The Antarctic Treaty

Measures adopted at
the Thirty-second Consultative Meeting
held at Baltimore 6 – 17 April 2009

Presented to Parliament
by the Secretary of State for Foreign and Commonwealth Affairs
by Command of Her Majesty
March 2011

Cm 8048 £33.00

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MEASURES ADOPTED AT THE THIRTY-SECOND CONSULTATIVE MEETING HELD AT BALTIMORE 6 – 17 APRIL 2009

The Measures[1] adopted at the Thirty-second Antarctic Treaty Consultative Meeting are reproduced below from the Final Report of the Meeting.

In accordance with Article IX, paragraph 4, of the Antarctic Treaty, the Measures adopted at Consultative Meetings become effective upon approval by all Contracting Parties whose representatives were entitled to participate in the meeting at which they were adopted (i.e. all the Consultative Parties). The full text of the Final Report of the Meeting, including the Decisions and Resolutions adopted at that Meeting, is available on the website of the Antarctic Treaty Secretariat at www.ats.aq.

The approval procedures set out in Article 6 (1) of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty[2] apply to Measures I to 14 (2009). The approval procedures set out in Article IX (4) of the Antarctic Treaty apply to Measure 15 (2009) and the approval procedures set out in Article 9 (1) of Annex II to the Protocol on Environment Protection to the Antarctic Treaty apply to Measure 16 (2009).

[1] As defined in Decision 1 (1995), published in Miscellaneous No. 28 (1996) Cm 3483

[2] Treaty Series No. 15 (2006) Cm 6855

The texts of the Antarctic Treaty together with the texts of the Recommendations of the first three Consultative Meetings (Canberra 1961, Buenos Aires 1962 and Brussels 1964) have been published in Treaty Series No. 97 (1961) Cmnd. 1535 and Miscellaneous No. 23 (1965) Cmnd. 2822. The text of the Environmental Protocol to the Antarctic Treaty has been published in Treaty Series No. 6 (1999) Cm 4256. The text of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty has been published in Treaty Series No. 15 (2006) Cm 6855.

The Recommendations of the Fourth to Eighteenth Consultative Meetings, the Reports of the First to Sixth Special Consultative Meetings and the Measures adopted at the Nineteenth and the Measures adopted at the Twenty-sixth, Twenty-seventh, Twenty-eighth, Twenty-ninth, Thirtieth and Thirty-first Consultative Meetings were also published as Command Papers. No Command Papers were published for the Twentieth to Twenty-fifth Consultative Meetings.

MEASURES ADOPTED AT THE XXXII Consultative Meeting held at Baltimore 6 - 17 April 2009

Note: The above page numbers have been produced for this command paper and do not correspond to the page numbering used on the original Final Report of the meeting. Colour copies of the maps found in this command paper can be found on the website of the Antarctic Treaty Secretariat at www.ats.aq.

Measure 1 (2009)

Antarctic Specially Managed Area No 3 (Cape Denison, Commonwealth Bay, George V Land, East Antarctica): Revised Management Plan

The Representatives,

Recalling Articles 4, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty, providing for the designation of Antarctic Specially Managed Areas ("ASMA") and the approval of Management Plans for those Areas;

Recalling

- Measure 1 (2004), which designated Cape Denison, Commonwealth Bay, George V Land, as Antarctic Specially Managed Area No 3 and annexed a management plan for the site;

- Measure 3 (2004), which added Historic Site and Monument No 77: Cape Denison, located within ASMA 3, to the List of Historic Sites and Monuments;

Noting that the Committee for Environmental Protection has endorsed a revised management plan for ASMA 3;

Noting Measure 12 (2009), dealing with Antarctic Specially Protected Area No 162 (Mawson's Huts, Cape Denison, Commonwealth Bay, George V Land, East Antarctica), which is located within ASMA No 3;

Desiring to replace the existing Management Plan for ASMA 3 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Managed Area No 3 (Cape Denison, Commonwealth Bay, George V Land, East Antarctica), which is annexed to this Measure, be approved;

2) the Management Plan for ASMA 3 annexed to Measure 1 (2004) shall cease to be effective.

Management Plan for Historic Site and Monument No. 77 and Antarctic Specially Managed Area No. 3

CAPE DENISON, COMMONWEALTH BAY, GEORGE V LAND, EAST ANTARCTICA

Latitude 67° 00’ 13” S — 67° 00’ 50” S, Longitude 142° 40’ 00.1” E — 142° 41’ 27” E

Introduction

Cape Denison, Commonwealth Bay is one of the principal sites of early human activity in Antarctica. It is the location of the base of the Australasian Antarctic Expedition of 1911-14 organised and led by Dr (later Sir) Douglas Mawson. An important symbol of the ‘heroic age’ of Antarctic exploration (1895-1917), it is one of only six hut sites remaining from this period. Cape Denison hosted some of the earliest comprehensive studies of Antarctic geology, geography, terrestrial magnetism, astronomy, meteorology, glaciology, oceanography, biology, zoology and botany. It was also the base of numerous explorations inland and features artefacts associated with these sledging parties, including food caches and equipment.

Due to its considerable historical, cultural and scientific significance, Cape Denison is designated under Measure 1 (2004) as Antarctic Specially Managed Area (ASMA) No. 3, consistent with Articles 2, 4, 5 and 6 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty. It is also listed under Measure 3 (2004) as Historic Site and Monument No. 77, in accordance with Article 8(2) of Annex V of the Protocol.

Cape Denison is characterised by four valleys aligned northwest/southeast. The majority of Australasian Antarctic Expedition artefacts, including buildings (‘Mawson’s Huts’) and other structures, are concentrated in the westernmost valley and on the ridges on either side of the valley. The four Australasian Antarctic Expedition historic huts and their immediate surrounds are designated under Measure 2 (2004) as Antarctic Specially Protected Area (ASPA) No. 162 Mawson’s Huts.

1. Description of Values to be Protected

1.1 Primary values

The ASMA is established because Cape Denison is a site of historic, archaeological, social and aesthetic values.

Historic value

Antarctica's 'heroic age' was a period of great human adventure and discovery. Cape Denison, Commonwealth Bay provides the setting for the buildings, structures and relics of the Main Base of the Australasian Antarctic Expedition (AAE) of 1911–14, led by Dr Douglas Mawson.

Mawson's prime focus was scientific research. Nevertheless, the expedition also had an exploratory agenda, with the aim of charting the entire Antarctic coastline immediately south of Australia. For this purpose at least five sledging expeditions were undertaken from Cape Denison from spring 1912, including the infamous Far-Eastern Sledging Party during which expeditioners Belgrave, Ninnis and Xavier Mertz perished, and Mawson himself barely survived. Overall, more than 6,500 km of coastline and hinterland was explored by sledging parties of the Expedition.

Cape Denison contains numerous relics relating to the work of Mawson's expedition, including Mawson's Huts and other significant and relatively untouched artefacts from the 'heroic age'. While the majority is concentrated in the westernmost valley and its immediate surrounds, the historical boundaries of the Main Base extend further. Artefacts and other evidence of occupation, such as food caches, extend across the entire Cape, forming a rich resource of material available for research and interpretation, and potentially yielding scientific data and information about aspects of expeditioner life not included in official written accounts.

Aesthetic values

The ASMA is designated to preserve not only the artefacts remaining in situ but also the cultural landscape of Cape Denison in which Mawson and his men lived and worked. Cape Denison is characterised by its almost incessant blizzard conditions, which severely limit access to the region and activities at the site. Katabatic winds pour down the plateau and funnel through the Cape's valleys, blasting the hut with gusts that in May 1912 reached 322 km/h. (The average wind speed for the month was 98 km/h). Cape Denison is not only the windiest place in Antarctica, but also the windiest place on Earth at sea level. The site thus demonstrates the physical and symbolic context of the extreme isolation and harsh conditions endured by the expedition members and, by association, all other 'heroic age' researchers and explorers. In designating the entire area as an ASMA, Cape Denison's unique 'sense of place' is protected, with Mawson's Huts and Boat Harbour as the focus of the visual catchment. Mawson's Huts themselves are provided with additional protection in ASPA No. 162.

Educational values

Cape Denison's wildlife and undisturbed artefacts, framed against the dramatic backdrop of the Antarctic Plateau, represent significant educational values. The Area's isolation and extreme weather provide visitors with a unique insight into the conditions endured by 'heroic age' researchers and explorers, and a chance to form a deeper appreciation of their achievements.

Environmental values

The paucity of relatively ice-free areas in the immediate region means that Cape Denison represents an important assemblage of life forms (Appendices A and C). The closest ice-free areas of similar or greater size to Cape Denison are approximately 20 km to the east of Cape Denison (from the centre of the ASMA), and approximately 60 km to the west. A haul-out site for Weddell, leopard and elephant seals, the Cape is also an important breeding area for Adélie penguins, Wilson's storm-petrels, snow petrels and south polar skuas.

Flora at Cape Denison is represented by 13 lichen species distributed on boulders and other moraines throughout the peninsula. These species are listed at Appendix A to the management plan for ASPA 162. No bryophytes are evident. The lichens' distribution on rocks, which are subject to different patterns of snow ablation, makes them vulnerable to trampling and other interference by visitors, however infrequent visitation may be.

Cape Denison has 13 small lakes. These are associated with glacial action, are a permanent feature, and are frozen over for most of the year. Since such lakes are also susceptible to physical, chemical and biological modification within their catchment boundaries, a catchment-based approach to the management of human activities is required.

Scientific values

Mawson, a geologist, planned his expedition in order to examine the theories about continental connection and the processes of glaciation and climate. He also sought to study the South Magnetic Pole and magnetic charting for navigational purposes; to conduct biological studies, including the identification of new species; and to establish a weather station.

Cape Denison provides opportunities to repeat Mawson's experiments and conduct further research into magnetism, meteorology, biology, and other sciences. For example, although Antarctic lakes are generally recognised as valuable due to their relatively simple natural ecosystems, the lakes at Cape Denison have neither been sampled nor their biota studied. There are also numerous non-marine algae present; however, no surveys have been undertaken. The records from Mawson's expedition provide a dataset against which the results of modern research may be compared, and the site's isolation lends it considerable value for future use as a reference site for other areas that experience a greater level of human activities.

2. Aims and Objectives

Management of the Area aims to assist in planning and co-ordinating current and future activities in the Area, to avoid possible conflicts, and to improve co-operation between Parties in order to avoid degradation of, or substantial risk to, the values of the Area. Management objectives are:

- to prevent degradation of the Area, its features, artefacts, and values;

- to maintain the heritage values of the Area through planned conservation[1] and archaeological work programs; and
- to provide for management activities which support the protection of the values and features of the Area.

3. Management Activities

The following management activities may be undertaken to protect the values of the Area:

- research and other activities essential or desirable for understanding, protecting and maintaining the values of the Area;
- the removal of objects not related to the AAE of 1911–14 and/or the British Australian New Zealand Antarctic Research Expeditions (BANZARE) of 1929–31 and that compromise the historic and aesthetic values of the Area, provided that removal does not adversely impact on the values of the Area, and that the objects are appropriately documented prior to removal. Priority should be given to the removal of field infrastructure from the Visual Protection Zone, giving consideration to the needs (including those of safety) of conservation workers and the program of conservation works;
- essential maintenance of other objects and infrastructure, including the Automatic Weather Station;
- installation of signage to indicate the boundaries of the HSM and ASMA;
- visitation of the Area as necessary to assess whether it continues to serve the purposes for which it was designated and to ensure that management activities are adequate; and
- consultation with other national Antarctic programs operating in the region, or those with an interest or experience in Antarctic historic site management, with a view to ensuring the above provisions are implemented effectively.

4. Period of designation

The ASMA is designated for an indefinite period.

[1] In the context of this Management Plan the term *conservation* "means all the processes of looking after a place so as to retain its cultural significance", as defined in Article 1.4 , of *The Burra Charter: The Australian ICOMOS Burra Charter, 1999*.

5. Description of the Area

5.1 Geographical coordinates, boundary markers and natural features

Cape Denison (67° 00' 13" S—67° 00' 0.50" S; 142° 39' 02" E—142° 41' 28" E) is located in the centre of Commonwealth Bay, a 60 km-wide stretch of coast in George V Land some 3,000 km south of Hobart, Australia. The Cape itself is a rugged, 1.5 km-wide tongue of ice, snow, rock and moraine projecting into Commonwealth Bay from the steeply rising wall of the ice cap of continental Antarctica. On the western side of the Cape is Boat Harbour, a 400m-long indentation in the coast.

The designated ASMA (Map A) extends from Land's End (67° 00' 46" S, 142° 39' 24" E) in the west, along the coastline to the northern tip of the western shore of Boat Harbour (67° 00' 24" S, 142° 39' 28" E), across the mouth of Boat Harbour (in a straight north-easterly diagonal) to the northern tip of Penguin Knob (67° 00' 17" S, 142° 39' 31" E) on the eastern shore of Boat Harbour, and then along the coastline in a south-easterly direction down to John O'Groats (67° 00' 47" S, 142° 41' 27" E). The southern boundary extends in a straight line from Land's End to John O'Groats along latitude 67° 00' 47" S. With the exception of the boundary across the mouth of Boat Harbour, the northern coastal boundary extends to that land above the lowest tide.

The shoreline and the ice cliffs at both ends of the Cape (Land's End and John O'Groats) form a clearly defined boundary; as such, no boundary markers have been installed because the coast is a clearly defined boundary.

Natural features: Topography and geomorphology

The topography of Cape Denison is defined by a series of four rocky ridges, running south-southeast to north-northwest, and three valleys. The largest, most westerly of these valleys contains the AAE buildings, which are protected within ASPA No. 162. The basement rock of the Cape Denison area consists of partially migmatised, massive felsic orthogneiss intruded about 2350 million years ago (Ma) into an older metamorphosed sequence. Above the basement the area features a lower zone of relatively polished rock and a higher zone of relatively unpolished rock; the former being especially prominent below 12 metres above sea level and indicative of more recent uplift and exposure than the upper zone. An upper and lower moraine are apparent, with the upper moraine, closer to the edge of plateau, containing a diversity of angular boulders. The lower moraine is dominated by local rocks sorted into bands, perhaps the result of an 'ice push' from the sea rather than being genuine glacial moraine.

Water bodies

Cape Denison contains 13 small glacial lakes, which are generally oriented parallel to the foliation of the basement rocks. At the height of summer Cape Denison also features numerous melt streams which flow into Commonwealth Bay. It is not known whether the streams flow down established courses, or whether the streams are a feature of the regular freeze/thaw cycle.

Biological features

Cape Denison is the summer habitat for breeding Adélie penguins, Wilson's storm-petrels, snow petrels and the south polar skua (Map C). Other species sighted in the area include the Cape petrel, Antarctic petrel, southern giant petrel and emperor penguin. A full list of species and number of breeding pairs (where available) is attached as Appendix A. Weddell seals, southern elephant seals and leopard seals have been recorded as hauling out and, in the case of elephant seals, moulting at Cape Denison. However, the sporadic nature of visits to the Area means that monitoring has been inconsistent and the exact extent of the seal population uncertain. Some data is presented in Appendix B(ii).

The only flora evident at Cape Denison is lichens, for which a list of species is included at Appendix A to the management plan for ASPA 162, and non-marine algae, which have yet to be studied.

5.2 Access to the Area

Sea, land and air access to Cape Denison is difficult due to the rugged topography and climate of the area. Sea ice extent and uncharted bathymetry may constrain ship access to approximately 3nm from the coastline. Access can be gained either by small watercraft or by helicopter, although attempts to land are frequently hampered by heavy seas and prevailing north-westerly or katabatic winds. Boat landings can be made at Boat Harbour and due north of Sørensen Hut. The helicopter landing site and approach and departure flight paths are indicated on Map C.

There are no roads or other transport infrastructure on shore. Land vehicles should only be used in accordance with the Code of Conduct (see Section 8).

Pedestrian access within the Area is unrestricted except in places where AAE buildings, artefacts, or bird or lichen colonies are present, and should be conducted in accordance with the Code of Conduct (see Section 8).

5.3 Location of structures and other anthropogenic objects within and near to the Area

Cape Denison is notable for being the location of four historic buildings and a Memorial Cross constructed by the AAE of 1911-1914. The buildings and their immediate environs are protected by ASPA 162.

Within the ASMA there are several AAE structures, including survey markers and the mast on top of Anemometer Hill, about 150 m east of Mawson's Main Hut. On 5 January 1931 members of the BANZARE party (including Douglas Mawson) visited Cape Denison to claim formal possession of George V Land on behalf of Great Britain, and used the mast to support the proclamation flag and canister containing the proclamation itself. A small timber plaque and proclamation, still attached to the mast, are the only 'formal' artefacts of that visit remaining in situ today.

Cape Denison additionally features six other structures: an automatic weather station (AWS); a field shelter known as Sørensen Hut; a red fibreglass 'Apple' hut; a wooden platform on which

tents may be pitched; a field shelter known as Granholm Hut, and a plaque near Mawson's Main Hut indicating that the hut is a Historic Monument.

The AWS is located at 67° 00' 33" S; 142° 39' 51" E on a rise near Round Lake and approximately 150 m southeast of Mawson's Main Hut. It has been operating since 1990 as part of the Antarctic Automatic Weather Project of the University of Wisconsin—Madison, and is the property of that institution.

Sørensen Hut is located about 400m east of Mawson's Main Hut at 67° 00' 29" S; 142° 40' 12" E. It was constructed by the Australian Antarctic program in 1986 to provide temporary shelter for parties conducting conservation works on Mawson's Huts and contains some provisions and field equipment. Numerous items are also stored underneath and immediately adjacent to Sørensen Hut, and in the adjacent Apple hut.

Granholm Hut is situated at 67° 00' 29" S; 142° 39' 26" E, some 160 m northwest of Mawson's Main Hut. It was constructed in 1978 to provide a temporary shelter and workshop for parties working on Mawson's Huts. It contains numerous building materials, some field equipment and limited provisions.

The signage will be in the English, French, Spanish and Russian languages, and will indicate the protection status of the site and its contents under the Antarctic Treaty.

Objects left by Mawson's expedition are scattered throughout the Area, and appear from year to year depending on snow cover. These include cairns; cached seal and penguin carcasses; timbers; and a large collection of disassembled penguin skeletons. It is believed that a significant number of artefacts exist under the snow and have yet to be uncovered. It is additionally possible that artefacts from the ice cave known as 'Aladdin's Cave', sledging depot excavated by Mawson's expedition in 1912, may also be present in the vicinity of the ASMA, if not within the ASMA itself. The cave was originally located on the plateau at 67° 05' S, 142° 38' E, some 8 km south of Mawson's Main Hut, but it may have been relocated (via the movement of ice) up to 4.5 km down-slope from the original 1912 location. Its exact location has yet to be determined.

5.4 Location of other protected areas in or near to the Area

ASPA No. 162 , encompassing the four AAE huts, is located within the Cape Denison ASMA, and exists to protect their historic and social values.

The Cape Denison ASMA is to be simultaneously listed as Historic Site and Monument No. 77 under the Antarctic Treaty.

There are no other ASPAs or ASMAs within 50 km of Cape Denison.

6. Zones within the Area

All activities within the Area are to comply with the provisions of the Protocol on Environmental Protection to the Antarctic Treaty, the Code of Conduct contained in this

management plan (see Section 8), and any other applicable instruments adopted by the Antarctic Treaty Consultative Meeting. In addition to these general guidelines, three zones are defined in which restrictions on certain activities are deemed necessary in order to meet the management objectives for the Area.

6.1 ASPA 162

ASPA 162 (Mawson's Huts) is located within the ASMA. This ASPA encompasses the four Australasian Antarctic Expedition huts in order to protect their historic and social values. Entry to the ASPA and activities within it require a permit and must be carried out in accordance with the ASPA Management Plan.

6.2 Visual Protection Zone

The visual catchment of Mawson's Huts and the Memorial Cross is of particular importance within the Cape Denison cultural landscape. In order to protect the landscape setting and 'sense of place' of Mawson's Huts, a Visual Protection Zone is defined within the ASMA. To preserve these values, no new structures should be built within the Visual Protection Zone. The Visual Protection Zone is illustrated on Maps A and B and is generally defined as the area enclosed by the western and eastern ridge lines of the valley containing the historic structures. The boundary extends from the coastline (67° 00' 24.9" S, 142° 39' 14.3" E) and runs southeast along the western side of the westernmost ridge to the ice plateau (67° 00' 46.8" S, 142° 39' 37.2" E); northeast along the edge of the ice plateau to 67° 00' 43.9" S, 142° 40' 5.6" E; north- northwest between Round Lake and Long Lake to 67° 00' 33.7" S, 142° 39' 59.8" E; then as far as Magnetograph House (67° 00' 20.3" S, 142° 39' 46.6" E); and then northwest along the eastern side of the eastern ridge line to the sea (67° 00' 15.7" S, 142° 39' 28.2" E).

6.3 Helicopter Zone

Helicopter operations have the potential to disturb breeding and moulting wildlife. To minimise disturbance to seals and nesting birds at Cape Denison during the summer months, helicopters should only land at the site indicated on Map C and approach and depart in accordance with the flight paths indicated on the map. Departure paths have been selected to avoid wildlife concentrations as much as possible. Use of a single-engined helicopter is preferable; however twin-engined helicopters may be used with due regard for the potentially greater disturbance to wildlife. The presence of seals and the breeding cycle of birds nesting in the Area are charted at Appendices B(i) and B(ii); twin-engine helicopter operations should be avoided during weeks that birds are hatching eggs or raising chicks (late October to early March).

7. Maps of the Area

Map A: Cape Denison Management Zones.

This map shows the boundaries of the ASMA, the Historic Site, the Visual Protection Zone, ASPA No. 162, and significant topographic features of the Area. The inset map indicates the location in relation to the Antarctic continent.

Map B: Cape Denison Visual Protection Zone

This map shows the boundaries of the Visual Protection Zone and indicates the position of significant historic artefacts, including the four Australasian Antarctic Expedition huts, the Memorial Cross, and Anemometer Hill, and the site of the BANZARE Proclamation Pole.

Map C: Cape Denison Flight Paths and Bird Colonies.

This map indicates the approaches, departures and landing site for helicopters, as well as the location of bird colonies in the vicinity.

Specification for all maps
Projection: UTM Zone 54
Horizontal Datum: WGS84

8. Code of Conduct

The actions of individuals contribute significantly to protecting the Antarctic environment. This Code of Conduct is intended to provide general guidelines to help minimise environmental impacts at Cape Denison, but it cannot be expected to cover every situation. All visitors, including national program personnel and tourists, should consider their responsibilities and seek to minimise their impact on all aspects of the environment and most particularly the values described.

8.1 Access to and movement within or over the Area

All land vehicles are prohibited within the Area, with the exception of small all-terrain vehicles which, due to the colonisation of rocky areas by lichens and seabirds, should be used on snow and ice surfaces only and with due consideration of the location of historic artefacts. Pedestrian access within the Area is unrestricted but artefact-rich areas (such as the scatter immediately to the north of the Main Hut), bird or lichen colonies, and penguin 'highways' (the established route of birds moving between their nest and the sea) should be avoided.

8.2 Activities which are or may be conducted within the Area

- Historic conservation and archaeological work.
- Research, including scientific research.
- Visitation for the purposes of education or recreation, including tourism.
- Essential maintenance of non-historic infrastructure, including the Automatic Weather Station, and removal of non-historic objects that compromise the historic and aesthetic values of the Area. These activities should be conducted by authorised personnel only.

8.3 The installation, modification, or removal of structures

To preserve the historic, archaeological, social, aesthetic and environmental values of the ASMA, no new structures should be constructed, nor additional scientific equipment installed in the Area, except for the conservation, research or maintenance activities specified in Section 3 above.

All equipment and infrastructure left in the Area should be periodically reviewed for maintenance and potential removal.

8.4 The location of field camps

Existing non-historic infrastructure should be used by Parties undertaking activities in accordance with this management plan, in preference to establishing new infrastructure.

Tents should be pitched on the wooden platform adjacent to Sørensen Hut. Use of the huts and any supplies should be reported to the Australian Antarctic program as soon as practicable to ensure the safety of other people who may be reliant upon known stores.

8.5 The taking of or harmful interference with native flora and fauna

Approach distances to wildlife should be consistent with those agreed within the Committee for Environmental Protection. Until guidelines are adopted by the Committee, Table 1 below provides guidance.

Visitors should not wash, swim or dive in the lakes. These activities could contaminate the water body and disturb the water column, microbial communities, and sediments.

Table 1: Minimum distances to maintain when approaching wildlife on foot

Species	**Phase of life**	**On foot (m)**
Snow petrels	Nesting	15
Wilson's storm-petrels	Nesting	15
South polar skuas	Nesting	15
Adélie penguins	Summer: on ice or away from colony	5
	Summer: breeding birds in colonies	15
Breeding Weddell seals and pups (includes weaners)	All times	15
Mature seals on their own (all species)	All times	5

8.6 The collection or removal of anything not brought into the Area by the visitor

Cape Denison is listed as a Historic Site under the Antarctic Treaty. In accordance with Annex V, Article 8 (4) of the Protocol, no historic structure or other artefact at Cape Denison should

be damaged, destroyed or removed, unless removal of an artefact is essential for conservation purposes. Any artefacts may only be removed by authorised and appropriately trained personnel. The repatriation of the artefact to the location at Cape Denison from which it was removed is generally preferable unless further damage or deterioration may result from repatriation.

If an artefact is to be removed, the Australian Antarctic program should be informed so that documentation regarding that program's archaeological research at Cape Denison may be amended accordingly.

8.7 The disposal of waste

All wastes, including human wastes, should be removed from the Area .

Refuelling of vehicles, generators and other essential equipment should be conducted with due care for the surrounding environment. Refuelling activities should not be conducted in the catchment areas of lakes or melt streams, at the ice edge, or in other sensitive areas.

8.8 Reports to be made to the appropriate authority regarding visits to the Area

To enhance cooperation and the coordination of activities in the Area, to allow for effective site monitoring and management, to facilitate the consideration of cumulative impacts, and to fulfil the aims and objectives of this Management Plan:

National program personnel, tourists and other non-government personnel proposing to visit, land, and/or conduct activities in the Area should inform the Australian Antarctic program of their intentions as far in advance of a visit as is practicable.

The details of all field activities should be accurately recorded for transfer to the management database of the Australian Antarctic program. See Section 9 below.

9. Information exchange

Parties with active programs in the Area and non-government operators should exchange information obtained during visits to the Area that may have a bearing on the operation of this Management Plan. For example, the expedition or tour leader should submit to the appropriate authority a report describing the activities undertaken in the Area. Such reports should include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of Resolution 2 (1998). Parties should maintain a record of such activities including summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of this Management Plan.
Parties should, wherever possible, deposit originals or copies of this information in a publicly accessible archive to maintain a record of visitation or usage of the site, to be used both in any review of this Management Plan and to assist in organising the use of the Area.

10. Supporting Documentation

Australian Antarctic Division 2007. *Mawson's Huts Historic Site Management Plan 2007-2012*. Kingston, Tas.

Dr Ian Allison, glaciologist, Australian Antarctic Division, pers. comm. 28 March 2003.

Ayres, P. 1999. *Mawson: a Life.* Melbourne: Melbourne University Press/Miegunyah Press: 68–69 passim.

Australia ICOMOS Inc. 2000. *The Burra Charter: The Australian ICOMOS Charter for Place of Cultural Significance,* 1999. Burwood: Australia ICOMOS Inc.: 2.

Dodge, C.W. 1948. *BANZARE Reports,* Series B, Vol. VII. British Australia New Zealand Antarctic Expedition.

Godden Mackay Logan 2001. *Mawson's Huts Historic Site, Cape Denison Commonwealth Bay Antarctica: Conservation Management Plan 2001*. Sydney: Godden Mackay Logan: 26, 27, 35, 89–96, passim.

Godfrey, I. 2006. *Mawson's Huts Conservation Expedition 2006*. Mawson's Huts Foundation, Sydney

Hall, L. 2000. *Douglas Mawson: The Life of an Explorer*. Sydney: New Holland: 100, 109.

Hughes, J. and B. Davis. "The Management of Tourism at Historic Sites and Monuments." In: Hall, C. M. and M.E. Johnston. 1995. *Polar Tourism: Tourism in the Arctic and Antarctic Regions.* London: John Wiley & Sons Ltd: 242, 245, 246.

Dr Jo Jacka, glaciologist, Australian Antarctic Division, pers. comm. 27 March 2003; 28 March 2003.

Lazer, E. *"Recommendations for Future Archaeological and Conservation Work at the Site Associated with Mawson's Hut Commonwealth Bay Antarctica."* October 1985: 1, 9, 10, Map 3.

Hayes, J. Gordon 1928. *Antarctica: a treatise on the southern continent*. London: The Richards Press Ltd.: 210–215.

McGregor, A. 1998. *Mawson's Huts: an Antarctic Expedition Journal*. Sydney: Hale and Iremonger: 7–15.

McIntyre, D, and M. McIntyre 1996. "Weddell seal survey in Boat Harbour". In: *Australian Antarctic Division 1997. Initial Environmental Evaluation: AAP Mawson's Huts Foundation Conservation Program* 1997–98: Attachment D.

Mawson, D. 1996 (reprint). *The Home of the Blizzard.* Adelaide: Wakefield Press: 121–122, 133, 200, 328.

Mawson's Huts Foundation 2005. *Mawson's Huts Conservation Expedition 2005*. Sydney

Mawson's Huts Foundation 2008. *Mawson's Huts Conservation Expedition 2007-08*. Sydney

Patterson, D. 2003. *Mawson's Huts Conservation Expedition 2002: Field Leader's Report*. Australian Antarctic Division.

Quilty, P. 1997. "Geology". In: *Australian Antarctic Division 1997. Initial Environmental Evaluation: AAP Mawson's Huts Foundation Conservation Program 1997–98*: 10–11.

Professor Rod Seppelt, botanist, Australian Antarctic Division, pers. comm. 19 February 2003. David Smith, mapping officer, Australian Antarctic Division, pers. comm. 15 April 2003.

Secretariat of the Antarctic Treaty, Environmental Protection, Protected Areas http://www.ats.aq/e/ep_protected.htm (Accessed 16 February 2009).

Stillwell, F.L. 1918. *The metamorphic rocks of Adélie Land. Australasian Antarctic Expedition*, Scientific Reports, Series A, Vol. III part 1:15–22.

Dr Eric J. Woehler, ornithologist, Australian Antarctic Division, pers. comm. September 2002; 31 March 2003.

Appendix A

Fauna recorded at Cape Denison, Commonwealth Bay: Breeding populations (pairs) of seabirds at Cape Denison

Species	No. pairs, December 2002
Adélie penguin *Pygoscelis adeliae*	18,737
Wilson's storm-petrel *Oceanites oceanicus*	38
Snow petrel *Pagodroma nivea*	30
South polar skua *Catharacta maccormicki*	8

? Antarctic prion *Pachyptila desolata* (indeterminate breeding status)

? Cape petrel *Daption capense* (indeterminate breeding status)

Other seabirds sighted at Cape Denison

Species
Antarctic petrel *Thalassoica antarctica*
Southern giant petrel *Macronectes giganteus*
Sing penguin *Aptenodytes patagonica*
Royal penguin (carcase) *Eudyptes schlegeli*
Chinstrap penguin *Pygoscelis Antarctica*
Emperor penguin *Aptenodytes forsteri*

Seals recorded at Cape Denison Species

Weddell seal *Leptonychotes weddellii*
Leopard seal *Hydrurga leptonyx*
Southern elephant seal *Mirounga leonina*

Appendix B(i)

Helicopter operations: Breeding cycles of nesting seabirds at Cape Denison, Commonwealth Bay

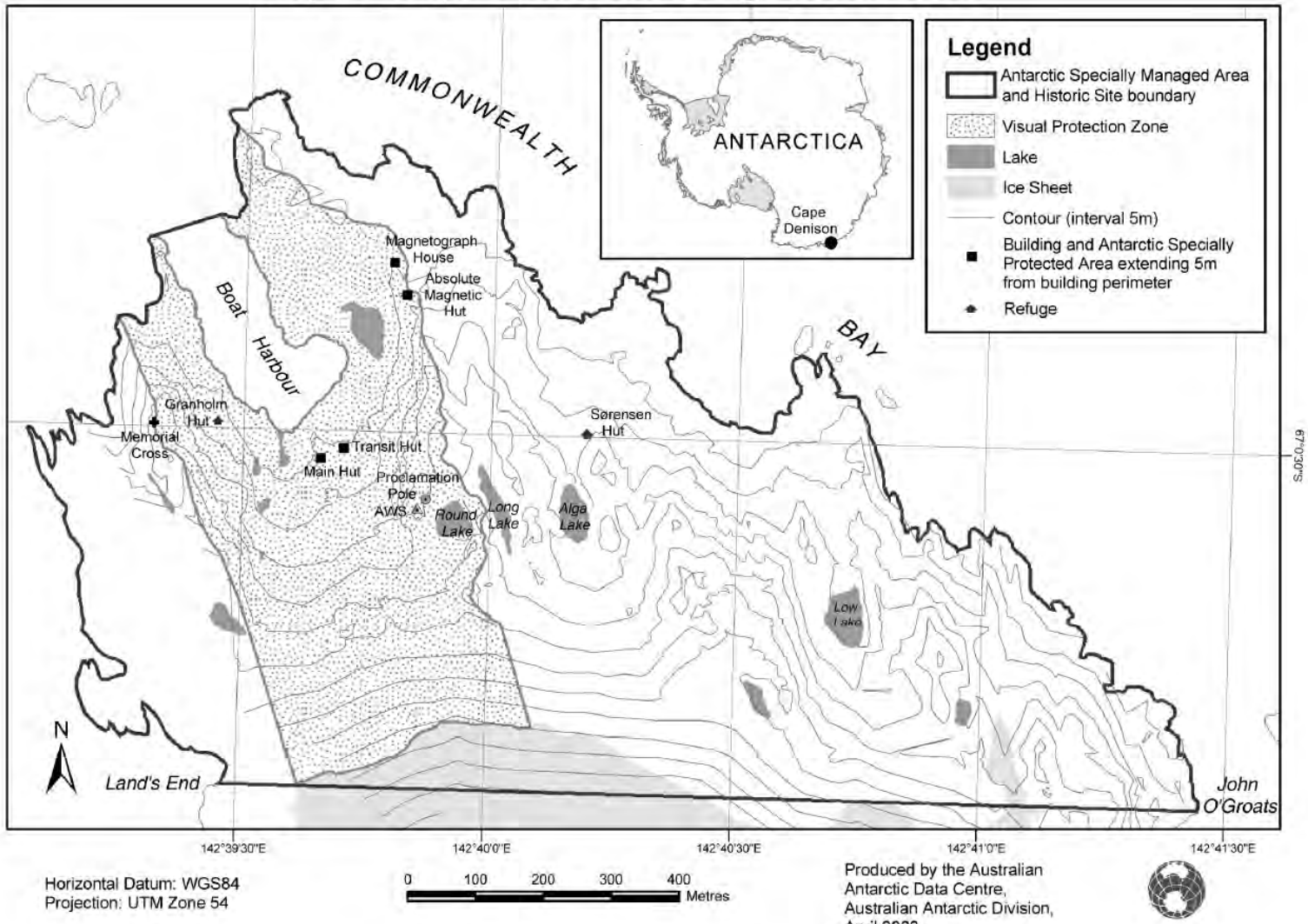
Species breeding at Cape Denison	**Number**	**Summer breeding cycle**
Wilson's storm-petrel (Oceanites oceanicus)	Approximately 38 pairs; three small colonies	Before mid-December: adults; after mid- December: adults, eggs and chicks
Snow petrel (Pagodroma nivea)	Approximately30; one small colony	Before late November: adults; after late November: adults, eggs and chicks
Adélie penguin (Pygoscelis adeliae)	Approximately 18,800 pairs, numerous colonies	Before November: adults; after November: adults, eggs and chicks
South polar skua (Catharacta maccormicki)	Approximately 8 pairs, scattered nests on fringes of penguin colonies	Before mid-December: adults; after mid- adults and chicks

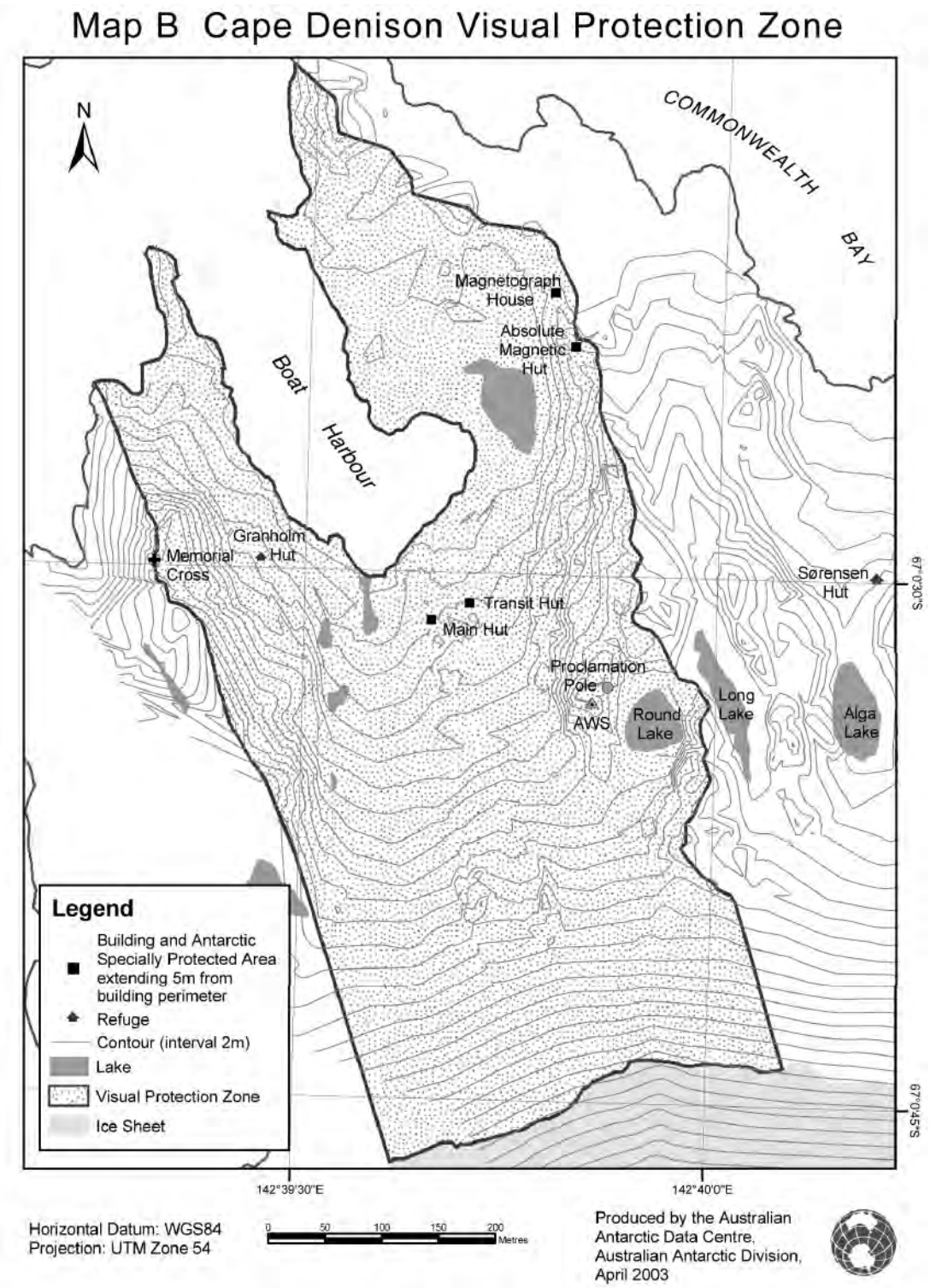
Appendix B(ii)

Helicopter operations: Seals at Cape Denison, Commonwealth Bay

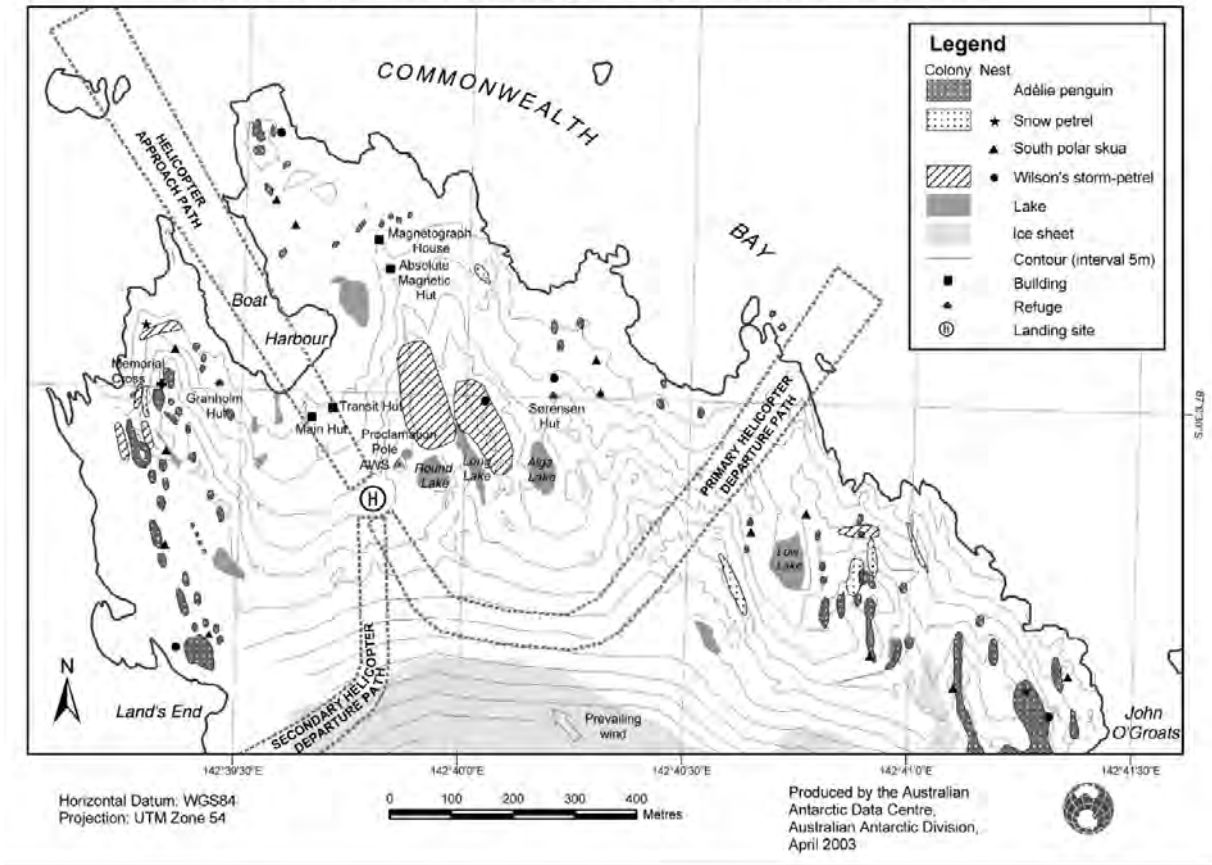
Species	**Number**	**Summer breeding cycle**
Weddell seal (Leptonychotes weddellii)	Exact number not known, no established colonies	Before November: no seals; between mid-November to end December, approx. 24 adults per day
Southern elephant seal(Mirounga leonina)	Exact number not known, no established colonies	Approx. 2 or adults per day in December

Map A Cape Denison Management Zones




Map B Cape Denison Visual Protection Zone
N
COMMONWEALTH BAY
Magnetograph House
Absolute Magnetic Hut
Boat Harbour
Granholm Hut
Memorial Cross
Transit Hut
Main Hut
Proclamation Pole
AWS
Round Lake
Long Lake
Alga Lake
Sørensen Hut
67°0'30"S
67°0'45"S
142°39'30"E
142°40'0"E
Legend
Building and Antarctic Specially Protected Area extending 5m from building perimeter
Refuge
Contour (interval 2m)
Lake
Visual Protection Zone
Ice Sheet
Horizontal Datum: WGS84
Projection: UTM Zone 54
0 50 100 150 200 Metres
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, April 2003

Map C Cape Denison Flight Paths and Bird Colonies



Measure 2 (2009)

Antarctic Specially Managed Area No 7 (Southwest Anvers Island and Palmer Basin): Revised Management Plan

The Representatives,

Recalling Articles 4, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty, providing for the designation of Antarctic Specially Managed Areas ("ASMA") and the approval of Management Plans for those Areas;

Recalling Measure 1 (2008), which designated Southwest Anvers Island and Palmer Basin as Antarctic Specially Managed Area No 7 and annexed a management plan for the site;

Noting that the Committee for Environmental Protection has endorsed a revised management plan for ASMA 7;

Noting Measure 4 (2009), dealing with Antarctic Specially Protected Area No 113 (Litchfield Island, Arthur Harbour, Anvers Island, Palmer Archipelago), which is located within ASMA 7;

Desiring to replace the existing Management Plan for ASMA 7 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Managed Area No 7 (Southwest Anvers Island and Palmer Basin), which is annexed to this Measure, be approved;

2) the Management Plan for ASMA 7 annexed to Measure 1 (2008) shall cease to be effective.

Management Plan for Antarctic Specially Managed Area No. 7

SOUTHWEST ANVERS ISLAND AND PALMER BASIN

Introduction

The region that includes southwest Anvers Island and the Palmer Basin and its fringing island groups has a wide range of important natural, scientific and educational values and is an area of considerable and increasing scientific, tourist and logistic activities. The importance of these values and the need to provide an effective means to manage the range of activities was recognised with adoption of the area as a Multiple-Use Planning Area for voluntary observance at the XVIth Antarctic Treaty Consultative Meeting (1991). With the acquisition of new data and information and changes to logistics and the pressures arising from human activities in the region, the original plan has been comprehensively revised and updated to meet current needs as an Antarctic Specially Managed Area (ASMA).

