa* Hook.f. to Heard Island: habitat, status and discussion of its arrival'. *Polar Biology.*

63. George, A.S., Orchard, A.E. & Hewson, H.J. 1993. *Oceanic Islands. Flora of Australia Volume 50*. Australian Government Printing Services, Canberra.
64. Chown, S.L., Greenslade, P. & Marshall, D.J. in press. 'Terrestrial invertebrates of Heard Island', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beatty.
65. Lee, K.E. 1968. 'Oligochaeta from sub-Antarctic islands', in *B.A.N.Z. Antartarctic Research Expedition 1929-1931*, Reports - Series B (Zoology and Botany). 8(8). ed. Thomas, P.M. Mawson Institute for Antarctic Research, Adelaide. pp 147-165.
66. Green, K. 1993. *Heard Island 1992 ANARE Report*. Australian Antarctic Division, Kingston.
67. Dartnall, H.J.G. in press. 'The freshwater fauna of Heard Island: a review of current knowledge', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beattie.
68. Simpson, R.D. 1998. 'Marine biota of the shore communities of Heard Island - history of investigation, relationships to other regions, and future work', in *Heard Island Wilderness Reserve; reports on natural science and cultural heritage research*, ANARE Research Notes. 101. ed. Selkirk, P.M. Australian Antarctic Division, Department of the Environment and Heritage, Kingston. pp 35.
69. Edgar, G.J. & Burton, H.R. 2000. 'The biogeography of shallow-water macrofauna at Heard Island'. *Pap. Proc. R. Soc. Tasm.*, **133**(3): 23-26.
70. Smith, S.D.A. 1998. 'Community structure of *Durvillaea antarctica* holdfast fauna: baseline data collection', in *Heard Island Wilderness Reserve: reports on natural science and cultural heritage research*, ANARE Research Notes 101. ed. Selkirk, P.M. Australian Antarctic Division, Department of the Environment and Heritage. pp 36.
71. Smith, J.M.B. & Simpson, R.D. 1985. 'Biotic zonation on rocky shores of Heard Island'. *Polar Biology*, **4**(2): 89-94.
72. Simpson 2004. Simpson, R.D., Director, National Marine Science Centre, Personal Communication.
73. Woehler, E.J. & Croxall, J.P. 1991. 'Status and conservation of the seabirds of Heard Island and the McDonald Islands', in *Seabird - status and conservation: a supplement*, ICBP Technical Publication 11. International Council for Bird Preservation, Cambridge. pp 263-277.
74. Woehler, E.J. in press. 'Status and trends of the seabirds of Heard Island, 2000', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beattie.
75. Woehler, E.J., Auman, H.J. & Riddle, M.J. 2002. 'Long-term population increase of black-browed albatrosses *Thalassarche melanophrys* at Heard Island, 1947/1948 - 2000/2001'. *Polar Biology*, **25**: 921-927.
76. SC-CAMLR 2002. *Report of the Working Group on Fish Stock Assessment*. Report of the Twenty-First Meeting of the Scientific Committee for the Conservation of Antarctic Marine Living Resources, Hobart, Australia.
77. Page, B., Welling, A., Chambellant, M., Goldsworthy, S.D., Dorr, T. & Veen, R.v. 2003. 'Population status and breeding chronology of Heard Island fur seals'. *Polar Biology*, **26**: 219-224.
78. Wynen, L.P., Goldsworthy, S.D., Guinet, C., Bester, M.N., Boyd, I.L., Gjertz, I., Hofmeyr, G.J.G., White, R.W.G. & Slade, R. 2000. 'Postsealing genetic variation and population structure of two species of fur seal (*Arctocephalus gazella* and *A. tropicalis*)'. *Molecular Ecology*, **9**: 299-314.
79. Green, K., Hindell, M. & Kemper, C. 1997. 'Diving behaviour of Antarctic fur seals Arctocephalus gazella Peters around Heard Island', in *Marine mammal research in the Southern Hemisphere. Volume 1. Status, ecology and medicine*. Surrey Beatty, Chipping Norton, NSW. pp 97-104.
80. Green, K. in press. 'The marine mammals of Heard Island', in *Heard Island: Southern Ocean Sentinel*. ed. Green, K. & Woehler, E. Surrey Beatty.
81. Slip, D.J. 1997. *Foraging ecology of southern elephant seals from Heard Island*. Unpublished Ph.D. thesis. Department of Zoology, University of Tasmania, Hobart.