In particular, scientific research being undertaken within the Area is important for considering ecosystem interactions and long-term environmental changes in the region, and how these relate to Antarctica and the global environment more generally. This research is important to the work of the Committee for Environmental Protection, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Antarctic Treaty System as a whole. There is a risk that these globally important research programs and long-term datasets could be compromised if activities were to occur in the marine area that were not appropriately managed to avoid potential conflicts and possible interference. While marine harvesting activities are not currently being conducted within the Area, and the marine component of the Area represents only 0.5% of CCAMLR Subarea 48.1, it is important that should harvesting be undertaken within the Area then it should be carried out in such a way that it would not impact on the important scientific and other values present within the Area.

Important values present in the proposed ASMA in the vicinity of Palmer Station and key activities to be managed are summarised as follows:

1. Values to be protected and activities to be managed

(i) Scientific values

The diverse and easily accessible assemblages of marine and terrestrial flora and fauna in the southwest Anvers Island and Palmer Basin area are particularly valuable for science, with some datasets spanning the past 100 years and intensive scientific interest beginning in the 1950s. Studies have been carried out on a wide variety of topics, including long-term monitoring of seal and bird populations, surveys of plants and animals in both the terrestrial and sub-tidal environments, investigations of the physiology and biochemistry of birds, seals, terrestrial invertebrates and zooplankton, the behavior and ecology of planktonic marine species, physical oceanography, and marine sedimentology and geomophology. While the United States (US) maintains the only permanent research station within the Area, research in these fields has been undertaken by scientists from a broad range of Antarctic Treaty Parties,

often as collaborative projects with US scientists. Some important recent examples from the Palmer Long Term Ecological Research (LTER) program are described below.

The southwest Anvers Island and Palmer Basin area has exceptional importance for long-term studies of the natural variability in Antarctic ecosystems, the impact of world-wide human activities on Antarctica and on the physiology, populations and behaviour of its plants and animals. Research in this region is essential for understanding the linkages among avifauna, krill dynamics and the changing marine habitat.

In particular, the United States Antarctic Program (USAP) has a major and ongoing commitment to ecosystem research in the Antarctic Peninsula region, which was formalized through the designation in 1990 of the area around Palmer Station (US) as a Long Term Ecological Research (LTER) site. The Palmer LTER (PAL-LTER) site is part of a wider network of LTER sites, and one of only two in the Antarctic, designed specifically to address important research questions related to environmental change over a sustained period spanning more than several decades. Since 1991, the PAL-LTER program has included spatial sampling during annual and seasonal cruises within a large-scale (200,000 km^2) regional grid along the west coast of the Antarctic Peninsula, as well as temporal sampling from October to March in the local area adjacent to Palmer Station. The Palmer LTER and the British Antarctic Survey are collaborating on research comparing the marine ecosystem in the Palmer Basin region with that in Marguerite Bay approximately 400 km further to the south. In the Palmer region, the ecosystem is changing in response to the rapid regional warming first documented by BAS scientists. In addition, recent collaboration has been established as part of the International Polar Year with scientists from France and Australia using metagenomic tools to understand microbial community adaptations to the polar winter.

A major theme in the PAL-LTER is the study of sea-ice dynamics and related impacts on all aspects of the ecosystem (Smith *et al*. 1995). The annual advance and retreat of sea-ice is a major physical determinant of spatial and temporal changes in the structure and function of the Antarctic marine ecosystem, from total and annual primary production to breeding success in seabirds. The Western Antarctic Peninsula (WAP) is a premier example of a region experiencing major changes in species abundance, range and distribution, in response to regional climate change. This change is manifested primarily as a southern migration of regional climate characteristics (Smith *et al*. 1999, 2001). Paleoecological records on sea-ice, diatom stratigraphy and penguin colonization have also placed the current LTER data into a longer-term context (Smith *et al*. 1999, 2001). In particular, the Palmer Basin has been the site of extensive paleoecological and climate change studies. The Palmer Basin also exhibits a variety of geomorphological features of value.

Extensive seabird research has focused on the ecology of Adélie penguins and their avian predators and scavengers within the inshore 50 km^2 PAL-LTER grid close to Palmer Station. Colonies on 18 islands in this area are visited every 2-7 days in the summer season, and three more distant control sites within the ASMA are also visited infrequently to assess the extent of possible disturbance from activities around Palmer Station. Sea ice forms a critical winter habitat for Adélie penguins, and interdisciplinary research has focused on the impacts of changes in the frequency, timing and duration of sea-ice on the life histories of this and other bird species, as well as on prey populations.

Torgersen Island is the site of a study on the impacts of tourism, and has been divided into two areas, one open to visitors and the other closed as a site for scientific reference. This site together with other nearby islands not visited by tourists provide a unique experimental setting to examine the relative effects of natural versus human-induced variability on

Adélie penguin populations. The long-term data sets obtained from this site are of particular value in understanding the impacts of tourism on birds.

The southwest Anvers Island and Palmer Basin region also hold particular scientific interest in terms of newly-exposed terrestrial areas that have been subject to vegetation colonization after glacial retreat. With continuing trends of glacial retreat, these areas are likely to be of increasing scientific value.

Seismic monitoring at Palmer Station contributes to a global seismic monitoring network, and the remote location of the station also makes it a valuable site for long-term monitoring of global levels of radionuclides.

It is important that the region is carefully managed so that these scientific values can be maintained and the results of the long-term research programs are not compromised.

(ii) Flora and fauna values

The southwest Anvers Island and Palmer Basin region is one of the most biologically diverse in Antarctica, with numerous species of bryophytes, lichens, birds, marine mammals and invertebrates (Appendix C). These organisms are dependent on both the marine and terrestrial ecosystems for food and habitat requirements, with the Palmer Basin exerting a substantial influence on regional ecological processes.

Breeding colonies of birds and seals are present on ice-free areas along the coast of Anvers Island, as well as on many of the offshore islands within the region. Eleven species of birds breed in the Area, with Adélie penguins (*Pygoscelis adeliae*) the most abundant, and several other species are frequent non-breeding visitors. Five species of seals are commonly found in the Area, but are not known to breed there. Palmer Basin is an important foraging area for birds, seals and cetaceans.

The two native Antarctic vascular plants, *Deschampsia antarctica* and *Colobanthus quitensis*, are commonly found on surfaces with fine soil in the area around Arthur Harbor, although they are relatively rare along the Antarctic Peninsula (Komárková *et al.* 1985). The vascular plant communities found at Biscoe Point (ASPA No. 139) and on the Stepping Stones are some of the largest and most extensive in the Anvers Island region, and are particularly abundant for such a southerly location. Dense communities of mosses and lichens are also found on Litchfield Island (ASPA No. 113) – a site specially protected for exceptional vegetation values – and at several other locations around Arthur Harbor.

The soils and plant communities provide an important habitat for invertebrates, and the ice-free islands and promontories close to Palmer Station are particularly valuable for their abundant populations of the endemic wingless midge *Belgica antarctica*, the southernmost, free-living true insect. This is also of significant value for scientific studies, since this species has not been found to the same extent close to other research stations on the Antarctic Peninsula.

(iii) Educational and visitor values

The southwest Anvers Island area holds a special attraction to tourists because of its biological diversity, accessibility and the presence of Palmer Station. These features offer tourists the opportunity to observe wildlife, and gain an appreciation of Antarctic environments and scientific operations. Outreach to tourists via local tours and shipboard

lectures given by scientists is a valuable educational tool, and information is also made available to high school students in the US by initiatives through the LTER program.

2. Aims and objectives

The aim of this Management Plan is to conserve and protect the unique and outstanding environment of the southwest Anvers Island and Palmer Basin region by managing the variety of activities and interests in the Area. The Area requires special management to ensure that these important values are protected and sustained in the long-term, especially the extensive scientific data sets collected over the last 100 years. Increasing human activity and potentially conflicting interests have made it necessary to manage and coordinate activities more effectively within the Area.

The specific objectives of management in the Palmer Basin region are to:

- Facilitate scientific research while maintaining stewardship of the environment;
- Assist with the planning and coordination of human activities in the region, managing potential or actual conflicts of interest among different values, activities and operators, including between different areas of scientific research;
- Ensure that any marine harvesting activities are coordinated with scientific research and other activities taking place within the Area. This coordination could include the development of a plan for harvesting within the Area in advance of any such activities taking place.
- Ensure the long-term protection of scientific, ecological, and other values of the Area through the minimization of disturbance to or degradation of these values, including disturbance to fauna and flora, and to minimize the cumulative environmental impacts of human activities;
- Minimize the footprint of all facilities and scientific experiments established in the Area, including the proliferation of field camps and boat landing sites;
- Promote the use of energy systems and modes of transport that have the least environmental impact, and minimize the use of fossil fuels for the conduct of activities in the Area;
- Encourage communication and co-operation between users of the Area, in particular through dissemination of information on the Area and the provisions that apply.

3. Management activities

To achieve the aims and objectives of this Management Plan, the following management activities are to be undertaken:

- National Programs operating within the Area should establish a Southwest Anvers Island and Palmer Basin Management Group to oversee coordination of activities in the ASMA. The Management Group is established to:

- facilitate and ensure effective communication among those working in or visiting the Area;
- provide a forum to resolve any potential conflicts in uses;
- maintain a record of activities and, where practical, impacts in the Area;
- develop strategies to detect and address cumulative impacts;
- evaluate the effectiveness of management activities; and
- disseminate information on the values and objectives of the ASMA to those working in or visiting the Area.

The Management Group should convene on an annual basis to review past, existing, and future activities and to make recommendations on the implementation of this Management Plan, including its revision when necessary.

- To guide activities in the Area, a general Code of Conduct for activities is included in this Management Plan (see Section 7) and further Guidelines relating to specific activities and zones are included in the Appendices.
- National Programs operating within the Area and tour operators visiting should ensure that their personnel (including staff, crew, visiting scientists and passengers) are briefed on, and are aware of, the requirements of this Management Plan;
- The USAP determines annually the number of tourist vessel visits to Palmer Station (approximately 12 per season) through a pre-season scheduling and approval process;
- Signs and markers shall be erected where necessary and appropriate to show the boundaries of Antarctic Specially Protected Areas (ASPAs) and other zones within the Area. Signs shall be secured and maintained in good condition, and removed when no longer necessary;
- Copies of this Management Plan and supporting documentation will be made available at Palmer Station (US). In addition, the Management Group shall make this information freely available in electronic form to enable visitors to consult plan requirements in advance and to enable them to carry a copy when visiting;
- Visits should be made to the Area as necessary (no less than once every 5 years) to evaluate the effectiveness of the Management Plan, and to ensure that management and maintenance measures are adequate. The Management Plan, Code of Conduct and Guidelines will be revised and updated as necessary.

Note: any activity planned inside an ASPA within the Area requires a permit and must refer to the appropriate management plan for guidance.

4. Period of Designation

Designated for an indefinite period.

5. Maps and photographs

Map 1. Regional map and ASMA boundary.

Map 2. SW Anvers Island Restricted Zones: Rosenthal, Joubin and Dream islands.

Map 3. Arthur Harbor & Palmer Station access.

Map 4. Palmer Station Operations Zone.

Map 5. Torgersen Island Zones.

Map 6. Dream Island Restricted Zone.

Map 7. Litchfield Island, ASPA No.113.

Map 8. Biscoe Point, ASPA No.139.

6. Description of the Area

(i) Geographical co-ordinates, boundary markers and natural features

General description

Anvers Island is the largest and most southerly island in the Palmer Archipelago, located approximately 25 km west of the Antarctic Peninsula. It is bounded by Neumayer Channel and Gerlache Strait in the southeast and Bismarck Strait to the south (Map 1). Anvers Island is heavily glaciated, the southwestern half being dominated by the Marr Ice Piedmont, a broad expanse of permanent ice rising gently from the coast to around 1000 m elevation. The southern and western coastlines of Anvers Island within the Area comprise mainly ice cliffs on the edge of the Marr Ice Piedmont, punctuated by small rocky outcrops, ice-free promontories and numerous small near-shore islands. Other prominent land features within the Area include ice-free Cape Monaco at the southwestern extremity of Anvers Island, and Cape Lancaster in the southeast. These ice-free areas form important sites for animal and plant colonisation.

Six main island groups exist within the Area: in the north are the Rosenthal Islands (~22 km NW of Palmer Station). Fringing the Palmer Basin are the Joubin Islands, the Arthur Harbor island group (location of Palmer Station), the Wauwermans Islands, the Dannebrog Islands and the Vedel Islands. These island groups are of low relief, generally of less than 100 m in elevation, although local topography can be rocky and rugged together with small relict ice-caps.

Palmer Station (US) (64°46'27"S, 64°03'15"W) is located within Arthur Harbor on Gamage Point, an ice-free promontory on the southwestern coast of Anvers Island at the edge of the Marr Ice Piedmont (Maps 3 & 4). Immediately to the south of the station are Hero Inlet and Bonaparte Point. Norsel Point lies 2.7 km from Palmer Station at the NW extremity of the largest island in Arthur Harbor, which until recently was joined to Anvers Island by an ice-bridge. Other islands within a few km west of the station include Torgersen (Map 5), Humble, Breaker and Litchfield (Map 7) islands, the latter designated as ASPA No. 113. Those nearby to the southeast include Shortcut, Christine, Hermit, Limitrophe, Laggard and Cormorant islands (Map 3). More distant, Biscoe Point, ASPA No. 136, lies on a small island ~14 km to the southeast that was until recently also joined by an ice-bridge to Anvers Island (Map 8). To the west, Fraser, Halfway (Map 2) and

Dream (Map 6) islands lie 5.9, 6.4 and 9.4 km respectively NW of Palmer Station in Wylie Bay.

There are three dominant marine features in the Palmer Basin region:

1. Shallow shelves: extend from Anvers Island and the adjacent island groups to depths of 90-140 m.
2. Bismarck Strait: located south of Palmer Station and north of the Wauwermans Islands on an east–west axis, with depths generally between 360 to 600 m, connecting the southern entrances to Gerlache Strait and Neumayer Channel to Palmer Basin.
3. Palmer Basin: the only deep basin in the area, located 22 km southwest of Palmer Station and with a maximum depth of ~1400 m. It is bordered by the Joubin Islands to the north, the Wauwermans Islands to the east, and the Dannebrog and Vedel island groups in the southeast, and is surrounded by shelves shallower than 165 m. A channel of ~460 m depth connects Palmer Basin to the continental shelf edge west of the Area.

Boundaries of the Area

The Southwest Anvers Island and Palmer Basin ASMA encompasses an area of approximately 3275 km^2, including both terrestrial and marine components. For ease of navigation, the boundaries of the Area follow geographic features where practical and latitude/longitude lines in open ocean areas remote from prominent land features. The northeastern boundary of the Area is defined as a line extending parallel to and approximately one kilometer inland from the southwest Anvers Island coastline. This terrestrial boundary extends from a northerly location at 64°33'S, 64°06'03"W, ~3.1 km north of Gerlache Island, to 64°51'21"S, 63°42'36"W at Cape Lancaster in the south. From Cape Lancaster, the eastern boundary is defined as the 63°42'36"W line of longitude extending 7.9 km across Bismarck Strait to 64°55'36"S on Wednesday Island, the most easterly of the Wauwermans Islands. The boundary then follows a general southwesterly direction to 65°08'33"S, 64°14'22"W at the southern extremity of the Vedel Islands, following the eastern coastlines of the Wauwermans, Dannebrog and Vedel island groups. The southern boundary of the area is defined as the 65°08'33"S line of latitude extending due west from 64°14'22"W in the Vedel Islands to 65°00'W.

The northern boundary is defined as the line of latitude extending from 64°33'S, 64°06'03"W to the coast (~3.1 km north of Gerlache Island) and thence due west to the 65°00'W line of longitude. The western boundary of the Area is defined as the 65°00'W line of longitude, extending between 64°33'S in the north and 65°08'33"S in the south.

The boundaries of the Area have been designed to include areas of high ecological value while also maintaining a practical configuration for ease of use and navigation. The original Multiple-use Planning Area boundary has been extended northwards to include the Rosenthal Islands, which contain several large colonies of chinstrap and gentoo penguins that may function as source populations for other colonies in the southwest Anvers Island region (W. Fraser *pers. comm.* 2006). The original boundary has also been extended westwards and southwards to include the full extent of the Palmer Basin, because of the biological, palaeoecological and oceanographic importance of this feature.

The extent of the terrestrial component has been revised from the original Multiple-use Planning Area boundary to exclude extensive ice fields on the Marr Ice Piedmont, which do not possess values related to the core objectives of the management plan. The boundary encompasses all ice-free coastal areas, the Palmer Basin which plays a key role in regional ecosystem processes, and the nearby associated island groups, which are biologically important and also the focus of most human activity in the region.

Climate

The western Antarctic Peninsula is experiencing the most rapid warming of any marine ecosystem on the planet (Ducklow *et al.* 2007). The mean annual temperature at Palmer Station between 1974-96 was –2.29° C, with an average minimum monthly air temperature over this period of –7.76° C in August, and a maximum of 2.51° C in January (Baker 1996). Data from Faraday / Vernadsky Station 53 km to the south demonstrate a statistically significant trend of annual average temperature rise, from –4.4º in 1951 to –2.0º in 2001, an average rate of 0.057º C per annum (Smith *et al.* 2003). The minimum recorded temperature at Palmer Station as of 2006 is –31° C, and the maximum is 9° C. Storms and precipitation are frequent, with approximately 35-50 cm water equivalent of precipitation received annually in the form of snow and rain (Smith *et al.* 1996). Winds are persistent but generally light to moderate in strength, prevailing from the northeast.

Glaciology, geology and geomorphology

The dominant glacial feature within the Area is the Marr Ice Piedmont. Smaller glaciers and ice-caps are found on many of the islands and promontories, the largest of which is located on Gerlache Island in the Rosenthal Islands (Map 2). Recent observations show the local glaciers to be retreating by approximately 10 m annually, with a number of ice-bridges between the Marr Ice Piedmont and offshore islands having collapsed.

Anvers Island and the numerous small islands and rocky peninsulas along its southwestern coast are composed of late-Cretaceous to early-Tertiary age granitic and volcanic rocks belonging to the Andean Intrusive Suite. These rocks dominate the Anvers Island area (Hooper 1962) and similar rock types extend into the island groups further south.

The main marine geomorphological feature within the Area is Palmer Basin, an erosional, inner-shelf trough located at the convergence of former ice-flows that once drained across the continental shelf from three distinct accumulation centers on the Antarctic Peninsula and Anvers Island (Domack *et al.* 2006). Seafloor features include relict terraces, sub-glacial lake deltas, channels, debris slopes and morainal banks. These remain as evidence of the development of a sub-glacial lake within the Palmer Basin during, or prior, to the last glacial maximum, its subsequent drainage, and the recession of the Palmer Basin ice stream system (Domack *et al*. 2006).

Freshwater habitat

Throughout the Area there are no significant lakes or streams, although there are numerous small ponds and temporary summer melt streams (Lewis Smith 1996). These are mainly on Norsel Point and some of the offshore islands in Arthur Harbor: notably on Humble Island, and also found on Breaker, Shortcut, Laggard, Litchfield and Hermit islands, and at Biscoe Point (W. Fraser, *pers. comm.* 2006), although many are heavily contaminated by neighboring penguin colonies and groups of non-breeding skuas. The streams possess few biota other than marginal mosses (e.g. *Brachythecium austrosalebrosum*, *Sanionia uncinata*), which are a favored habitat for the larvae of the Antarctic wingless midge,

Belgica antarctica. However, the ponds support a diverse micro-algal and cyanobacterial flora, with over 100 taxa being recorded, although numbers vary considerably between ponds (Parker 1972, Parker & Samsel 1972). Of the freshwater fauna there are numerous species of protozoans, tardigrades, rotifers, and nematodes, and a few free-swimming crustaceans of which the anostracan *Branchinecta gaini* (Antarctic fairy shrimp) and copepods *Parabroteus sarsi* and *Pseudoboeckella poppii* are the largest and most conspicuous (Heywood 1984).

Flora

The Area lies within the cold maritime Antarctic environment of the western Antarctic Peninsula, where conditions of temperature and moisture availability are suitable to support a high diversity of plant species, including the two native flowering plants Antarctic hairgrass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*) (Longton 1967; Lewis Smith 1996, 2003). In Antarctica these flowering plants occur only in the western Peninsula region, South Shetland and South Orkney Islands, occurring most frequently on sheltered, north-facing slopes, especially in gullies and on ledges near sea level. In a few favourable sites the grass has developed locally extensive closed swards (Lewis Smith 1996), notably at Biscoe Point (ASPA No. 139), where closed swards cover up to 6500 m^2. Throughout the maritime Antarctic, and especially in the Arthur Harbor area, the warming trend since the early 1980s has resulted in populations of both species rapidly increasing in number and extent, and numerous new colonies becoming established (Fowbert & Lewis Smith 1994; Day *et al*. 1999).

Vegetation within the Area is otherwise almost entirely cryptogamic (Lewis Smith 1979), with bryophytes dominating moist to wet habitats and lichens and some cushion-forming mosses occupying the drier soils, gravels and rock surfaces (Komárková *et al.* 1985). Dense communities of mosses and lichens are found at several locations around Arthur Harbor, including Norsel Point, Bonaparte Point and Litchfield Island, as well as some of the outer islands and Cape Monaco. In particular, sheltered north-facing slopes support locally extensive communities of the moss turf sub-formations up to 30 cm in depth, with stands of the *Polytrichum strictum–Chorisodontium aciphyllum* association predominating (Lewis Smith 1982). In Arthur Harbor large banks of these mosses can be found overlying an accumulation of peat exceeding a meter in depth and radio-carbon dated at almost 1000 years old. These are particularly apparent on Litchfield Island (ASPA No. 113), which is protected principally because of its outstanding vegetation values. Smaller examples are found on Laggard Island, Hermit Island and on Norsel Point, with small banks occurring on coastal promontories and islands throughout the Area. The largest of the Joubin Islands has a peat bank composed solely of *Chorisodontium* (Fenton & Lewis Smith 1982). From the late 1970s relictual patches of centuries-old peat formed by these mosses became exposed below the receding ice cliffs of Marr Ice Piedmont, notably on Bonaparte Point (Lewis Smith 1982). Wet level areas and seepage slopes usually support communities of the moss carpet and mat sub-formation in which *Sanionia uncinata, Brachythecium austrosalebrosum* and *Warnstorfia* spp. are usually dominant. One exceptionally extensive stand on Litchfield Island was destroyed by the increasing summer influx of fur seals during the 1980s.

Lichen-dominated (e.g. species of *Usnea*, *Pseudephebe*, *Umbilicaria* and many crustose forms) communities of the fruticose and foliose lichen sub-formation (often referred to as fellfield) are widespread on most stable, dry stony ground and exposed rock surfaces, often with associated cushion-forming mosses (e.g. species of *Andreaea*, *Hymenoloma*, *Orthogrimmia* and *Schistidium*) (Lewis Smith & Corner 1973). Rocks and boulders close to the shore, especially where influenced by nutrient (nitrogen) input from nearby penguin

and petrel colonies, usually support various communities of the crustose and foliose lichen sub-formation. Many of the species (e.g. *Acarospora*, *Amandinea*, *Buellia*, *Caloplaca*, *Haematomma*, *Lecanora*, *Lecidea*, *Xanthoria*) are brightly coloured (orange, yellow, gray-green, brown, white).

The green foliose alga *Prasiola crispa* develops a conspicuous zone on the highly nutrient enriched soil and gravel around penguin colonies. In late summer melting ice fields and permanent snow patches develop a reddish hue as huge aggregations of unicellular snow algae accumulate in the melting firn. Elsewhere, green snow algae give the surface a distinctive coloration.

A checklist of flora observed in the Area is included in Appendix C.

Invertebrates

The vegetation communities found within the Area serve as important habitat for invertebrate fauna. As is common elsewhere on the Antarctic Peninsula, springtails and mites are especially prominent. Colonies of the mite *Alaskozetes antarcticus* are frequently observed on the sides of dry rocks, while other species are associated with mosses, fruticose lichens and Antarctic hairgrass. The most common springtail, *Cryptopygus antarcticus*, is found in moss beds and under rocks. Springtails and mites are also found in other habitats, including bird nests and limpet accumulations (Lewis Smith 1966).

The islands near Palmer Station are notable for their abundant populations of the wingless midge *Belgica antarctica*, a feature not found to the same extent close to other research stations on the Antarctic Peninsula. This endemic species is significant because it is the southernmost, free-living true insect. It inhabits a wide range of habitats including moss, the terrestrial alga *Prasiola crispa* and nutrient-enriched microhabitats adjacent to elephant seal wallows and penguin colonies. Larvae are exceptionally tolerant of freezing, anoxia, osmotic stress and desiccation.

Colonies of the seabird tick *Ixodes uriae* are frequently found beneath well-drained rocks adjacent to seabird nests and especially Adélie penguin colonies. This tick has a circumpolar distribution in both hemispheres and exhibits the greatest range of thermal tolerance (-30 to 40°C) of any Antarctic terrestrial arthropod. The abundance of this tick has decreased during the past three decades concomitantly with observed decreases in Adélie penguin populations (R. Lee *pers. comm.* 2007).

Birds

Three species of penguins, Adélie (*Pygoscelis adeliae*), chinstrap (*P. antarctica*) and gentoo (*P. papua*), breed in the southwest Anvers Island area (Parmelee & Parmelee 1987, Poncet & Poncet 1987, Woehler 1993). The most abundant species is the Adélie penguin, which breeds on Biscoe Point, Christine, Cormorant, Dream, Humble, Litchfield and Torgersen islands, as well as the Joubin and Rosenthal islands (Maps 2-8). Numbers of Adélie penguins have declined significantly over the last 30 years, thought to be linked to the effects of the changing climate on sea-ice conditions, snow accumulation and prey availability (Fraser & Trivelpiece 1996, Fraser & Hofmann 2003, Fraser & Patterson 1997, Trivelpiece & Fraser 1996). Numbers of Adélie penguins breeding on Litchfield Island declined from 884 pairs to 143 pairs between 1974/75 and 2002/03, with no pairs breeding in 2006/07 (W. Fraser *pers. comm.* 2007). Chinstrap penguins are present on Dream Island,

on small islands near Gerlache Island, and on the Joubin Islands. The Rosenthal Islands contain source populations of chinstrap and gentoo penguins that are likely to be closely linked to other colonies in the southwest Anvers Island region. Gentoo penguins are thought to be increasing in the region in response to the regional warming, and may be colonising new sites in recently deglaciated areas or sites vacated by Adélie penguins. In particular, small glaciers on the Wauwermans Islands are retreating and may provide important habitat for new gentoo colonies (W. Fraser *pers. comm.* 2006).

Southern giant petrels (*Macronectes giganteus*) breed at numerous locations within the Area. Blue-eyed shags (*Phalacrocorax* [atriceps] *bransfieldensis*) breed on Cormorant Island, Elephant Rocks and in the Joubin Islands. Other breeding bird species occurring in the Area include kelp gulls (*Larus dominicanus*), Wilson's storm petrels (*Oceanites oceanicus*), sheathbills (*Chionis alba*), south polar skuas (*Catharacta maccormicki*), brown skuas (*C. loennbergi*) and Antarctic terns (*Sterna vittata*). Common non-breeding visitors include southern fulmars (*Fulmarus glacialoides*), Antarctic petrels (*Thalassoica antarctica*), cape petrels (*Daption capense*) and snow petrels (*Pagadroma nivea*). A full list of breeding, frequent and less common or transient visitors recorded in the Area is provided in Appendix C.

Marine mammals

There are few published data on the marine mammals within the area. Cruises conducted in Gerlache Strait have observed fin (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*) and southern bottlenose (*Hyperoodon planifrons*) whales (Thiele 2004). Anecdotal observations by Palmer Station personnel and visitors have noted fin, humpback, sei (*Balaenoptera borealis*), southern right (*Eubalaena australis*), minke (*Balaenoptera bonaerensis*) and killer (*Orcinus orca*) whales within the Area, as well as hourglass dolphins (*Lagenorhynchus cruciger*) (W. Fraser *pers. comm.* 2007). Non-breeding Weddell (*Leptonychotes weddellii*) and southern elephant seals (*Mirounga leonina*) haul out on accessible beaches, and crabeater (*Lobodon carcinophagus*) and leopard seals (*Leptonyx hydrurga*) are also commonly seen at sea and on ice floes within the Area. Numbers of non-breeding Antarctic fur seals (*Arctocephalus gazella*), mainly juvenile males, have increased in recent years, and depending on the time of year hundreds to thousands of individuals may be found on local beaches throughout the Area. Their increasing abundance is damaging vegetation at lower elevations (Lewis Smith 1996, Harris 2001). Despite the lack of published data concerning marine mammals within the Area, their presence is likely to be related to foraging for Antarctic krill, which forms an important component in their diets (Ducklow *et al.* 2007). A list of marine mammals observed within the Area is provided in Appendix C.

Oceanography

The Western Antarctic Peninsula is unique as the only region where the Antarctic Circumpolar Current (ACC) is adjacent to the continental shelf. The ACC flows in a northeasterly direction off the shelf, and there is also some southward flow on the inner part of the shelf (Smith *et al*. 1995). Circumpolar Deep Water (CDW) transports macronutrients and warmer, more saline water onto the shelf, which has significant implications for heat and salt budgets in the southwest Anvers Island and Palmer Basin region. Circulation patterns and the presence of the CDW water mass may also affect the timing and extent of sea ice (Smith *et al*. 1995). The extent of sea ice cover and the timing of the appearance of the marginal ice zone (MIZ) in relation to specific geographic areas have high interannual variability (Smith *et al*. 1995), although Smith and Stammerjohn (2001) have shown a statistically significant reduction in overall sea-ice extent in the

Western Antarctic Peninsula region over the period for which satellite observations are available. The ice edge and the MIZ form major ecological boundaries, and are of particular interest in the region because of their interaction with many aspects of the marine ecosystem, including phytoplankton blooms and seabird habitat. Within the Area, the Palmer Basin is a focal point of biological and biogeochemical activity and an important area of upwelling.

Marine ecology

The marine ecosystem west of the Antarctic Peninsula is highly productive, with dynamics that are strongly coupled to the seasonal and interannual variations in sea ice. The rapid climate changes occurring on the western Antarctic Peninsula, with resultant changes in sea ice, is affecting all levels of the food web (Ducklow *et al.* 2007). Marine flora and fauna within the Area are strongly influenced by factors including low temperatures, a short growing season, high winds influencing the depth of the mixed layer, proximity to land with the potential for input of micronutrients, and the varying sea-ice coverage. It is a high-nutrient, low-biomass environment.

High levels of primary production are observed within the region, maintained by topography-induced upwellings and stratification by fresh water input from glaciers (Prézelin *et al.* 2000, 2004; Dierssen *et al.* 2002). In terms of biomass, the phytoplankton communities are dominated by diatoms and cryptomonads (Moline & Prezelin 1996). Species distribution and composition varies with water masses, fronts and the changing position of the ice edge.

Salps and Antarctic krill (*Euphausia* sp.) often dominate the total zooplankton biomass (Moline & Prezelin 1996). Dominant organisms in the neritic province on the shelf southwest of Anvers Island are *E. superba, E. crystallorophias,* and fish larvae (Ross *et al.* 1996). The distribution and abundance of zooplankton is variable over time, and Spiridonov (1995) found krill in the Palmer Archipelago to exhibit a highly variable life cycle as compared with other areas of the western Antarctic Peninsula.

There is a high level of endemism among fish species sampled on the Antarctic continental shelf as compared with other isolated marine communities, with new species still being regularly discovered (Eastman 2005). Examples of fish collected within the Area are six species of Nototheniidae (*Notothenia coriiceps neglecta, N. gibberifrons, N. nudifrons, Trematomus bernachii, T. hansoni* and *T. newnesi*), one of Bathydraconidae (*Parachaenichthys charcoti*) and one of Channichthydae (*Chaenocephalus aceratus*) (De Witt & Hureau 1979, Detrich 1987, McDonald *et al.* 1992).

The soft-bottomed macrobenthic community of Arthur Harbor is characterised by high species diversity and abundance, being dominated by polychaetes, peracarid crustaceans and molluscs (Lowry 1975, Richardson & Hedgpeth 1977, Hyland *et al.* 1994). Samples collected during a study of UV effects on marine organisms carried out close to Palmer Station during the austral spring (Karentz *et al.* 1991) yielded 57 species (1 fish, 48 invertebrates, and 8 algae). Sampling was from a combination of rocky intertidal areas (yielding 72% of organisms), subtidal and planktonic habitats. Of the marine invertebrates collected, the greatest number of species was found in the phylum Arthropoda (12 species). The Antarctic limpet (*Nacella concinna*) is common in Arthur Harbor (Kennicutt *et al.* 1992b).

'Base N' (UK) was built on Norsel Point (Map 3) in 1955 and operated continuously until 1958. The United States established 'Old Palmer' Station nearby on Norsel Point in 1965, although in 1968 transferred the main US operations to the present site of Palmer Station on Gamage Point. 'Base N' was used as a biological laboratory by US scientists from 1965-71, although this burnt to the ground in 1971. 'Old Palmer' station was removed by the US in 1991, and all that remains of both 'Old Palmer' and 'Base N' are the original concrete footings.

On 28 January 1989, the Argentine vessel *Bahia Paraiso* ran aground 750 m south of Litchfield Island, releasing more than 600,000 liters (150,000 gallons) of petroleum into the surrounding environment (Kennicutt 1990, Penhale *et al.* 1997). Contamination was lethal to some of the local biota including krill, intertidal invertebrates and seabirds, particularly Adélie penguins and blue-eyed shags (Hyland *et al.* 1994, Kennicutt *et al.* 1992a&b, Kennicutt & Sweet 1992). A summary of the spill, research on the environmental impact, and the joint 1992/1993 clean-up by Argentina –and The Netherlands can be found in Penhale *et al.* (1997).

All fin-fishing is currently prohibited in the western Antarctic Peninsula region (CCAMLR Statistical Subarea 48.1) under CCAMLR Conservation Measure 32-02 (1998) (CCAMLR 2006a). Krill fishing occurs in the offshore region to the northwest of the Palmer Archipelago, and is currently concentrated mainly around the South Shetland Islands further to the north. The total krill catch for Subarea 48.1 was reported at 7095 tonnes in the 2004/05 season (CCAMLR 2006b), and there has been some limited historical activity in the vicinity of the ASMA. However, fine-scale data show krill catches in the southwest Anvers Island region during only one 3-month period between 2000 and 2005, with a total catch of less than 4 tonnes (Q2, 2002/03)(CCAMLR 2006b: 187). CCAMLR-related activities are therefore occurring within or close to the Area, but are currently minimal.

Current human activities in the Area are mainly related to science and associated logistic activities, and tourism. Palmer Station (US) serves as the base for scientific research and associated logistic operations conducted in the western Antarctic Peninsula and Palmer Archipelago by the United States Antarctic Program (USAP) and collaborators from a number of other Antarctic Treaty Parties. Scientific and logistic support is received from ships operated or chartered by the USAP, which visit the station approximately 15 times per year. Aircraft are not operated routinely from Palmer Station, although helicopters may visit occasionally in summer. Local scientific transport and support is provided using small inflatable boats, which are operated throughout the 3-mile (~5 km) 'safe boating limit' area during the summer season (Map 3). Frequent visits are made to islands within the safe boating limit for scientific research, and also for recreation by base personnel.

Published information on the impacts of science (for example from sampling, disturbance or installations) within the Area is limited. However, numerous welding rods inserted into soil to mark vegetation study sites (Komárková 1983) were abandoned at Biscoe Point (ASPA No. 139) and Litchfield Island (ASPA No. 113) in 1982. Where these remained, surrounding vegetation had been killed as an apparent result of highly localised contamination by chemicals from the rods (Harris 2001).

Between 1984/85 and 1990/91, the number of tour ship visits each season at Palmer Station increased from 4 visits (340 visitors) to 12 (1300 visitors). Since 1991 the number of tour ship visits to Palmer Station has been maintained at approximately 12 vessels annually, with visits arranged prior to the start of the season. Tourists typically land at the station itself for a tour of

the facilities, visit the Visitor Zone on Torgersen Island (Map 5), and make short cruises around the nearshore islands using inflatable boats. Yachts also visit Palmer Station and the surrounding area, with 17 vessels visiting during the 2007/08 season. Studies of changes in penguin populations on Torgersen Island and nearby islands suggest that the impacts of visits by tourists, base personnel, and scientists on breeding performance have been small compared to longer-term climate-related forcing factors (Fraser & Patterson 1997, Emslie *et al.* 1998, Patterson 2001).

(ii) Structures within the Area

Modern Palmer Station (Map 4) consists of two main buildings, a laboratory facility and several ancillary structures including an aquarium, small boathouse, workshops, storage and communications facilities. The station is powered by one diesel-electric generator, the fuel for which is stored in two double-walled tanks. A pier has been constructed adjacent to the station at the entrance to Hero Inlet, which may accommodate medium-sized scientific and logistic support ships. The station is operated year-round and can accommodate approximately 44 people, with a summer occupancy of at least 40, and a winter complement of around 10.

(iii) Restricted and managed zones within the Area

Three types of management zones (Restricted, Visitor and Operations) are designated within the Area. Two ASPAs are also located within the Area.

(a) Restricted Zones

Sixteen sites of special ecological and scientific value are designated as Restricted Zones (Maps 2-6). These sites are particularly sensitive to disturbance during the summer months, and are listed as follows:

Table 1: Restricted Zones within the Southwest Anvers Island and Palmer Basin ASMA

Bonaparte Point (incl. 'Diana's Island' and 'Kristie Cove') Christine Island Cormorant Island Dream Island Elephant Rocks Hermit Island Humble Island Joubin Islands	Laggard Island Limitrophe Island Norsel Point Rosenthal Islands Shortcut Island Shortcut Point Stepping Stones Torgersen Island (SW half of island)

The Restricted Zones include a buffer extending 50 m from the shore into any adjacent marine area (Map 2). A 50 m Restricted Zone buffer also extends around Litchfield Island (ASPA No. 113). In order to protect sensitive bird colonies throughout the breeding season to the maximum extent possible, and also plant communities, access to Restricted Zones between 1 October to 15 April inclusive is restricted to those conducting essential scientific research, monitoring or maintenance. All non-essential small boat traffic should avoid transit of or cruising within the 50 m marine buffers of Restricted Zones.

Specific guidelines for scientific research activities within Restricted Zones are included in the Scientific Guidelines for the ASMA (Appendix A).

(b) Visitor Zone

The northeastern half of Torgersen Island is designated as a Visitor Zone (Map 5). Visitors are currently directed to this part of the island, while access to the Restricted Zone in the southwest part of the island, which is set aside as a scientific reference area, is restricted to those conducting essential scientific research, monitoring or maintenance. Specific guidelines for activities within the Visitor Zone are included in the Visitor Guidelines for the ASMA (Appendix B).

(c) Operations Zone

Palmer Station facilities are largely concentrated within a small area on Gamage Point. The Operations Zone is designated as the area of Gamage Point encompassing the station buildings, together with adjacent masts, aerials fuel storage facilities and other structures and extending to the permanent ice edge of the Marr Ice Piedmont (Map 4).

(d) Antarctic Specially Protected Areas (ASPAs)

Two Antarctic Specially Protected Areas, ASPA No. 113 Litchfield Island and ASPA No. 139 Biscoe Point, are located within the ASMA (Maps 7 and 8). Revised management plans for both sites were adopted by the Antarctic Treaty Parties in 2004. All entry is prohibited unless in accordance with a Permit issued by an appropriate national authority.

(iv) Location of other protected areas within close proximity of the Area

In addition to ASPA No. 113 and ASPA No. 139 within the Area, the only other protected area within close proximity is ASPA No. 146, South Bay, Doumer Island, 25 km southeast of Palmer Station (Map 1). There are no Historic Sites and Monuments within the Area, with the nearest being HSM No. 61, Base A, Port Lockroy, Goudier Island, 30 km east of Palmer Station (Map 1).

7. General Code of Conduct

The Code of Conduct in this section is the main instrument for the management of activities in the Area. It outlines the overall management and operational principles for the Area. More specific environmental, scientific and visitor guidelines are provided in the appendices.

(i) Access to and movement within the Area

Access to the Area is generally by ship (Map 4), with occasional access by helicopter. There are no special restrictions on the transit of vessels through the Area, with the exception of seasonal buffer zones extending 50 m from the shore at a small number of islands designated as Restricted Zones (see Section 6(iii)(a)). Prior to visiting Palmer Station, radio contact should always be made to obtain guidance on local activities being conducted in the region (Map 3).

Tour ships, yachts and National Program vessels may stand offshore and access Palmer Station and the surrounding coast and islands by small boat, taking into account the access restrictions applying within designated zones. The region of safe small boat operations and preferred small boat landing sites within the area local to Palmer Station are shown on Map 3 (see also Appendix A).

Access to Restricted Zones between 1 October – 15 April inclusive is restricted to those conducting essential scientific research, monitoring or maintenance, including the nearshore marine area within 50 m of the coast of these zones (see Section 6(iii)(a) for details). Access to ASPAs is prohibited except in accordance with a Permit issued by an appropriate national authority.

Aircraft operating within the Area should follow the 'Guidelines for the operation of aircraft near concentrations of birds in Antarctica' (Resolution 4, XXVII Antarctic Treaty Consultative Meeting). The primary helicopter landing site at Palmer Station is a flat, rocky area approximately 400 m east of Palmer Station. Helicopter approach should be high over the peninsula east of Palmer Station or up the channel from SE (refer to Palmer Station page in the Anvers Island section of the *Wildlife Awareness Manual* (Harris 2006)). Overflight of wildlife colonies should be avoided throughout the Area, and specific overflight restrictions apply at Litchfield Island (ASPA No.113) and Biscoe Point (ASPA No.139) (Maps 7 & 8 and specific provisions in the ASPA management plans).

Movement on land within the Area is generally on foot, although vehicles are used in the Operations Zone. A route leading from Palmer Station up onto the Marr Ice Piedmont is marked by flags to avoid crevassed areas. The precise route varies according to conditions and visitors should obtain the latest information on the route from Palmer Station. In the winter, snowmobiles are sometimes used on this route. All movement should be undertaken carefully to minimise disturbance to animals, soil and vegetated areas.

(ii) Activities that are or may be conducted within the Area

Activities that may be conducted in the Area include:

- scientific research, or the logistical support of scientific research, that will not jeopardise the values of the Area;
- management activities, including the maintenance or removal of facilities, clean-up of abandoned work-sites, and monitoring the implementation of this Management Plan; and
- tourist or private expedition visits consistent with the provisions of this Management Plan and the Visitor Guidelines (Appendix B);
- media, arts, education or other official national program visitors;
- harvesting of marine living resources, which should be conducted in accordance with the provisions of this Management Plan and with due recognition of the important scientific and environmental values of the Area. Any such activities should be conducted in coordination with research and other activities taking place, and could include development of a plan and guidelines that would help to ensure that harvesting activities did not pose a significant risk to the other important values of the Area.

All activities in the Area should be conducted in such a manner so as to minimize environmental impacts. Specific guidelines on the conduct of activities within the Area, including within specific zones, can be found in the Appendices.

(iii) Installation, modification or removal of structures

Site selection, installation, modification or removal of temporary refuges or tents should be undertaken in a manner that does not compromise the values of the Area. Installation sites should be re-used to the greatest extent possible and the location recorded. The footprint of installations should be kept to the minimum practical.

Scientific equipment installed in the Area should be clearly identified by country, name of principal investigator, contact details, and date of installation. All such items should be made of materials that pose minimal risk of contamination to the area. All equipment and associated materials should be removed when no longer in use.

(iv) Location of field camps

Temporary field camps may be made where required for research, and in accordance with the Restricted Zone and ASPA provisions. Field camps should be located on non-vegetated sites, or on thick snow or ice cover when practical, and should avoid concentrations of mammals or breeding birds. The location of field camps should be recorded, and previously occupied campsites should be re-used where appropriate. The footprint of campsites should be kept to the minimum practical.

Emergency caches are located on several islands within the Area for safety purposes, and are identified on Map 3. Please respect the caches and only use them in a genuine emergency, reporting any such use to Palmer Station so the cache can be restocked.

(v) Taking or harmful interference with native flora and fauna

Taking (including killing or capturing) or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the *Protocol on Environmental Protection to the Antarctic Treaty* (1998).

(vi) Collection or removal of anything not brought into the Area

Material not covered by 7(v) above should only be removed from the area for scientific and associated educational purposes or essential management or conservation purposes, and should be limited to the minimum necessary to fulfill those needs. Material of human origin likely to compromise the values of the Area may be removed unless the impact of removal is likely to be greater than leaving the material in place. If this is the case the appropriate authority should be notified. Do not disturb experimental sites or scientific equipment.

(vii) Restrictions on materials and organisms which can be brought into the Area

Visitors should seek to minimize the risk of introduction of non-native species to the maximum extent practical.

(viii) Waste disposal / management

All wastes other than human wastes and domestic liquid waste shall be removed from the Area. Human and domestic liquid wastes from stations or field camps may be disposed of into the sea below the high water mark. In accordance with Article 4, Annex III of the Protocol on Environmental Protection, wastes shall not be disposed of into freshwater streams or lakes, onto ice-free areas, or onto areas of snow or ice which terminate in such areas or have high ablation.

(ix) Requirements for Reports

Reports of activities in the Area should be maintained by the Management Group to the greatest extent possible, and made available to all Parties. In accordance with Article 10 of Annex V of the Protocol on Environmental Protection, arrangements should be made for collection and exchange of reports of inspection visits and on any significant changes or damage within the Area.

Tour operators should record their visits to the Area, including the number of visitors, dates, and any incidents in the Area.

8. Exchange of information

In addition to the normal exchange of information by means of the annual national reports to the Parties of the Antarctic Treaty, and to SCAR and COMNAP, Parties operating in the Area should exchange information through the Management Group. All National Antarctic Programs planning to conduct scientific activities within the Area should, as far as practical, notify the Management Group in advance of their nature, location and expected duration, and any special considerations related to the deployment of field parties or scientific instrumentation within the Area.

All tour ships and yachts should, as far as practical, provide the Management Group with details of scheduled visits in advance.
All those planning to conduct marine harvesting activities within the Area should, as far as practical, notify the Management Group in advance of their nature, location and expected duration, and of any special considerations related to how these activities could impact on scientific investigations being carried out within the Area.

Information on the location of scientific activities within the Area should be disseminated as far as practical.

9. Supporting documentation

This Management Plan includes the following supporting documents as appendices:

- Appendix A: Scientific and Environmental Guidelines (including guidelines for Restricted Zones);
- Appendix B: Visitor Guidelines (including guidelines for the Visitor Zone);
- Appendix C: Plant, bird and mammal species recorded within the Southwest Anvers Island and Palmer Basin ASMA;

- Appendix D: References.

Appendices

Appendix A - Supporting Guidelines and Data

Scientific and Environmental Guidelines (including guidelines for Restricted Zones)

The coastal marine environmental of the West Antarctic Peninsula has become an important site for scientific research, with a history of study going back some fifty years. This code suggests how you can help to protect the values of the area for future generations and ensure that your presence in the region will have as little impact as possible.

- Everything taken into the field must be removed. Do not dump any unwanted material on the ground or in the water.
- Do not collect specimens or any natural material of any kind, including fossils, except for approved scientific and educational purposes.
- For those based at Palmer Station, stay within the safe boating limits: these are approximately 5 km (3 miles) from the station and no closer than 300 m from the glacier front along the Anvers Island coastline (Map 3).
- Visit only approved islands at approved times. Do not harass wildlife. Do not disturb mummified seals or penguins.
- When traveling on foot, stay on established trails whenever possible. Do not walk on vegetated areas or rock formations. Some of the biological communities in them have taken several thousand years to develop.
- Ensure that equipment and supplies are properly secured at all times to avoid dispersion by high winds. High velocity winds can arrive suddenly and with little warning.
- Avoid any activities that would result in the dispersal of foreign substances (e.g., food, fuel, reagents, litter). Do not leave any travel equipment behind.

Fuel and chemicals:

- Take steps to prevent the accidental release of chemicals such as laboratory reagents and isotopes (stable or radioactive). When permitted to use radioisotopes, precisely follow all instructions provided.
- Ensure you have spill kits appropriate to the volume of fuel or chemicals you have and are familiar with their use.

Sampling and experimental sites:

- All sampling equipment should be clean before being brought into the field.
- Once you have drilled a sampling hole in sea ice or dug a soil pit, keep it clean and make sure all your sampling equipment is securely tethered.
- Avoid leaving markers (e.g. flags) and other equipment for more than one season without marking them clearly with your event number and duration of your project.

Glaciers:

- Minimize the use of liquid water (e.g., with hot water drills) which could contaminate the isotopic and chemical record within the glacier ice.
- Avoid the use of chemical-based fluids on the ice.
- If stakes or other markers are placed on a glacier, use the minimum number of stakes required to meet the needs of the research; where possible, label these with event number and project duration.

Restricted Zones:

- Research in Restricted Zones should be carried out with particular care to avoid or minimize trampling of vegetation and disturbance of wildlife;
- Minimize any disturbance to birds during the breeding season (1 October to 15 April) except for compelling scientific reasons;
- Access to the mooring adjacent to the Restricted Zone on Bonaparte Point should be by small boat when ice and weather permit. If it is necessary to approach the mooring from within the Restricted Zone, walk as close to the coastline as possible to avoid south polar skua (*Catharacta* [skua] *maccormicki*) nesting territories on the ridge crest.
- All visits to and activities within Restricted Zones should be recorded, in particular records should be kept of the type and quantity of all sampling.

Appendix B- Visitor Guidelines (including guidelines for the Visitor Zone)

These guidelines are for commercial tour operators and private expeditions, as well as for National Antarctic Program staff when undertaking recreational activities within the Area.

- Visitor activities should be undertaken in a manner so as to minimize adverse impacts on the southwest Anvers Island and Palmer Basin ecosystem and/or on the scientific activities in the Area;
- Tour operators should provide visit schedules to National Programs operating in the Area in advance of their visits, which should be circulated to the Management Group as soon as they become available;
- In addition to the above, tour vessels and yachts planning to visit Palmer Station should make contact with the station at least 24 hours before arrival to confirm details of the visit;
- At Palmer Station, no more than 40 passengers should be ashore at any time;
- Small boat cruising should avoid any disturbance of birds and seals, and take account of the 50 m operation limit around Restricted Zones;
- Visitors should maintain a distance of 5 meters from birds or seals, to avoid causing them disturbance. Where practical, keep at least 15 meters away from fur seals;
- Visitors should avoid walking on any vegetation including mosses and lichens;
- Visitors should not touch or disturb scientific equipment, research areas, or any other facilities or equipment;
- Visitors should not take any biological, geological or other souvenirs, or leave behind any litter;
- Within the group of islands in Arthur Harbor, tourist landings should be confined to the designated Visitor Zone.

Visitor Zone (Torgersen Island)

Visits to Torgersen Island should be undertaken in accordance with the general visitor guidelines outlined above. Further site-specific guidelines are as follows:

- Landings on Torgersen Island should be made at the designated small boat landing site at 64°46'17.8"S, 64°04'31"W on the northern shore of the island;
- No more than 40 passengers should be ashore at any time;
- Visitors should limit their visit to the Visitor Zone portion of the island, as the Restricted Zone is a control site for scientific research (Map 5).

Appendix C- Plant, bird and mammal species recorded within the Southwest Anvers Island and Palmer Basin ASMA

Table C.1: Plant species recorded within the Area (extracted from British Antarctic Survey Plant Database (2007)).

Flowering plants	**Lichens**
Colobanthus quitensis	*Acarospora macrocyclos*
Deschampsia antarctica	*Amandinea petermannii*
Liverworts	*Buellia anisomera, B. melanostola, B. perlata, B. russa*
Barbilophozia hatcheri	*Catillaria corymbosa*
Cephaloziella varians	*Cetraria aculeata*
Lophozia excisa	*Cladonia carneola, C. deformis, C. fimbriata, C. galindezii, C. merochlorophaea var. novochloro, C. pleurota, C. pocillum, C. sarmentosa, C. squamosa*
Mosses	*Coelopogon epiphorellus*
Andreaea depressinervis, A. gainii var. gainii, A. regularis M	*Haematomma erythromma*
Bartramia patens	*Himantormia lugubris*
Brachythecium austrosalebrosum	*Lecania brialmontii*
Bryum archangelicum, B. argenteum, B. boreale, B. pseudotriquetrum	*Lecanora polytropa, L. skottsbergii*
Ceratodon purpureus	*Leptogium puberulum*
Chorisodontium aciphyllum	*Massalongia carnosa*
Dicranoweisia crispula, D. dryptodontoides	*Mastodia tessellata*
Grimmia reflexidens	*Melanelia ushuaiensis*
Hymenoloma grimmiaceum	*Ochrolechia frigida*
Kiaeria pumila	*Parmelia cunninghamii, P. saxatilis*
Platydictya jungermannioides	*Physcia caesia, P. dubia*
Pohlia cruda, P. nutans	*Physconia muscigena*
Polytrichastrum alpinum	*Pseudephebe minuscula, P. pubescens*
Polytrichum juniperinum, P.piliferum, P. strictum	*Psoroma cinnamomeum, P. hypnorum*
Sanionia uncinata	*Rhizoplaca aspidophora*
Sarconeurum glaciale	*Rinodina turfacea*
Schistidium antarctici, S. urnulaceum	*Sphaerophorus globosus*
Syntrichia magellanica	*Stereocaulon alpinum*
Syntrichia princeps, S. sarconeurum	*Umbilicaria antarctica, U. decussata*
Warnstorfia laculosa	*Usnea antarctica, U. aurantiaco-atra*
	Xanthoria candelaria
	Xanthoria elegans

Notes: The number of species recorded within the Area = 83

Table C.2: Bird and mammal species recorded within the Area (Parmelee et al. 1977; W. Fraser pers. comm. 2007).

Common name	Scientific name	Status within Area
Birds		
chinstrap penguin	*Pygoscelis antarctica*	Confirmed breeder
Adélie penguin	*Pygoscelis adeliae*	Confirmed breeder
gentoo penguin	*Pygoscelis papua*	Confirmed breeder
southern giant petrel	*Macronectes giganteus*	Confirmed breeder
blue-eyed shag	*Phalacrocorax* [atriceps] *bransfieldensis*	Confirmed breeder
kelp gull	*Larus dominicanus*	Confirmed breeder
Wilson's storm petrel	*Oceanites oceanites*	Confirmed breeder
sheathbill	*Chionis alba*	Confirmed breeder
south polar skua	*Catharacta maccormicki*	Confirmed breeder
brown skua	*Catharacta loennbergi*	Confirmed breeder
Antarctic tern	*Sterna vittata*	Confirmed breeder
southern fulmar	*Fulmarus glacialoides*	Frequent visitor
Antarctic petrel	*Thalassoica antarctica*	Frequent visitor
cape petrel	*Daption capense*	Frequent visitor
snow petrel	*Pagadroma nivea*	Frequent visitor
emperor penguin	*Aptenodytes forsteri*	Occasional visitor
king penguin	*A. patagonicus*	Occasional visitor
macaroni penguin	*Eudyptes chrysolophus*	Occasional visitor
rockhopper penguin	*Eudyptes chrysocome*	Occasional visitor
Magellanic penguin	*Spheniscus magellanicus*	Occasional visitor
black-browed albatross	*Diomedea melanophris*	Occasional visitor
gray-headed albatross	*D. chrystosoma*	Occasional visitor
northern giant petrel	*Macronectes halli*	Occasional visitor
black-bellied storm petrel	*Fregetta tropica*	Occasional visitor
red phalarope	*Phalaropus fulicarius*	Occasional visitor
South Georgia pintails	*Anas georgica*	Occasional visitor
black-necked swan	*Cygnus melancoryphus*	Occasional visitor
sandpiper	(sp. unknown)	Occasional visitor
cattle egret	*Bubulcus ibis*	Occasional visitor
Arctic tern	*Sterna paradisaea*	Occasional visitor
Seals (no data on breeding or numbers available)		
Weddell seal	*Leptonychotes weddellii*	Frequent visitor
southern elephant seal	*Mirounga leonina*	Frequent visitor
crabeater seal	*Lobodon carcinophagus*	Frequent visitor
leopard seal	*Leptonyx hydrurga*	Frequent visitor
Antarctic fur seals	*Arctocephalus gazella*	Frequent visitor
Whales and dolphins (no data on breeding or numbers available)		
fin whale	*Balaenoptera physalus*	Observed
humpback whale	*Megaptera novaeangliae*	Observed
sei whale	*Balaenoptera borealis*	Observed
southern right whale	*Eubalaena australis*	Observed
minke whale	*Balaenoptera bonaerensis*	Observed
killer whale	*Orcinus orca*	Observed
hourglass dolphins	*Lagenorhynchus cruciger*	Observed

Appendix D: References

Baker, K.S. 1996. Palmer LTER: Palmer Station air temperature 1974 to 1996. *Antarctic Journal of the United States* **31**(2): 162-64.

CCAMLR 2006a. Schedule of Conservation Measures in force 2006/07 season. CCAMLR, Hobart, Australia.

CCAMLR 2006b. Statistical Bulletin, Vol. 18 (1996*2005). CCAMLR, Hobart, Australia.

Day, T.A., C.T. Ruhland, C.W. Grobe & F. Xiong 1999. Growth and reproduction of Antarctic vascular plants in response to warming and UV radiation reductions in the field. *Oecologia* **119**: 24-35.

Detrich III, H.W. 1987. Formation of cold-stable microtubules by tubulins and microtubule associated proteins from Antarctic fishes. *Antarctic Journal of the United States* **22**(5): 217-19.

Domack E., D. Amblàs, R. Gilbert, S. Brachfeld, A. Camerlenghi, M. Rebesco, M. Canals & R. Urgeles 2006. Subglacial morphology and glacial evolution of the Palmer deep outlet system, Antarctic Peninsula. *Geomorphology* **75**(1-2): 125-42.

Ducklow, H.W., K.S. Baker, D.G. Martinson, L.B. Quetin, R.M. Ross, R.C. Smith, S.E. Stammerjohn, M. Vernet & W. Fraser 2007. Marine pelagic ecosystems: The West Antarctic Peninsula. Special Theme Issue, Antarctic Ecology: From Genes to Ecosystems. *Philosophical Transactions of the Royal Society of London* **362**: 67-94.

Eastman, J.T. 2005. The nature and diversity of Antarctic fishes. *Polar Biology* **28**(2): 93-107.

Emslie, S.D., W.R. Fraser, R.C. Smith & W. Walker 1998. Abandoned penguin colonies and environmental change in the Palmer Station area, Anvers Island, Antarctic Peninsula. *Antarctic Science* **10**(3): 257-68.

Fraser, W.R. & Trivelpiece, W.Z. 1996. Factors controlling the distribution of seabirds: winter-summer heterogeneity in the distribution of Adélie penguin populations. In: R. Ross, E. Hofmann, & L. Quetin (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**. American Geophysical Union, Washington, DC: 257-52.

Fraser, W.R. & Hofmann, E.E. 2003. A predator's perspective on causal links between climate change, physical forcing and ecosystem response. *Marine Ecology Progress Series* **265**: 1-15.

Fraser, W.R. & Patterson, D.L. 1997. Human disturbance and long-term changes in Adélie penguin populations: a natural experiment at Palmer Station, Antarctic Peninsula. In: B. Battaglia, J. Valencia & D. Walton (eds) *Antarctic communities: species, structure and survival*. Cambridge University Press, Cambridge: 445-52.

Fraser, W.R., W.Z. Trivelpiece, D.G. Ainley & S.G. Trivelpiece 1992**.** Increases in Antarctic penguin populations: reduced competition with whales or a loss of sea ice due to global warming? *Polar Biology* **11**: 525-31.

Fenton, J.H.C. & Lewis Smith, R.I. 1982. Distribution, composition and general characteristics of the moss banks of the maritime Antarctic. *British Antarctic Survey Bulletin* **51**: 215-36.

Fowbert, J.A. & Lewis Smith, R.I. 1994. Rapid population increases in native vascular plants in the Argentine Islands, Antarctic Peninsula. *Arctic and Alpine Research* **26**: 290-96.

Harris, C.M. 2001. Revision of management plans for Antarctic Protected Areas originally proposed by the United Kingdom and the United States of America: 2001 field visit report. Unpublished report, Environmental Research & Assessment, Cambridge.

Harris, C.M. (ed) 2006. *Wildlife Awareness Manual: Antarctic Peninsula, South Shetland Islands, South Orkney Islands*. First Edition. Wildlife Information Publication No. 1. Prepared for the UK Foreign & Commonwealth Office and HMS *Endurance*. Environmental Research & Assessment, Cambridge.

Heywood, R.B. 1984. Antarctic inland waters. In: R. Laws (ed) *Antarctic ecology* (Volume 1). Academic Press, London: 279-344.

Hooper, P.R. 1962. The petrology of Anvers Island and adjacent islands. *FIDS Scientific Reports* **34**.

Huiskes, A.H.L., D. Lud, T.C.W. Moerdijk-Poortviet, & J. Rozema 1999. Impact of UV-B radiation on Antarctic terrestrial vegetation. In: J. Rozema (ed) *Stratospheric ozone depletion; the effects of enhancing UV-B radiation on terrestrial ecosystems*. Blackhuys Publishers, Leiden: 313-37.

Kennicutt II, M.C. 1990. Oil spillage in Antarctica: initial report of the National Science Foundation-sponsored quick response team on the grounding of the *Bahia Paraiso*. *Environmental Science and Technology* **24**: 620-24.

Kennicutt II, M.C., T.J. McDonald, G.J. Denoux & S.J. McDonald 1992a. Hydrocarbon contamination on the Antarctic Peninsula I. Arthur Harbor – subtidal sediments. *Marine Pollution Bulletin* **24**(10): 499-506.

Kennicutt II, M.C., T.J. McDonald, G.J. Denoux & S.J. McDonald 1992b. Hydrocarbon contamination on the Antarctic Peninsula I. Arthur Harbor – inter- and subtidal limpets (*Nacella concinna*). *Marine Pollution Bulletin* **24**(10): 506-11.

Kennicutt II, M.C & Sweet, S.T. 1992. Hydrocarbon contamination on the Antarctic Peninsula III. The *Bahia Paraiso* – two years after the spill. *Marine Pollution Bulletin* **24**(9-12): 303-06.

Komárková, V. 1983. Plant communities of the Antarctic Peninsula near Palmer Station. *Antarctic Journal of the United States* **18**: 216-18.

Komárková, V. 1984. Studies of plant communities of the Antarctic Peninsula near Palmer Station. *Antarctic Journal of the United States* **19**: 180-82.

Komárková, V., S. Poncet & J. Poncet 1985. Two native Antarctic vascular plants, *Deschampsia antarctica* and *Colobanthus quitensis*: a new southernmost locality and other localities in the Antarctic Peninsula area. *Arctic and Alpine Research* **17**(4): 401-16.

Lascara, C.M., E.E. Hofmann, R.M. Ross & L.B. Quetin 1999. Seasonal variability in the distribution of Antarctic krill, *Euphausia superba*, west of the Antarctic Peninsula. *Deep Sea Research Part I: Oceanographic Research Papers* **46**(6): 951-84.

Lewis Smith, R.I. & Corner, R.W.M. 1973. Vegetation of the Arthur Harbour-Argentine Islands region of the Antarctic Peninsula. *British Antarctic Survey Bulletin* **33-34**: 89-122.

Lewis Smith, R.I. 1979. Peat forming vegetation in the Antarctic. In: E. Kivinen, L. Heikurainen & P. Pakarinen (eds), *Classification of peat and peatlands*. University of Helsinki, Helsinki: 58-67.

Lewis Smith, R.I. 1982. Plant succession and re-exposed moss banks on a deglaciated headland in Arthur Harbour, Anvers Island. *British Antarctic Survey Bulletin* **51**: 193-99.

Lewis Smith, R.I. 1996. Terrestrial and freshwater biotic components of the western Antarctic Peninsula. In: R. Ross, E. Hofmann, & L. Quetin (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**. American Geophysical Union, Washington, DC: 15-59.

Lewis Smith, R.I. 2003. The enigma of *Colobanthus quitensis* and *Deschampsia antarctica* in Antarctica. In A. Huiskes, W. Gieskes, J. Rozema, R. Schorno, S. van der Vies & W. Wolff (eds) *Antarctic biology in a global context*. Backhuys Publishers, Leiden: 234-39.

Longton, R.E. 1967. Vegetation in the maritime Antarctic. In: J. Smith (ed) A discussion on the terrestrial Antarctic ecosystem. *Philosophical Transactions of the Royal Society of London* **252B**(777): 213-35.

McDonald, S., M. Kennicutt II, K. Foster-Springer & M. Krahn 1992. Polynuclear aromatic hydrocarbon exposure in Antarctic fish. *Antarctic Journal of the United States* **27**(5): 333-35.

Moline, M.A. & Prezelin, B.B. 1996. Palmer LTER 1991-1994: long term monitoring and analysis of physical factors regulating variability in coastal Antarctic phytoplankton biomass, in situ productivity and taxanomic composition over subseasonal, seasonal and interannual time scales phytoplankton dynamics. *Marine Ecology Progress Series* **145**: 143-60.

Parker, B.C. 1972. Conservation of freshwater habitats on the Antarctic Peninsula. In: B. Parker (ed) *Conservation problems in Antarctica*. Allen Press Inc., Lawrence, Kansas: 143-162.

Parker, B.C. & Samsel, G.L. 1972. Fresh-water algae of the Antarctic Peninsula. 1. Systematics and ecology in the U.S. Palmer Station area. In: G. Llano (ed) *Antarctic terrestrial biology*. *Antarctic Research Series* **20**. American Geophysical Union, Washington, DC: 69-81.

Parmelee, D.F., W.R. Fraser & D.R. Neilson 1977. Birds of the Palmer Station area. *Antarctic Journal of the United States* **12**(1-2): 15-21.

Parmelee, D.F. & Parmelee, J.M. 1987. Revised penguin numbers and distribution for Anvers Island, Antarctica. *British Antarctic Survey Bulletin* **76**: 65-73.

Patterson, D.L. 2001. The effects of human activity and environmental variability on long-term changes in Adélie penguin populations at Palmer Station, Antarctica. Unpublished MSc thesis in Fish & Wildlife Management, Montana State University, Bozeman.

Patterson, D.L., E.H. Woehler, J.P. Croxall, J. Cooper, S. Poncet & W.R. Fraser (in press). Breeding distribution and population status of the northern giant petrel *Macronectes halli* and the southern giant petrel *M. giganteus*. *Marine Ornithology* (submitted).

Penhale, P.A., J. Coosen & E.R. Marshcoff 1997. The *Bahai Paraiso*: a case study in environmental impact, remediation and monitoring. In: B. Battaglia, J. Valencia & D. Walton (eds) *Antarctic Communities: species, structure and survival*. Cambridge University Press, Cambridge: 437-44.

Poncet, S. & Poncet, J. 1987. Censuses of penguin populations of the Antarctic Peninsula 1983-87. *British Antarctic Survey Bulletin* **77**: 109-29.

Smith, R.C. & Stammerjohn, S.E. 2001. Variations of surface air temperature and sea-ice extent in the western Antarctic Peninsula (WAP) region. *Annals of Glaciology* **33**(1): 493-500.

Smith, R.C., K.S. Baker, W.R. Fraser, E.E. Hofmann, D.M. Karl, J.M. Klinck, L.B. Quetin, B.B. Prézelin, R.M. Ross, W.Z. Trivelpiece & M. Vernet 1995. The Palmer LTER: A long-term ecological research program at Palmer Station, Antarctica. *Oceanography* **8**(3): 77-86.

Smith, R.C., S.E. Stammerjohn & K.S. Baker. 1996. Surface air temperature variations in the western Antarctic Peninsula region. In: R. Ross, E. Hofmann, & L. Quetin (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**. American Geophysical Union, Washington, DC: 105-12.

Smith, R.C., K.S. Baker & S.E. Stammerjohn. 1998. Exploring sea ice indexes for polar ecosystem studies. *BioScience* **48**: 83-93.

Smith, R.C., D. Ainley, K.S. Baker, E. Domack, S. Emslie, W.R. Fraser, J. Kennett, A. Leventer, E. Mosley-Thompson, S.E. Stammerjohn & M. Vernet. 1999. Marine Ecosystem Sensitivity to Climate Change. *BioScience* **49**(5): 393-404.

Smith, R.C., K.S. Baker, H.M. Dierssen, S.E. Stammerjohn, & M. Vernet 2001. Variability of primary production in an Antarctic marine ecosystem as estimated using a multi-scale sampling strategy. *American Zoologist* **41**(1): 40-56.

Smith, R.C., W.R. Fraser, S.E. Stammerjohn & M. Vernet 2003. Palmer Long-Term Ecological Research on the Antarctic marine ecosystem. In: E. Domack, A. Leventer, A. Burnett, R. Bindschadler, P. Convey & M. Kirby (eds) *Antarctic Peninsula climate variability: historical and paleoenvironmental perspectives. Antarctic Research Series* **79**. American Geophysical Union, Washington, DC: 131-44.

Stammerjohn, S.E. & Smith, R.C. 1996. Spatial and temporal variability of western Antarctic Peninsula sea ice coverage. In: R. Ross, E. Hofmann, & L. Quetin (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**. American Geophysical Union, Washington, DC: 81-104.

Stammerjohn, S.E. & Smith, R.C. 1997. Opposing Southern Ocean climate patterns as revealed by trends in regional sea ice coverage. *Climatic Change* **37**: 617-39.

Stammerjohn, S.E., M.R. Drinkwater, R.C. Smith & X. Liu 2003. Ice-atmosphere interactions during sea-ice advance and retreat in the western Antarctic Peninsula region. *Journal of Geophysical Research* **108** (C10) 10: 1029/2002JC001543.

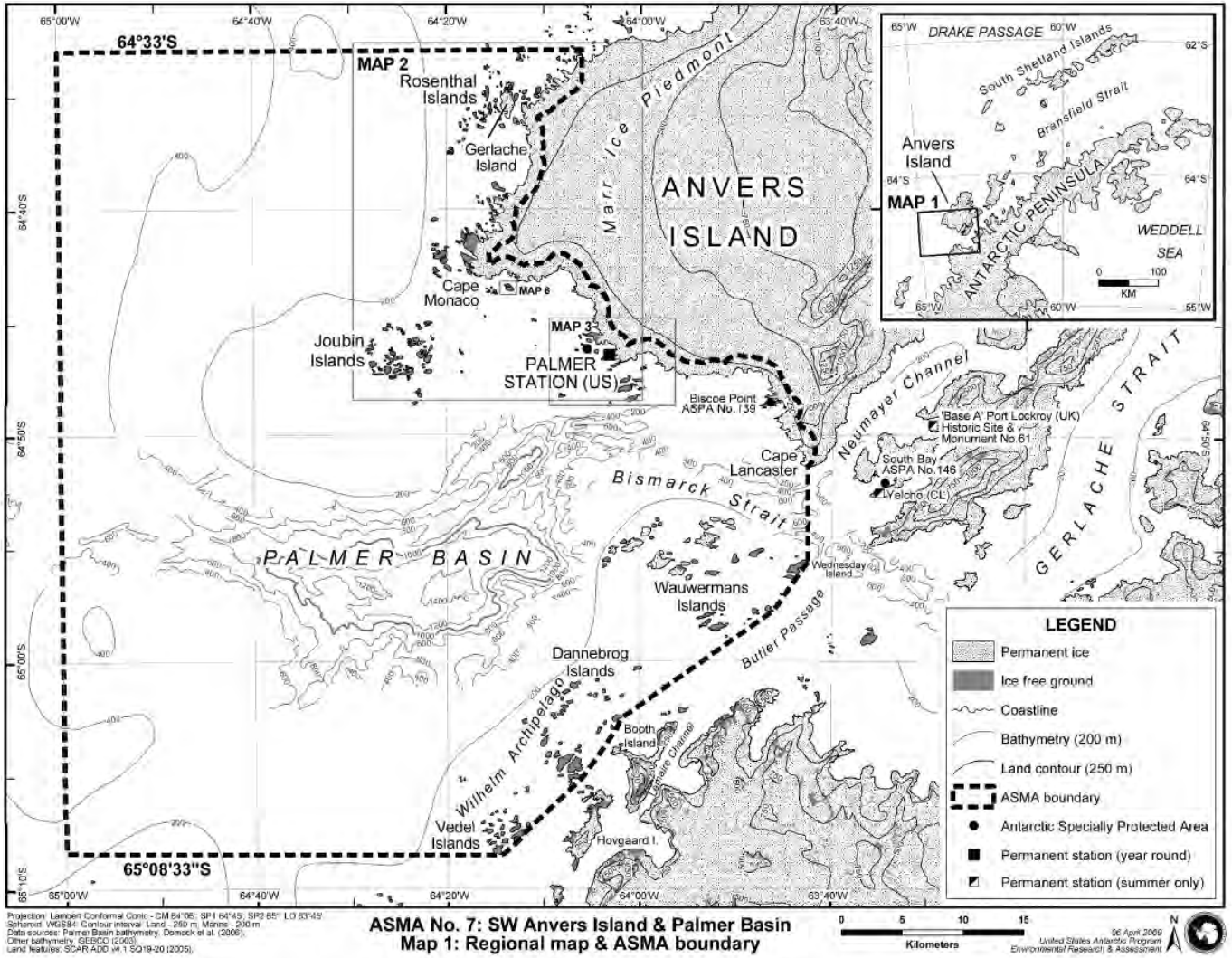
Thiele D., K. Asmus, S. Dolman, C.D. Falkenberg, D. Glasgow, P. Hodda, M. McDonald, E. Oleson, A. Širovic, A. Souter, S. Moore & J. Hildebrand 2004. International Whaling Commission – Southern Ocean GLOBEC/CCAMLR collaboration: Cruise Report 2003-2004. *Journal of Cetacean Research & Management* SC/56/E24.

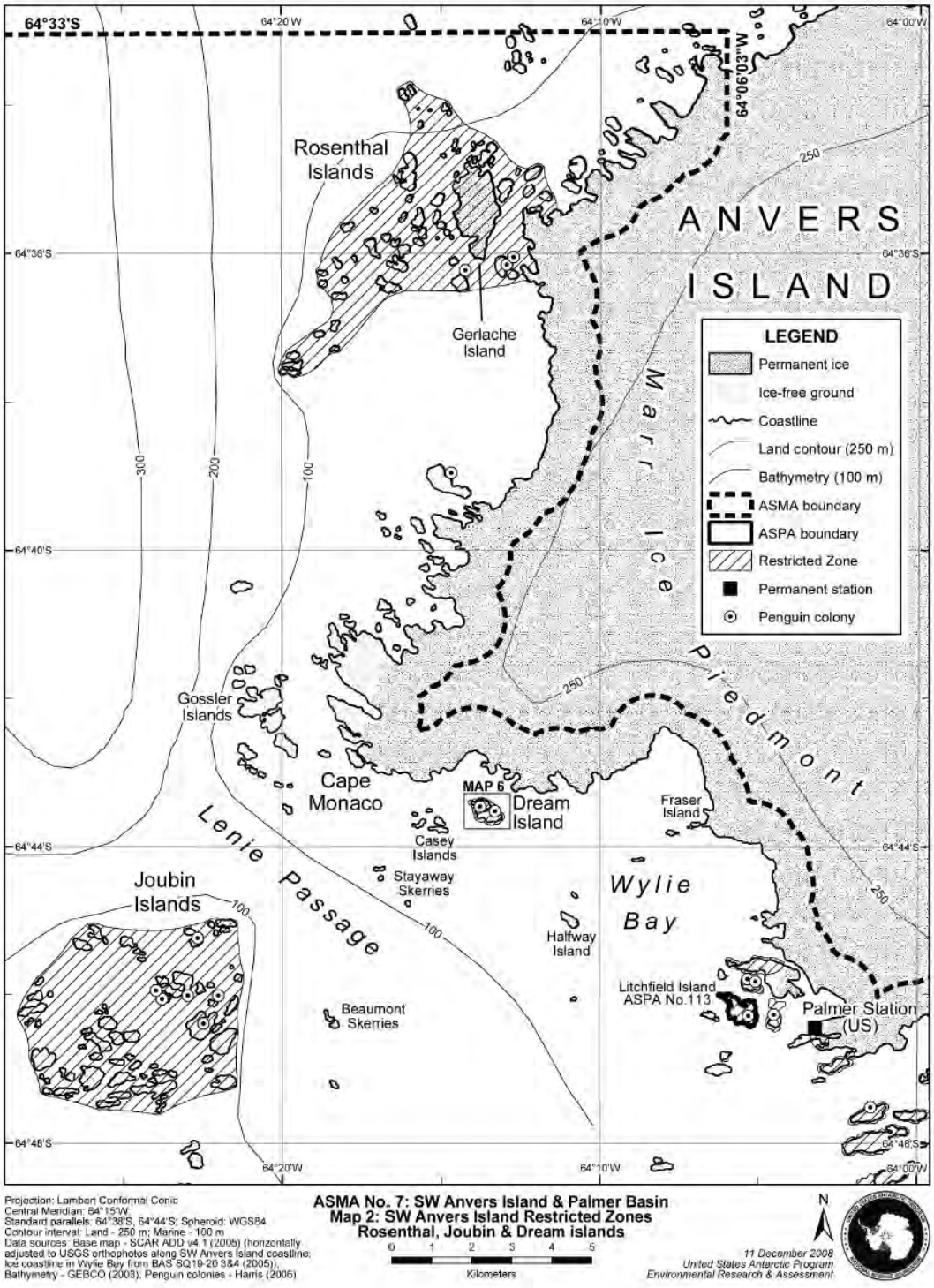
Trivelpiece W.Z. & Fraser, W.R. 1996. The breeding biology and distribution of Adélie penguins: adaptations to environmental variability. In: R. Ross, E. Hofmann, & L. Quetin (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**. American Geophysical Union, Washington, DC: 273-85.

Woehler, E.J. (ed) 1993. *The distribution and abundance of Antarctic and Subantarctic penguins.* SCAR, Cambridge.

Personal communications

Fraser, W. various personal communications 2003-08;
Patterson, D. 2006;
Lee, R. 2007;
Lewis Smith, R. 2007.


64°33'S
65°08'33"S
MAP 2
MAP 3
MAP 6
MAP 1
Rosenthal Islands
Gerlache Island
Marr Ice Piedmont
ANVERS ISLAND
Cape Monaco
Joubin Islands
PALMER STATION (US)
Biscoe Point ASPA No. 139
Cape Lancaster
Bismarck Strait
PALMER BASIN
Wauwermans Islands
Dannebrog Islands
Wilhelm Archipelago
Vedel Islands
Hovgaard I.
Booth Island
Lemaire Channel
Butler Passage
Neumayer Channel
GERLACHE STRAIT
'Base A' Port Lockroy (UK) Historic Site & Monument No.61
South Bay ASPA No.146
Yelcho (CL)
Wednesday Island
DRAKE PASSAGE
South Shetland Islands
Bransfield Strait
Anvers Island
ANTARCTIC PENINSULA
WEDDELL SEA
LEGEND
Permanent ice
Ice free ground
Coastline
Bathymetry (200 m)
Land contour (250 m)
ASMA boundary
Antarctic Specially Protected Area
Permanent station (year round)
Permanent station (summer only)
ASMA No. 7: SW Anvers Island & Palmer Basin
Map 1: Regional map & ASMA boundary
Kilometers



Projection: Lambert Conformal Conic
Central Meridian: 64°15'W
Standard parallels: 64°38'S, 64°44'S; Spheroid: WGS84
Contour interval: Land - 250 m; Marine - 100 m
Data sources: Base map - SCAR ADD v4.1 (2005) (horizontally adjusted to USGS orthophotos along SW Anvers Island coastline; Ice coastline in Wylie Bay from BAS SQ19-20 3&4 (2005)); Bathymetry - GEBCO (2003); Penguin colonies - Harris (2006)

ASMA No. 7: SW Anvers Island & Palmer Basin
Map 2: SW Anvers Island Restricted Zones
Rosenthal, Joubin & Dream islands

0 1 2 3 4 5
Kilometers

N

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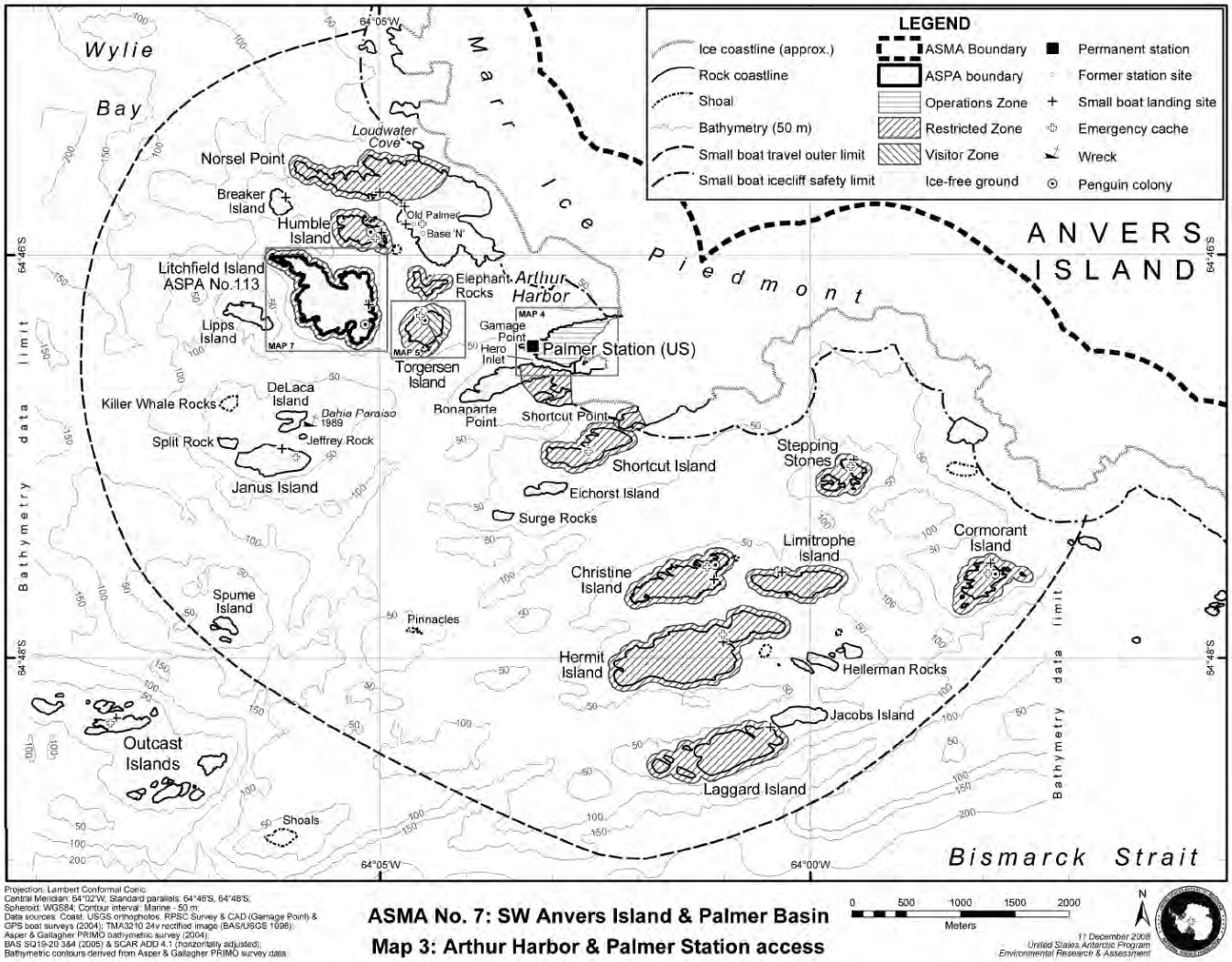

Projection: Lambert Conformal Conic.
Central Meridian: 64°02'W. Standard parallels: 64°46'S, 64°48'S.
Spheroid: WGS84. Contour interval: Marine - 50 m.
Data sources: Coast, USGS orthophotos, RPSC Survey & CAD (Gamage Point) & GPS boat surveys (2004); TMA3210 24v rectified image (BAS/USGS 1998); Asper & Gallagher PRIMO bathymetric survey (2004); BAS SQ19-20 3&4 (2005) & SCAR ADD 4.1 (horizontally adjusted); Bathymetric contours derived from Asper & Gallagher PRIMO survey data.

ASMA No. 7: SW Anvers Island & Palmer Basin
Map 3: Arthur Harbor & Palmer Station access