82. Slip, D.J. 1997. 'Diving and foraging behaviour of juvenile southern elephant seals from Heard Island', in *Marine mammal research in the Southern Hemisphere*, 1. ed. Hindell, M. & Kemper, C. Surrey Beatty, Chipping Norton, NSW. pp 114-124.
83. Slip, D.J. 1993. 'Diving of southern elephant seals, *Mirounga leonina*, from Heard Island', in *Heard Island 1992 ANARE Report*. ed. Green, K. Australian Antarctic Division, Hobart.
84. Green, K. & Williams, R. 1986. 'Observations on food remains in faeces of elephant, leopard and crabeater seals'. *Polar Biology*, **6**: 43-45.
85. Goldsworthy, S.D.S., P.D. 1989. 'Subantarctic fur seals Arctocephalus tropicalis at Heard Island'. *Polar Biology*, **9**(5): 337-339.
86. Gwynn, A.M. 1953. *The egg-laying and incubation periods of rockhopper, macaroni and gentoo penguins*. ANARE Reports. Antarctic Division, Department of External Affairs, Melbourne.
87. Brown, P.L. 1957. *Twelve came back*. Robert Hale, London.
88. Gales 2004. Gales, N., Marine Ecologist, Australian Antarctic Division, Personal Communication.
89. ODP 1998. *Leg 183 Scientific Prospectus Kerguelen Plateau -Broken Ridge: A Large Igneous Province*. Scientific Prospectus. Ocean Drilling Program, Texas A&M University, College Station.
90. Orsi, A.H., Whitworth, T., III & Nowlin, W.D., Jr 1995. 'On the meridional extent and fronts of the Antarctica Circumpolar Current'. *Deep Sea Research I*, **42**: 641-673.
91. Sparrow, M.D., Heywood, K.J., Brown, J. & Stevens, D.P. 1996. 'Current structure of the south Indian Ocean'. *Journal of Geophysical Research*, **101**: 6377-6391.

92. Speer, K.G. & Forbes, A. 1994. 'A deep western boundary current in the South Indian Basin'. *Deep Sea Research I*, **41**: 1289-1303.
93. Park, Y.-H., Gamberoni, L. & Charriaud, E. 1993. 'Frontal structure, water masses, and circulation in the Crozet Basin'. *Journal of Geophysical Research*, **98**: 12361-12385.
94. Belkin, I.M. & Gordon, A.L. 1996. 'Southern Ocean fronts from the Greenwich meridian to Tasmania'. *Journal of Geophysical Research*, **101**: 3675-3696.
95. Park, Y.-H. & Gamberoni, L. 1997. 'Cross-frontal exchange of Antarctic Intermediate Water and Antarctic Bottom Water in the Crozet Basin'. *Deep Sea Research II*, **44**: 963-986.
96. Forbes 1998. 'Heard Island regional oceanography', in *Heard Island Wilderness Reserve: reports on natural science and cultural heritage research*, ANARE Research Notes 101. ed. Selkirk, P.M. Australian Antarctic Division, Department of the Environment and Heritage. pp 12.
97. Williams, R. in press. 'The nearshore fishes', in *Heard Island: Southern Ocean Sentinel.* ed. Green, K. & Woehler, E. Surrey Beatty.
98. Gon, O. & Heemstra, P.C. 1990. *Fishes of the Southern Ocean.* JLB Smith Institute of Ichthyology, Grahamstown, South Africa.
99. Williams, R. 1983. 'Inshore fishes of Heard and McDonald Islands, Southern Indian Ocean'. *Journal of fish biology*, **23**(3): 283-292.
100. Williams, R. & de la Mare, W.K. 1995. 'Fish distribution and biomass in the Heard Island zone (Division 58.5.2)'. *CCAMLR Science*, **2**: 1-20.
101. Slip, D.J.M., Geoffrey J.; Green, Ken 1995. 'Stomach contents of a southern bottlenose whale, Hyperoodon planifrons, stranded at Heard Island'. *Marine Mammal Science*, **11**(4): 575-584.
102. Shaugnessy, P.D. 2000. *Antarctic seals, whales and dolphins of the early twentieth century: Marine mammals of the Australasian Antarctic Expedition 1911 - 14 (AAE) and the British, Australian and New Zealand Antarctic Research Expedition 1929 - 31 (BANZARE).* ANARE Reports. Australian Antarctic Division, Department of the Environment and Heritage, Kingston.
103. Bowles, A.E., Smultea, M., Wursig, B., DeMaster, D.P. & Palka, D. 1994. 'Relative Abundance and Behaviour of Marine Mammals Exposed to Transmissions from the Heard Island Feasibility Test'. *J. Acoust. Soc. Am.*, **96**(4): 2469-2484.