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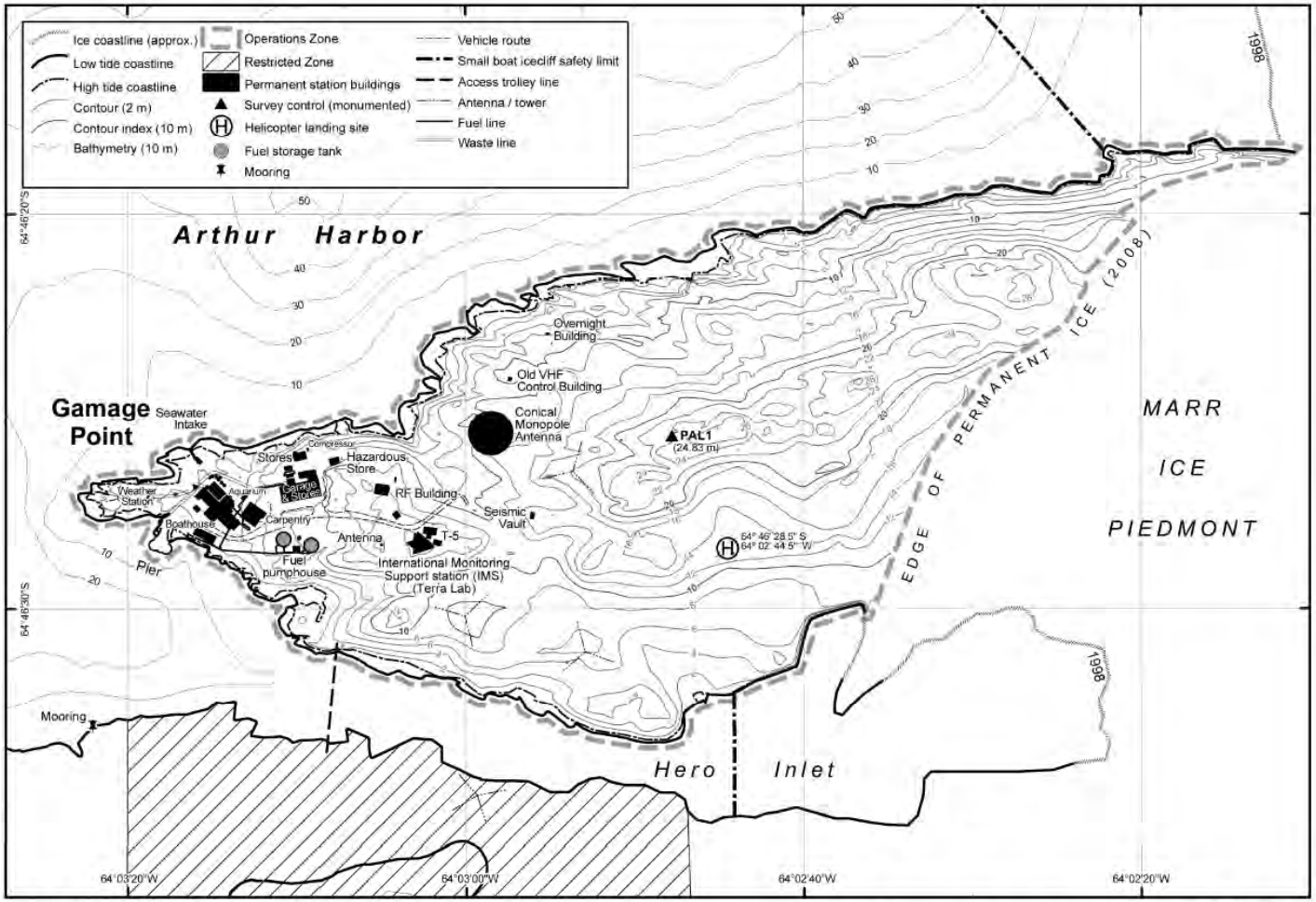
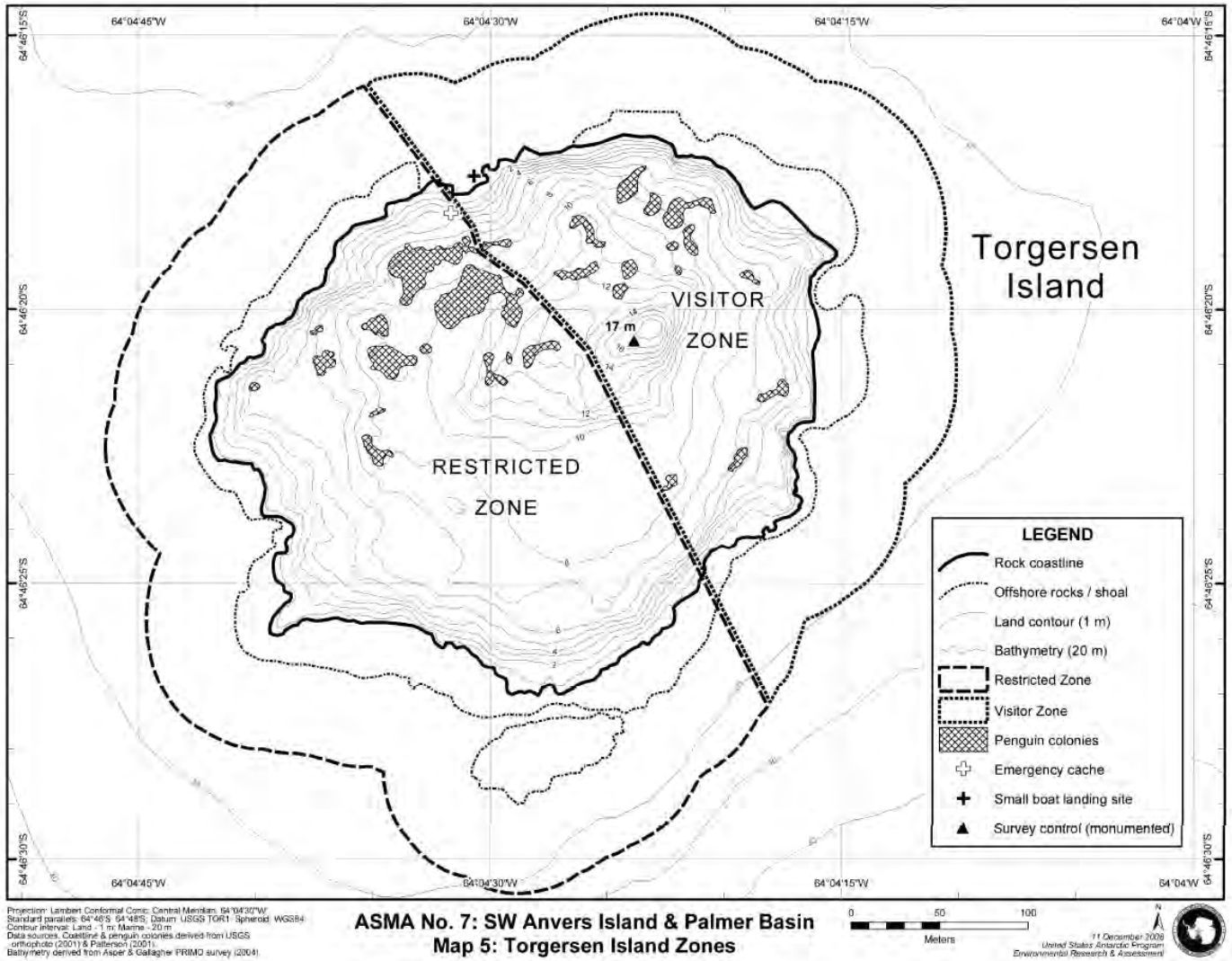
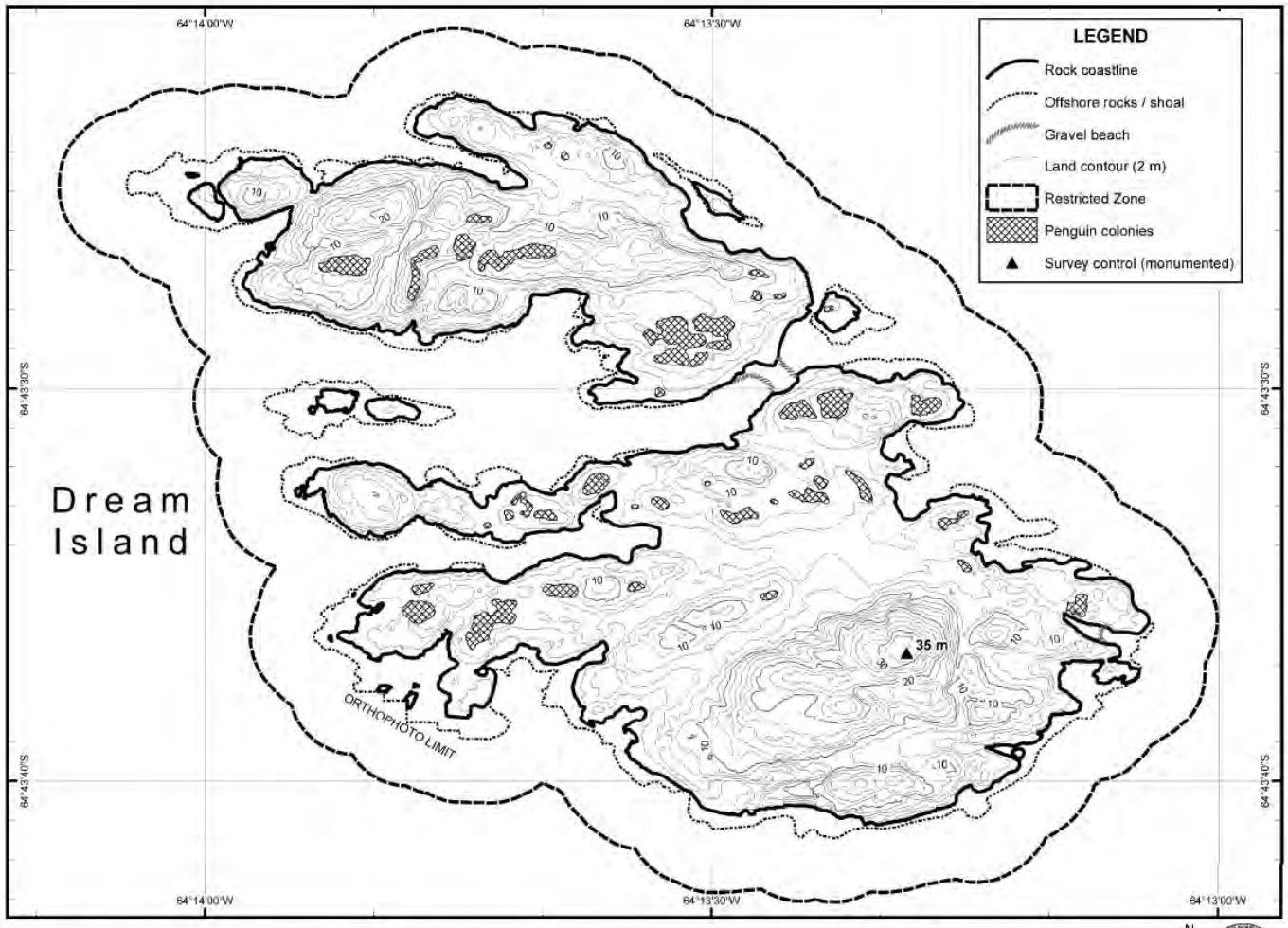
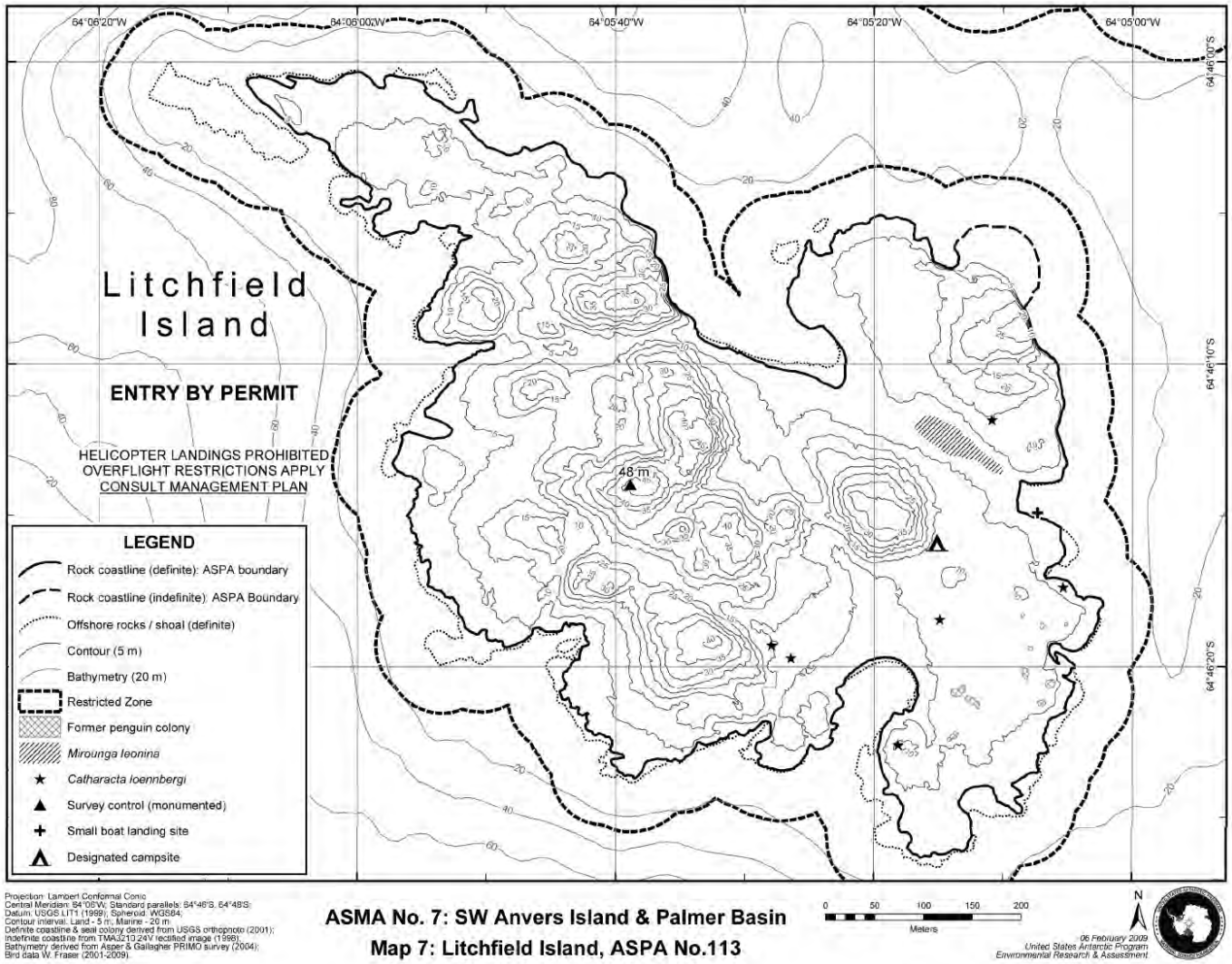
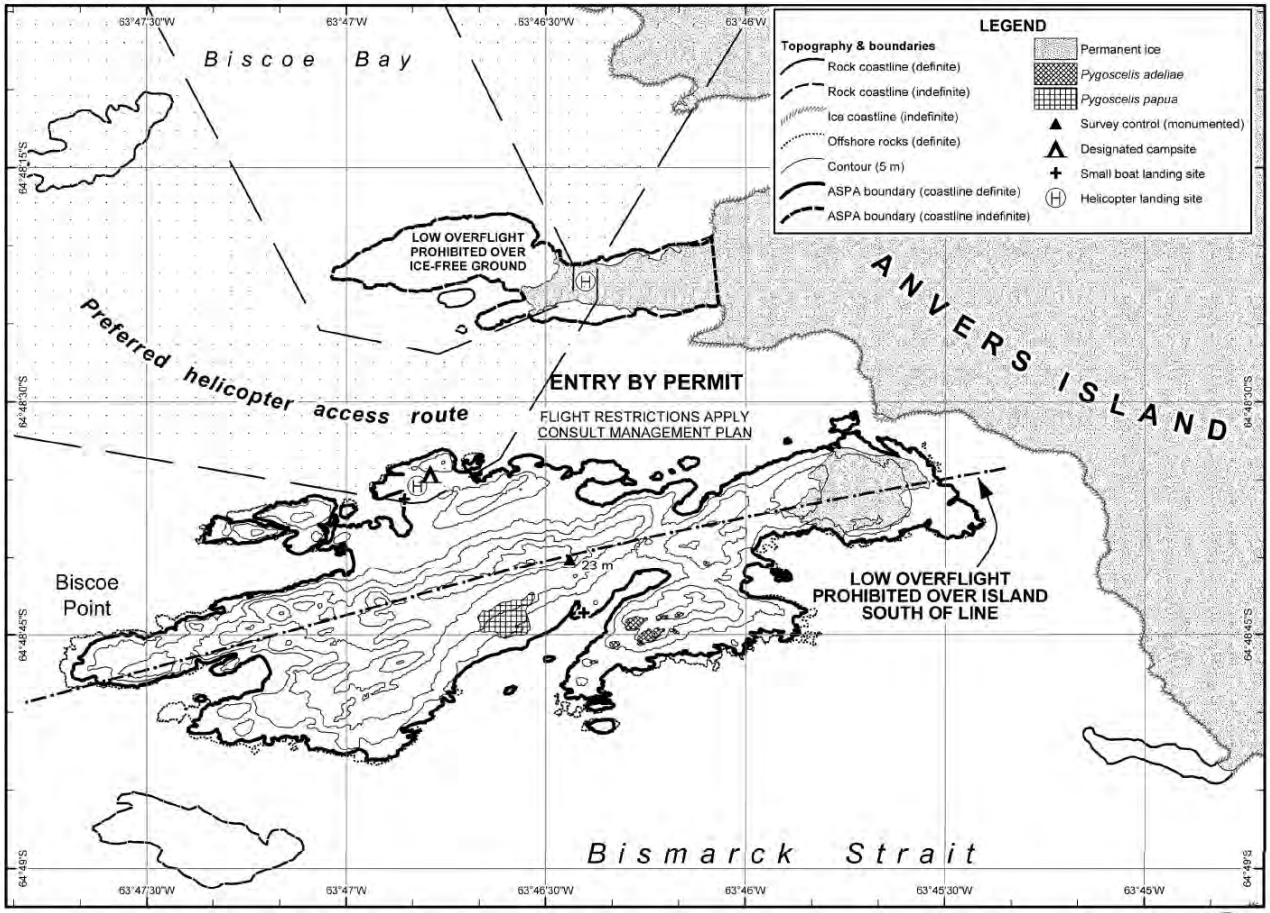

Ice coastline (approx.)
Low tide coastline
High tide coastline
Contour (2 m)
Contour index (10 m)
Bathymetry (10 m)
Operations Zone
Restricted Zone
Permanent station buildings
Survey control (monumented)
Helicopter landing site
Fuel storage tank
Mooring
Vehicle route
Small boat icecliff safety limit
Access trolley line
Antenna / tower
Fuel line
Waste line
Arthur Harbor
Gamage Point
Seawater Intake
Compressor
Stores
Hazardous Store
Weather Station
Aquarium
Carpentry & Stores
RF Building
Boathouse
Carpentry
Seismic Vault
Antenna
T-5
Fuel pumphouse
International Monitoring Support station (IMS) (Terra Lab)
Pier
Overnight Building
Old VHF Control Building
Conical Monopole Antenna
PAL1 (24.83 m)
64° 46' 28.5" S
64° 02' 44.5" W
EDGE OF PERMANENT ICE (2008)
MARR ICE PIEDMONT
1998
Mooring
Hero Inlet
64°46'20"S
64°46'30"S
64°03'20"W
64°03'00"W
64°02'40"W
64°02'20"W
Projection: Lambert Conformal Conic
Central Meridian: 64°03'W; Standard parallels: 64°48'S, 64°48'S;
Datum: USGS PAL1; Spheroid: WGS84;
Bathymetry contour interval: 10 m
Data sources: Infrastructure RPSC CAD & Survey (2007);
Coastline: RPSC CAD & Survey (2004) & TMA3210 24v rectified image (1998);
Ice edge: TMA3210 24v rectified image (1998);
Bathymetry derived from Asper & Gallagher PRIMO survey (2004).
ASMA No. 7: SW Anvers Island & Palmer Basin
Map 4: Palmer Station Operations Zone
0 50 100 150
Meters
N
05 Feb 2009
United States Antarctic Program
Environmental Research & Assessment


64°04'45"W
64°04'30"W
64°04'15"W
64°04'W
64°46'15"S
64°46'20"S
64°46'25"S
64°46'30"S
Torgersen Island
VISITOR ZONE
17 m
RESTRICTED ZONE
LEGEND
Rock coastline
Offshore rocks / shoal
Land contour (1 m)
Bathymetry (20 m)
Restricted Zone
Visitor Zone
Penguin colonies
Emergency cache
Small boat landing site
Survey control (monumented)
Projection: Lambert Conformal Conic; Central Meridian: 64°04'30"W
Standard parallels: 64°46'S, 64°48'S; Datum: USGS TOR1; Spheroid: WGS84
Contour interval: Land - 1 m; Marine - 20 m
Data sources: Coastline & penguin colonies derived from USGS orthophoto (2001) & Patterson (2001).
Bathymetry derived from Asper & Gallagher PRIMO survey (2004).
ASMA No. 7: SW Anvers Island & Palmer Basin
Map 5: Torgersen Island Zones
0
50
100
Meters
N
11 December 2008
United States Antarctic Program
Environmental Research & Assessment


64°14'00"W
64°13'30"W
64°13'00"W
64°43'30"S
64°43'40"S
LEGEND
Rock coastline
Offshore rocks / shoal
Gravel beach
Land contour (2 m)
Restricted Zone
Penguin colonies
Survey control (monumented)
Dream Island
35 m
ORTHOPHOTO LIMIT
Projection: Lambert Conformal Conic
Central Meridian: 64°13'30"W; Standard parallels: 64°43'S, 64°44'S;
Datum: USGS.DRE1 (1969); Spheroid: WGS84;
Contour Interval: 2 m
Data sources:
Coastline & penguin colonies derived from USGS orthophoto (2001)
ASMA No. 7: SW Anvers Island & Palmer Basin
Map 6: Dream Island Restricted Zone
0 50 100 150
Meters
N
11 December 2008
United States Antarctic Program
Environmental Research & Assessment


64°06'20"W
64°06'00"W
64°05'40"W
64°05'20"W
64°05'00"W
64°46'00"S
64°46'10"S
64°46'20"S
Litchfield Island
ENTRY BY PERMIT
HELICOPTER LANDINGS PROHIBITED
OVERFLIGHT RESTRICTIONS APPLY
CONSULT MANAGEMENT PLAN
48 m
LEGEND
Rock coastline (definite): ASPA boundary
Rock coastline (indefinite): ASPA Boundary
Offshore rocks / shoal (definite)
Contour (5 m)
Bathymetry (20 m)
Restricted Zone
Former penguin colony
Mirounga leonina
Catharacta loennbergi
Survey control (monumented)
Small boat landing site
Designated campsite
Projection: Lambert Conformal Conic
Central Meridian: 64°06'W; Standard parallels: 64°46'S, 64°48'S;
Datum: USGS LIT1 (1999); Spheroid: WGS84;
Contour interval: Land - 5 m; Marine - 20 m.
Definite coastline & seal colony derived from USGS orthophoto (2001);
Indefinite coastline from TMA3210 24V rectified image (1998).
Bathymetry derived from Asper & Gallagher PRIMO survey (2004);
Bird data W. Fraser (2001-2009).
ASMA No. 7: SW Anvers Island & Palmer Basin
Map 7: Litchfield Island, ASPA No.113
0 50 100 150 200
Meters
N
06 February 2009
United States Antarctic Program
Environmental Research & Assessment


63°47'30"W
63°47'W
63°46'30"W
63°46'W
63°45'30"W
63°45'W
64°45'15"S
64°46'30"S
64°46'45"S
64°49'S
Biscoe Bay
Bismarck Strait
ANVERS ISLAND
Biscoe Point
LOW OVERFLIGHT PROHIBITED OVER ICE-FREE GROUND
Preferred helicopter access route
ENTRY BY PERMIT
FLIGHT RESTRICTIONS APPLY
CONSULT MANAGEMENT PLAN
23 m
LOW OVERFLIGHT PROHIBITED OVER ISLAND SOUTH OF LINE
LEGEND
Topography & boundaries
Rock coastline (definite)
Rock coastline (indefinite)
Ice coastline (indefinite)
Offshore rocks (definite)
Contour (5 m)
ASPA boundary (coastline definite)
ASPA boundary (coastline indefinite)
Permanent ice
Pygoscelis adeliae
Pygoscelis papua
Survey control (monumented)
Designated campsite
Small boat landing site
Helicopter landing site
Projection: Lambert Conformal Conic
Central Meridian: 63°46'W; Standard parallels: 64°48'S, 64°50'S
Datum: USGS 81S1 (1999); Spheroid: WGS84; Contour interval: Land - 5 m;
Data sources: Map updated from ASPA management plan (2004).
Definite coastline derived from USGS orthophoto (2001);
Indefinite coastline derived from TMA3208 006V rectified image (1998);
Penguin colonies & other features from orthophoto & GPS survey (ERA 2001)
ASMA No. 7: SW Anvers Island & Palmer Basin
Map 8: Biscoe Point, ASPA No.139
0 100 200 300 400
Meters
N
11 December 2008
United States Antarctic Program
Environmental Research & Assessment

Measure 3 (2009)

Antarctic Specially Protected Area No 104 (Sabrina Island, Balleny Islands): Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation IV-4 (1966), which designated Sabrina Island, Balleny Islands, as Specially Protected Area ("SPA") No 4 and annexed a map for the site;
- Decision 1 (2002), which renamed and renumbered SPA 4 as Antarctic Specially Protected Area No 104;

Noting that the Committee for Environmental Protection has endorsed a Management Plan for ASPA 104;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the Management Plan for Antarctic Specially Protected Area No 104 (Sabrina Island, Balleny Islands), which is annexed to this Measure, be approved.

2) Recommendation IV-4: Sabrina Island, Balleny Islands shall cease to be effective.

Management Plan For
Antarctic Specially Protected Area No. 104

SABRINA ISLAND, NORTHERN ROSS SEA, ANTARCTICA

Introduction

Sabrina Island, in the Balleny Archipelago, was originally designated as SPA No. 4 in Recommendation IV-4 (1966) on the grounds that "The Balleny Islands, as the most northerly Antarctic land in the Ross Sea region, support fauna and flora which reflect many circumpolar distributions at this latitude and that Sabrina Island in particular provides a representative sample of such fauna and flora."

1. Description of values to be protected

Sabrina Island has outstanding environmental and scientific value. It is a representative sample of the Balleny Islands which is the only oceanic archipelago located within the main Antarctic Coastal Current. (Peter I Island, some 4000km away, is the only other oceanic island in the Current). As such, they provide important resting and breeding habitat for seabird and seal species (see Tables 1 and 2), and are significant in circumpolar distributions of a variety of species. Being isolated and prone to difficult weather and ice conditions, the Islands have had very little human disturbance.

The Islands are the only known breeding site for chinstrap penguins (*Pygoscelis antarctica*) between Bouvetoya and Peter I Islands (a span of 264° longitude). The chinstrap nests occur within Adélie penguin (*Pygoscelis adeliae*) colonies. Adélies and chinstraps have very different breeding ranges and there are few sites where the species coexist. Sabrina Island's Adélie colony is of particular importance because it is the largest in the archipelago (and has the majority of the chinstrap pairs), and because it is growing very rapidly.

2. Aims and Objectives

Management of Sabrina Island aims to:

- Protect a representative Antarctic oceanic island from unnecessary human disturbance and exposure to biological introductions;
- avoid disturbance to a chinstrap penguin colony which is anomalous in terms of species distribution; and
- allow scientific research to better understand the Island's ecosystem.

3. Management activities

The following measures shall be taken to protect the values of the Area:

- Expeditions traveling in the vicinity of the Balleny Islands should carry a copy of this Management Plan.
- Parties should coordinate to ensure the Area and the need for permits for entry is noted on charts of the region.
- Given the difficulties of access, erection of signage does not currently seem warranted, however this should be reviewed if visits to the Area increase.

4. Period of Designation

Designated for an indefinite period.

5. Description of the Area

5(i) Geographical coordinates, boundaries and natural features of the Area

Location and general description:
The Balleny Islands are located around 325km north of the Pennell Coast, Northern Victoria Land. The Islands are the exposed portion of a volcanic seamount chain. There are three main islands and a number of smaller islands and exposed rocks. Sabrina Island is located at 66°55S, 163°19E, three kilometres off the southern end of Buckle Island (the central of the main islands). It is less than 2km across and reaches an estimated height of 180m above sea level. A volcanic plug approximately 80m high, named the Monolith, is attached to the southern end of Sabrina Island by a boulder spit. A small islet lies to the north east of Sabrina, commonly known as Chinstrap Islet.

Boundaries:
The ASPA comprises all of Sabrina Island above sea level, including the Monolith, and Chinstrap Islet.

Natural Features:
Approximately a quarter of the island is covered in permanent snow and ice, and an ice foot meets the sea at the northern end. A steep ridge runs across the island, with scoria slopes to the east and south. Sheer cliffs form the majority of the island's coast except for a cobble beach in the south west.

The scoria slopes to the east of the central ridge on the Island are occupied by Adélie and chinstrap penguin nests. The birds access their nesting sites via the beach. Sabrina has the largest of the Balleny Island penguin colonies with approximately 3770 Adélie pairs recorded in 2000 and 202 chinstrap adults and 109 chicks in 2006. Only 24 chinstrap nests were observed on Sabrina in 2000, suggesting a rapidly increasing population. Chinstrap Islet, just to the south east of Sabrina had 2298 penguin pairs in 2000, with approximately 10 chinstrap pairs recorded on the Islet in 1965 and 1984.

Cape pigeons were seen nesting on Sabrina Island in 2006 and also on the southern side of the Monolith in 1965 (although this has not been confirmed by more recent expeditions).

Individual macaroni penguins have been sighted on Sabrina Island (1964, possible sighting 1973).

Various species of algae (including *Myxopycophyta*, *Xanthophyceae* (*Tribonema* spp.*)* and *Chlorophycophyta* (*prasiola* spp.*)*) have been recorded on Sabrina. Chromogenic (brightyellow) bacteria, yeasts, 14 species of *filamentous fungi*, two species of *thermophilous fungi* (*Aspergillus fumigatus* and *Chaetomium gracile*), mites (*Stereotydeus mollis, Nanorchestes antarcticus, Coccorhgidia* spp.) and nematodes have also been reported. Rock encrusting lichens, mainly *Caloplaca* or *Xanthoria* species occur on top of the main ridge.

5(ii) Access to the Area

Landings by small boat or helicopter can be made on the beach to the south west of the Island, 66°55.166'S, 163°18.599'E (see figure 1). All air movements in the vicinity of the Island should avoid disturbance to the penguin colonies as much as possible. Movement within the Area shall be by foot only.

5(iii) Location of structures within or adjacent to the Area

Although some records suggest shelters have been erected on Borradaile Island and Sabrina Island, recent visits have not identified any existing structures in or adjacent to the Area.

5 (iv) Location of other Protected Areas within close proximity

The nearest Antarctic Specially Protected Area is No. 106, Cape Hallett, approximately 675km to the south east.

6. Special Zones within the Area

There are no prohibited, restricted or specially managed zones within the Area.

7. Maps and photographs

Map A: Location of ASPA 104, Sabrina Island. Chart NZ14912 (INT9012) sourced from Land Information New Zealand, Crown Copyright Reserved. Scale: 1:300000. Projection: Mercator. Central Meridian: 161°20'00". Standard Parallel: 66°45'00".

Figure 1: Sketch Map of Sabrina Island. Reproduced with permission from Macdonald, JA., Barton, Kerry J., Metcalf, Peter. 2002. Chinstrap penguins (*Pygoscelis antarctica*) nesting on Sabrina Islet, Balleny Islands, Antarctica. *Polar Biology* 25:443-447.

Figure 2: Aerial view of penguin breeding areas, Sabrina Island. Photographer: Kerry Barton, Landcare Research New Zealand, December 2000.

Figure 3: Overview of Sabrina and neighbouring islands. Photographer: Kerry Barton, Landcare Research New Zealand, December 2000.

Figure 4: Landing beach at south west of Sabrina Island and the Monolith. Photographer: Rebecca McLeod, University of Otago, 2006.

Figure 5: Adélie and chinstrap penguins on south ridge of Sabrina Island, looking south to the Monolith. Photographer: Rebecca McLeod, University of Otago, 2006.

8. Supporting documentation

The following documents were used in preparation of this management plan:

Bradford-Grieve, Janet and Frenwick, Graham. November 2001. *A Review of the current knowledge describing the biodiversity of the Balleny Islands: Final Research Report for Ministry of Fisheries Research Projects ZBD2000/01 Objective 1 (in part).* NIWA, New Zealand.

de Lange W., Bell R. 1998. Tsunami risk from the southern flank: Balleny Islands earthquake. *Water and atmosphere*. 6(3), pp 13-15.

Macdonald, JA., Barton, Kerry J., Metcalf, Peter. 2002. Chinstrap penguins (*Pygoscelis antarctica*) nesting on Sabrina Islet, Balleny Islands, Antarctica. *Polar Biology* 25:443-447

Robertson,CJR, Gilbert, JR, Erickson, AW. 1980. Birds and Seals of the Balleny Islands, Antarctica. *National Museum of New Zealand Records* 1(16).pp 271-279

Sharp, Ben R. 2006. *Preliminary report from New Zealand research voyages to the Balleny Islands in the Ross Sea region, Antarctica, during January-March 2006.* Ministry of Fisheries, Wellington, New Zealand.

Smith, Franz. 2006. *Form 3: Format and Content of Voyage Reports: Balleny Islands Ecology Research Voyage.*

Varian, SJ. 2005. *A summary of the values of the Balleny Islands, Antarctica.* Ministry of Fisheries, Wellington, New Zealand.

9. Permit conditions

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority.

Conditions for issuing a permit to enter the Area are that:

- it is issued only for a compelling scientific purpose which cannot be served elsewhere, or for essential management purposes;
- the actions permitted will not jeopardize the natural ecological system in the Area;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or a copy, must be carried within the Area;

- a report is supplied to the authority issuing the Permit; and
- the Permit is issued for a stated period.

9(i) Access to and movement within the Area

Landings by small boat or helicopter can be made on the beach to the south west of the Island, 66°55.166'S, 163°18.599'E (see figure 1). All air movements in the vicinity of the Island should avoid disturbance to the penguin colonies as much as possible. Movement within the Area shall be by foot only.

9(ii) Activities which may be conducted within the Area

Only scientific research or essential management activities (such as inspection, monitoring or review), in accordance with a Permit, may be conducted within the Area.

9(iii) Installation, modification or removal of structures

No structures are to be erected in the Area, or scientific equipment installed, except for essential scientific or management activities, as specified in the Permit. Any equipment installed should be labeled with name and country of the principal investigator and year of installation. Any such equipment should be made of materials which can withstand the environmental conditions and designed so as to pose no entrapment risk for wildlife. Removal of equipment once its purpose has been served shall be a condition of the Permit.

9(iv) Location of field camps

Field camps may be established if necessary to support permitted scientific or management activity. The camp location should be selected to minimise disturbance to wildlife as much as possible and care should be taken to secure all equipment.

9(v) Restrictions on materials and organisms that may be brought into the Area

No living animals, plant material or microorganisms shall be deliberately introduced into the Area.

All sampling equipment, footwear, outer clothing, backpacks and other equipment used or brought into the Area shall be thoroughly cleaned before entering the Area. Scrubbing footwear in a disinfectant footbath before each landing is recommended.

No poultry products, including food products containing uncooked dried eggs, shall be taken into the Area.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, which may be introduced for compelling scientific, management or safety purposes specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted.

Fuel, food and other materials are not to be deposited in the Area, unless required for essential purposes connected with the activity for which the Permit has been granted. All such materials introduced are to be removed when no longer required. Permanent depots are not permitted.

Spill response materials appropriate to the volume of fuels or other hazardous liquids taken into the Area should be carried. Any spills should be immediately cleaned up, provided the response has less environmental impact than the spill itself.

9(vi) Taking or harmful interference with native flora and fauna

Taking or harmful interference with native flora and fauna is prohibited, except in accordance with a Permit.

Where animal taking or harmful interference is involved this should be in accordance with the SCAR Code of Conduct for Use of Animals for Scientific Purposes in Antarctica, as a minimum standard.

9(vii) Collection and removal of anything not brought into the Area by the Permit holder

Material may be collected or removed from the Area only in accordance with a Permit. Material of human origin not introduced in accordance with 9(iii) may be removed, where doing so causes less environmental impact than leaving it in place. Any such material should be noted in the visit report.

9(viii) Disposal of waste

All wastes, including human waste, shall be removed from the Area.

9(ix) Measures that may be necessary to ensure that the aims and objectives of the Management Plan continue to be met

Permits may be granted to enter the Area to carry out environmental monitoring and site inspection, which may involve the collection of small samples for analysis or audit, to erect or maintain signposts, or for other management measures.

Research within the Area has been very limited and any new information collected should be incorporated into future reviews of the Management Plan.

9(x) Requirements for reports

The Principal Permit Holder for each issued Permit shall submit a report of activities conducted in the Area including, as appropriate, the information specified in the Visit Report form suggested by SCAR. This report shall be submitted to the authority named in the Permit as soon as practicable, but not later than 6 months after the visit has taken place. Parties should retain such reports indefinitely, making them available to interested Parties (preferably publicly accessible) and including summary information in the Annual Exchange of Information.

Spills of any size should be reported to the authority named in the permit, using the COMNAP Spill Report Form as appropriate.

Map data currently available for the Area is very limited. New Zealand, as the Party responsible for review of this Management Plan, would therefore appreciate copies of data and images which could assist future management of the Area.

Table 1: Bird species recorded from the Balleny Islands
The table lists sightings recorded in expedition reports and scientific publications. Species indicated as breeding have been confirmed in recent expeditions (i.e. since 2000), those marked with S breed on Sabrina Island itself.

Common name	Species	Breeding
Adélie penguin	*Pygoscelis adeliae*	✓ S
Antarctic fulmar	*Fulmarus glacialoides*	✓
Antarctic petrel	*Thalassoica antarctica*	✓
Antarctic prion	*Pachyptila desolata*	
Antarctic tern	*Sterna paradisea*	
Black browed mollymawk	*Diomedea melanophrys*	
Cape pigeon	*Daption capense*	✓ S
Chinstrap penguin	*Pygoscelis antarctica*	✓ S
Grey-headed mollymawk	*Diomedea chrysostoma*	
Light-mantled sooty albatross	*Phoebetria palpebrata*	
Macaroni penguin	*Eudyptes chrysolphus*	
Snow petrel	*Pagodroma nivea*	✓
Sooty shearwater	*Puffinus griseus*	
Southern giant petrel	*Macronectes giganteus*	
Southern skua	*Catharacta lonnbergi*	
Wandering albatross	*Diomedea exulans*	
White chinned petrel	*Procellaria aequinoctialis*	
Wilson's storm petrel	*Oceanites oceanicus oceanicus*	

Table 2: Seal species recorded from the Balleny Islands

The table lists sightings recorded in expedition reports and scientific publications. Breeding has not been confirmed for any species.

Common name	Species
Crabeater seal	*Lobodon carcinophagus*
Elephant seal	*Mirounga leonina*
Leopard seal	*Hydrurga leptonyx*
Weddell seal	*Leptonychotes weddellii*

Map A - Location of Antarctic Specially Protected Area 104 Sabrina Island

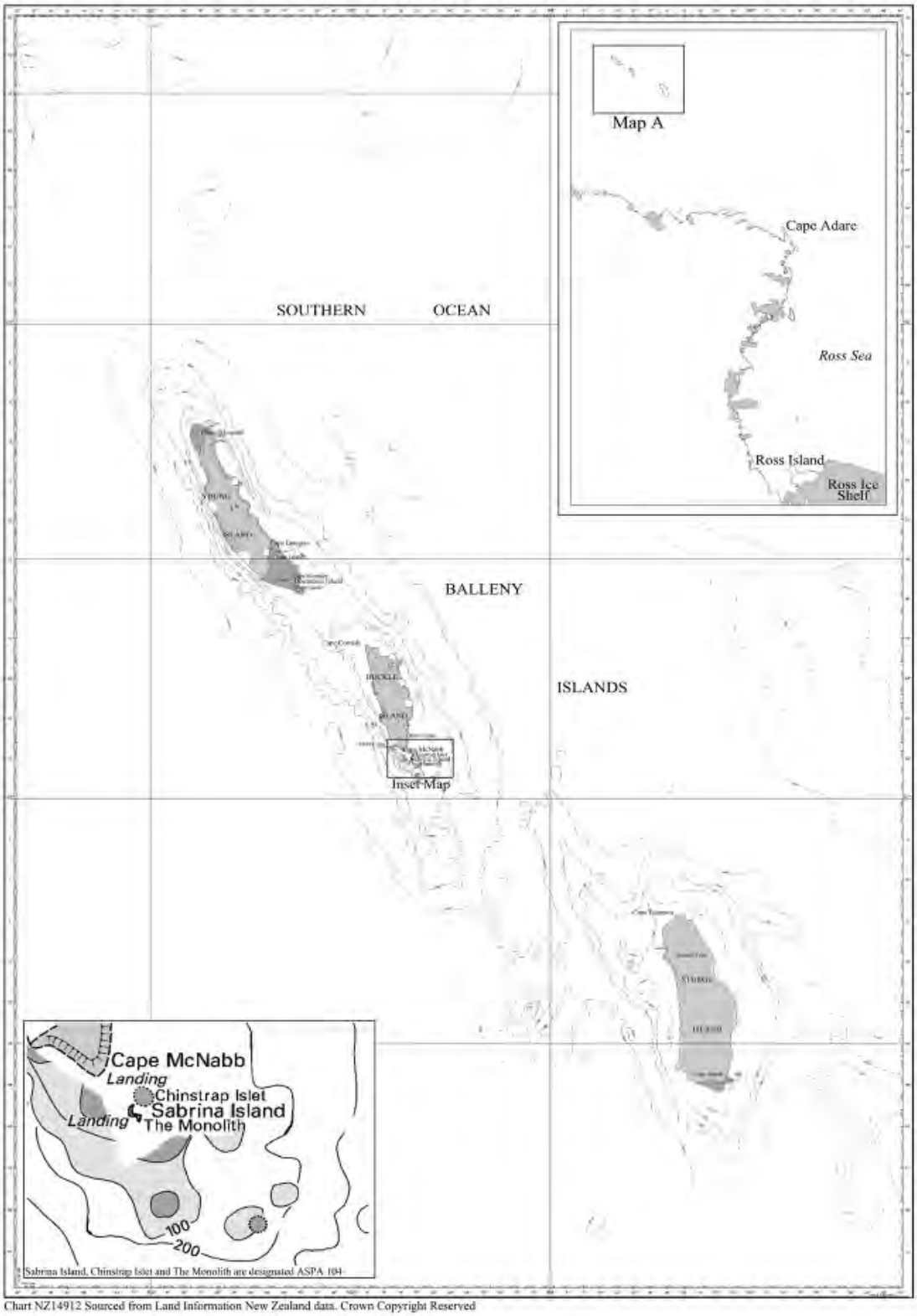
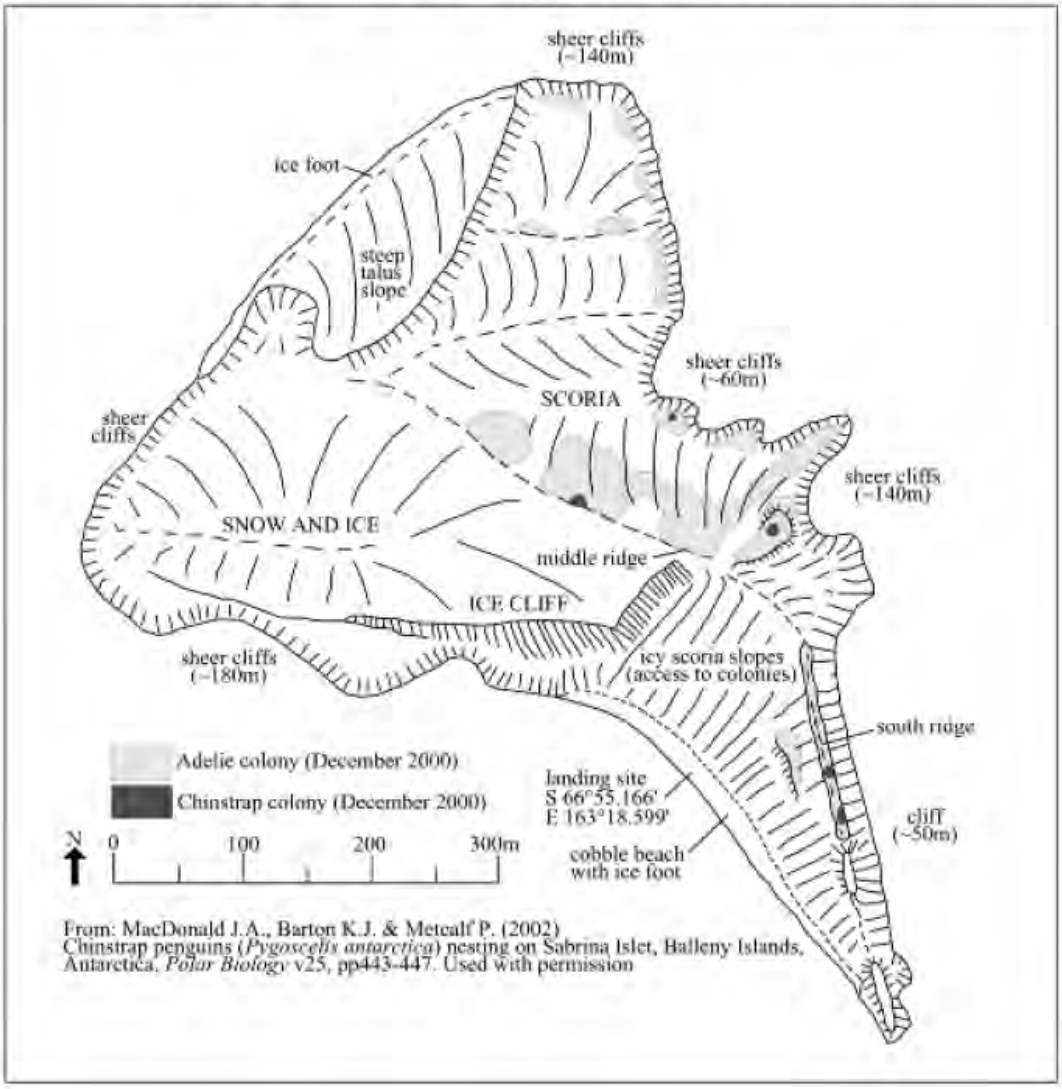


Chart NZ14912 Sourced from Land Information New Zealand data. Crown Copyright Reserved

Scale: 1:300,000
Depths and Heights in Metres

Projection: Mercator, Central Meridian: 161°20'00", Standard Parallel: 66°45'00"
Datum: WGS84

Figure 1: Sketch Map of Sabrina Island



From: MacDonald J.A., Barton K.J. & Metcalf P. (2002) Chinstrap penguins (*Pygoscelis antarctica*) nesting on Sabrina Islet, Balleny Islands, Antarctica, *Polar Biology* v25, pp443-447. Used with permission

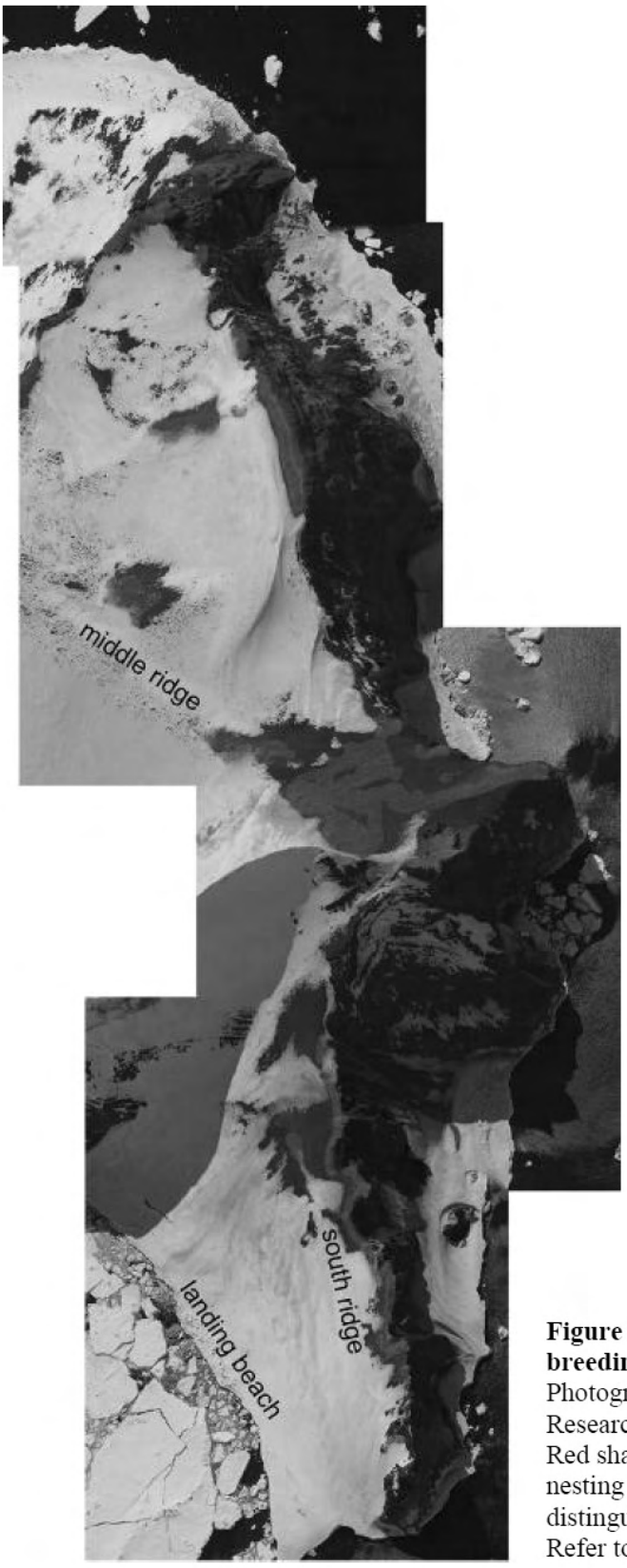


Figure 2: Aerial view of penguin breeding areas, Sabrina Island
Photographs: Kerry Barton, Landcare Research New Zealand, December 2000
Red shading highlights areas of penguin nesting (Adélie and chinstrap not distinguishable).
Refer to Figure 1 for location.

Figure 3: Overview of Sabrina and neighbouring islands.
Kerry Barton, Landcare Research New Zealand, December 2000.
Left to right: the Monolith, Sabrina Island, Chinstrap Island. Buckle Island in background

Figure 4: Landing beach at south west of Sabrina Island and the Monolith.
Rebecca McLeod, University of Otago, 2006.

Figure 5: Adélie and chinstrap penguins on south ridge of Sabrina Island, looking south to the Monolith
Rebecca McLeod, University of Otago, 2006.

Measure 4 (2009)

Antarctic Specially Protected Area No 113 (Litchfield Island, Arthur Harbour, Anvers Island, Palmer Archipelago): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation VIII-1 (1975), which designated Litchfield Island, Arthur Harbour, Palmer Archipelago, as Specially Protected Area ("SPA") No 17 and annexed a map for the site;
- Decision 1 (2002), which renamed and renumbered SPA 17 as Antarctic Specially Protected Area No 113;
- Measure 2 (2004), which adopted a management plan for ASPA 113;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 113;

Noting Measure 2 (2009), dealing with ASMA No 7 (Southwest Anvers Island and Palmer Basin), in which ASPA 113 is located;

Desiring to replace the existing Management Plan for ASPA 113 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 113 (Litchfield Island, Arthur Harbour, Anvers Island, Palmer Archipelago), which is annexed to this Measure, be approved;

2) the Management Plan for ASPA 113 annexed to Measure 2 (2004) shall cease to be effective;

3) Recommendation VIII-1 (1975): Litchfield Island, Arthur Harbour, Palmer Archipelago shall cease to be effective.

Management Plan for Antarctic Specially Protected Area No. 113

LITCHFIELD ISLAND, ARTHUR HARBOR ANVERS ISLAND, PALMER ARCHIPELAGO

Introduction

Litchfield Island lies within Arthur Harbor, SW Anvers Island, at 64°46'S, 64°06'W. Approximate area: 2.7km^2. Designation on the grounds that Litchfield Island, together with its littoral zone, possesses an unusually high collection of marine and terrestrial life, is unique amongst the neighboring islands as a breeding place for six species of native birds and provides an outstanding example of the natural ecological system of the Antarctic Peninsula area. In addition, Litchfield Island possesses rich growths of vegetation and has the most varied topography and the greatest diversity of terrestrial habitats of the islands in Arthur Harbor. Proposed by the United States of America. Adopted through Recommendation VIII-1 (1975, SPA No. 17); renamed and renumbered by Decision 1 (2002); original management plan adopted through Measure 2 (2004).

1. Description of values to be protected

Litchfield Island (Latitude 64°46'S, Longitude 64°06'W, 2.7km^2), Arthur Harbor, Anvers Island, Antarctic Peninsula was originally designated as a Specially Protected Area through Recommendation VIII-1 (1975, SPA No. 17) after a proposal by the United States of America. It was designated on the grounds that "Litchfield Island, together with its littoral, possesses an unusually high collection of marine and terrestrial life, is unique amongst the neighboring islands as a breeding place for six species of native birds and provides an outstanding example of the natural ecological system of the Antarctic Peninsula area".

The current management plan reaffirms the original reasons for designation associated with the bird communities. The island supports a diverse assemblage of bird species that is representative of the mid-western Antarctic Peninsula region. The number of bird species recorded as breeding on Litchfield Island is currently six, following the recent local extinction of Adélie penguins (*Pygoscelis adeliae*) on the island. Population decline has been attributed to the negative impact of increased snow accumulation and reduced sea ice extent on both food availability and survival of young (McClintock *et al*. 2008). The species continuing to breed on Litchfield Island are southern giant petrels (*Macronectes giganteus*), Wilson's storm petrels (*Oceanites oceanicus*), kelp gulls (*Larus dominicanus*), south polar skuas (*Catharacta maccormicki*), brown skuas (*Catharacta lonnbergi*), and Antarctic terns (*Sterna vittata*). The status of these bird colonies as being relatively undisturbed by human activities is also an important value of the Area.

In 1964 Litchfield Island supported one of the most extensive moss carpets known in the Antarctic Peninsula region, dominated by *Warnstorfia laculosa* which was then considered near its southern limit (Corner 1964a). *W. laculosa* is now known to occur at a number of sites further south, including Green Island (ASPA No. 108, in the Berthelot Islands) and Avian Island (ASPA No. 118, in Marguerite Bay). Accordingly, the value originally cited that this species is near its southern limit at Litchfield Island is no longer valid. Nevertheless, at the time Litchfield Island represented one of the best examples of

maritime Antarctic vegetation off the western coast of Graham Land. Furthermore, several banks of *Chorisodontium aciphyllum* and *Polytrichum strictum* of up to 1.2m in depth were described in 1982, which were considered to be some of the best examples of their kind in the Antarctic Peninsula area (Fenton and Lewis Smith 1982). In February 2001 it was observed that these values have been severely compromised by the impact of Antarctic fur seals (*Arctocephalus gazella*), which have damaged and destroyed large areas of vegetation on the lower accessible slopes of the island by trampling and nutrient enrichment. Some areas previously richly carpeted by mosses have been completely destroyed, while others have suffered moderate-to-severe damage. Slopes of *Deschampsia antarctica* are more resilient and have persisted even where fur seals have been numerous, although here signs of damage are also obvious. However, on the steeper and higher parts of the island, and other areas that are inaccessible to seals, the vegetation remains undamaged. Furthermore, observations suggest that a recent local decline in Antarctic fur seal numbers has led to the recovery of previously damaged vegetation on Litchfield Island (Fraser pers. comm. 2009). While the vegetation is less extensive and some of the moss carpets have been compromised, the remaining vegetation continues to be of value and an important reason for special protection of the island. Litchfield Island also has the most varied topography and the greatest diversity of terrestrial habitats of the islands in Arthur Harbor.

The Antarctic Peninsula is currently experiencing regional warming at a rate that exceeds any other observed globally. The marine ecosystem surrounding Litchfield Island is undergoing substantial and rapid change in response to this climatic warming, which has included a decline in local Adélie penguin and Antarctic fur seal populations and changes in vegetation patterns. As such, maintenance of the relatively undisturbed state of Litchfield Island has potential value for long-term studies of this ecosystem.

Litchfield Island has been afforded special protection for most of the modern era of scientific activity in the region, with entry permits having been issued only for compelling scientific reasons. Litchfield Island has therefore never been subjected to intensive visitation, research or sampling and has value as terrestrial area that has been relatively undisturbed by human activities. The Area is thus valuable as a reference site for some types of comparative studies with higher use areas, and where longer-term changes in the abundance of certain species and in the micro-climate can be monitored. The island is easily accessible by small boat from nearby Palmer Station (US), and Arthur Harbor is visited frequently by tourist ships. Continued special protection is therefore important to ensure the Area remains relatively undisturbed by human activities.

The designated Area is defined as including all of Litchfield Island above the low tide water level, excluding all offshore islets and rocks.

2. Aims and objectives

Management at Litchfield Island aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance and sampling in the Area;
- allow scientific research on the natural ecosystem and physical environment in the Area provided it is for compelling reasons which cannot be served elsewhere and provided it will not compromise the values for which the Area is protected;

- minimize the possibility of introduction of alien plants, animals and microbes to the Area;
- allow visits for management purposes in support of the aims of the management plan.

3. Management activities

The following management activities shall be undertaken to protect the values of the Area:

- Copies of this management plan, including maps of the Area, shall be made available at Palmer Station (US) on Anvers Island.
- Markers, signs or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition.
- Visits shall be made as necessary (at least once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: Litchfield Island, ASPA No. 113, in relation to Anvers Island, showing the location of nearby stations (Palmer Station, US; Yelcho Station, Chile; Port Lockroy Historic Site and Monument No. 61, UK), the boundary of Antarctic Specially Managed Area No. 7 SW Anvers Island and Palmer Basin, and the location of nearby protected areas. Projection: Lambert Conformal Conic; Central Meridian: 64°06'W; Standard parallels: 64°45'S, 65°00'S; Datum and Spheroid: WGS84; Contour interval: Land - 250m; Marine - 200m. Data sources: coastline & topography SCAR Antarctic Digital Database V4.1 (2005); Palmer Basin bathymetry Domack *et al.* (2006), other bathymetry GEBCO (2003). Inset: the location of Anvers Island and the Palmer Archipelago in relation to the Antarctic Peninsula.

Map 2: Litchfield Island ASPA No. 113: Physical features and selected wildlife. Map specifications: Projection: Lambert Conformal Conic; Central Meridian: 64°06'W; Standard parallels: 64°46'S, 64°48'S; Datum: USGS LIT1 (1999); Spheroid: WGS84; Contour interval: Land - 5m; Marine - 20m; Definite coastline, topography & seal colony derived from USGS orthophotograph with a horizontal and vertical accuracy of ± 2m (Sanchez and Fraser 2001); Bathymetry derived from Asper & Gallagher PRIMO survey (2004); Bird data W. Fraser (2001-09). The northeastern coastline is beyond the limits of the orthophotograph and is digitized from a rectified aerial image covering the wider area (estimated accuracy ± 10m – image ref: TMA 3210 025V, 23 Dec 98).

6. Description of the Area

6(i) Geographical coordinates, boundary markers and natural features

General description

Litchfield Island (64°46'15"S, 64°05'40"W, 0.35km^2) is situated in Arthur Harbor approximately 1500m west of Palmer Station (US), Gamage Point, Anvers Island, in the region west of the Antarctic Peninsula known as the Palmer Archipelago (Map 1). Litchfield Island is one of the largest islands in Arthur Harbor, measuring approximately 1000m northwest to southeast and 700m from northeast to southwest. Litchfield Island has the most varied topography and the greatest diversity of terrestrial habitats of the islands in Arthur Harbor (Bonner and Lewis Smith 1985). Several hills rise to between 30-40m, with the maximum elevation of 48m being in the central western part of the island (Map 2). Rocky outcrops are common both on these slopes and on the coast. The island is predominantly ice-free in summer, apart from small snow patches occurring mainly on the southern slopes and in valleys. Cliffs of up to 10m form the northeastern and southeastern coasts, with pebble beaches found in bays in the north and south.

The designated Area is defined as all of Litchfield Island above the low tide water level, excluding all offshore islets and rocks. The coast itself is a clearly defined and visually obvious boundary feature, so boundary markers have not been installed. Several signs drawing attention to the protected status of the island are in place and legible, although deteriorating (Fraser pers. comm. 2009).

Climate

Few meteorological data are available for Litchfield Island, although temperature data were collected at two north- and south-facing sites on Litchfield Island from January – March 1983 (Komárková 1983). The north-facing site was the warmer of the two, with January temperatures generally ranging between 2° to 9°C, February between -2° to 6°C, and March -2° to 4°C in 1983. A maximum temperature of 13°C and a minimum of -3°C were recorded at this site over this period. The south-facing site was generally about 2°C cooler, with January temperatures generally ranging between 2° to 6°C, February between -2° to 4°C, and March -3° to 2°C. A maximum temperature of 9°C and a minimum of -4.2°C were recorded at the south-facing site.

Longer-term data available for Palmer Station show regional temperatures to be relatively mild because of local oceanographic conditions and because of the frequent and persistent cloud cover in the Arthur Harbor region (Lowry 1975). Monthly air temperature averages recorded at Palmer Station during the period 1974 to 2004 show a distinct warming trend but also demonstrate significant inter-annual variability (Figure 1). The maximum temperature recorded during the period was 10.8ºC in December 2000, whilst the minimum was –26ºC in August 1995. Previous studies have identified August as the coldest month and January as the warmest (Baker 1996). Storms and precipitation at Palmer Station are frequent, with winds being persistent but generally light to moderate in strength, prevailing from the northeast.

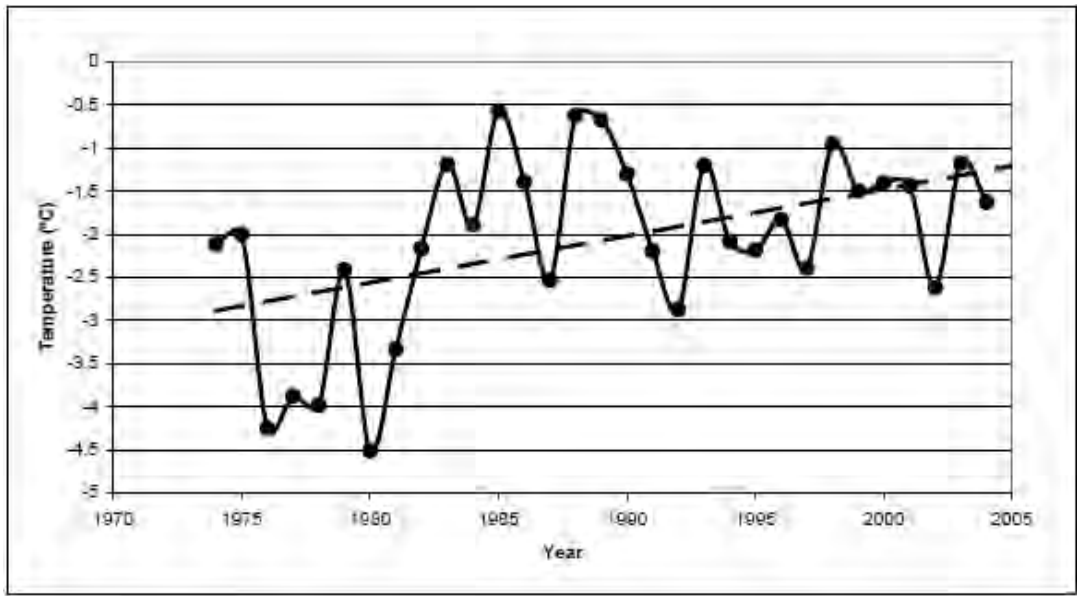


Figure 1. Mean annual surface air temperature at Palmer Station 1974 – 2004.
Data source: Palmer LTER (*http://pal.lternet.edu/data/study_catalog.php#weather)*.

Geology, geomorphology and soils

Litchfield Island is one of numerous small islands and rocky peninsulas along the southwestern coast of Anvers Island which are composed of an unusual assemblage of late Cretaceous to early Tertiary age rock types called the Altered Assemblage (Hooper 1962). The primary rock types of the Altered Assemblage are tonalite, a form of quartz diorite, and trondhjemite, a light-colored plutonic rock. Also common are granite and volcanic rocks rich in minerals such as plagioclase, biotite, quartz and hornblende. Litchfield Island is characterized by a central band of medium-dark gray, fine-grained diorites which separate the predominantly light gray medium-grained tonalites and trondhjemites of the east and west (Willan 1985). The eastern part is characterized by paler dykes up to 40m across and trending north-south and east-west. Minor quartz, epidote, chlorite, pyrite and chalcopyrite veins of up to 8cm thick strike SSE, cutting the tonalite. Dark gray fine-grained plagioclase-phyric dykes with traces of magnetite strike ENE to ESE. Numerous dark gray feldspar-phyric dykes are present in the west, up to 3m thick and trending north-south and ESE. Some cut, or are cut by, sparse quartz, epidote, chlorite, pyrite, chalcopyrite and bornite veins of up to 20cm thick.

The soils of Litchfield Island have not been described, although peaty soils of up to one meter in depth may be found in areas where there is, or once was, rich moss growth.

Freshwater habitat

There are a few small ponds on Litchfield Island: one small pond on a hill in the central, northeastern part of the island has been described as containing the algae *Heterohormogonium* sp. and *Oscillatoria brevis*. Another pond 50m further south has been described as containing *Gonium* sp., *Prasiola crispa, P. tesselata* and *Navicula* sp (Parker *et al.* 1972).

Vegetation

The plant communities at Litchfield Island were surveyed in detail in 1964 (Corner 1964a). At that time, vegetation on Litchfield Island was well-developed and comprised several distinct communities with a diverse flora (Lewis Smith and Corner 1973; Lewis Smith 1982). Both species of Antarctic vascular plant, Antarctic hairgrass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*) were present on Litchfield Island (Corner 1964a; Greene and Holtom 1971; Lewis Smith and Corner 1973). Corner (1964a) noted that *D. antarctica* was common along the northern and northwestern coast of the island, with more localized patches growing further inland on ledges with deposits of mineral material and forms closed swards (Greene and Holtom 1971; Lewis Smith 1982). *C. quitensis* was present in two localities: a patch on the northeastern coast measuring approximately 9x2m and a series of about six cushions scattered over a steep, flushed cliff above the northwestern coast. Commonly associated with the two vascular plants was a moss carpet assemblage comprising *Bryum pseudotriquetrum* (= *Bryum imperfectum*), *Sanionia uncinata* (= *Drepanocladus uncinatus*), *Syntrichia princeps* (= *Tortula grossiretis*) and *Warnstorfia laculosa* (= *Calliergidium austro-stramineum*) (Corner 1964a). Factors controlling the distribution of *C. quitensis* and *D. antarctica* area include the availability of suitable substrate and air temperature (Komarkova *et al*. 1985). In conjunction with recent warming, existing populations of *C. quitensis* have expanded and new colonies have been established within the Arthur Harbor area, although this has not been studied specifically at Litchfield Island (Grobe *et al*. 1997; Lewis Smith 1994).

On well-drained rocky slopes, several banks of *Chorisodontium aciphyllum* (= *Dicranum aciphyllum*) and *Polytrichum strictum* (= *Polytrichum alpestre*) were described in 1982 as up to 1.2m in depth, and were considered to be some of the best examples of their kind in the Antarctic Peninsula area (Fenton and Lewis Smith 1982; Lewis Smith 1982). The more exposed areas of moss turf were covered by crustose lichens, species of *Cladonia* spp. and *Sphaerophorus globosus* and *Coelocaulon aculeatum* (= *Cornicularia aculeata*). In deep, sheltered gullies there was often a dense lichen cover comprising *Usnea antarctica*, *U. aurantiaco-atra* and *Umbilicaria antarctica*. Raised areas of *P. strictum* turf of approximately 0.5m high occurred at the bottom of a narrow, east to west trending, valley. The hepatics *Barbilophozia hatcheri* and *Cephaloziella varians* were associated with the turf communities, particularly in frost heave channels and often occurred as stunted specimens on exposed humus.

There were a number of permanently wet areas on the island, an outstanding feature of which was one of the most extensive moss carpets known in the Antarctic Peninsula region, dominated by *W. laculosa* (Fenton and Lewis Smith 1982). Elsewhere, *S. uncinata* and *Brachythecium austro-salebrosum* formed smaller stands. *Pohlia nutans* lined the drier areas where the moss carpet communities merged with the moss turf communities.

Rock surfaces supported a variety of lichen-dominated communities in addition to the numerous epiphytic species that occurred on the moss banks. An open lichen and bryophyte community covered rocks and cliffs around the coast and in the center of the island. The southern coast of the island consisted of primarily crustose species of lichen, predominantly *Usnea antarctica* along with the mosses *Andreaea depressinervis* and *A. regularis*. The foliose alga *Prasiola crispa* forms small stands associated with the penguin colonies and other seabird habitats.

Other species recorded as present within the Area are: the hepatic *Lophozia excisa*; the lichens *Buellia* spp., *Caloplaca* spp., *Cetraria aculeata*, *Coelopogon epiphorellus*, *Lecanora* spp., *Lecidia* spp., *Lecidella* spp., *Lepraria* sp., *Mastodia tessellata*, *Ochrolechia*

frigida, *Parmelia saxatilis*, *Physcia caesia*, *Rhizocarpon geographicum*, *Rhizocarpon* sp., *Stereocaulon glabrum, Umbilicaria decussata*, *Xanthoria candelaria* and *X. elegans*; and the mosses *Andreaea gainii* var. *gainii*, *Bartramia patens*, *Dicranoweisia grimmiacea*, *Pohlia cruda*, *Polytrichastrum alpinum*, *Sarconeurum glaciale* and *Schistidium antarctici* (BAS Plant Database 2009).

Previously, increasing populations of Antarctic fur seals (*Arctocephalus gazella*) have caused significant damage to the moss banks and carpets at lower elevations (Lewis Smith 1996; Harris 2001). However, observations suggest the beginning of recovery of previously damaged vegetation at some sites following a recent decline in fur seal populations on Litchfield Island (Fraser pers. comm. 2009). South Polar skuas (*Catharacta maccormicki*) nest in the moss banks and cause some local damage.

Invertebrates, bacteria and fungi

The invertebrate fauna of Litchfield Island has not been studied in detail. The tardigrades *Macrobiotus furciger*, *Hypsibius alpinus* and *H. pinguis* have been observed in moss patches, predominantly on north-facing slopes (Jennings 1976).

Breeding birds

Six bird species breed on Litchfield Island, making it one of the most diverse avifauna breeding habitats within the Arthur Harbor region. A small Adélie penguin (*Pygoscelis adeliae*) colony was previously situated on the eastern side of the island and has been censused regularly since 1971 (Table 1, Map 2). Following the substantial decline in the numbers of breeding pairs over a 30-year period, Adélie penguins are presently extinct on Litchfield Island (Fraser pers. comm. 2009). Population decline has been attributed to changes in both sea ice distribution and snow accumulation (McClintock *et al*. 2008). Adélie penguins are sensitive to changes in sea ice concentration, which has an influence on penguin access to feeding areas and on the abundance of Antarctic krill, which is their primary prey (Fraser and Hofmann 2003; Ducklow *et al*. 2007). The recent substantial extension of ice-free conditions within the Palmer LTER study area occurred concurrently with an 80 percent decrease in krill abundance along the northern half of the western Antarctic Peninsula and as a result may have significantly reduced the food supply of Adélie penguins inhabiting Litchfield Island (Fraser and Hofmann 2003; Forcada *et al*. 2008). In recent years, spring blizzards in the Arthur Harbor area have become more frequent and more intense, which coupled with widespread precipitation increases, is thought to have substantially increased mortality rates of Adélie chicks and eggs (McClintock *et al*. 2008; Patterson *et al*. 2003). The Litchfield Island colony receives the most snowfall of the seven penguin colonies studied in the Palmer area and has shown the most rapid decline, strongly implicating increased snowfall as a contributing factor in Adélie penguin losses (Fraser, in Stokstad 2007).

Table 1. Numbers of breeding Adélie penguins (*Pygoscelis adeliae*) on Litchfield Island 1971-2009

Year	BP	Count Type[1]	Source	Year	BP	Count Type[1]	Source	Year	BP	Count Type[1]	Source
1971-72	890	N3	2	1985-86	586	N1	2	1997-98	365	N1	3
1972-73				1986-87	577	N1	3	1998-99	338	N1	3
1973-74				1987-88	430	N1	3	1999-2000	322	N1	3
1974-75	1000	N4	2	1988-89				2000-01	274	N1	3
1975-76	884	N1	3	1989-90	606	N1	3	2001-02	166	N1	3
1977-78	650	N1	2	1990-91	448	N1	3	2002-03	143	N1	3
1978-79	519	N1	2	1991-92	497	N1	3	2003-04	52		4
1979-80	564	N1	2	1992-93	496	N1	3	2004-05	33		4
1980-81	650	N1	2	1993-94	485	N1	3	2005-06	15		4
1981-82				1994-95	425	N1	3	2006-07	4		4
1982-83				1995-96	410	N1	3	2007-08	0		4
1983-84	635	N1	2	1996-97	346	N1	3	2008-09	0		4
1984-85	549	N1	2								

1. BP = Breeding pairs, N = Nest, C = Chick, A = Adults; 1 = < ± 5%, 2 = ± 5-10%, 3 = ± 10-15%, 4 = ± 25-50% (classification after Woehler, 1993)
2. Parmelee and Parmelee, 1987 (N1 and December counts are shown where several counts were made in one season).
3. W.R. Fraser data supplied February 2003, based on multiple published and unpublished sources.
4. W.R. Fraser data supplied January 2009.

Southern giant petrels (*Macronectes giganteus*) breed in small numbers on Litchfield Island. Approximately 20 pairs were recorded in 1978-79, including an incubating adult that had been banded in Australia (Bonner and Lewis Smith 1985). More recent data on numbers of breeding pairs are given in Table 2 and show a continuing upward trend in numbers. Population increases on Litchfield Island and in the vicinity of Palmer Station provide a notable exception to more widespread decline of southern giant petrels in the Antarctic Peninsula region, and have been attributed to the close proximity of prey-rich feeding grounds and the relatively low level of commercial fishing activity within the region (Patterson and Fraser 2003). In austral summer 2004, six southern giant petrel chicks from four colonies located close to the Palmer Station were found to have poxviral infection (Bochsler *et al*. 2008). While the reasons for the emergence of the virus and its potential impacts on southern giant petrel populations are currently unknown, it has been suggested that Adélie penguins may be equally vulnerable to infection.

Table 2. Numbers of breeding southern giant petrels (*Macronectes giganteus*) on Litchfield Island 1993-2009 (nest counts accurate < ± 5%)

Year	Breeding pairs	Year	Breeding pairs	Year	Breeding pairs
1993-94	26	1998-99	44	2003-04	47
1994-95	32	1999-2000	41	2004-05	48
1995-96	37	2000-01	39	2005-06	43
1996-97	36	2001-02	46	2006-07	50
1997-98	20	2002-03	42	2007-08	45
				2008-09	57

Source: Unpublished data supplied by W.R. Fraser, February 2003 and January 2009.

It is likely that Wilson's storm petrels (*Oceanites oceanicus*) breed within the Area, although numbers have not been determined. Up to 50 pairs of South Polar skuas (*Catharacta maccormicki*) occur on the island, although the number of breeding pairs fluctuates widely from year to year. Brown skuas (*Catharacta lonnbergi*) have in the past been closely associated with the Adélie penguin colony (Map 2), with the number of breeding pairs having ranged from two to eight. The low count of two pairs in 1980-81 followed an outbreak of fowl cholera, which killed many of the brown skuas on Litchfield Island in 1979. Hybrid breeding pairs also occur. Although 12-20 kelp gulls (*Larus dominicanus*) are seen regularly on the island, there are only two or three nests each season. A small number of Antarctic terns (*Sterna vittata*) regularly breed on Litchfield Island, usually less than a dozen pairs (approximately eight pairs in 2002-03) (Fraser pers. comm. 2003). They are most commonly found on the NE coast although their breeding sites change from year to year, and in 1964 they occupied a site on the NW coast (Corner 1964a). A recent visit to Litchfield Island indicates that the number of Wilson's storm petrels, South Polar skuas, brown skuas, kelp gulls and Antarctic terns breeding on the island has undergone minimal change in recent years (Fraser pers. comm. 2009).

Among the non-breeding birds commonly seen around Litchfield Island, the Antarctic shag (*Phalacrocorax* [atriceps] *bransfieldensis*) breeds on Cormorant Island several kilometers to the east; chinstrap penguins (*Pygoscelis antarctica*) and gentoo penguins (*P. papua*) are both regular summer visitors in small numbers. Snow petrels (*Pagodroma nivea*), cape petrels (*Daption capense*), Antarctic petrels (*Thalassoica antarctica*) and southern fulmars (*Fulmarus glacialoides*), are irregular visitors in small numbers, while two gray-headed albatross (*Diomedea chrysostoma*) were sighted near the island in 1975 (Parmelee *et al.* 1977).

Marine mammals

Antarctic fur seals (*Arctocephalus gazella*) started to appear in Arthur Harbor in the mid-1970s and are now common on Litchfield Island from around February each year. Regular censuses conducted in February and March over the period 1988-2003 recorded on average 160 and 340 animals on the island in these months respectively (Fraser pers. comm. 2003). In recent years, however, Antarctic fur seal numbers have decreased within the Arthur Harbor area (Siniff *et al*. 2008). Population decline has been tentatively attributed to reduced Antarctic krill availability within the area, which represents a key component of

the diet of Antarctic fur seals, particularly during pupping (Clarke *et al*. 2007; Siniff *et al*. 2008). Diminished Antarctic krill abundance is thought to be a result of reduced sea ice extent and persistence within the Arthur Harbor area (Fraser and Hoffman 2003; Atkinson *et al*. 2004).

Elephant seals (*Mirounga leonina*) haul out on accessible beaches from October to June, numbering on average 43 animals throughout these months since 1988 (Fraser pers. comm. 2003). The larger groups of a dozen or more are found in the low-lying valley on the northeastern side of the island (Map 2). A few Weddell seals (*Leptonychotes weddellii*) occasionally haul out on beaches. Long term census data (1974–2005) indicate that elephant seal populations within the Arthur Harbor area have recently expanded, as larger ice-free areas have become available for breeding. In contrast, data indicate that Weddell seal numbers have declined as a consequence of reduced fast-ice extent, which is necessary for breeding (Siniff *et al*. 2008). Both crabeater seals (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*) may also commonly be seen on ice floes near Litchfield Island. Minke whales (*Balaenoptera acutorostrata*) have been sighted in the Arthur Harbor area during both the austral summer (Dec-Feb) and autumn (Mar-May) (Scheidat *et al*. 2008).

Littoral and benthic communities

Strong tidal currents occur between the islands within Arthur Harbor, although there are numerous sheltered coves along the coast (Richardson and Hedgpeth 1977). Subtidal rocky cliffs grade into soft substrate at an average depth of 15m and numerous rock outcrops are found within the deeper soft substrate. Sediments in Arthur Harbor are generally poorly sorted and consist primarily of silt sized particles with an organic content of approximately 6.75% (Troncoso *et al*. 2008). Significant areas of the seabed within Arthur Harbor are covered by macroalgae, including *Desmarestia anceps* and *D. menziesii*, and sessile invertebrates such as sponges and corals are also present (McClintock *et al*. 2008; Fairhead *et al*. 2006). The predominantly soft mud substrate approximately 200m off the northeastern coast of Litchfield Island has been described as supporting a rich macrobenthic community, characterized by a high diversity and biomass of non-attached, deposit-feeding polychaetes, arthropods, molluscs and crustaceans (Lowry 1975). Analysis of molluscan assemblages within Arthur Harbor, conducted as part of an integrated study of the benthic ecosystem in the austral summers 2003 and 2006, indicates that species richness and abundance are relatively low (Troncoso *et al*. 2008). The fish species *Notothenia neglecta, N. nudifrons* and *Trematomus newnesi* have been recorded between 3 and 15 meters depth (De Witt and Hureau 1979; McDonald *et al*. 1995). The Antarctic limpet (*Nacella concinna*) is common in the marine area around Litchfield Island and is widespread within shallow water areas of the western Antarctic Peninsula (Kennicutt *et al.* 1992b; Clarke *et al*. 2004). Monitoring of zooplankton distribution within the marine area surrounding Litchfield Island indicates that the abundance of *Euphausia superba* and *Salpa thompsoni* decreased significantly between 1993 and 2004 (Ross *et al*. 2008).

Human activities and impact

In January 1989 the vessel *Bahía Paraíso* ran aground 750m south of Litchfield Island, releasing more than 600,000 liters (150,000 gallons) of petroleum into the surrounding environment (Kennicutt 1990; Penhale *et al.* 1997). The intertidal communities were most affected, and hydrocarbon contaminants were found in both sediments and inter- and sub-tidal limpets (*Nacella concinna*), with an estimated mortality of up to 50% (Kennicutt *et al.* 1992a&b; Kennicutt and Sweet 1992; Penhale *et al.* 1997). However, numbers recovered soon after the spill (Kennicutt 1992a&b). Levels of petroleum contaminants

found in intertidal sample sites on Litchfield Island were among some of the highest recorded (Kennicutt *et al.* 1992b; Kennicutt and Sweet 1992). It was estimated that 80% of Adélie penguins nesting in the vicinity of the spill were exposed to hydrocarbon pollution, and exposed colonies were estimated to have lost an additional 16% of their numbers in that season as a direct result (Penhale *et al*. 1997). However, few dead adult birds were observed. Samples collected in April 2002 detected hydrocarbons within the waters surrounding the *Bahía Paraíso* wreck, suggesting some leakage of Antarctic gas oil (Janiot *et al*. 2003) and fuel occasionally reaches beach areas on south-western Anvers Island (Fraser pers. comm. 2009). However, hydrocarbons were not found within sediment or biota samples collected in 2002 and high sea energy within the area is thought to significantly limit the impact of fuel leaks on local biota and the persistence of contaminants on beaches. In addition, marine debris, including fishing hooks, lines and floats are occasionally observed on Litchfield Island.

US permit records show that between 1978-92 only about 35 people visited Litchfield Island, with possibly around three visits being made per season (Fraser and Patterson 1997). This suggests a total of approximately 40 visits over this 12-year period, although given that a total of 24 landings were made at the island over two seasons in 1991-93 (Fraser and Patterson 1997), this would seem likely to represent an underestimate. Nevertheless, visitation at Litchfield Island was undoubtedly low over this period, and has remained at a minimal level. Visits have been primarily related to bird and seal censuses and work on terrestrial ecology.

Plant studies carried out on Litchfield Island in 1982 (Komárková 1983) used welding rods inserted into the soil to mark study sites. At nearby Biscoe Point (ASPA No. 139), where similar studies were conducted, numerous rods left *in situ* killed surrounding vegetation (Harris 2001). It is unknown how many of the rods were used to mark sites on Litchfield Island, or whether most were subsequently removed. However, one was found and removed from a vegetated site in a small valley approximately 100m west of the summit of the island after a brief search in February 2001 (Harris, 2001) and welding rods are still occasionally found (Fraser pers. comm. 2009). A more comprehensive search would be required to determine whether further welding rods remain within the Area. No other impacts on the terrestrial environment that could be attributed to human visitation were observed on 28 February 2001, although one of the two protected area signs was in poor condition and insecurely placed. The impact of human activities upon the terrestrial ecology, birds and seals on Litchfield Island from direct visits may thus be considered to have been minor (Bonner and Lewis Smith 1985; Fraser and Patterson 1997; Harris 2001).

6(ii) Restricted and managed zones within the Area

None within the Area, although a Restricted Zone designated under Antarctic Specially Managed Area No. 7 surrounds the Area, encompassing the marine environment within 50m of the coastline of Litchfield Island (Map 2).

6(iii) Structures within and near the Area

With the exception of a cairn on the summit of the island, there are no structures present within the Area. A permanent survey marker, consisting of a 5/8" stainless steel threaded rod, was installed on Litchfield Island by the USGS on 9 February 1999. The marker is located near the summit of the island at 64°46'13.97"S, 64°05'38.85"W at an elevation of 48m, about 8m west of the cairn (Map 2). The marker is set in bedrock and marked by a red plastic survey cap. A survival cache is located near the crest of a small hill overlooking

the former Adélie penguin colony, approximately 100m south of the small boat landing site.

6(iv) Location of other protected areas within close proximity of the Area

Litchfield Island lies within Antarctic Specially Managed Area (ASMA) No.7 Southwest Anvers Island and Palmer Basin (Map 1). The nearest Antarctic Specially Protected Areas (ASPAs) to Litchfield Island are: Biscoe Point (ASPA No. 139) which is 16km east of the Area adjacent to Anvers Island; South Bay (ASPA No. 146), which is approximately 27km to the southeast at Doumer Island; and Eastern Dallmann Bay (ASPA No. 153) which is approximately 90km to the northeast, adjacent to Brabant Island (Inset, Map 1).

7. Permit conditions

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit to enter the Area are that:

- it is issued only for compelling scientific reasons that cannot be served elsewhere, or for essential management purposes consistent with plan objectives such as inspection, maintenance or review;
- the actions permitted will not jeopardize the ecological or scientific values of the Area or the value of the Area as a terrestrial reference site;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the Permit, or a copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the Permit;
- permits shall be issued for a stated period.

7(i) Access to and movement within the Area

Access to the Area shall be by small boat, or over sea ice by vehicle or on foot. Vehicles are prohibited and all movement within the Area shall be on foot. The recommended landing site for small boats is on the beach in the small cove mid-way along the eastern coast of the island (Map 2). Access by small boat at other locations around the coast is allowed, provided this is consistent with the purposes for which a Permit has been granted. When access over sea ice is viable, there are no special restrictions on the locations where vehicle or foot access may be made, although vehicles are prohibited from being taken on land.

Boat crew, or other people in boats or vehicles, are prohibited from moving on foot beyond the immediate vicinity of the landing site unless specifically authorised by Permit. Visitors should move carefully so as to minimize disturbance to flora, fauna, and soils, and should walk on snow or rocky terrain if practical, but taking care not to damage lichens. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

Landing by aircraft within the Area is prohibited and landings within 930m (~1/2 nautical mile) of the Area should be avoided wherever possible. Overflight below 610m (~2000ft) above ground level is prohibited except when operationally necessary for scientific purposes.

7(ii) Activities that are or may be conducted in the Area, including restrictions on time or place

- Scientific research that will not jeopardize the ecosystem values of the Area or the value of the Area as a reference site, and which cannot be served elsewhere;
- Essential management activities, including monitoring.

7(iii) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit and, with the exception of permanent survey markers and the existing cairn at the summit of the island, permanent structures or installations are prohibited;
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be made of materials that pose minimal risk of contamination of the Area;
- Installation (including site selection), maintenance, modification or removal of structures shall be undertaken in a manner that minimizes disturbance to flora and fauna.
- Removal of specific equipment for which the permit has expired shall be the responsibility of the authority which granted the original Permit, and shall be a condition of the permit.

7(iv) Location of field camps

Camping should be avoided within the Area. However, when necessary for essential purposes specified in the Permit, temporary camping is allowed at the designated site on the terrace above the former penguin colony. The campsite is located at the foot of a small hill (~35m), on its eastern side, approximately 100m south-west of the small boat landing beach (Map 2). Camping on surfaces with significant vegetation cover is prohibited.

7(v) Restrictions on materials and organisms which can be brought into the Area

- No living animals, plant material, microorganisms or soils shall be deliberately introduced into the Area, and the precautions listed below shall be taken against accidental introductions;
- To help maintain the ecological and scientific values derived from the relatively low level of human impact at Litchfield Island visitors shall take special precautions against introductions. Of concern are pathogenic, microbial, invertebrate or plant introductions sourced from other Antarctic sites, including stations, or from regions outside Antarctica. Visitors shall ensure that sampling equipment or markers brought into the Area are clean. To the maximum extent practicable, footwear and other equipment used or

brought into the Area (including backpacks, carry-bags and tents) shall be thoroughly cleaned before entering the Area.

- In view of the presence of breeding birds on Litchfield Island, no poultry products, including products containing uncooked dried eggs, including wastes from such products, shall be released into the Area;
- No herbicides or pesticides shall be brought into the Area;
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted;
- Fuel, food, and other materials are not to be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted or are contained within an emergency cache authorized by an appropriate authority;
- All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of their introduction into the environment is minimized;
- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

7(vi) Taking or harmful interference with native flora or fauna

Taking or harmful interference of native flora and fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II by the appropriate national authority specifically for that purpose.

7(vii) Collection or removal of anything not brought into the Area by the Permit holder

- Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs.
- Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed from any part of the Area, unless the impact of removal is likely to be greater than leaving the material *in situ.* If this is the case the appropriate authority should be notified.

7(viii) Disposal of waste

All wastes shall be removed from the Area. Human wastes may be disposed of into the sea.

7(ix) Measures that are necessary to ensure that the aims and objectives of the Management Plan can continue to be met

1. Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities, which may involve the collection of limited samples for analysis or review, or for protective measures.
2. Any specific sites of long-term monitoring shall be appropriately marked.

7(x) Requirements for reports

- Parties should ensure that the principal holder of each permit issued submit to the appropriate authority a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of Resolution 2 (1998)(CEP I).
- Parties should maintain a record of such activities, and, in the annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organizing the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures undertaken, and/or of any materials released and not removed, that were not included in the authorized permit.

References

Atkinson, A., Siegel, V., Pakhomov, E. & Rothery, P. 2004. Long-term decline in krill stock and increase in salps within the Southern Ocean. *Nature* **432**: 100–03.

Bonner, W.N. & Lewis Smith, R.I. (eds) 1985. *Conservation areas in the Antarctic.* SCAR, Cambridge: 73-84.

Baker, K.S. 1996. Palmer LTER: Palmer Station air temperature 1974 to 1996. *Antarctic Journal of the United States* **31** (2): 162-64.

Clarke, A., Murphy, E.J., Meredith, M.P., King, J.C., Peck, L.S., Barnes, D.K.A. & Smith, R.C. 2007. Climate change and the marine ecosystem of the western Antarctic Peninsula. *Philosophical Transactions of the Royal Society B* **362:** 149–166 [doi:10.1098/rstb.2006.1958]

Clarke, A., Prothero-Thomas, E. Beaumont, J.C., Chapman, A.L. & Brey, T. 2004. Growth in the limpet *Nacella concinna* from contrasting sites in Antarctica. *Polar Biology* **28**: 62–71. [doi 10.1007/s00300-004-0647-8]

Corner, R.W.M. 1964a. Notes on the vegetation of Litchfield Island, Arthur Harbour, Anvers Island. Unpublished report, British Antarctic Survey Archives Ref AD6/2F/1964/N3.

Corner, R.W.M. 1964b. Catalogue of bryophytes and lichens collected from Litchfield Island, West Graham Land, Antarctica. Unpublished report, British Antarctic Survey Archives Ref LS2/4/3/11.

Domack E., Amblàs, D., Gilbert, R., Brachfeld, S., Camerlenghi, A., Rebesco, M., Canals M. & Urgeles, R. 2006. Subglacial morphology and glacial evolution of the Palmer deep outlet system, Antarctic Peninsula. *Geomorphology* **75**(1-2): 125-42.

Ducklow, H.W., Baker, K., Martinson, D.G., Quentin, L.B., Ross, R.M., Smith, R.C. Stammerjohn, S.E. Vernet, M. & Fraser, W. 2007. Marine pelagic ecosystems: the West Antarctic Peninsula. *Philosophical Transactions of the Royal Society B* **362**: 67–94. [doi:10.1098/rstb.2006.1955]

Fairhead, V.A., Amsler, C.D. & McClintock, J.B. 2006. Lack of defense or phlorotannin induction by UV radiation or mesograzers in *Desmarestia anceps* and *D. menziesii* (phaeophyceae). *Journal of Phycology* **42:** 1174–83.

Fenton, J.H.C & Lewis Smith, R.I. 1982. Distribution, composition and general characteristics of the moss banks of the maritime Antarctic. *British Antarctic Survey Bulletin* **51**: 215-36.

Forcada, J. Trathan, P.N., Reid, K., Murphy, E.J. & Croxall, J.P. 2006. Contrasting population changes in sympatric penguin species in association with climate warming. *Global Change Biology* **12**: 411–23. [doi: 10.1111/j.1365-2486.2006.01108.x]

Fraser, W.R. in: Stokstad, 2007. Boom and bust in a polar hot zone. *Science* **315:** 1522–23.

Fraser, W.R. & Hofmann, E.E. 2003 A predator's perspective on causal links between climate change, physical forcing and ecosystem response. *Marine Ecological Progress Series* **265**: 1–15.

Fraser, W.R. & Patterson, D.L. 1997. Human disturbance and long-term changes in Adélie penguin populations: a natural experiement at Palmer Station, Antarctic Peninsula. In Battaglia, B. Valencia, J. & Walton, D.W.H. (eds) *Antarctic Communities: species, structure and survival.* Cambridge University Press, Cambridge: 445-52.

Greene, D.M. & Holtom, A. 1971. Studies in *Colobanthus quitensis* (Kunth) Bartl. and *Deschampsia antarctica* Desv.: III. Distribution, habitats and performance in the Antarctic botanical zone. *British Antarctic Survey Bulletin* **26**: 1-29.

Grobe, C.W., Ruhland, C.T. & Day, T.A. 1997. A new population of *Colobanthus quitensis* near Arthur Harbor, Antarctica: correlating recruitment with warmer summer temperatures. *Arctic and Alpine Research* **29**(2): 217-21.

Harris, C.M. 2001. Revision of management plans for Antarctic protected areas originally proposed by the United States of America and the United Kingdom: Field visit report. Internal report for the National Science Foundation, US, and the Foreign and Commonwealth Office, UK. Environmental Research & Assessment, Cambridge.

Holdgate, M.W. 1963. Observations of birds and seals at Anvers Island, Palmer Archipelago, in 1956-57. *British Antarctic Survey Bulletin* **2**: 45-51.

Hooper, P.R. 1958. Progress report on the geology of Anvers Island. Unpublished report, British Antarctic Survey Archives Ref AD6/2/1957/G3.

Hooper, P.R. 1962. The petrology of Anvers Island and adjacent islands. *FIDS Scientific Reports* **34**.

Janiot, L.J., Sericano, J.L. & Marcucci, O. 2003. Evidence of oil leakage from the *Bahia Paraiso* wreck in Arthur Harbour, Antarctica. *Marine Pollution Bulletin* **46**: 1615–29.

Jennings, P.G. 1976. Tardigrada from the Antarctic Peninsula and Scotia Ridge region. *BAS Bulletin* **44**: 77-95.

Kennicutt II, M.C. 1990. Oil spillage in Antarctica: initial report of the National Science Foundation-sponsored quick response team on the grounding of the *Bahia Paraiso. Environmental Science and Technology* **24**: 620-24.

Kennicutt II, M.C., McDonald, T.J., Denoux, G.J. & McDonald, S.J. 1992a. Hydrocarbon contamination on the Antarctic Peninsula I. Arthur Harbour – subtidal sediments. *Marine Pollution Bulletin* **24** (10): 499-506.

Kennicutt II, M.C., McDonald, T.J., Denoux, G.J. & McDonald, S.J. 1992b. Hydrocarbon contamination on the Antarctic Peninsula I. Arthur Harbour – inter- and subtidal limpets (*Nacella concinna*). *Marine Pollution Bulletin* **24** (10): 506-11.

Kennicutt II, M.C. & Sweet, S.T. 1992. Hydrocarbon contamination on the Antarctic Peninsula III. The *Bahia Paraiso* – two years after the spill. *Marine Pollution Bulletin* **25** (9-12): 303-06.

Komárková, V. 1983. Plant communities of the Antarctic Peninsula near Palmer Station. *Antarctic Journal of the United States* **18**: 216-18.

Komárková, V. 1984. Studies of plant communities of the Antarctic Peninsula near Palmer Station. *Antarctic Journal of the United States* **19**: 180-82.

Lewis Smith, R.I. 1982. Plant succession and re-exposed moss banks on a deglaciated headland in Arthur Harbour, Anvers Island. *British Antarctic Survey Bulletin* **51**: 193–99.

Lewis Smith, R.I. 1994. Vascular plants as bioindicators of regional warming in Antarctica. *Oecologia* **99**: 322-28.

Lewis Smith, R.I. 1996. Terrestrial and freshwater biotic components of the western Antarctic Peninsula. In Ross, R.M., Hofmann, E.E. and Quetin, L.B. (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**: 15-59.

Lewis Smith, R.I. & Corner, R.W.M. 1973. Vegetation of the Arthur Harbour – Argentine Islands region of the Antarctic Peninsula. *British Antarctic Survey Bulletin* **33 & 34**: 89-122.

Lowry, J.K. 1975. Soft bottom macrobenthic community of Arthur Harbor, Antarctica. In Pawson, D.L. (ed.). Biology of the Antarctic Seas V. *Antarctic Research Series* **23** (1): 1-19.

McClintock, J., Ducklow, H. & Fraser, W. 2008. Ecological responses to climate change on the Antarctic Peninsula. *American Scientist* **96:** 302.

McDonald, S.J., Kennicutt II, M.C., Liu, H. & Safe S.H. 1995. Assessing aromatic hydrocarbon exposure in Antarctic fish captured near Palmer and McMurdo Stations, Antarctica. *Archives of Environmental Contamination and Toxicology* **29:** 232-40.

Parker, B.C, Samsel, G.L. & Prescott, G.W. 1972. Freshwater algae of the Antarctic Peninsula. 1. Systematics and ecology in the U.S. Palmer Station area. In Llano, G.A. (ed) *Antarctic terrestrial biology*. *Antarctic Research Series* **20**: 69-81.

Parmelee, D.F, Fraser, W.R. & Neilson, D.R. 1977. Birds of the Palmer Station area. *Antarctic Journal of the United States* **12** (1-2): 15-21.

Parmelee, D.F. & Parmelee, J.M. 1987. Revised penguin numbers and distribution for Anvers Island, Antarctica. *British Antarctic Survey Bulletin* **76**: 65-73.

Patterson, D.L., Easter-Pilcher, A. & Fraser, W.R. 2003. The effects of human activity and environmental variability on long-termchanges in Adelie penguin populations at Palmer Station, Antarctica. In A. H. L. Huiskes, W. W. C. Gieskes, J. Rozema, R. M. L. Schorno, S. M. van der Vies & W. J. Wolff (eds) *Antarctic biology in a global context*. Backhuys, Leiden, The Netherlands: 301–07.