104. Bryden, M., Marsh, H. & Shaugnessy, P. 1998. *Dugongs, Whales, Dolphins and Seals. A guide to the sea mammals of Australasia.* Allen & Unwin, St Leonards.
105. Tynan, C.T. 1997. 'Cetacean distributions and oceanographic features near the Kerguelen Plateau'. *Geophysical Research Letters*, **24**(22): 2793-2796.
106. McGowan, A. & Lazer, E. 1989. *Heard Island archaeological survey (1986-1987).* Unpublished report to Australian Heritage Commission, Canberra.
107. Downes, M.C. 1996. *Indexing sealer's logbooks from Heard Island.* ANARE Research Notes. Australian Antarctic Division, Department of the Environment and Heritage, Kingston.
108. Crowther, W.E. 1970. 'Captain JW Robinson's narrative of a sealing voyage to Heard Island, 1858-60'. *Polar Record*, **15**(96): 301-316.
109. Bertrand, K.J. 1971. *Americans in Antarctica 1775-1948.* American Geographical Society Special Publication no. 39. American Geographical Society, New York.
110. Busch, B.C. 1980. 'Elephants and Whales: New London and Desolation, 1840-1900'. *American Neptune*, **XL**(2).
111. Moseley, H.N. 1879. *Notes by a Naturalist. An account of observations made during the voyage of H.M.S. "Challenger".* John Murray, London.
112. McKinney, M.L. & Lockwood, J. 1999. 'Biotic homogenization: a few winners replacing many losers in the next mass extinction'. *Trends in Ecology and Evolution*, **14**: 450-453.
113. Sala, O.E., Chapin, F.S., Armesto, J.J., Berlow, E., Bloomfield, J., Dirzo, R., Huber-Sanwald, E., Huenneke, L.F., Jackson, R.B., Kinzig, A., Leemans, R., Lodge, D.M., Mooney, H.A., Oesterheld, M., Poff, N.L., Sykes, M.T., Walker, B.H., Walker, M. & Wall, D.H. 2000. 'Global biodiversity scenarios for the year 2100'. *Science*, **287**: 1770-1774.
114. D'Antonio, C.M. & Dudley, T.L. 1995. 'Biological invasions as agents of change on islands versus mainlands', in *Islands. Biological Diversity and Ecosystem Function.* ed. Vitousek, P.M., Loope, L.L. & Adsersen, H. Springer, Berlin. pp 103-121.
115. Ruiz, G.M., Carlton, J.T., Groholz, E.D. & Hines, A.H. 1997. 'Global invasions of marine and estuarine habitats by non-indigenous species: mechanisms, extent, and consequences'. *American Zoologist*, **37**: 621-632.
116. Ruiz, G.M., Rawlings, T.K., Dobbs, F.C., Drake, L.A., Mullady, T., Huq, A. & Colwell, R. 2000. 'Global spread of microorganisms by ships'. *Nature*, **408**: 49-50.
117. Mack, R.N., Simberloff, D., Lonsdale, W.M., Evans, H., Clout, M. & Bazzaz, F.A. 2000. 'Biotic invasions: causes epidemiology, global consequences, and control'. *Ecological applications*, **10**: 689-710.
118. Bax, N., Carlton, J.T., Mathews-Amos, A., Haedrich, R.L., Howarth, F.G., Purcell, J.E., Rieser, A. & Gray, A. 2001. 'The control of biological invasions in the world's oceans'. *Conservation Biology*, **15**: 1234-1246.
119. Lockwood, J.L. & McKinney, M.L. 2001. *Biotic Homogenization.* Kluwer Academic, New York.

120. WBM Oceanics Australia 1997. *Guidelines for managing visitation to seabird breeding islands*. Prepared for Great Barrier Reef Marine Park Authority and Environment Australia - Biodiversity Group. Environment Australia, Canberra.
121. Chown, S.L., Gremen, N.J.M. & Gaston, K.J. 1998. 'Ecological biogeography of Southern Ocean islands: species-area relationships, human impacts, and conservation.' *American Naturalist*, **152**: 562-575.
122. Whinam, J. 1989. 'Structure and floristic composition of the Heard Island "pool complex" community.' *Polar Biology*, **9**: 499-503.
123. Woehler, E.J. & Croxall, J.P. 1997. 'The Status and Trends of Antarctic and Sub-Antarctic Seabirds'. *Marine Ornithology*, **25**: 43-66.
124. Ricker, R.W. 1987. *Taxonomy and Biogeography of Macquarie Island Seaweeds*. British Museum (Natural History), London.