Patterson, D.L. & Fraser, W. 2003. *Satellite tracking southern giant petrels at Palmer Station, Antarctica*. Feature Article 8, Microwave Telemetry Inc.

Penhale, P.A., Coosen, J. & Marschoff, E.R. 1997. The *Bahia Paraiso*: a case study in environmental impact, remediation and monitoring. In Battaglia, B. Valencia, J. & Walton, D.W.H. (eds) *Antarctic Communities: species, structure and survival.* Cambridge University Press, Cambridge: 437-44.

Richardson, M.D. & Hedgpeth, J.W. 1977. Antarctic soft-bottom, macrobenthic community adaptations to a cold, stable, highly productive, glacially affected environment. In Llano, G.A. (ed.). *Adaptations within Antarctic ecosystems: proceedings of the third SCAR symposium on Antarctic biology*: 181-96.

Ross, R.M., Quetin, L.B., Martinson, D.G., Iannuzzi, R.A., Stammerjohn, S.E. & Smith, R.C. 2008. Palmer LTER: patterns of distribution of major zooplankton species west of the Antarctic Peninsula over a twelve year span. *Deep-Sea Research II* **55**: 2086–2105.

Sanchez, R. & Fraser, W. 2001. *Litchfield Island Orthobase*. Digital orthophotograph of Litchfield Island, 6 cm pixel resolution and horizontal / vertical accuracy of ± 2 m. Geoid heights, 3 m^2 DTM, derived contour interval: 5 m. Data on CD-ROM and accompanied by USGS Open File Report 99-402 "GPS and GIS-based data collection and image mapping in the Antarctic Peninsula". Science and Applications Center, Mapping Applications Center. USGS, Reston.

Scheidat, M., Bornemann, H., Burkahardt, E., Flores, H., Friedlaender, A. Kock, K.-H, Lehnert, L., van Franekar, J. & Williams, R. 2008. Antarctic sea ice habitat and minke whales. Annual Science Conference in Halifax, 2008.

Shearn-Bochsler, V. Green, D.E., Converse, K.A., Docherty, D.E., Thiel, T., Geisz, H. N., Fraser, W.R. & Patterson-Fraser, D.L. 2008. Cutaneous and diphtheritic avian poxvirus infection in a nestling Southern giant petrel (*Macronectes giganteus*) from Antarctica. *Polar Biology* **31**: 569–73. [doi 10.1007/s00300-007-0390-z]

Siniff, D.B., Garrot, R.A. & Rotella, J.J. 2008. Opinion: Projecting the effects of environmental change on Antarctic seals. *Antarctic Science* **20**: 425-35.

Stammerjohn, S.E., Martinson, D.G., Smith, R.C. & Iannuzzi, R.A. 2008. Sea ice in the Western Antarctic Peninsula region: spatio-temporal variability from ecological and

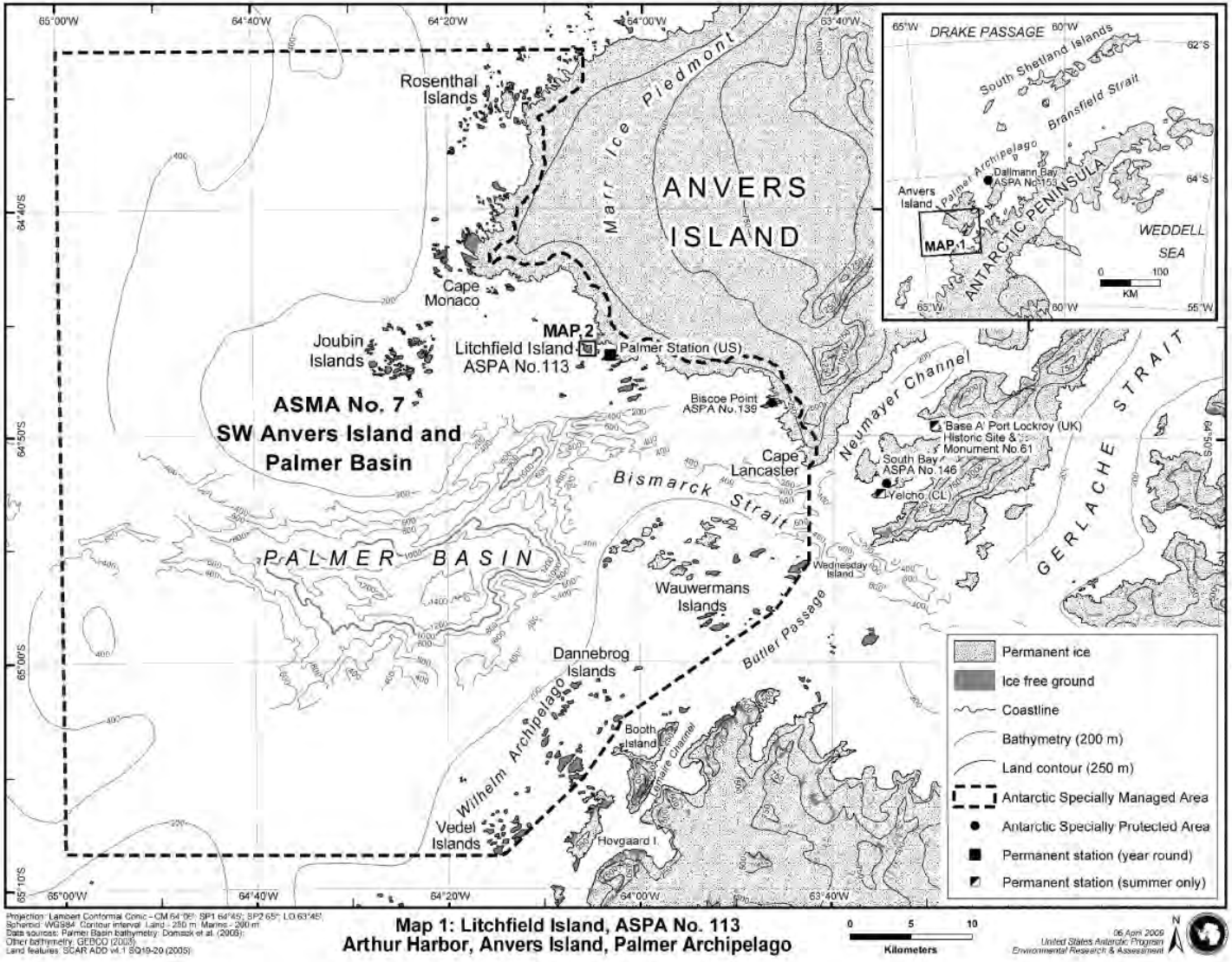
climate change perspectives. *Deep-Sea Research II* **55:** 2041–58. [doi:10.1016/j.dsr2.2008.04.026]

Troncoso, J.S. & Aldea, C. 2008. Macrobenthic mollusc assemblages and diversity in the West Antarctica from the South Shetland Islands to the Bellingshausen Sea. *Polar Biology* **31**(10): 1253–65. [doi 10.1007/s00300-008-0464-6]

Vaughan, D.G., Marshall, G.J., Connolley, W.M., Parkinson, C., Mulvaney, R., Hodgson, D.A., King, J.C., Pudsey, C.J., & Turner, J. 2003. Recent rapid regional climate warming on the Antarctic Peninsula. *Climatic Change* **60:** 243–74.

Willan, R.C.R. 1985. Hydrothermal quartz+magnetite+pyrite+chalcopyrite and quartz+polymetallic veins in a tonalite-diorite complex, Arthur Harbour, Anvers Island and miscellaneous observations in the southwesternAnvers Island area. Unpublished report, British Antarctic Survey Archives Ref AD6/2R/1985/G14.

Woehler, E.J. (ed) 1993. *The distribution and abundance of Antarctic and sub-Antarctic penguins.* SCAR, Cambridge.



Projection: Lambert Conformal Conic - CM 64°00'; SP1 64°45'; SP2 65°; LO 63°45'.
Spheroid: WGS84. Contour interval: Land - 250 m; Marine - 200 m.
Data sources: Palmer Basin bathymetry: Domack et al. (2005);
Other bathymetry: GEBCO (2003).
Land features: SCAR ADD v4.1 SQ19-20 (2005).

Map 1: Litchfield Island, ASPA No. 113
Arthur Harbor, Anvers Island, Palmer Archipelago

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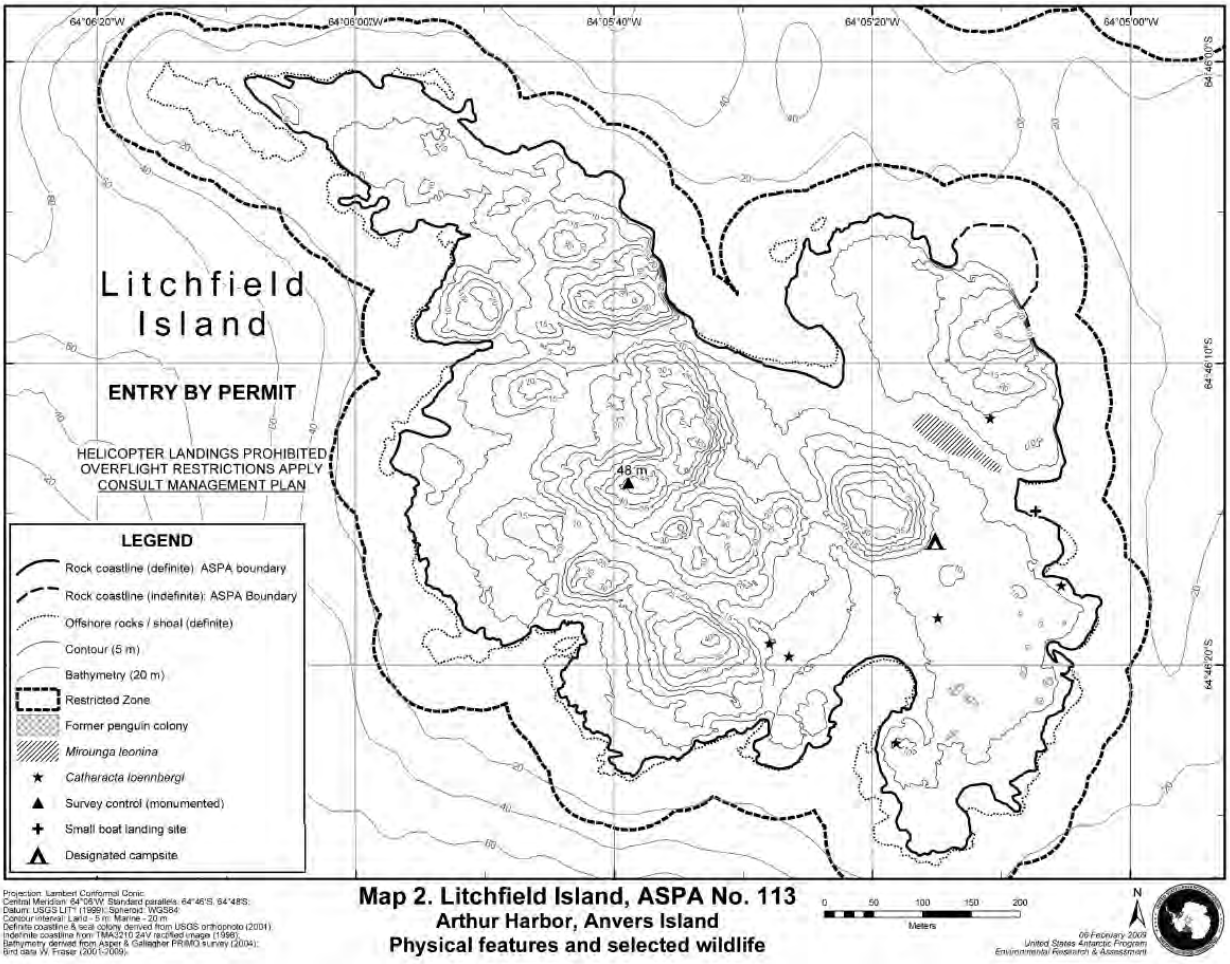
Kilometers

06 April 2009
United States Antarctic Program
Environmental Research & Assessment



Map 2. Litchfield Island, ASPA No. 113
Arthur Harbor, Anvers Island
Physical features and selected wildlife

Measure 5 (2009)

Antarctic Specially Protected Area No 121 (Cape Royds, Ross Island): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas (ASPA) and approval of Management Plans for those Areas;

Recalling

- Recommendation VIII-4 (1975), which designated Cape Royds, Ross Island as Site of Special Scientific Interest ("SSSI") No 1 and annexed a management plan for the site;
- Recommendation X-6 (1979), which extended the expiry date of SSSI 1 from 30 June 1981 to 30 June 1985;
- Recommendation XII-5 (1983), which extended the expiry date of SSSI 1 from 30 June 1985 to 31 December 1985;
- Recommendation XIII-9 (1985), which annexed a revised management plan for SSSI 1;
- Resolution 7 (1995), which extended the expiry date of SSSI 1 from 31 December 1995 to 31 December 2000;
- Measure 2 (2000), which extended the expiry date of SSSI 1 from 31 December 2000 to 31 December 2005;
- Decision 1 (2002), which renamed and renumbered SSSI 1 as Antarctic Specially Protected Area No 121;
- Measure 1 (2002), which adopted a revised management plan for ASPA 121;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 121;

Desiring to replace the existing Management Plan for ASPA 121 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) he revised Management Plan for Antarctic Specially Protected Area No 121 (Cape Royds, Ross Island), which is annexed to this Measure, be approved;

2) all prior management plans for ASPA 121, namely those annexed to:

- Recommendation XIII-9 (1985) and
- Measure 1 (2002)

shall cease to be effective; and

3) Measure 2 (2000), which is not yet effective, be withdrawn.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 121 CAPE ROYDS, ROSS ISLAND

Introduction

Cape Royds lies at the western extremity of Ross Island, McMurdo Sound, at 166°09'56"E, 77°33'20"S. Approximate area: 0.62km^2. Designation on the grounds that the Area supports the most southerly established Adélie penguin (*Pygoscelis adeliae*) colony known, and which has a long time series of population data that is of unique and outstanding scientific value. In addition, the Area has important terrestrial and freshwater ecological values, including the most southerly observation of snow algae, the type locality for original descriptions of a number of species of algae, and the unusual presence of a form of Dissolved Organic Matter (DOM) that is almost entirely microbially-derived. Proposed by the United States of America: adopted through Recommendation VIII-1 (1975, SPA No. 17); renamed and renumbered by Decision 1 (2002); revised management plan adopted through Measure 1 (2002).

1. Description of values to be protected

An area of about 300m^2 at Cape Royds was originally designated in Recommendation VIII-4 (1975, SSSI No. 1) after a proposal by the United States of America on the grounds that it supports the most southerly established Adélie penguin (*Pygoscelis adeliae*) colony known. The Adélie penguin population at Cape Royds had declined from 1956 as a consequence of human interference during a period when heavy sea ice cover made the colony particularly susceptible to reduced recruitment. In 1963 United States and New Zealand authorities agreed to restrict activities and develop a management plan for the area in order to protect the scientific values related to penguin research. The site was specially protected to allow the population to recover and protect on-going science programmes. The population has recovered and now exceeds pre-1956 levels; since 1990 numbers have fluctuated between 2,500 and 4,500 pairs, primarily due to natural variation in local sea ice extent. The long time series of population data on the penguin colony at Cape Royds is of unique and outstanding scientific value, for it enables investigations into long-term biological interactions with and responses to environmental forcing factors. The colony remains of high scientific and ecological value and as such merits continued long-term special protection, especially in view of ongoing visits to Cape Royds from nearby stations and tourist groups.

The original Area was enlarged in 1985 as a result of a proposal by New Zealand (Recommendation XIII-9) to include a 500m–wide coastal strip to protect the seaward access and nearshore feeding ground of the Adélie penguins, as well as projected research on the Cape Royds inshore marine ecosystem. This coastal area of Cape Royds was a site of studies on Nototheniid fish population structure and dynamics. More recently, research on foraging patterns of Adélie penguins from Cape Royds, conducted since this marine component of the Area was adopted, has shown that the marine area as it had been designated is not significant as a penguin feeding ground and that the birds forage more widely than had previously been known. In addition, projected research on the Cape Royds inshore marine ecosystem has not occurred to the extent that had been anticipated, and currently few studies are being carried out on the Nototheniid fish population at Cape Royds. In view of these factors, and because specific values related to the marine

environment adjacent to Cape Royds remain undescribed, the marine boundary has been redefined in this management plan to focus more particularly on the area immediately surrounding the Adélie penguin colony. The marine component immediately adjacent to the Cape Royds penguin colony has been retained because it includes the primary access route of the penguins to the colony, which could otherwise be subjected to unnecessary disturbance by both visitors and local helicopter activity in the vicinity.

Research carried out over the last several decades has also noted that the Area has important values related to freshwater and terrestrial ecology. Pony Lake is a type locality for original descriptions of a number of species of algae collected during Shackleton's British Antarctic Expedition of 1907-09. The most southerly observation of snow algae, dominated by *Chlamydomonas*, has been made within the Area. In addition, recent studies have shown fulvic acid Dissolved Organic Matter present in Pony Lake is almostly entirely microbially-derived, which is considered unusual. Because these substances are poorly understood, isolated reference samples are needed for research purposes: a sample collected from Pony Lake has made a valuable contribution as a reference for the International Humic Substances Society. Finally, it has been noted that the very low diversity of soil organisms at the site makes it valuable for comparisons with other, more favorable, habitats.

Shackleton's Hut (Historic Monument No. 15), located in ASPA No. 157 (Backdoor Bay), is located 170 meters to the northeast of the Adélie colony and, together with the colony, are attractions of high aesthetic and educational value to visitors. Regular and frequent visits to Cape Royds means that the Area could easily be damaged by human impact if not provided with adequate protection. The scientific and ecological values of the Area require long-term protection from possible adverse impacts associated with these activities. However, in recognition of the value of the Adélie colony as the most accessible of any penguin species to the personnel of McMurdo Station (US) and Scott Base (NZ), provision has been made for controlled access to two viewing areas near to, but outside of, the boundaries in order to allow visitors to Cape Royds the opportunity to observe the colony without causing significant impact. Such visits are subject to Site Guidelines agreed through Resolution 4 (2009).

Relics from the time of Shackleton's voyages are present at the site of a small depot in an embayment on the west side of the penguin nesting area (166°09'35.2"E, 77°33'14.3"S: Map 2). The depot has historic value and should not be disturbed except by permit for conservation or management purposes.

The boundaries encompass the entire Adélie penguin colony, the southern part of Pony Lake, and the marine environment up to 500 meters from the shoreline surrounding Flagstaff Point.

2. Aims and objectives

Management at Cape Royds aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance and sampling in the Area;

- allow scientific research on the ecosystem of the Area, in particular on the avifauna and terrestrial and freshwater ecology, provided it will not compromise the values for which the Area is protected;
- minimize the possibility of introduction of alien plants, animals and microbes to the Area;
- take into account the potential historic and heritage values of any artifacts before their removal and/or disposal, while allowing for appropriate clean-up and remediation if required;
- allow visits for management purposes in support of the aims of the management plan.

3. Management activities

- Brightly colored markers, which should be clearly visible from the air and pose no significant threat to the environment, should be placed to mark the helicopter landing pad adjacent to the protected area (Maps 1 and 2).
- Signs illustrating the location and boundaries with clear statements of entry restrictions shall be placed at appropriate locations at the boundaries of the Area to help avoid inadvertent entry. In addition, flags should be placed on the sea-ice in Backdoor Bay along the southeast boundary of the marine area (offshore from Derrick Point) on the first visit over sea-ice each season to indicate the restricted area so those travelling to Cape Royds over sea ice are aware of the marine boundary of the Area. Flags placed shall be removed immediately prior to closure of sea-ice travel each season.
- Signs showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently, and a copy of this management plan shall be kept available, in all research hut facilities located at Cape Royds.
- Markers, signs or structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer necessary.
- Visits shall be made as necessary (no less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- National Antarctic Programs operating in the region shall consult together with a view to ensuring these steps are carried out.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No. 121 Cape Royds boundaries and topographic map. The map is derived from digitized contours from NZ Lands and Survey Plan 37/108 (1982) combined with an orthophotograph using the following specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 77°33'14"S; 2nd 77°33'26"S; Central Meridian: 166°10'02"E; Latitude of Origin: 75°00'00"S; Spheroid: WGS84. Positional accuracy of original orthophotograph at 1:10,000 is ±5.0m (horizontal) and ±5.0m (vertical).

Inset 1: The location of Ross Island in the Ross Sea. *Inset 2*: Ross Island, showing the location of McMurdo Station (US) and Scott Base (NZ), and the location of other nearby protected areas on Ross Island.

Map 2: Cape Royds terrestrial area topographic map. Specifications are as follows: Projection: Lambert Conformal Conic; Standard parallels: 1st 77°33'09"S; 2nd 77°33'16"S; Central Meridian: 166°10'02"E; Latitude of Origin: 75°00'00"S; Spheroid: WGS84. Contours are derived from the digital elevation model used to generate the orthophotograph.

6. Description of the Area

6(i) Geographical coordinates, boundary markers and natural features
General description

Cape Royds (166°09'56"E, 77°33'20"S) is situated at the western extremity of Ross Island, McMurdo Sound, on a coastal strip of ice-free land approximately 8km wide, on the lower western slopes of Mount Erebus (Map 1, Insets). The Area comprises both a terrestrial and marine component.

The terrestrial component of the Area consists of ice-free land within approximately 350m of Flagstaff Point (166°09'55"E, 77°33'21"S) that is seasonally occupied by a breeding Adélie penguin (*Pygoscelis adeliae*) colony. The boundary includes all of the area occupied by breeding penguins and the main southern route used by the penguins to the access the sea. The northern boundary of the terrestrial component of the Area extends from a small embayment at the northwestern corner of the Area for 45m in a straight line NE to a survey mark identified on earlier New Zealand maps as IT2 (166°09'33.3"E, 77°33'11.1"S), which is an iron tube embedded in the ground. The boundary thence extends 10m east from IT2 to a signpost (166°09'34.8"E, 77°33'11.1"S), thence a further 80m east to a signpost (166°09'46.1"E, 77°33'11.0"S) south of a small pond north of Pony Lake. From this signpost the boundary extends in a SE direction for 114m north of Pony Lake to the eastern shore of the lake (166°10'01.3"E, 77°33'12.6"S). The northeastern boundary thence extends 86m in a SSE direction to a third signpost (166°10'05"E, 77°33'15.2"S), thence to the coast at Arrival Bay (166°10'06.0"E, 77°33'15.9"S). The northeastern boundary thence extends along the coastline from Arrival Bay to Derrick Point. The boundary from Pony Lake to Derrick Point is coincident with the southern boundary of ASPA No. 157 Backdoor Bay, which has been designated to protect Shackleton's historic hut and associated artefacts (Historic Site and Monument No. 15).

The marine component of the Area encompasses the area within 500m of the mean high water coastline of Flagstaff Point, with the boundary extending 500m southeast from Derrick Point (166°10'22"E, 77°33'14.1"S) to the southeastern corner of the Area at 166°11'08"E, 77°33'27"S, thence westward maintaining a distance of 500m from the shore to 166°08'10"E, 77°33'11.8"S, thence due east 500m to coast at the northwestern corner of the Area (166°9'25"E, 77°33'11.8"S).

Geology and soils

The terrestrial component of the Area comprises rocky terrain of irregular lava flows, volcanic gravels and dark reddish scoria, bounded on the seaward side by a low cliff of approximately 10-20m in height. Mineral soils and sand are present together with encrusted salts and compacted ornithogenic soils associated with the Adélie penguin colony (Cowan and Casanueva 2007).

Breeding birds

The Area contains the world's most southerly established Adélie penguin (*Pygoscelis adeliae*) colony, with annual population numbers currently fluctuating between 2,500 and 4,500 breeding pairs during the approximate mid-October to mid-February occupation (Figure 1). The population size in 1959 was deemed to be equivalent to that in 1909 with no evidence that it had been larger in historical times (Ainley 2002), then declined to fewer than 1000 breeding pairs in 1963 as a result of severe ice conditions which made the colony more susceptible to disturbance by visitation and helicopter movements (Thompson 1977). Following visitor restrictions and relocation of the helicopter pad away from the colony, penguin populations gradually recovered during the 1970's, increasing at a mean annual rate of 15% between 1983 and 1987 and quadrupling the population (Ainley *et al*. 2005; Taylor and Wilson 1990). Following a peak in 1987, Adélie numbers at Cape Royds declined sharply in 1988 and 1989, before recovering once more to reach a population comparable to levels recorded during the late 1980's. By 1998, the Adélie population at Cape Royds had reached 4,000 breeding pairs, with numbers subsequently declining to 2,400 pairs by 2000 (Ainley *et al*. 2004).

Fluctuations in Adélie penguin populations at Cape Royds have been linked to changes in a range of climatic and environmental variables. Wilson *et al*. (2001) found a significant inverse correlation between Adélie numbers and winter sea ice extent, with more extensive (i.e. more northerly) sea ice coverage reducing sub-adult survival rates by restricting access to productive feeding areas. Consequently, total Adélie numbers at Cape Royds showed a five - year lagged response to sea ice concentration variation. The influence of sea ice coverage on Adélie numbers within the Area was further highlighted following the grounding of a large iceberg (designated B15A, 175 x 54km in size) on the shore of Ross Island prior to the 2000 nesting season (Arrigo *et al*. 2002; Ainley *et al*. 2003). The obstruction caused by the B-15 iceberg resulted in unusually extensive sea ice coverage in 2000, which in turn caused a 40 % reduction in primary productivity. However, while Adélie surveys carried out at Cape Royds in 2000 showed a significant change in penguin diet, the impact of increased sea ice coverage on chick production was minimal (Ainley *et al*. 2003).

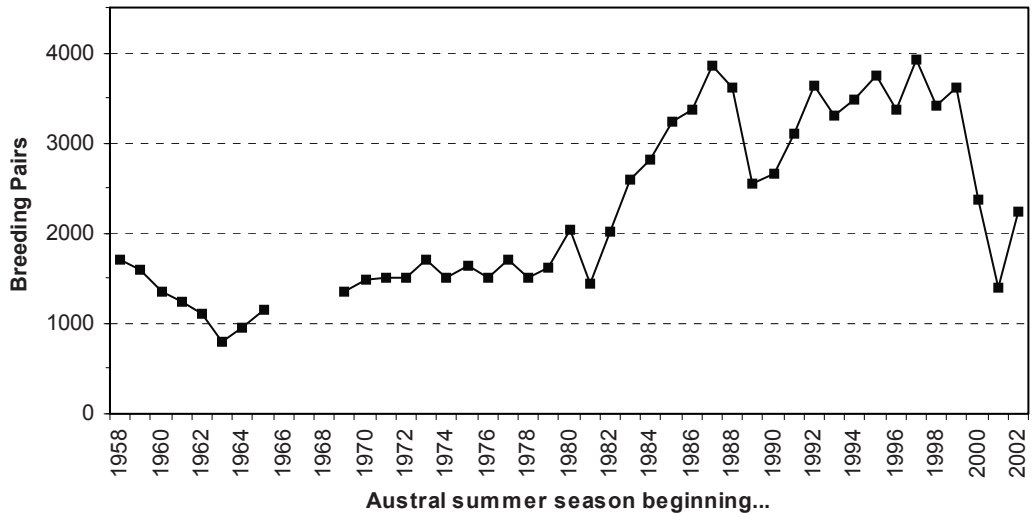


Figure 1. Numbers of breeding pairs of Adélie penguins at Cape Royds 1958/59 – 2002/03.

In addition to specific influences of sea ice extent, Adélie population expansion at Cape Royds has been attributed to the broader effects of climatic warming within the McMurdo Sound area (Ainley *et al*. 2005: Blackburn *et al*. 1991), which began in the mid 1960's and became particularly pronounced in the 1980's (Taylor and Wilson 1990). Climatic amelioration is thought to have positively influenced Adélie populations by reducing sea ice extent and enlarging the Ross Sea Polynya, increasing marine productivity and the availability of food, lowering winter mortality, and enhancing penguin breeding success (Taylor and Wilson 1990: Blackburn *et al*. 1991; Ainley *et al*. 2005). An alternative explanation for the rapid expansion of the Cape Royds colony in the 1980's may lie in a substantial decrease in numbers of Antarctic minke whale, *Balaenoptera bonaerensis*, removed from the Ross Sea during this decade (Ainley *et al*. 2007). The habitat and prey of the minke whale overlaps that of the Adélie penguin, suggesting that release from competition may have caused the population boom observed at Cape Royds and elsewhere on Ross Island.

The underlying causes of the Adélie population crash at Cape Royds in 1988 and 1989 have yet to be resolved, although a link has been made to changes in the Antarctic Oscillation (AAO), with resultant impacts on weather and sea ice conditions, which in turn may have increased Adélie mortality (Ainley *et al*. 2005). Subsequent to 1989, the Cape Royds colony grew rapidly, in contrast to trends at Cape Crozier, suggesting that changes in emigration patterns may have been responsible (Ainley, Ballard *et al.* unpublished data). In addition, continued oceanic warming within the region is likely to have significantly impacted upon sea ice persistence (Ainley *et al*. 2005) and may have contributed to colony growth.

The Area has been monitored regularly since 1957 and has been photographed from the air during the incubation phase of breeding annually since 1981.The annual assessment of Adélie penguin population size at colonies on Ross Island, Ross Sea, from 1959 to 1997 is one of the longest-running marine biological time series in the Antarctic (Taylor and Wilson 1990; Taylor *et al*. 1990; Wilson *et al*. 2001). The long history of scientific

observations at Cape Royds thus provides rare opportunities to assess population trends over long periods, enabling assessment of the effects of changing ice regimes against the population dynamics of these bird colonies in the relatively pristine southern Ross Sea ecosystem (Ballard pers. comm. 2008).

Studies of Adélie foraging patterns during the austral summers 1997–98 to 2000–01 indicated the mean foraging distance from Cape Royds ranged between 9.70km and 12.09km (Ainley *et al*. 2004) and observations suggest that little foraging occurs within 200m of the coast (Ainley pers. comm. 2008). The foraging range of penguins belonging to the Cape Royds colony overlaps extensively (30–75%) with the ranges of birds originating from both Cape Bird and Beaufort Island (Ainley *et al*. 2004). Banded penguins from Cape Royds, Cape Bird and Beaufort Island are often seen within the other colonies (Ainley unpublished data, referenced in Ainley *et al*. 2003) and it has been suggested that immigration to Cape Royds from these locations was a major causal factor of population growth during the 1980's onwards (Ainley *et al*. 2004; Ainley pers. comm. 2008).

In addition to the Cape Royds Adélie colony, a significant breeding population of South Polar skuas (*Catharacta maccormicki*) is located close to the ASPA boundary, which totalled 76 breeding pairs in 1981 (Ainley *et al*. 1986). The skuas have been observed to nest and forage for food within penguin rookeries at Cape Royds (Young 1962a). It was noted however, that preying of skuas on young penguins was limited and that only a portion of the skuas breeding at Cape Royds obtained food from within the Adélie colony (Young 1962b). Skua populations declined substantially following cessation of human refuse disposal at McMurdo Station, but are currently not thought to be under threat (Ainley pers. comm. 2008).

Climate

The wind at Cape Royds is predominantly from the southeast and deposits sea spray across the Area (Broady 1988). Data from McMurdo Station, located approximately 35km southeast of Cape Royds, over the period 1973–2004 showed average wind speeds of around 10 knots, whilst the maximum recorded reached 112.3 knots (Antarctic Meteorological Research Centre 2009). Air temperature data collected at nearby Scott Base (NZ) during the period 1957–1997 indicate that January is the warmest month, with a mean temperature of -4.7ºC and that August is the coolest month with an average temperature of -30.2ºC (data sourced from National Institute of Water and Atmospheric Research, New Zealand, *http://www.niwa.cri.nz* 17 Feb 2009). The minimum air temperature recorded during the period 1957 to 1997 was –41.5ºC, recorded in August 1978, whilst the maximum temperature attained was –1.6ºC in January 1971.

Long term climate records indicate that during the 1960's air temperatures and wind speeds recorded at Scott Base were relatively low, which was followed by a period of warming in the early 1970's (Ainley *et al*., 2005). From the early 1980's a marked warming trend was observed across the McMurdo Sound area (Blackburn *et al*. 1991) and records from McMurdo Station suggest that air temperatures peaked in the late 1980's, before cooling once again in the early 1990's (Wilson *et al*. 2001).

Marine biology and oceanography

The marine component of the Area has neither been intensively studied nor fully described. This region has not been subjected to the level of sampling that has occurred close to Hut Point further to the south on Ross Island. To 500m west of the shore the sea floor generally

drops off steeply down to several hundred meters, with some submarine cliffs. Sea floor samples collected several kilometers north of Cape Royds and approximately 100m offshore consisted of coarse volcanic gravels and small to large boulders. Research on the Nototheniid fish population and structure in this vicinity between 1978–81 suggested that fish were abundant, with the most common species at that time being *Trematomus bernacchii*. The surveys also recorded the presence of *Trematomus hansoni, T. centronotus, T. nicolai and Gymnodraco acuticeps*. The surveys identified the presence of invertebrates such as echinoids, asteroids (e.g. *Odontaster validus*), ophiuroids, pycnogonids (e.g. *Pentanymphon antarcticum, Colossendeis robusta*), pteropods, copepods, amphipods, isopods, hirudinea, bryozoa, polycheates, ctenophores, mollusca, and medusae. More recent data describing the marine environment close to Cape Royds is not available.

Local ocean currents originate from the eastern Ross Sea continental shelf and flow westward along the Ross Ice Shelf past Cape Crozier, and then turns northward along the Victoria Land coast. The current divides at Beaufort Island, where a minor arm veers southward past Capes Bird and Royds (Jacobs *et al.* 1970; Barry 1988).

Terrestrial and freshwater ecology

Ponds within the Area, including Pony Lake, are nutrient-enriched and contain an abundant and diverse algal community adapted to high nutrients and salinity, dominated by phytoplankton, diatoms and oscillatorian benthic felts (Broady 1987). Some species of algae were first formally described from Pony Lake (West and West 1911), making the site a 'type locality'. Snow algae are present on small patches of snow on the coastal ice-foot adjacent to the penguin colony, dominated by species of *Chlamydomonas*, which is the most southerly record of snow algae (Broady 1988).

Pony Lake has been identified as an important source of microbially derived Dissolved Organic Material (DOM) (Brown *et al.*2004). One type of DOM, fulvic acid, is derived from decaying plant matter and microbial activity. The fulvic acid present in Pony Lake has been identified as an important end-member as it is almostly entirely microbially-derived. Fulvic acids affect the chemistry, cycling and bioavailability of chemical elements in terrestrial and aquatic environments. Because these substances are poorly understood, isolated reference samples are needed for research purposes. A reference sample of Pony Lake fulvic acid was collected and made available to serve as a microbial end-member for distribution through the International Humic Substances Society. The lake's abundant levels of DOM and convenient location from McMurdo Station make it an ideal place to conduct such fieldwork.

Studies of terrestrial invertebrate (nematode) populations from the ornithogenic soils at Cape Royds have been carried out since 1990. In contrast to the greater invertebrate diversity in the Dry Valleys, only one species of nematode was observed at Cape Royds (*Panagrolaimus davidi*) (Porazinska *et al*. 2002). The very high-nutrient soils at Cape Royds lead to low biodiversity of soil organisms, making the Area susceptible to local and global human disturbance. Additionally, Cape Royds serves as a comparison for habitats under investigation in the McMurdo Dry Valleys.

There is little lichen growth within the Area, although different lichen growth forms (crustose, foliose and fruticose) are found in other parts of Cape Royds, distributed in three distinct zones believed to result from marine aerosol and snow accumulation patterns (Broady 1988, 1989).

Human activities and impact

Changes to the population of Adélie penguins at Cape Royds attributed at least in part to human visitation and helicopter movements is discussed in the section above on breeding birds.

Cape Royds is a popular destination for recreational visits from McMurdo Station (US) and Scott Base (NZ), particularly early in the season when travel to the site is possible by vehicle over sea ice. Such visits are carefully controlled by national authorities, and entry to protected areas are strictly by permit. Cape Royds is one of the most popular tourist sites in the Ross Sea, with 501 passengers landing in 2004/05, 390 in 2005/06, and 377 in 2006/07 (IAATO data). Most station personnel and tourists travelling to Cape Royds visit Shackleton's Hut (Historic Site & Monument No.15 and ASPA No.157), located 170m northeast of the colony, as well as the penguin viewing areas immediately to the north and east of the existing boundary, close to Pony Lake. Visits are closely supervised and visitors are well-briefed, and the boundaries of the Area are generally respected.

6(ii) Restricted and managed zones within the Area

None.

6(iii) Structures within and near the Area

Shackleton's Hut (ASPA No. 157 and Historic Site and Monument No. 15) (166°10'06.4"E, 77°33'10.7"S) is situated approximately 70m from the NE boundary sign of the terrestrial component of the Area, 100m northeast of which is a small research shelter (New Zealand) (166°10'10.6"E, 77°33'07.5"S) (Map 2). Two survey markers are present within the Area – marker IT2 is on the northern boundary of the terrestrial part of the Area and is described above, while marker IT3 (166°09'52.7"E, 77°33'19.7"S) (also an iron tube embedded in the ground) is 45m NW of Flagstaff Point. Relics at the site of a small depot from the time of Shackleton's voyages are present in a small embayment on the west side of the penguin nesting area (166°09'35.2"E, 77°33'14.3"S: Map 2). The depot should not be disturbed except by permit for conservation or management purposes.

6(iv) Location of other protected areas within close proximity of the Area

The nearest protected areas to Cape Royds are Backdoor Bay (ASPA No.157 and HSM No.15) which is adjacent to and shares the northern boundary of the Area, Cape Evans (ASPA No.155) 10km to the south, Tramway Ridge (ASPA No.130) close to the summit of Mount Erebus situated 20km east, New College Valley (ASPA No.116) 35km to the north at Cape Bird, and Arrival Heights (ASPA No.122) which is adjacent to McMurdo Station 35km to the south. Cape Crozier (ASPA No.124) is 75km to the east on Ross Island. Antarctic Specially Managed Area No. 2 McMurdo Dry Valleys is located approximately 70km to the west of Cape Royds.

7. Permit conditions

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a permit to enter the Area are that:

- it is issued for scientific purposes, or for educational purposes that cannot be served elsewhere, or for essential management purposes consistent with plan objectives such as inspection, maintenance or review;
- the actions permitted will not jeopardize the ecological, scientific, educational, or historic values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the permit, or a copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the permit;
- permits shall be issued for a stated period.

7(i) Access to and movement within the Area

Within the terrestrial part of the Area access shall be on foot and vehicles are prohibited. Within the marine part of the Area, access should be by foot or vehicle when sea-ice is present, or by ship or small boat during open water periods. Access into the Area should be from the direction of the helicopter landing site, and if arriving over the sea ice or by boat, then access should be from the embayment below and east of the helicopter landing site from the NW shore of Backdoor Bay (Maps 1 and 2).

Landing by aircraft within the Area is prohibited. Overflight below 610m (~2000ft) above ground level is prohibited except when operationally necessary for scientific purposes. Helicopters should land throughout the year at the Primary landing site (166°10'22.9"E, 77°33'03.5"S), 250m northeast of the northern extent of Pony Lake (Map 2).

Foot traffic within the Area should be kept to the minimum necessary consistent with the objectives of any permitted activities. Permitted visitors should keep to the natural penguin access routes through the colony and not approach occupied nests except as required for scientific or management purposes. Access to the marine component of the Area should generally avoid the main seaward access routes used by the penguins.

7(ii) Activities that are or may be conducted in the Area, including restrictions on time or place

- Scientific research that will not jeopardize the ecosystem or scientific values of the Area;
- activities with educational aims that cannot be served elsewhere;
- activities with the aim of preserving or protecting historic resources within the Area;
- Essential management activities, including monitoring and inspection.

7(iii) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit and, with the exception of permanent survey markers and signs, permanent structures or installations are prohibited;

- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be made of materials that pose minimal risk of contamination of the Area;
- Installation (including site selection), maintenance, modification or removal of structures shall be undertaken in a manner that minimizes disturbance to flora and fauna.
- Removal of specific equipment for which the permit has expired shall be the responsibility of the authority which granted the original Permit, and shall be a condition of the permit.

7(iv) Location of field camps

Camping within the terrestrial part of the Area is prohibited. A field campsite exists 175m northeast of the Area adjacent to the New Zealand shelter (Map 2). Camping within the marine part of the Area when sea ice is present is allowed by permit. Such camps should avoid the penguin approach routes within 200m of the breeding colony, but are otherwise not restricted to a particular location.

7(v) Restrictions on materials and organisms that can be brought into the Area

- No living animals, plant material, microorganisms or soils shall be deliberately introduced into the Area, and the precautions listed below shall be taken against accidental introductions;
- To help maintain the ecological and scientific values at Cape Royds visitors shall take special precautions against introductions. Of concern are pathogenic, microbial, invertebrate or plant introductions sourced from other Antarctic sites, including stations, or from regions outside Antarctica. Visitors shall ensure that sampling equipment or markers brought into the Area are clean. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including backpacks, carry-bags and tents) shall be thoroughly cleaned before entering the Area.
- In view of the presence of breeding birds at Cape Royds, no poultry products, including products containing uncooked dried eggs, including wastes from such products, shall be released into the Area;
- No herbicides or pesticides shall be brought into the Area;
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted;
- Fuel, food, and other materials are not to be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted;
- All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of their introduction into the environment is minimized;

- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

7(vi) Taking or harmful interference with native flora or fauna

Taking or harmful interference of native flora and fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II by the appropriate national authority specifically for that purpose.

7(vii) Collection or removal of anything not brought into the Area by the permit holder

- Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs.
- Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed from any part of the Area, unless the impact of removal is likely to be greater than leaving the material *in situ.* If this is the case the appropriate authority should be notified.
- Unless specifically authorized by permit, visitors are prohibited from interfering with or from handling, taking or damaging any historic artifacts found within the Area. Any new artifacts observed should be notified to the appropriate national authority. Relocation or removal of artifacts for the purposes of preservation, protection or to re-establish historical accuracy is allowable by permit.

7(viii) Disposal of waste

All wastes shall be removed from the Area.

7(ix) Measures that are necessary to ensure that the aims and objectives of the management plan can continue to be met

1. Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities, which may involve the collection of limited samples for analysis or review, or for protective measures.
2. Any specific sites of long-term monitoring shall be appropriately marked.

7(x) Requirements for reports

- Parties should ensure that the principal holder of each permit issued submit to the appropriate authority a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of Resolution 2 (1998)(CEP I).
- Parties should maintain a record of such activities, and, in the annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in

any review of the Management Plan and in organizing the scientific use of the Area.

- The appropriate authority should be notified of any activities/measures undertaken, and/or of any materials released and not removed, that were not included in the authorized permit.

References

Ainley, D.G. 2002. The Adélie penguin: bellwether of climate change. Columbia University Press, New York.

Ainley, D.G., Ballard, G., Ackley, S., Blight, L.K., Eastman, J.T., Emslie, S.D., Lescroël, A., Olmastroni, S., Townsend, S.E., Tynan, C.T., Wilson, P. & Woehler, E. 2007. Paradigm lost, or is top-down forcing no longer significant in the Antarctic marine ecosystem? *Antarctic Science* **19**(3): 283–290.

Ainley, D.G., Ballard, G., Barton, K.J. & Karl, B.J. 2003. Spatial and temporal variation of diet within a presumed metapopulation of Adélie penguins. *Condor* **105**: 95–106.

Ainley, D.G., Clarke, E.D., Arrigo, K., Fraser, W.R., Kato, A., Barton, K.J. & Wilson, P.R. 2005. Decadal-scale changes in the climate and biota of the Pacific sector of the Southern Ocean, 1950s to the 1990s. *Antarctic Science* **17**: 171–82.

Ainley, D.G., Morrell, S.H. & Wood R. C. 1986. South Polar skua breeding colonies in the Ross Sea region, Antarctica. *Notornis* **33**(3): 155–63.

Ainley, D.G., Ribic, C.A., Ballard, G., Heath, S., Gaffney, I., Karl, B.J., Barton, K.J., Wilson, P.R. & Webb, S. 2004. Geographic structure of Adélie penguin populations: overlap in colony-specific foraging areas. *Ecological Monographs* **74**(1):159–78.

Arrigo, K. R., van Dijken, G.L., Ainley, D.G., Fahnestock, M.A. & Markus, T. 2002. Ecological impact of a large Antarctic iceberg. *Geophysical Research Letters* **29**(7): 1104.

Barry, J. 1988. Hydrographic patterns in McMurdo Sound, Antarctica and their relationship to local benthic communities. *Polar Biology* **8**: 377–91.

Blackburn, N., Taylor, R.H. & Wilson, P.R. 1991. An interpretation of the growth of the Adelie penguin rookery at Cape Royds, 1955-1990.New Zealand Journal of Ecology **15**(2): 117-21.

Broady PA 1987. Protection of terrestrial plants and animals in the Ross Sea regions, Antarctica. *New Zealand Antarctic Record* **8** (1): 18-41.

Broady PA 1988. Broadscale patterns in the distribution of aquatic and terrestrial vegetation at three ice-free regions on Ross Island, Antarctica. In Vincent, W. & Ellis-Evans, C. (eds) *High latitude limnology*. Kluwer, Dordrecht. *Developments in Hydrobiology* **49**: 77-95.

Broady PA 1989. The distribution of *Prasiola calophylla* (Carmich.)Menegh. (Chlorophyta) in Antarctic freshwater and terrestrial habitats. *Antarctic Science* **1** (2): 109-18.

Brown, A., McKnight, D.M., Chin, Y.P., Roberts, E.C. & Uhle, M. 2004. Chemical characterization of dissolved organic material in Pony Lake, a saline coastal pond in Antarctica. *Marine Chemistry* **89** (1-4): 327-37.

Cowan, D.A. & Casanueva, A. 2007. Stability of ATP in Antarctic mineral soils. *Polar Biology* **30** (12): 1599-1603.

Jacobs, S.S., Amos, A.F. &. Bruchhausen, P.M. 1970. Ross Sea oceanography and Antarctic bottom water formation. *Deep-Sea Research* **17**: 935–62.

Martin, L. 1991. Cumulative environmental change: case study of Cape Royds, Antarctica. Unpublished M.Sc. thesis, University of Auckland.

Porazinska, D.L., Wall, D.H. &Virginia R.A. 2002. Invertebrates in ornithogenic soils on Ross Island, Antarctica. *Polar Biology* **25** (8): 569-74.

Sladen, W.J.L. & Leresche, R.E. 1970. New and developing techniques in Antarctic ornithology. In Holdgate, W.M. (ed) *Antarctic ecology I*. Academic Press, London: 585-96.

Stonehouse, B. 1963. Observations on Adélie penguins (*Pygoscelis adeliae*) at Cape Royds, Antarctica. *Proceedings XIIIth International Ornithological Congress, 1963:* 766-79.

Stonehouse, B. 1965. Counting Antarctic animals. *New Scientist* (July 29): 273-76.

Taylor, R.H. & Wilson, P.R. 1990. Recent increase and southern expansion of Adelie penguin populations in the Ross Sea, Antarctica, related to climatic warming. *New Zealand Journal of Ecology* **14**: 25-29.

Taylor, R.H., Wilson, P.R. & Thomas, B.W. 1990. Status and trends of Adélie penguin populations in the Ross Sea region. *Polar Record* **26** (159): 293-304.

Thomson, R.B. 1977. Effects of human disturbance on an Adélie penguin rookery and measures of control. In Llano, G.A. (ed) *Adaptations within Antarctic ecosystems. Proceedings of the Third SCAR Symposium on Antarctic Biology*. Smithsonian Institution, Washington, DC: 1177-80.

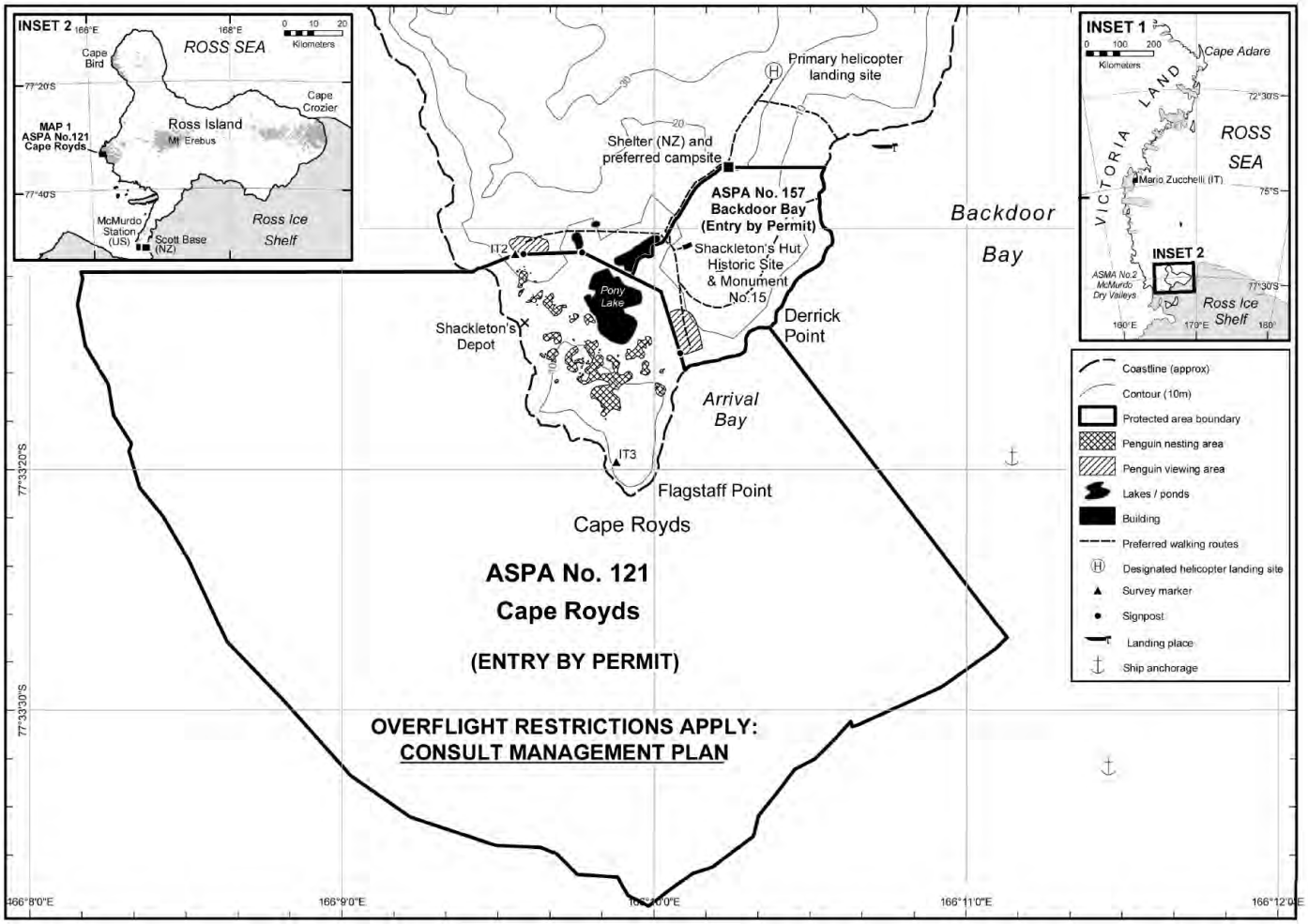
West, W. & West, G.S. 1911. Freshwater algae. *Reports on the scientific investigations: Biology, by the British Antarctic Expedition 1907-1909* **1:** 263-298; Plates 24-26.

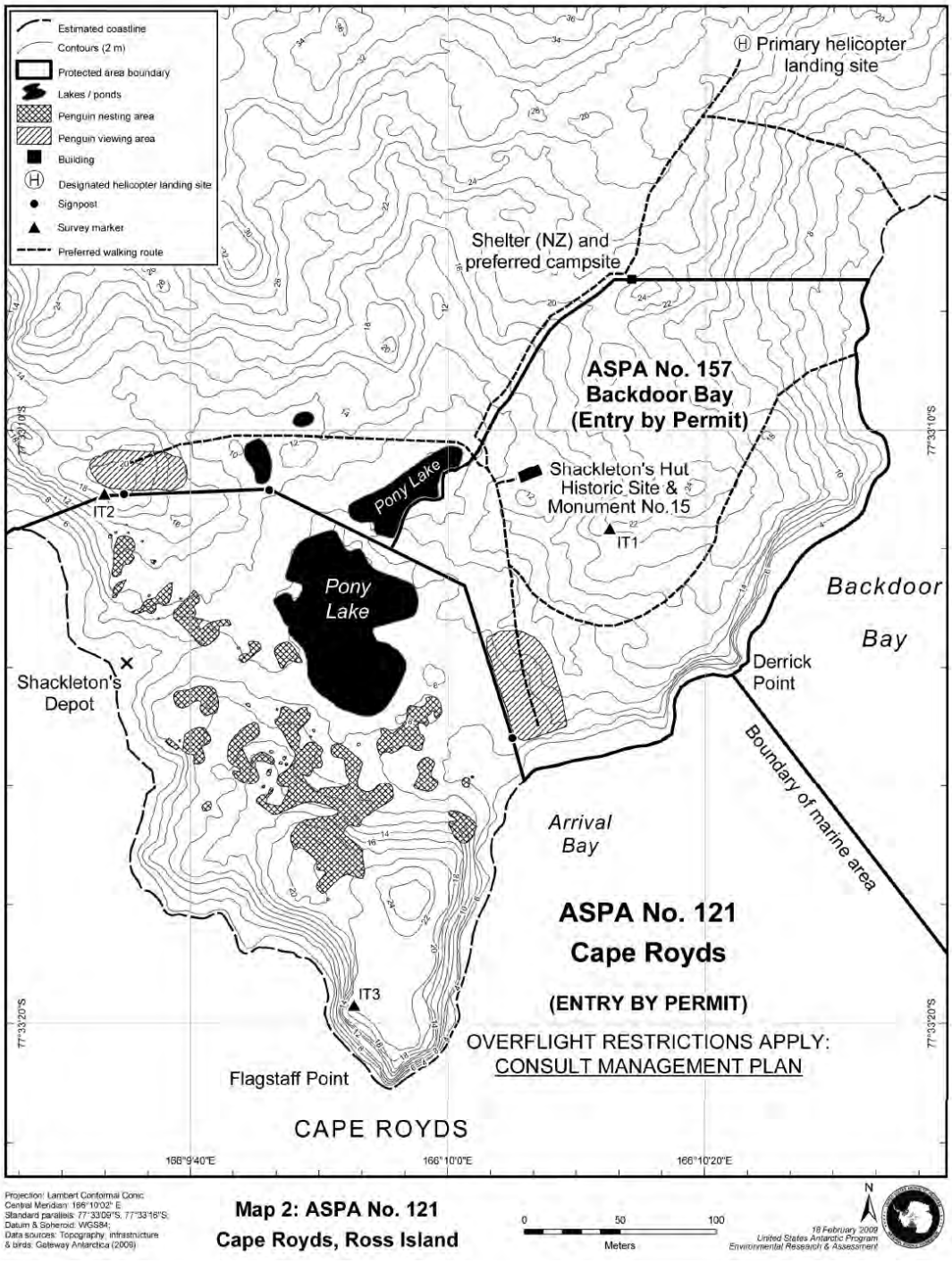
Wilson, P.R., Ainley, D.G., Nur, N. Jacobs, S.S., Barton, K.J.., Ballard, G. & Comiso, J.C., 2001. Adélie penguin population change in the Pacific sector of Antarctica: relation to sea-ice extent and the Antarctic Circumpolar Current. *Marine Ecology Progress Series* **213**: 301-09.

Woehler, E.J. (ed) 1993. *The distribution and abundance of Antarctic and subantarctic penguins*. SCAR, Cambridge.

Young, E.C. 1962a. The breeding behaviour of the South Polar skua *Catharacta maccormicki*. *Ibis* **105** (2): 203–33.

Young, E.C. 1962b. Feeding habits of the South Polar skua *Catharacta maccormicki*. *Ibis* **105** (3): 301–18.


INSET 2
ROSS SEA
Cape Bird
Cape Crozier
MAP 1
ASPA No.121
Cape Royds
Ross Island
Mt Erebus
McMurdo Station (US)
Scott Base (NZ)
Ross Ice Shelf
Primary helicopter landing site
Shelter (NZ) and preferred campsite
ASPA No. 157
Backdoor Bay
(Entry by Permit)
Shackleton's Hut
Historic Site
& Monument
No.15
Backdoor
Bay
IT2
Pony Lake
Shackleton's Depot
Derrick Point
Arrival Bay
IT3
Flagstaff Point
Cape Royds
ASPA No. 121
Cape Royds
(ENTRY BY PERMIT)
OVERFLIGHT RESTRICTIONS APPLY:
CONSULT MANAGEMENT PLAN
77°32'0"S
77°33'0"S
166°8'0"E
166°9'0"E
166°10'0"E
166°11'0"E
166°12'0"E
INSET 1
Cape Adare
VICTORIA LAND
ROSS SEA
Mario Zucchelli (IT)
INSET 2
ASMA No.2 McMurdo Dry Valleys
Ross Ice Shelf
Coastline (approx)
Contour (10m)
Protected area boundary
Penguin nesting area
Penguin viewing area
Lakes / ponds
Building
Preferred walking routes
Designated helicopter landing site
Survey marker
Signpost
Landing place
Ship anchorage
Projection: Lambert Conformal Conic
Central Meridian: 166°10'02" E;
Standard parallels: 77°33'14"S, 77°33'26"S;
Datum & Spheroid: WGS84;
Data source:
Topography, infrastructure & birds: Gateway Antarctica (2009)
Map 1: ASPA No. 121 Cape Royds, Ross Island
Boundaries and topography
0 100 200
Meters
N
18 February 2009
United States Antarctic Program
Environmental Research & Assessment


Estimated coastline
Contours (2 m)
Protected area boundary
Lakes / ponds
Penguin nesting area
Penguin viewing area
Building
Designated helicopter landing site
Signpost
Survey marker
Preferred walking route
Primary helicopter landing site
Shelter (NZ) and preferred campsite
ASPA No. 157
Backdoor Bay
(Entry by Permit)
Shackleton's Hut
Historic Site &
Monument No.15
IT1
IT2
Pony Lake
Pony Lake
Backdoor Bay
Derrick Point
Shackleton's Depot
Boundary of marine area
Arrival Bay
ASPA No. 121
Cape Royds
(ENTRY BY PERMIT)
OVERFLIGHT RESTRICTIONS APPLY:
CONSULT MANAGEMENT PLAN
IT3
Flagstaff Point
CAPE ROYDS
77°33'10"S
77°33'20"S
166°9'40"E
166°10'0"E
166°10'20"E
Projection: Lambert Conformal Conic
Central Meridian: 166°10'02" E
Standard parallels: 77°33'06"S, 77°33'16"S;
Datum & Spheroid: WGS84;
Data sources: Topography, infrastructure & birds: Gateway Antarctica (2008)
Map 2: ASPA No. 121
Cape Royds, Ross Island
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18 February 2009
United States Antarctic Program
Environmental Research & Assessment

Measure 6 (2009)

Antarctic Specially Protected Area No 125 (Fildes Peninsula, King George Island, South Shetland Islands): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation IV-12 (1966), which designated Fildes Peninsula, King George Island, South Shetland Islands as Specially Protected Area ("SPA") No 12;
- Recommendation V-5 (1968), which revised the description of SPA 12;
- Recommendation VIII-2 (1975), which terminated Recommendation V-5 and Recommendation IV-12;
- Recommendation VIII-4 (1975), which renamed and renumbered SPA 12 as Site of Special Scientific Interest (SSSI) No 5 and annexed a management plan for the site;
- Recommendation X-6 (1979), which extended the expiry date of SSSI 5 from 30 June 1981 to 30 June 1985;
- Recommendation XII-5 (1984), which extended the expiry date of SSSI 5 from 30 June 1985 to 31 December 1985;
- Recommendation XIII-7 (1985), which extended the expiry date of SSSI 5 from 31 December 1985 to 31 December 1991;
- Recommendation XVI-7 (1991), which extended the expiry date of SSSI 5 until 31 December 2001;
- Measure 3 (2001), which extended the expiry date of SSSI 5 from 31 December 2001 to 31 December 2005;
- Decision 1 (2002), which renamed and renumbered SSSI 5 as Antarctic Specially Protected Area No 125;
- Measure 4 (2005), which extended the expiry date of ASPA 125 from 31 December 2005 to 31 December 2010;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 125;

Desiring to replace the existing Management Plan for ASPA 125 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 125 (Fildes Peninsula, King George Island, South Shetland Islands), which is annexed to this Measure, be approved;

2) the Management Plan for ASPA 125 annexed to Recommendation VIII-4 (1975) shall cease to be effective.

Management Plan for Antarctic Specially Protected Area No. 125 FILDES PENINSULA, KING GEORGE ISLAND (25 DE MAYO)

(Fossil Hill, Holz Stream (Madera Stream), Glacier Dome Bellingshausen (Collins Glacier), Halfthree Point, Suffield Point, Fossil Point, Gradzinski Cove and Skua Cove)

Introduction

An area of 1.8 km^2 (444,79 acres) in the Fildes Peninsula, King George Island (25 de Mayo), South Shetland Islands archipelago, was proposed as a SPA (Special Protected Area) by Chile four decades ago on the grounds of its uniqueness and paleontological richness. The area was officially designated SPA No 12 at ATCM IV (Santiago, 1966). After 42 years under different statuses (SPA, SSSI and ASPA), and numerous scientific studies, it is necessary to review whether these areas can be considered an ASPA, whether or not they can be defined as "an area designated to protect outstanding environmental, scientific, historic, aesthetic or wilderness values".

Paleontological research conducted in the early 1960s by the Chilean geologist Vladimir Covacevich revealed the existence of avian ichnofossils on Fossil Hill. The proximity of these unique fossils to permanent stations was the principal basis for the designation of SPA No 12. Given that Fildes also harbors areas of paleobotanical richness, SPA No 12 was redesignated SSSI No 5 (Site of Special Scientific Interest) at ATCM VIII (Oslo, 1975). Finally, when Annex V entered into force in May 2002, all previously designated SPAs and SSSIs were included as ASPAs, with ASPA No 125 being created from SSSI No 5.

In this management plan for the ASPA No 125 it is proposed a division of 8 areas, where the old two areas are included in three new ones, but additionally it is proposed five new areas, on the basis of the new findings and research carried out during the last 20 years. Halfthree Point, Skua Cove, Gradzinski Cove, Glacier Dome Bellingshausen (Collins Glacier) and Fossil Point are the new areas, where three of them could provide very relevant information about the evolution of the Upper Cretaceous paleoenvironment of west Antarctica. The extension of the zones has been determined based in paleontological criteria, giving more value to the *in situ* outcrops and the quality and uniqueness degree of the fossil content.

The boundaries for the ASPA No 125 zones contributes to put under protection key fossil outcrops that with complimentary and unique records of the Cretaceous and Eocene times, completing the puzzle of fossiliferous protected areas of Antarctica.

1. Description of values to be protected

Fildes Peninsula, King George Island (25 de Mayo), is one of the areas in Antarctica of greatest paleontological interest, owing to the presence of outcrops with fossil remains of a wide range of organisms, including vertebrate and invertebrate ichnites, and abundant flora with impressions of leaves and fronds, trunks, and pollen grains and spores that date from the

Late Cretaceous to the Eocene. The Cretaceous was a crucial time of vegetation change, due largely to the evolutionary and geographic radiation of angiosperms. Throughout the Late Cretaceous angiosperms progressively infiltrated the pre-existing vegetation, but gymnosperms, ferns and sphenophytes dominated land-plant biomass until the Cenozoic. Also, the Eocene represents the warmest lapse of time since the end-Cretaceous mass extinction. The study of this periods could answer several important scientific questions, were Fildes Peninsula outcrops could be a key.

The Fildes Peninsula Group (Hawkes, 1961) has been defined as the stratigraphic unit. Its basal unit consists of outcrops assigned to the Late Cretaceous (Late Campanian to Early Maastrichtian) and comprises fine intercalations of volconclastic sediments among andesitic rocks with suprajacent limestones, tuffaceous conglomerates, sandstones and clays assigned to the early-mid Eocene (Barton, 1965; Birkenmajer, 1997; Hawkes, 1961; Li & Liu, 1991; Liu *et al.*, 2005; Liu, 1992; Park & Jwa, 1991; Zhou *et al*., 1991). The sequence represents continental environments dominated by vegetation consisting of warm to temperate forest elements. Further, the sequence contains important vestiges of the rapid expansion of angiosperms in the region, as well as of the beginning of Nothofagaceae dominance among the forest components of the Antarctic Flora.

On Fildes Peninsula, at least three locations have continental volcano sedimentary rocks from the Late Cretaceous: Halfthree Point, Skua Cove and Gradzinski Cove. Halfthree Point (62º13'34''S; 58º56'56''W) is located southwest of the Chinese Station "Great Wall". The site is characterized by palynomorphs and leaf impressions deposited in a lacustrine environment (Shen, 1994) and conserved in tuffaceous sedimentary rock, suggesting a warm and humid environment (Cao, 1994). Shen (1994) used Rb-Sr to determine the age of the rocks, 71.3 ± 0.3 Ma. The presence of acritarchs among the microfossils has been interpreted as the sporadic influence of the ocean on the depositional environment, even though palynomorphs indicate a primarily continental environment. Nearly 80% of the palynomorphs pertain to cryptogamic flora (fungi, bryophytes and ferns) and 5% to the gymnosperms (*Araucariaceae* and *Podocarpaceae*). Angiosperm pollen grains are few in number; these are dominated by the morphogenus *Nothofagidites* but contain the species *N. senectus*, a primitive form of *Nothofagus*, which underscores the Cretaceous age of the sequence. Among the megafossils found, the most important impressions are of *Sphenopteris*, *Podocarpaceae* and dicotyledons, such as *Nothofagus*.

Skua Cove or Skuabucht, as the official SCAR-CGA name Ref. No. 13455 (62º10'44''S; 58º58'59''W), situated northwest of the Frei Station airport, is considered the most exceptional Late Cretaceous outcrop on Fildes Peninsula, because of the degree of conservation of its megaflora, and the uniqueness of the flora, which contains at least two endemic morphospecies. But the access to the outcrops and in situ fossils is very difficult. In this section, tuffaceous sandstones with paleosoils are found subjacent to limestone beds with carbonate lenses, impressions and palynomorphs, which in turn lie subjacent to conglomerates of fossil wood remains. A late andesitic unit has been dated to 57.7 Ma (Fensterseifer *et al*. 1988). Megafossil remains of pteridophytes (*Culcita*, *Osmundaceae*, *Thyrsopteris*), gymnosperms (*Phyllocladus* and *Podocarpus*), and anemophilous dicotyledenous angiosperms pertaining to distinct taxa, including Monimiaceae, Nothofagaceae, Myricaceae, among others, have been found.

Gradzinski Cove, also known as Bahía Cormoranes (62º09'12''S; 58º56'16''W) is an oblong shaped bay northwest of the peninsula, and west of the southwest margin of Glacier Dome Bellingshausen (Collins glacier). Here, small outcrops are confined within a 50 meter span, and no more than 7 meters thick composed of tuffaceous-sedimentary rocks -primarily clays, lutites, and sandstones. Although the conservation of impressions is average, the site has a

good record of palynomorphs. More than 50% of these are represented by angiosperm pollen, among which there is a large presence of *Nothofagidites*; some 40% and 10% are represented by cryptogams and gymnosperms, respectively (Dutra & Batten 2000). This location corresponds to Price Point as indicted by Dutra and Batten (2000).

There is general agreement among geologists and paleobiologists about the importance of the Fildes Peninsula for understanding geological, biogeographical, and evolutionary events during the Eocene. The Fildes outcrops have already led to the rejection of models postulating cold and warm humid climates. The paleoassemblages discovered in the Fildes outcrops have permitted the reconstruction of a vegetation type very similar to that of the Valdivian Forest in southern Chile, that is, a temperate flora composed of elements commonly found in the modern floras of New Zealand, Australia, and South America, including Araucariaceae, Podocarpaceae, Nothofagaceae, Cunoniaceae, Lauraceae, Winteraceae and Proteaceae. In addition, important vertebrate and invertebrate ichnites were found on the Fildes Peninsula, shedding light on a time period of recent and growing interest, the Eocene. Interest stems from the fact that the largest temperature increase in the last 60 Ma occurred during this period.

There are two extensive zones with important fossil deposits, Fossil Hill (62º12’22’’S; 58º59’03’’W) and Glacier Dome Bellingshausen (Collins glacier) (62º10’11’’S; 58º55’18’’W). The stratigraphic sequences are correlated. The middle sequence of Glacier Dome Bellingshausen (Collins glacier) corresponds to the central portion of the Fossil Hill sequence, in what is denominated Fossil Hill Formation. It consists of alternating layers of volcanic breccia, lavas, tuffs, tuffaceous sandstones, and carbonate lenses, adding to a total of 13 meters thick. Fossil Hill is one of the most famous paleontological sites in Antarctica, because of the presence of leaf and fossil wood impressions, as well as invertebrate and at least four types of avian ichnites (fossilized footprints) (Covacevich & Lamperein 1970, 1972; Covacevich & Rich 1977, 1982; Li & Zhen 1994), including one phororacoid, a giant bird that occupied the niche of raptors during the Eocene. In addition, the flora of Glacier Dome Bellingshausen (Collins glacier) consists of abundant silicified trunk remains that are exposed at the front of the receding Glacier Dome Bellingshausen (Collins glacier), which limits the Fildes peninsula on the north. Internal conservation of the trunks is extraordinary, allowing study of the anatomical superstructure and dendroecological analyses to be used in their recognition and identification.

Smaller outcrops exist in Holz Stream, also known in scientific literature as Madera Stream (62º11’27’’S; 58º56’19’’W), Suffield Point (62º11’34’’S; 58º55’16’’W) and Fossil Point (62º11’16’’S; 58º54’30’’W). The latter two, in the northeastern section of the peninsula, near Artigas Station, have silicified trunks and tuffaceous sediments that may link them with the middle unit of the Fossil Hill Formation. In contrast, at the head of the Holz Stream (Madera Stream), to the west of the Bellingshausen Station tanks, on the eastern central coast of the peninsula, the trunks either exist *in situ* or fragments have been transported downstream. These outcrops have tentatively been assigned to the Eocene.

2. Aims and objectives

Management of Fildes Peninsula aims to:

- protect the paleontological values because of their uniqueness and the ease with which scientific research can be conducted in the Area;

- facilitate non-destructive paleontological and geological scientific research in the Area;
- create a public exhibition and improve understanding of the values protected in ASPA No 125, and
- promote education and awareness about the values of this remarkable area.

3. Management activities

The following management activities will be carried out to protect the values of the Area:

- When visitors are approaching the facilities of the Fildes Peninsula (stations, bay and airport) and upon their arrival, all persons should be informed of the existence of ASPA No 125, its location and the relevant provisions of the management plan.
- There shall be copies of the management plan and maps of the Area that clearly indicate its location on all units conducting logistical and scientific activities on Fildes Peninsula, specially in all the stations, bases and logistic facilities of the Fildes Peninsula.
- The transit to reach the zones will be developed following only the pre-existent demarked routes in Fildes Peninsula. In the places where there are not a pre-existent demarked routes, the transit must developed only by foot.
- On the access routes to Fossill Hill, Halfthree Point, Skua Cove, Gradzinski Cove, Holz Stream (Madera Stream), Glacier Dome Bellingshausen (Collins glacier), Suffield Point and Fossil Point, signs shall be erected that show the boundaries of the Area and clearly indicate restricted access ("Entry forbidden. Antarctic Specially Protected Area"), so as to avoid accidental entry into the Area.
- Signs installed in the Area should be secure, maintained in good condition and not harm the environment.
- The management plan shall be revised periodically to ensure protection of the values of the ASPA.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: Location of Fildes Peninsula, King George Island (25 de Mayo), South Shetland Islands Archipelago.

Map 2: Boundaries of Antarctic Specially Protected Area No 125, Fildes Peninsula.

Map 3: Location of zone 125a, Fossil Hill.

Map 4: Location of zone 125b, Holz Stream (Madera Stream).

Map 5: Location of zone 125c, Glacier Dome Bellingshausen (Collins glacier).

Map 6: Location of zone 125d, Halfthree Point.

Map 7: Location of zones 125e and 125f, Suffield and Fossil Points, respectively.

Map 8: Location of zone 125g, Gradzinski Cove.

Map 9: Location of zone 125h, Skua Cove.

6. Description of the Area

i. Geographical coordinates, boundary markers and natural features

GENERAL DESCRIPTION

The Fildes Peninsula is the most extensive coastal area free of snow in summer in King George Island (25 de Mayo), with a length of around 7 km. In general terms, appears as a tableland made up of old coastal landforms, with an average height of 30 m above sea level and rocky outcrops around the 100 meters. It is a territory with its own special characteristics, different from those of the rest of the island, which is covered by the ice from Collins Glacier.

ZONES

This Management Plan consider 8 different zones for the ASPA No 125, four of them located in the southern coast of Fildes Peninsula, two of them in the northern coast, one in the central southern part of Fildes and the last one, in the vicinity of the glacier:

125a: Zone located on Fossil Hill, in the central south part of Fildes Peninsula (see Map 3). It considers an area of 0.568 km^2.

125b: Zone located by Holz Stream (Madera Stream), in the southeast part of Fildes Peninsula (see Map 4). It zone consider two areas crossed by the road that connect Artigas Station with the other Stations in the southern part of the peninsula. The total area compromised is 0.178 km^2 (zone 125b1: 0.104 km^2 and zone 125b2: 0.074 km^2).

125c: Is the buffer zone surrounding the snout of Glacier Dome Bellingshausen (Collins glacier) (Map 5). Compromise an area of 1.412 km^2.

125d: Is the zone Area surrounding Halfthree and Dario Points, facing Maxwell Bay (Fildes Bay) (Map 6). The zone has an area of 0.019 km^2.

125e: It is the zone located at Suffield Point, in front of Maxwell Bay (Fildes Bay) (Map 7). It has an area of 0.024 km^2.

125f: Zone that compromise Fossil Point, facing Maxwell Bay (Fildes Bay) (Map 7), with an area of 0.013 km^2.

125g: Zone located in the northern part of Gradzinski Cove, also known as Biologists Bay, with an access from Klotz Valley (Map 8). The zone is located in the northern coast of Fildes Peninsula and has an area of 0.021 km^2.

125h: The zone in the vicinity of Skua Cove, covered by the Fuschloger beach, in the northern coast of Fildes Peninsula (Map 9). The zone has a total area of 0.117 km^2.

The transit to and from each one of these zones must be developed following only the pre-existent demarked routes in Fildes Peninsula. In the places where there are not a pre-existent demarked routes, the transit must developed only by foot.

PLANT FOSSILS

The palaeobotanical importance of Fildes Peninsula has been remarked by several researches during at least fifty years. A high level of diversity of Pteridophyta and Magnoliophyta could be inferred from the table 1, exhibiting the floral diversity of the Fildes Peninsula Group.

Table 1. Plant fossil taxa (at family taxonomic rank) present in the Upper Cretaceous and Eocene outcrops of Fildes Peninsula.

Principal plant families in the Fildes Peninsula Group					
Sphenophyta	Pteridophyta	Lycophyta	Cycadophyta	Coniferophyta	Magnoliophyta
Equisetaceae	Adiantaceae	Selaginellaceae	Zamiaceae	Araucariaceae	Araliaceae
	Aspleniaceae			Cupressaceae	Caesalpinaceae
	Blechnaceae			Podocarpaceae	Hydrangeaceae
	Cyatheaceae				Malvaceae
	Dicksoniaceae				Poaceae
	Gleicheniaceae				Anacardiaceae
	Hymenophyllaceae				Cochlospermaceae
	Lophosoriaeceae				Cunoniaceae
	Osmundaceae				Dilleniaceae
	Polypodiaceae				Gunneraceae
	Salviniaceae				Icacinaceae
	Schizeaceae				Lauraceae
					Loranthaceae
					Melastomataceae
					Monimiaceae
					Myricaceae
					Myrtaceae
					Nothofagaceae
					Proteaceae
					Rhamnaceae
					Sapindaceae
					Sterculiaceae

Source: Cao 1989, 1994; Czajkowski & Rosler 1986; Dutra 2001; Dutra & Batten 2000; Gazdzicki & Wrona 1982; Li 1991, Li & Shen 1989; Li 1994; Li & Zhou 2007; Li & Shen 1994; Liu 1990; Lyra 1986; Palma-Heldt 1987; Perea *et al.* 2001; Poole *et al.* 2000; Poole *et al*. 2001; Shen 1989, 1994, 1992a, 1992b, 1994a, 1994b; Song & Cao 1994; Sun *et al*. 2002a; Sun *et al*. 2002b; Sun *et al*. 2005; Tatur & Del Valle 1986; Torres & Meon 1993; Torres & Meon 1990; Troncoso 1986; Vakhrameev 1991; Xue 1994; Xue *et al*. 1996; Zhang & Wang 1994; Zhou & Li 1994a; Zhou & Li 1994b; Zhou & Li 1994c.

PLANTS

The amount and type of terrestrial vegetation depends on relief, soil moisture content, and the degree of soil enrichment from birds and seals. The Region is home to two flowering plants - Antarctic hair grass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*). Some areas are densely covered by moss carpets. A total of about 175 lichen and 40 moss species have been identified in the Region (Peter *et al.* 2008).

Freshwater phytoplankton (Chlorophyceae-diatomes) biomass is low. The zooplankton is primarily composed of *Pseudoboeckella poppei* and *Branchinecta gaini* (Bonner & Smith 1985). The shoreline assemblages are made up of important communities of *Nacella concinna* and algae populations, such as *Phyllogigas*, *Desmarestia*, *Leptogomia*, *Iridaea*, *Gigartina*, *Ascoseira* and *Phaerus* (Bonner & Smith 1985).

VERTEBRATES

12 bird species have been identified on the Peninsula, including the Brown skua (*Catharacta antarctica lonnbergi*), South polar skua *(Catharacta maccormicki)*, Snowy sheathbill (*Chionis alba*), Cape petrel (*Daption capense*), Kelp gull (*Larus dominicanus*), Southern giant petrel (*Macronectes giganteus*), Wilson's storm petrel (*Oceanites oceanicus*), Blackbellied storm petrel (*Fregetta tropica*), Adelie penguin (*Pygoscelis adeliae*), Chinstrap penguin (*P. antarctica*), Gentoo penguin (*P. papua*) and Antarctic tern (*Sterna vittata*). Of the mammal species, the most important are the Weddell seals (*Leptonychotes weddellii*) and the Southern elephant seals (*Mirounga leonina*). At the end of the summer, Antarctic fur seals (*Arctocephalus gazella*) are found in large numbers. Antarctic fur seals pups had been recorded in the northern coast of Fildes Peninsula; nevertheless, the breeding success has not been informed. Occasionally, Leopard seals (*Hydrurga leptonyx*) visit the area.

ii. Special and managed zones within the Area

There are no special zones within the Area.

iii. Structures within and near the Area

There are no structures in the Area.

iv. Location of other protected areas within close proximity of the Area

There are four protected areas in Nelson and King George (25 de Mayo) Islands, close to Fildes Peninsula. The nearest one is Ardley Island, ASPA No 150, about 1 km east from Fossil Hill and 2 km south of Suffield Point. ASPA No 128, on the western shore of Admiralty Bay, is located about 25.3 km northeast of Fildes Peninsula. Also in King George Island (25 de Mayo), ASPA No 132, Potter Peninsula, is approximately 15 km southeast of Fildes Peninsula. Finally, Harmony Point, ASPA No 133, is located around 18 km southwest of Fossil Hill.

7. Permit conditions

Entry into the Area is prohibited except in accordance with a permit issued by an appropriate national authority.

Conditions for issuing a Permit to enter the Area are that:

- permits will be issued only for the purposes specified in section 2 of the management plan;
- permits shall be issued for a stated period;
- the actions permitted will not jeopardize the natural ecological or scientific values of the Area;
- during the stated period, scientific staff present within the Area must carry the permit or an authorized copy thereof;
- visits to the Area shall be allowed, with an authorization of their own national Antarctic representative. Visits shall be recorded in a visitor's book at Escudero Scientific Station (Chile), specifying the date and purpose of the visit, as well as the number of visitors.

- A report of the visit shall be presented to the appropriate national authority when the permit ends or at the end of the season.
- Permits shall be issued for scientific research that is justified and that guarantees minimal impact to the outcrops. Duplication of research should be avoided.
- Permits issued for visits to or stays in the Area shall specify the extent and duration of the activities and the maximum number of persons authorized to visit the area.

i. Access to and movement within the Area

Access to the ASPA shall be on foot, and the movement within the Area shall be only on foot.

On foot

Only permit holders with authorized entry into the Area shall be permitted to access it on foot.

Pedestrian traffic is restricted to the trails indicated on the maps, which are annexed to this management plan. The access to each zone is shown in the maps.

Vehicle access

Entry into the Area by vehicles of any kind is strictly forbidden.

ii. Activities that are or may be conducted within the Area, including restrictions on time or place

- Research on fossil outcrops and other environmental studies that cannot be conducted elsewhere;
- Essential management activities, including monitoring;
- Educational visits to the Fildes paleontological museum in the Chilean Station "Profesor Julio Escudero", located outside the ASPA 125, but with a collection of fossils from this area.

iii. Installation, modification or removal of structures

Installation of structures or scientific equipment in the Area shall only be permitted for scientific or management purposes, and must be approved by the appropriate national authority.

All installations shall be removed when they are no longer required.

iv. Location and regulation of field camps

Camping is not permitted in the Area, given access to facilities at the stations.

v. Restrictions on materials and organisms that can be brought into the Area

No living organisms shall be introduced into the Area. Chemicals not required for the scientific purposes specified in the permit shall not be brought into the Area. Chemicals introduced for research purposes shall be removed from the Area before the permit expires.

Fuel shall not be stored in the Area.

All materials introduced shall be for a stated period only, shall be stored and handled so that risk of their introduction into the environment is minimized, and shall be removed at or before the conclusion of the stated period. Permanent storage installations shall not be erected in the Area.

vi. Taking or harmful interference with native flora or fauna

Taking or harmful interference with native flora and fauna is prohibited, except in accordance with a permit issued under Arcticle 3 of Annex II to the Madrid Protocol. Where the activity involves removing or tampering with native flora or fauna, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica should be used as a minimum standard.

vii. Collection or removal of anything not brought into the Area by the permit holder

Material not brought into the Area by the permit holder may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs. Removal of dead biological specimens or geological samples for scientific purposes must not exceed levels that affect the other species or values in the Area, and may only be taken for scientific studies.
Human waste produced due the development of any activities, shall be removed from the Area.

viii. Disposal of waste

All waste must be removed from the area.

ix. Measures that are necessary to ensure that the aims and objectives of the management plan can continue to be met

- Permits may be granted to enter the Area to conduct scientific research, biological monitoring and site inspection activities, which may involve the collection of limited samples of rocks for scientific purposes.
- To help maintain the ecological and scientific values of the Area, visitors shall take special precautions against the introduction of non-native materials and organisms.
- Long-term monitoring sites should be appropriately marked on the map and at the site.
- At the Artigas, Bellingshausen, Escudero, Frei and Great Wall stations, a copy of the management plan and a map showing the boundaries of the ASPA should be placed in full view. Free copies of the management plan shall be made available.

x. Requirements for reports

- Parties should ensure that the principal holder of each permit issued submit to the appropriate authority a report describing the activities undertaken.
- The report shall include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas, appended to Resolution 2 (1998). Parties should maintain a record of such activities, and, in the annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction.
- Said descriptions should be in sufficient detail to allow evaluation of the effectiveness of the Management Plan.
- Parties shall, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organizing the scientific use of the Area.

8. References

Barton C. M. 1965. The Geology of South Shetland Islands. III. The stratigraphy of King George Island. Scientific Reports of the British Antarctic Survey, 44: 1-33.

Birkenmajer, K. 1997. Geology of the northern of King George Island, South Shetland Islands (West Antarctica). Geological results of the Polish Antarctic expeditions, edited by K. Birkenmajer. Studia Geologica Polonica 110(12): 7-26.

Bonner, W. & L. Smith. 1985. Conservation areas in the Antarctica. Scientific Committee on Antarctic Research, pp.139-146.

Cao, L. 1989. Late Cretaceous sporopollen flora from Half Three Point on Fildes Peninsula of King George Island, Antarctica. International Symposium on Antarctic Research. Proceedings, p.151-156.

Cao, L. 1994. Late Cretaceous palynoflora in King George Island of Antarctica with reference to its paleoclimatic significance. Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica). Edited by Y.B. Shen, p.51-83. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Covacevich, V. & C. Lamperein. 1970. Ichnites of the Fildes Peninsula, King George Island, South Shetland Islands, Antarctica. Serie Científica INACH 1(1): 55-74.

Covacevich, V. & C. Lamperein. 1972. Ichnites from Fildes Peninsula, King George Island, South Shetland Islands (in Antarctic geology and geophysics). International Union of Geological Sciences. Series B, 1: 71-74.

Covacevich, V. & P.A. Rich. 1977, New bird ichnites from Fildes Peninsula, King George Island, West Antarctica. Antarctic Geoscience. 3rd Symposium, Antarctic Geology and Geophysics, p. 245–254.

Covacevich, V. & P.V. Rich. 1982. New bird ichnites from Fildes Peninsula, King George Island, Antarctica. International Union of Geological Sciences. Series B, 4: 245-254.

Czajkowski, S. & O. Rosler. 1986. Fossil plants from the Fildes Peninsula, King George Island: morphology of leaf impressions [Plantas fósseis da Península Fildes, Ilha Rei Jorge (Shetland do Sul): morfografia das impressóes foliares]. Anais do Academia Brasileira do Ciencias, 58 (1-Suppl.): 99-110.

Dutra T.L. 2001. Paleoflora da ilha 25 de Mayo, Península Antártica: contribuição à paleogeografia, paleoclima e para a evolução de Nothofagus. Public. Especial Asoc. Paleontol. Argentina, 8: 29-37.

Dutra, T.L. & D. Batten. 2000. Upper Cretaceous floras of King George Island, West Antarctica, and their palaeoenvironmental and phytogeographic implications. Cretaceous Research 21: 181–209.

Fensterseifer, H.C., J.R. Soliani, M.A.F.Hansen & F.L. Trojan.1988. Geologia e estratigrafía da associação de rochas do setor centro-norte da Península Fildes, ilha Rei George, Shetland do Sul, Antártica. Serie Científica INACH, 38: 29-43.

Gazdzicki, A. & R. Wrona. 1982. Paleontological research by the 5th Antarctic Expedition of the Polish Academy of Sciences [Badania paleontologiczne v Polskiej Wyprawy Antarktycznej Polskiej Akademii Nauk (1980-1981)]. Przeglad geologiczny 30(2): 57-61.

Hawkes, D.D. 1961. The geology of the South Shetland Islands. I. The petrology of King George Island. Scientific Reports of the Falkland Islands Dependencies Survey (London) 26. 28 pp. 3 pls.

Hunt, R.J.: Biodiversity and palaeoecological significance of Tertiary fossil floras from King George Island, West Antarctica (2001), University of Leeds. PhD Thesis.

Li, H. 1991. Early Tertiary palaeoclimate of King George Island, Antarctica. Antarctic research (Chinese edition), 3(4): 18-23.

Li, H. & Y. Shen. 1989. Primary study of Eocene flora from the Fildes Peninsula of King George Island, Antarctica. International Symposium on Antarctic Research. Proceedings, p.128-135. Publisher: Tianjin, China Ocean Press. China, Mainland.

Li, H.M. 1994. Early Tertiary Fossil Hill flora from Fildes Peninsula of King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.133-171. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Li H.M. & Z.K. Zhou. 2007. Fossil nothofagaceous leaves from the Eocene of western Antarctica and their bearing on the origin, dispersal and systematics of Nothofagus. Sci China Ser D-Earth Sci, 50(10): 1525-1535.

Li, J.J. & S.N. Zhen. 1994. New materials of bird ichnites from Fildes Peninsula, King George Island of Antarctica and their biogeographic significance. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen., p.239-249. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Li, X.Y. & Y.B. Shen. 1994. Preliminary study on the genesis of Tertiary coal from Fildes Peninsula of King George Island, Antarctica, based on petrographical, chemical and organic geochemical characteristics. In: Stratigraphy and palaeontology of Fildes

Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.251-261. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Li, Z. & X. Liu. 1991. Geological and geochemical evolution of Cenozoic volcanism in central and southern Fildes Peninsula, King George Island, South Shetland Islands. International Symposium on Antarctic Earth Sciences, 5th, Cambridge, Aug. 1987, Proceedings. Edited by M.R.A. Thomson, J.A. Crame, and J.W. Thomson, p.487-491. Publisher: Cambridge, University Press. United Kingdom.

Liu, Q. 1990. Tertiary flora on Fildes Peninsula of King George Island, Antarctica and its environmental significance. Antarctic research, 2(3): 39-45.

Liu, C. 1992. Paleomagnetism of the Late Cretaceous and Early Tertiary rocks from Fildes Peninsula, West Antarctica, and its geotectonic significance. Antarctic research (Chinese edition), 3(1): 40-49.

Liu X.D., L. Sun, X.B. Yin, R. Zhu, Z.Q. Xie & Y.H. Wang. 2005. A preliminary study of elemental geochemistry and its potential application in Antarctic seal palaeoecology. Geochemical Journal, 39(1): 47-59.

Lyra, C.S. 1986. Tertiary sediment palynology at Fildes Peninsula, King George Island, South Shetland Islands, and some paleoenvironmental considerations [Palinologia de sedimentos Terciarios da Península Fildes, Ilha Rei George (Ilhas Shetland do Sul, Antártica) a algumas considerasoes paleoambientais]. Anais do Academia Brasileira do Ciencias. 58(1-Suppl.): 137-147.

Palma-Heldt, S. 1987. Estudio palinológico en el Terciario de islas Rey Jorge y Brabante, territorio insular Antártico. Serie Científica INACH, 36: 59-71.

Park, B.K. & Y.J. Jwa. 1991. Potassium-argon radiometric ages of volcanic rocks from the Fildes Peninsula, King George Island, Antarctica. Journal of the Geological Society of Korea, 27(4): 409-415.

Perea, D., E. Masquelin, M. Verde & R. Guerequiz. 2001. Estratigrafia y paleontologia de "Fossil Hill", Peninsula Fildes, Isla Rey Jorge, Antartida; un nuevo aporte (in Instituto Antartico Uruguayo; actividad cientifica 1998/2000, Anonymous,) Actividad Cientifica - Instituto Antartico Uruguayo, 7 49-56.

Poole, I., R.J. Hunt & D.J. Cantrill. 2001. A fossil wood flora from King George Island; ecological implications for an Antarctic Eocene vegetation. Annals of Botany, 88(1): 33-54.

Poole I, D.J. Cantrill, P. Hayes & J.E. Francis. 2000. The fossil record of Cunoniaceae: new evidence from Late Cretaceous wood of Antarctica. Review of Palaeobotany and Palynology, 111: 127-144.

Poole, I. 2005. Anatomical and Morphological Assessment of Plant Macrofossils from King George Island, Antarctica. In: Peter, H.-U., Buesser, C., Mustafa, O. & Pfeiffer, S. 2008. Risk assessment for the Fildes Peninsula and Ardley Island, and development of management plans for their designation as Specially Protected or Specially Managed Areas. Umweltbundesamt Research Report 203 13 124, UBA-FB 001155e, Texte 20/08.

Peter, H.-U., Buesser, C., Mustafa, O. & Pfeiffer, S. 2008. Risk assessment for the Fildes Peninsula and Ardley Island, and development of management plans for their

designation as Specially Protected or Specially Managed Areas. Umweltbundesamt Research Report 203 13 124, UBA-FB 001155e, Texte 20/08.

Shen, Y. 1989. Recent advances in research on the palaeontology of the Fildes Peninsula, King George Island, Antarctica. International Symposium on Antarctic Research. Proceedings, p.119-127. Publisher: Tianjin, China Ocean Press. China, Mainland.

Shen, Y.B. 1992a. Non-marine Late Cretaceous depositional unit on King George Island, West Antarctica. Antarctic research (Chinese edition), 3(1): 17-24.

Shen, Y.B. 1992b. Discussion on stratigraphic subdivision and nomenclature in Fildes Peninsula, King George Island, Antarctica. Antarctic research (Chinese edition), 4(2): 18-26.

Shen, Y.B. 1994a. Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. State Antarctic Committee, Monograph, No.3, 348p. + plates. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Shen, Y.B. 1994b. Cretaceous and Paleogene biogeography in Antarctic Peninsula and its significance in the reconstruction of Gondwanaland. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.329-348. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Shen, Y.B. 1994. Subdivision and correlation of Cretaceous to Paleogene volcano-sedimentary sequence from Fildes Peninsula, King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.1-36. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Song, Z.C. & L. Cao. 1994. Late Cretaceous fungal spores from King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.37-49. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Sun, L., X. Liu, Z. Xie & J. Zhao. 2002. Palaeoenvironmental records from palaeogene sediments on Fildes Peninsula, Antarctica / Jidi Yanjiu, Chinese Journal of Polar Research, 14(3): 163-173.

Sun, L.G., X.D. Liu, X.B. Yin, Z.Q. Xie, & J.L. Zhao. 2005. Sediments in palaeo-notches; potential proxy records for palaeoclimatic changes in Antarctica. Palaeogeography, Palaeoclimatology, Palaeoecology, 218(3-4): 175-193.

Tatur, A. & R.A. Del Valle. 1986. Paleolimnological and geomorphological investigations on King George Island, 1984-1986 [Badania paleolimnologiczne i geomorfologiczne na Wyspie Krola Jerzego, Antarktyka Zachodnia (1984-1986)]. Przeglad geologiczny, 11(403): 621-626.

Torres, T. & H. Meon. 1990. Preliminary palynological study of the Fossil Hill, Fildes Peninsula, King George Island, Antarctica [Estudio palinológico preliminar de cerro Fósil, peninsula Fildes, isla Rey Jorge, Antártica]. Serie Científica INACH, 40: 21-39.

Torres G., T. & H. Meon. 1993. Lophosoria from the Tertiary of King George I. and central Chile [Lophosoria del Terciario de isla Rey Jorge y Chile Central: origen y dispersión en el hemisferio Sur]. Serie Científica INACH, 43: 17-30.

Troncoso A. 1986. Nuevas órgano-especies en la Tafoflora Terciaria Inferior de Península Fildes, Isla Rey Jorge, Antártica. Serie Científica del INACH, 34: 23-46.

Vakhrameev, V. A. 1991. Jurassic and Cretaceous floras and climates of the Earth, xix+318 pp. (Cambridge University Press, Cambridge).

Xue, Y.S. 1994. Characteristics and sedimentary environment of volcanic debris rocks of Upper Cretaceous Half Three Point Formation from King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.97-108. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Xue, Y.S., Y.B. Shen & E.J. Zhuo. 1996. Petrological characteristics of the sedimentary volcaniclastic rocks of the Fossil Hill Formation (Eocene) in King George Island, West Antarctica. Antarctic research (Chinese edition), 7(2): 99-117.

Zhang, S.Z. & Q.Z. Wang. 1994. Paleocene petrified wood on the west side of Collins Glacier in the King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.223-238. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Zhou, Z.Y. & H.M. Li. 1994a. Early Tertiary gymnosperms from Fildes Peninsula, King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.191-221. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland. 1994

Zhou, Z.Y. & H.M. Li. 1994b. Some Late Cretaceous plants from King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.85-96. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Zhou, Z.Y. & H.M. Li. 1994c. Early Tertiary ferns from Fildes Peninsula, King George Island, Antarctica. In: Stratigraphy and palaeontology of Fildes Peninsula, King George Island, Antarctica. Edited by Y.B. Shen, p.173-189. Publisher: Beijing, Science Press (Kexue chubanshe). China, Mainland.

Zhu, M., M. L. E, X.H. Liu, & X.S. Zheng. 1991. Isotope age of the volcanic rocks and the correlation of stratigraphy in the Fildes Peninsula, King George Island, West Antarctica. Antarctic research (Chinese edition), 3(2): 126-135.

ANNEX: MAPS

Map 1: Location of Fildes Peninsula, King George Island (25 de Mayo), South Shetland Islands Archipelago.

Map 2: Boundaries of Antarctic Specially Protected Area No 125, Fildes Peninsula.

Map 3: Location of zone 125a, Fossil Hill.

Map 4: Location of zone 125b, Holz Stream (Madera Stream).

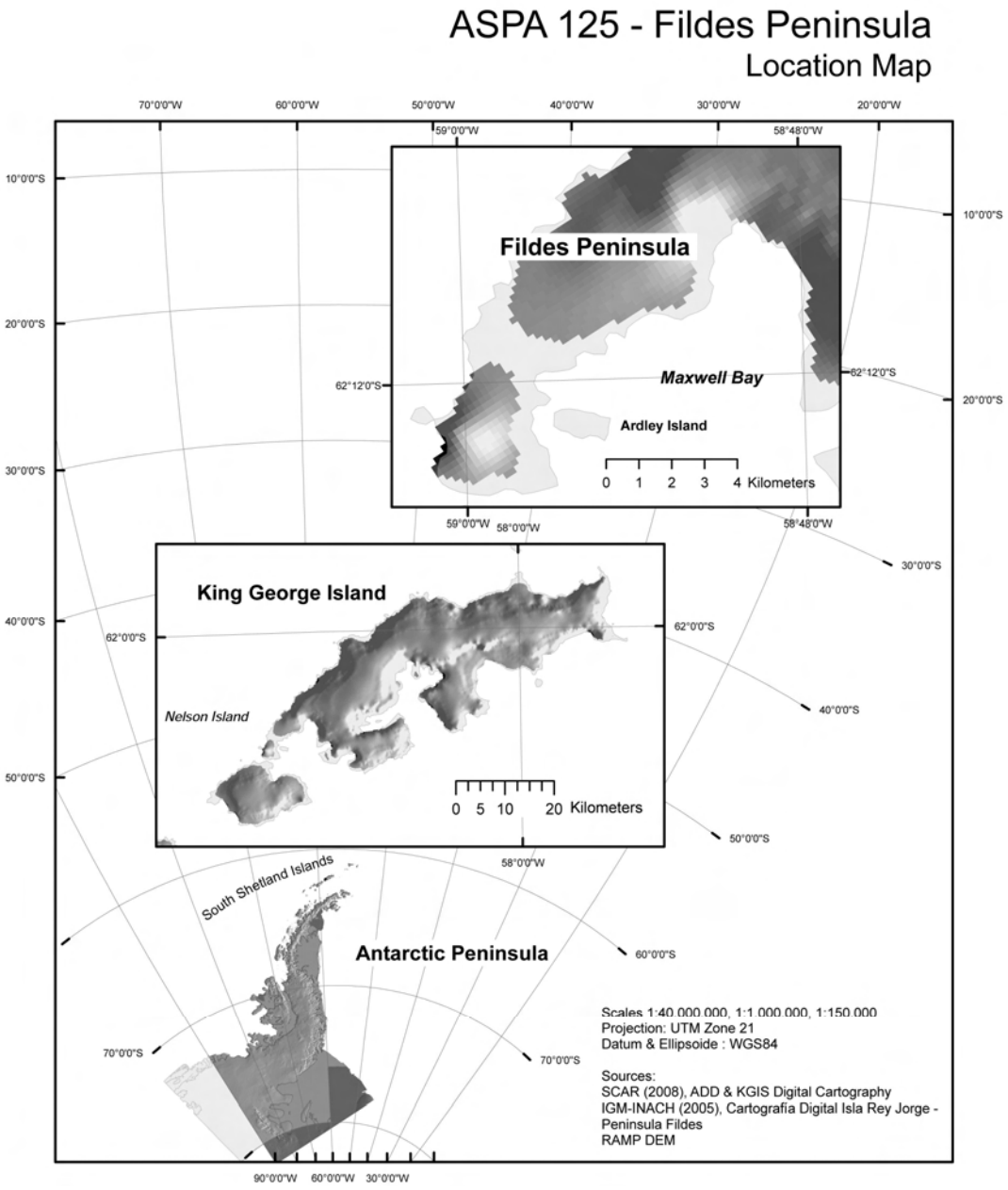
Map 5: Location of zone 125c, Glacier Dome Bellingshausen (Collins glacier).

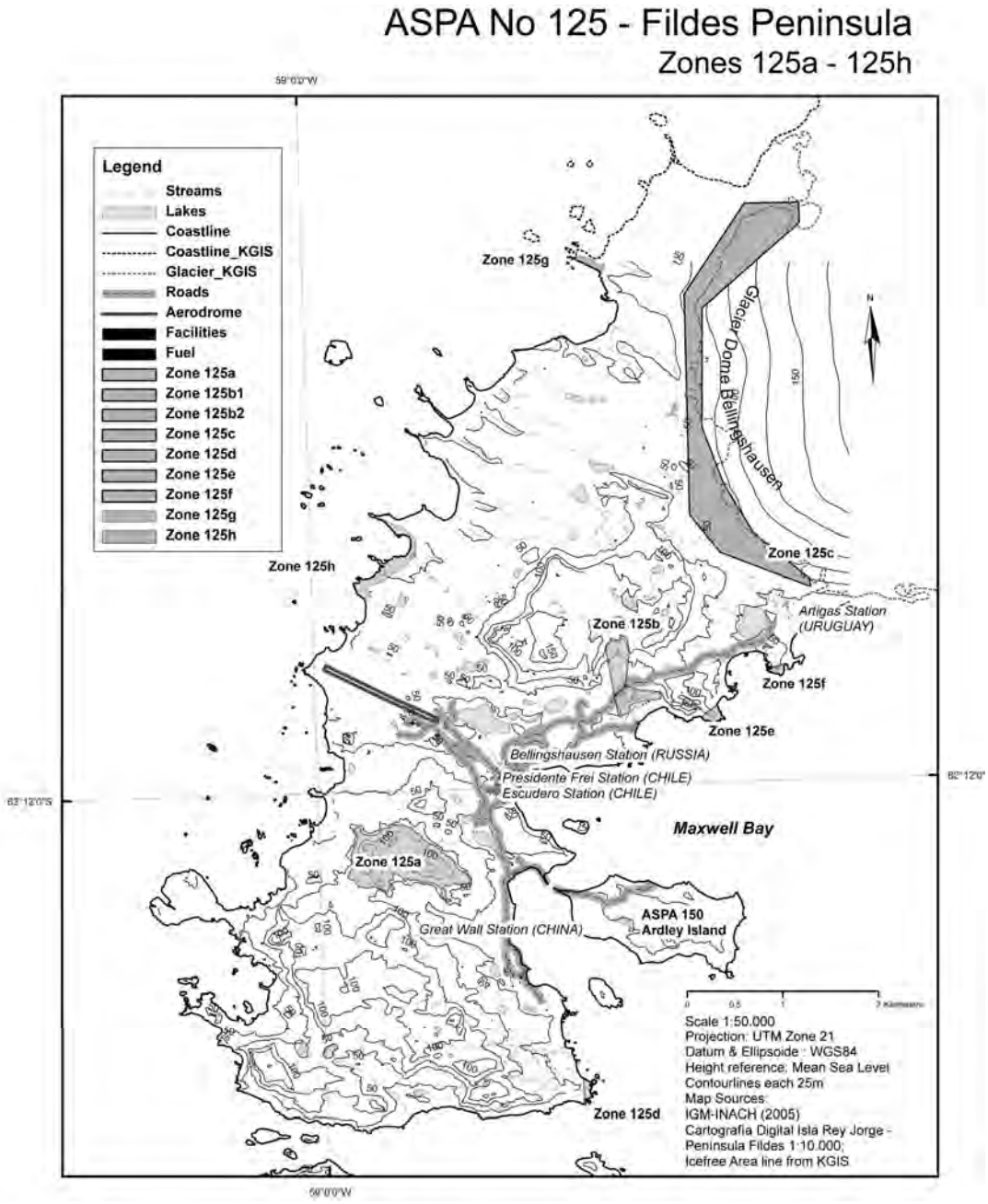
Map 6: Location of zone 125d, Halfthree Point.

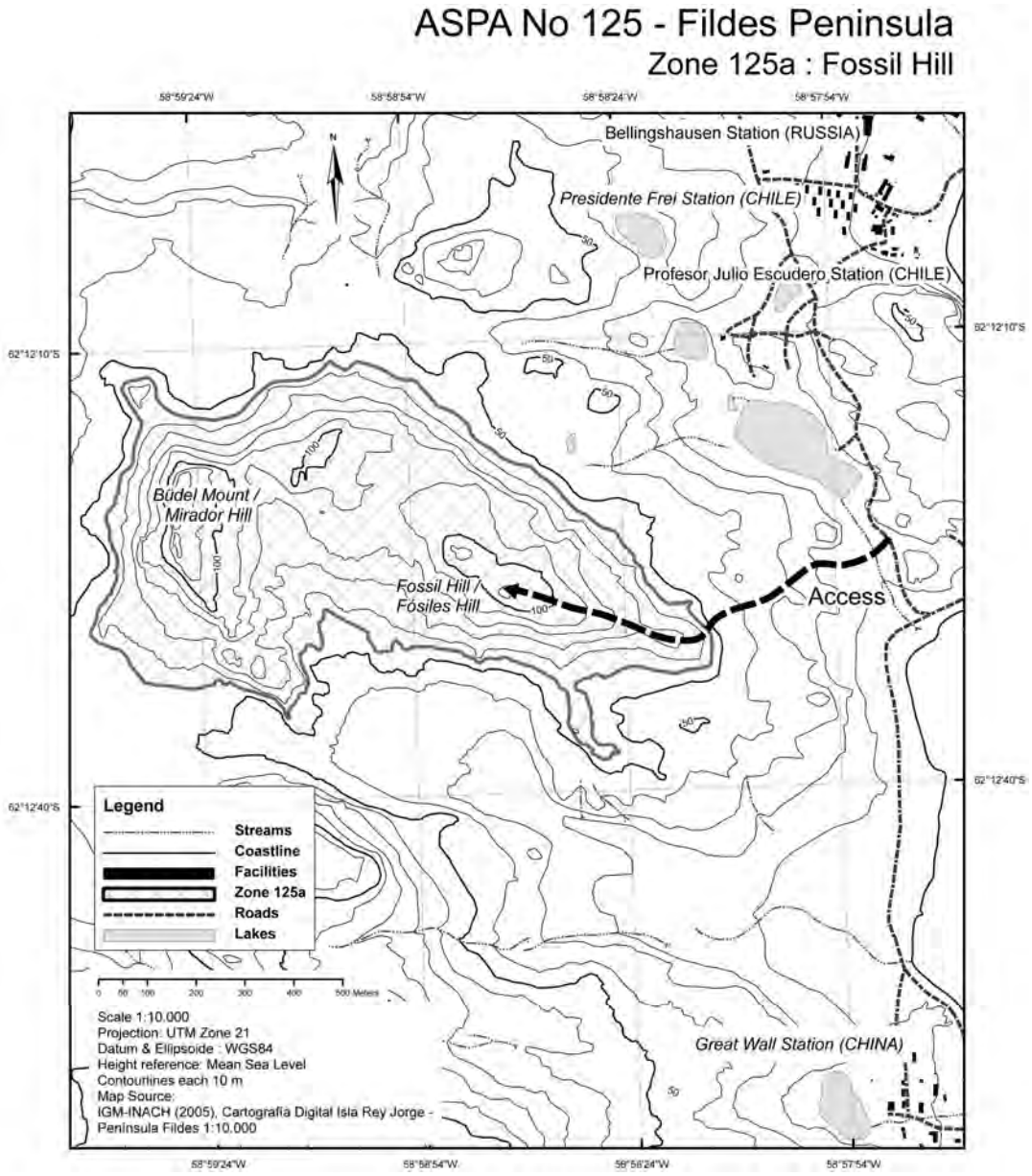
Map 7: Location of zones 125e and 125f, Suffield and Fossil Points, respectively.

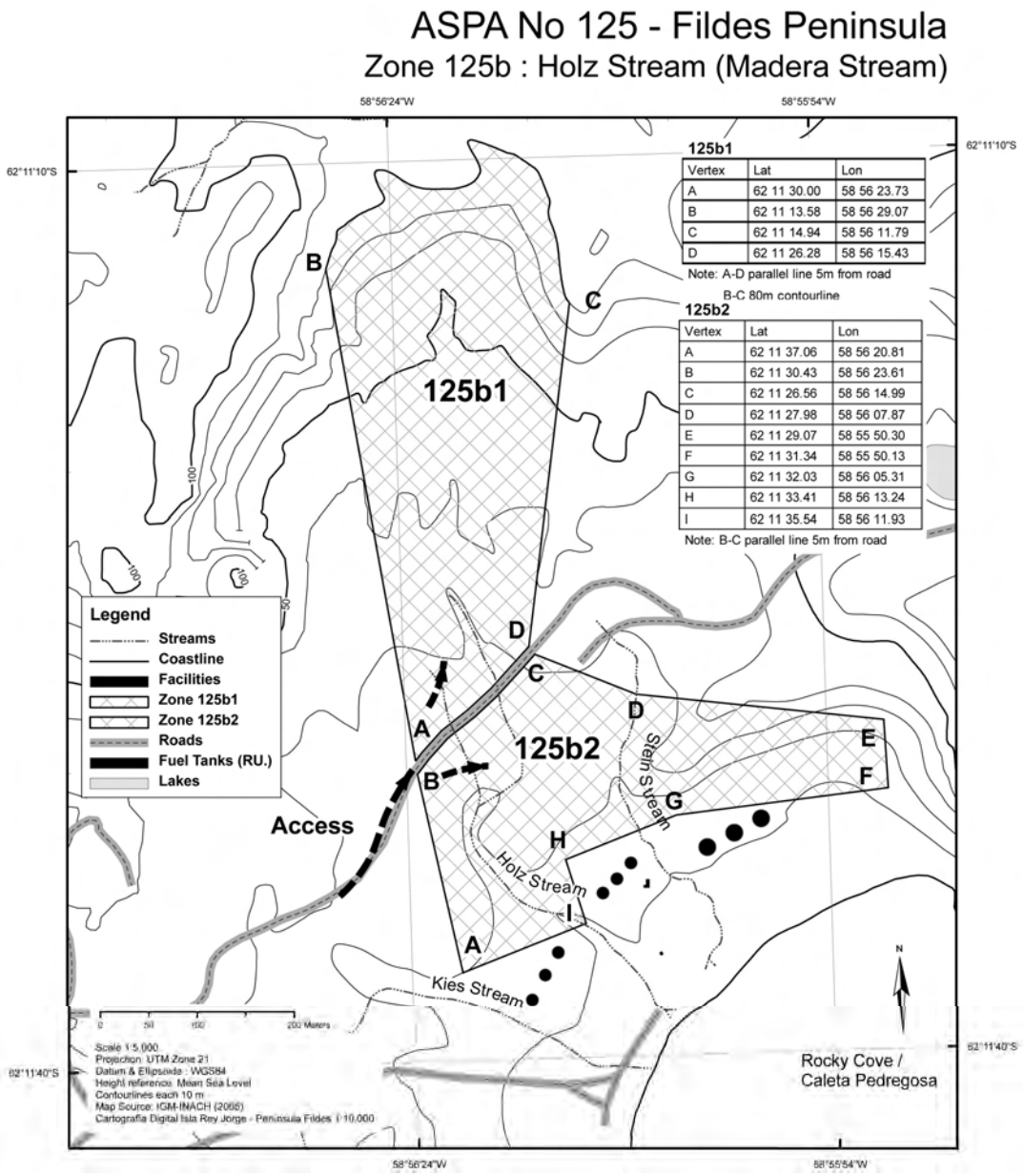
Map 8: Location of zone 125g, Gradzinski Cove.

Map 9: Location of zone 125h, Skua Cove.

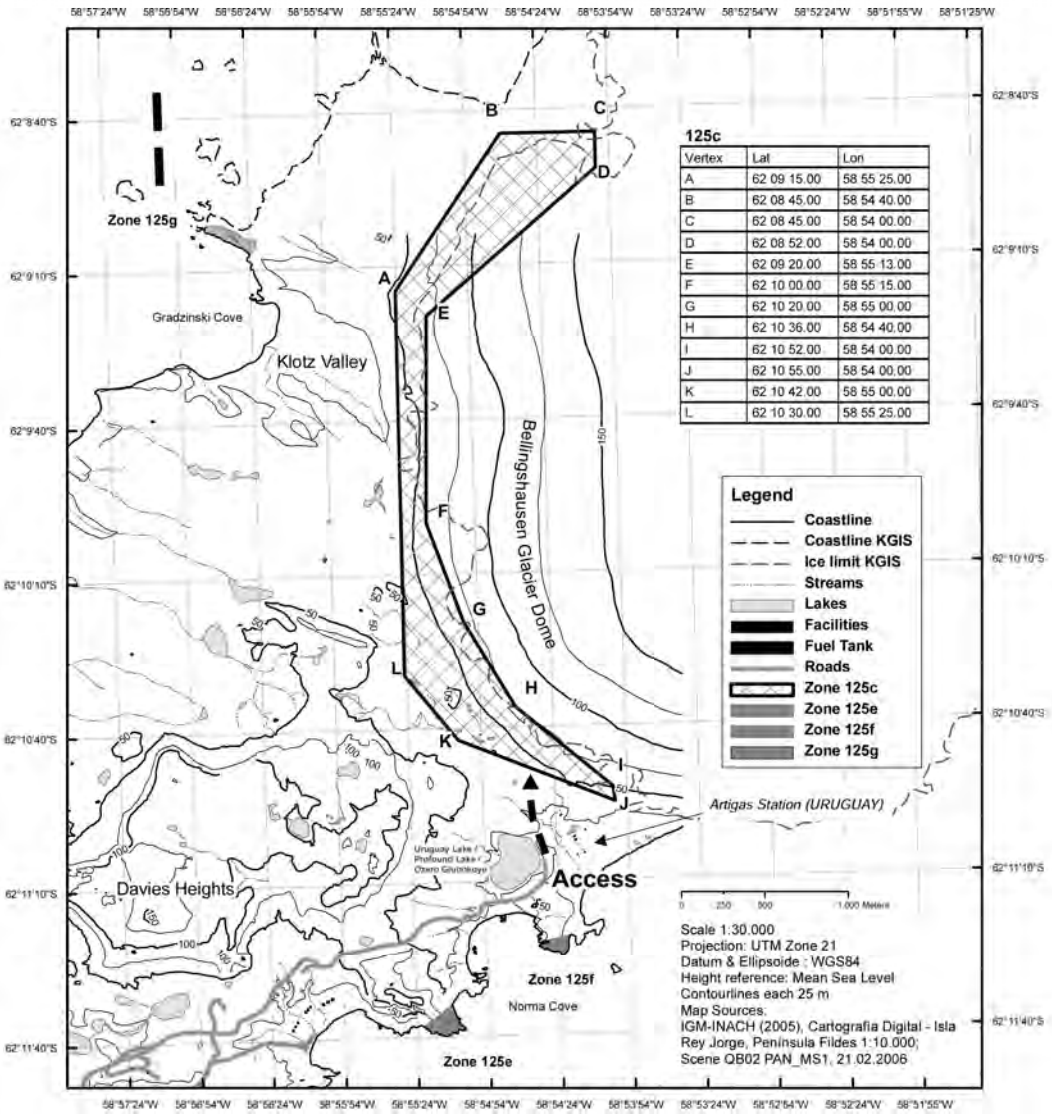

ASPA 125 - Fildes Peninsula
Location Map
Fildes Peninsula
Maxwell Bay
Ardley Island
0 1 2 3 4 Kilometers
King George Island
Nelson Island
0 5 10 20 Kilometers
South Shetland Islands
Antarctic Peninsula
Scales 1:40.000.000, 1:1.000.000, 1:150.000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Sources:
SCAR (2008), ADD & KGIS Digital Cartography
IGM-INACH (2005), Cartografia Digital Isla Rey Jorge - Peninsula Fildes
RAMP DEM

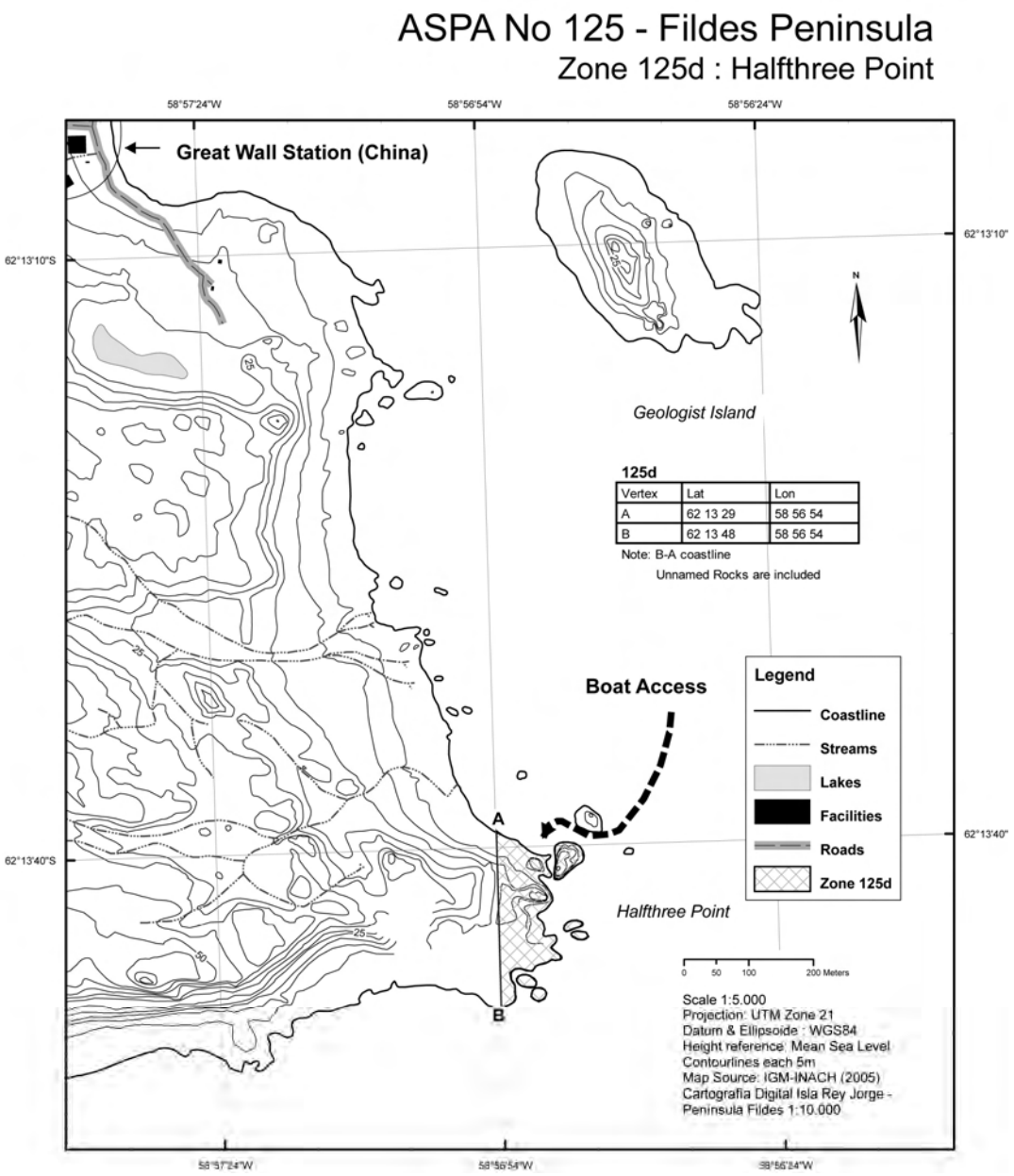

ASPA No 125 - Fildes Peninsula
Zones 125a - 125h
Legend
Streams
Lakes
Coastline
Coastline_KGIS
Glacier_KGIS
Roads
Aerodrome
Facilities
Fuel
Zone 125a
Zone 125b1
Zone 125b2
Zone 125c
Zone 125d
Zone 125e
Zone 125f
Zone 125g
Zone 125h
Zone 125g
Glacier Dome Bellingshausen
Zone 125h
Zone 125c
Zone 125b
Artigas Station (URUGUAY)
Zone 125f
Zone 125e
Bellingshausen Station (RUSSIA)
Presidente Frei Station (CHILE)
Escudero Station (CHILE)
Maxwell Bay
Zone 125a
ASPA 150
Ardley Island
Great Wall Station (CHINA)
Zone 125d
Scale 1:50.000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Height reference: Mean Sea Level
Contourlines each 25m
Map Sources:
IGM-INACH (2005)
Cartografia Digital Isla Rey Jorge - Peninsula Fildes 1:10.000;
Icefree Area line from KGIS


ASPA No 125 - Fildes Peninsula
Zone 125a : Fossil Hill
58°59'24"W
58°58'54"W
58°58'24"W
58°57'54"W
62°12'10"S
62°12'40"S
Bellingshausen Station (RUSSIA)
Presidente Frei Station (CHILE)
Profesor Julio Escudero Station (CHILE)
Büdel Mount / Mirador Hill
Fossil Hill / Fósiles Hill
Access
Great Wall Station (CHINA)
Legend
Streams
Coastline
Facilities
Zone 125a
Roads
Lakes
0 50 100 200 300 400 500 Meters
Scale 1:10.000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Height reference: Mean Sea Level
Contourlines each 10 m
Map Source:
IGM-INACH (2005), Cartografía Digital Isla Rey Jorge - Península Fildes 1:10.000


ASPA No 125 - Fildes Peninsula
Zone 125b : Holz Stream (Madera Stream)
58°56'24"W
58°55'54"W
62°11'10"S
62°11'40"S
125b1
Vertex | Lat | Lon
A | 62 11 30.00 | 58 56 23.73
B | 62 11 13.58 | 58 56 29.07
C | 62 11 14.94 | 58 56 11.79
D | 62 11 26.28 | 58 56 15.43
Note: A-D parallel line 5m from road
B-C 80m contourline
125b2
Vertex | Lat | Lon
A | 62 11 37.06 | 58 56 20.81
B | 62 11 30.43 | 58 56 23.61
C | 62 11 26.56 | 58 56 14.99
D | 62 11 27.98 | 58 56 07.87
E | 62 11 29.07 | 58 55 50.30
F | 62 11 31.34 | 58 55 50.13
G | 62 11 32.03 | 58 56 05.31
H | 62 11 33.41 | 58 56 13.24
I | 62 11 35.54 | 58 56 11.93
Note: B-C parallel line 5m from road
Legend
Streams
Coastline
Facilities
Zone 125b1
Zone 125b2
Roads
Fuel Tanks (RU.)
Lakes
125b1
125b2
Access
Stein Stream
Holz Stream
Kies Stream
Rocky Cove /
Caleta Pedregosa
Scale 1:5,000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Height reference: Mean Sea Level
Contourlines each 10 m
Map Source: IGM-INACH (2008)
Cartografía Digital Isla Rey Jorge - Península Fildes 1:10,000

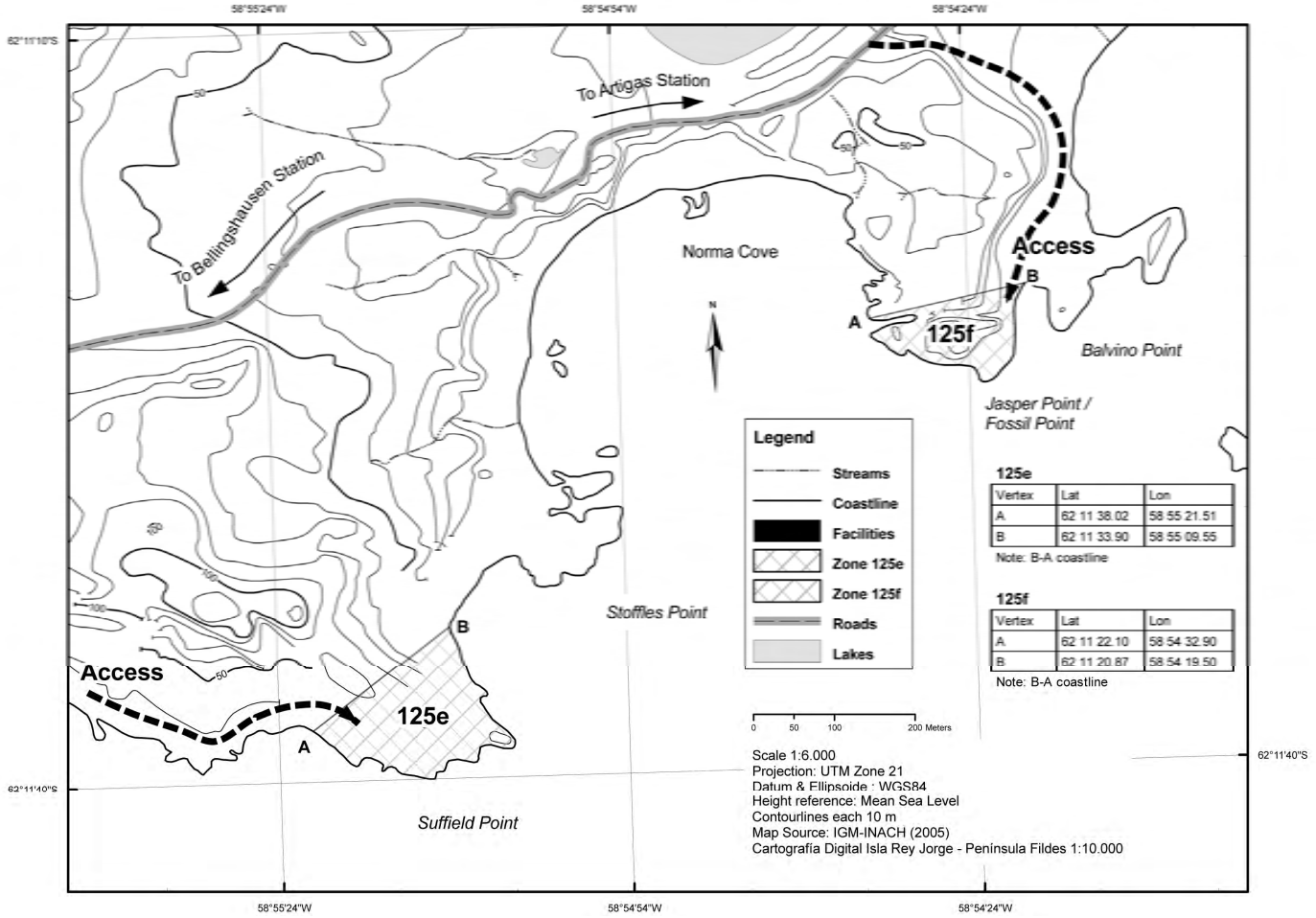
ASPA No 125 - Fildes Peninsula
Zone 125c : Bellingshausen Glacier Dome




ASPA No 125 - Fildes Peninsula
Zone 125d : Halfthree Point
58°57'24"W
58°56'54"W
58°56'24"W
62°13'10"S
62°13'40"S
Great Wall Station (China)
Geologist Island
N
125d
Vertex | Lat | Lon
A | 62 13 29 | 58 56 54
B | 62 13 48 | 58 56 54
Note: B-A coastline
Unnamed Rocks are included
Boat Access
A
B
Halfthree Point
Legend
Coastline
Streams
Lakes
Facilities
Roads
Zone 125d
0 50 100 200 Meters
Scale 1:5.000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Height reference: Mean Sea Level
Contourlines each 5m
Map Source: IGM-INACH (2005)
Cartografia Digital Isla Rey Jorge -
Peninsula Fildes 1:10.000

ASPA No 125 - Fildes Peninsula

Zone 125e :Suffield Point & Zone 125f : Fossil Point



125e

Vertex	Lat	Lon
A	62 11 38.02	58 55 21.51
B	62 11 33.90	58 55 09.55

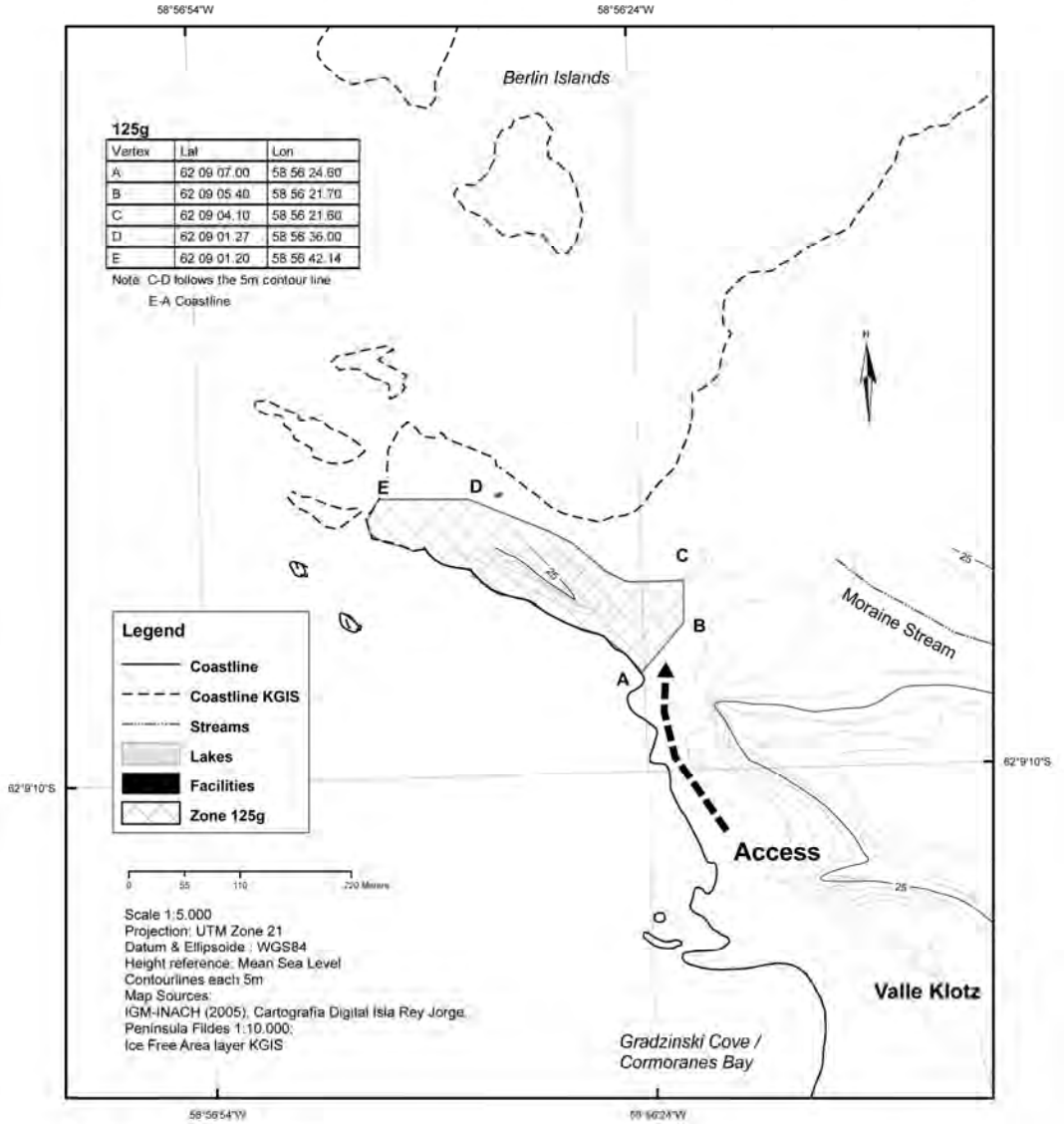
Note: B-A coastline

125f

Vertex	Lat	Lon
A	62 11 22.10	58 54 32.90
B	62 11 20.87	58 54 19.50

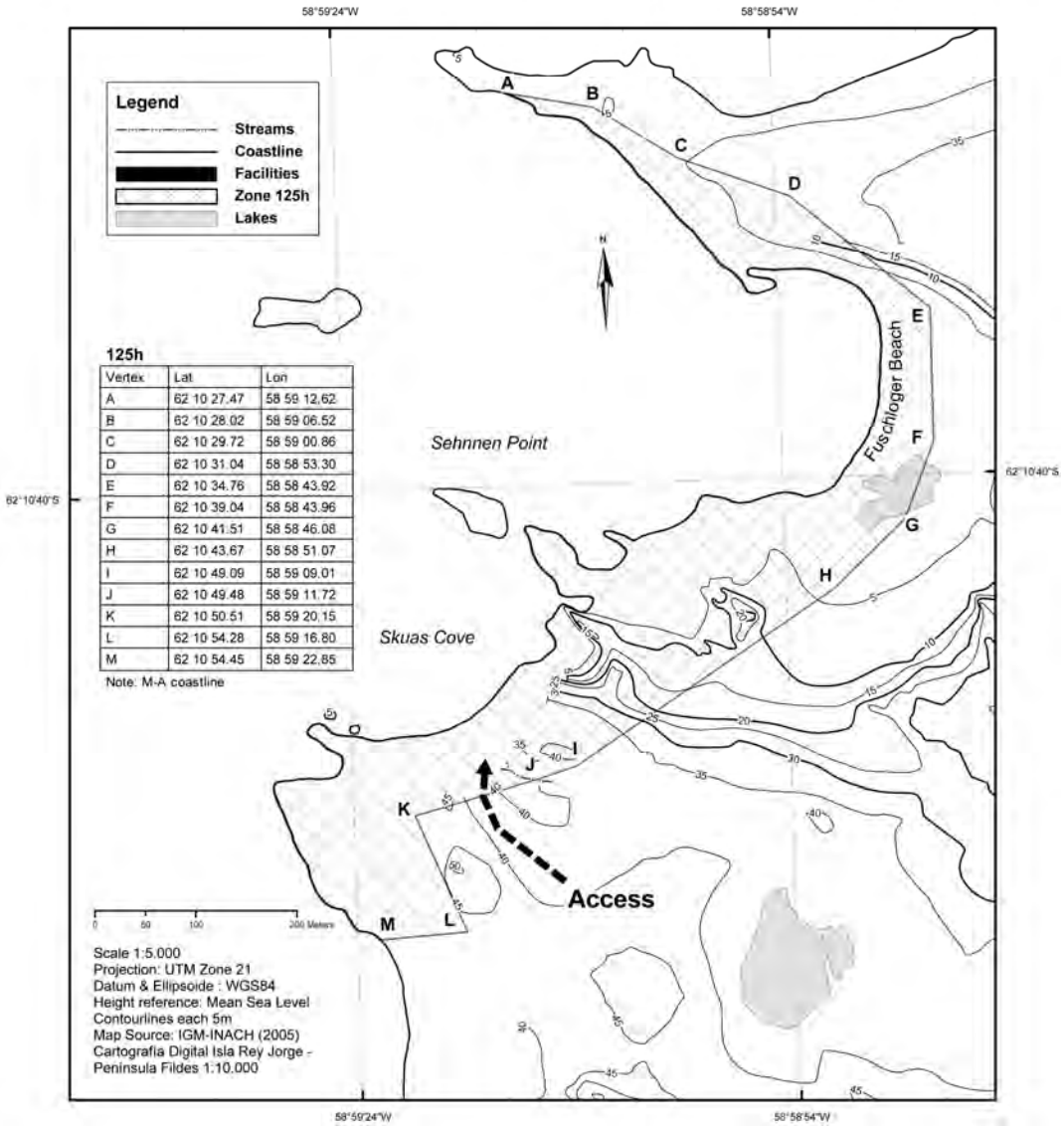
Note: B-A coastline

ASPA No 125 - Fildes Peninsula
Zone 125g : Gradzinski Cove (Cormoranes Bay)



ASPA No 125 - Fildes Peninsula

Zone 125h : Skuas Cove



Measure 7 (2009)

Antarctic Specially Protected Area No 136 (Clark Peninsula, Budd Coast, Wilkes Land): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation XIII-8 (1985), which designated Clark Peninsula, Budd Coast, Wilkes Land, as Site of Special Scientific Interest ("SSSI") No 17 and annexed a management plan for the site;
- Resolution 7 (1995), which extended the expiry date of SSSI 17 from 31 December 1995 to 31 December 2000;
- Measure 1 (2000), which adopted a revised management plan for SSSI 17
- Decision 1(2002), which renamed and renumbered SSSI 17 as Antarctic Specially Protected Area No 136;
- Measure 1 (2006), which adopted a revised management plan for ASPA 136;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 136;

Desiring to replace the existing Management Plan for ASPA 136 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 136 (Clark Peninsula, Budd Coast, Wilkes Land), which is annexed to this Measure, be approved;

2) the prior management plans for ASPA 136 annexed to

- Recommendation XIII-8 (1985) and
- Measure 1 (2006)

shall cease to be effective; and

3) the Management Plan for SSSI 17 annexed to Measure 1 (2000), which is not yet effective, be withdrawn.

Management Plan for
Antarctic Specially Protected Area No. 136

CLARK PENINSULA, BUDD COAST, WILKES LAND

Introduction

Clark Peninsula was originally designated as Site of Special Scientific Interest No. 17 under Recommendation 8 (1985) and revised Management Plans were adopted under Measure 1 (2000) and under Measure 1 (2006). The Area is approximately 9.4 km^2 in area and is adjacent to the Windmill Islands on the Budd Coast, Wilkes Land, East Antarctica (Map A). Scientific research within the Area has focused on plant communities and long term population studies of Adélie penguin colonies. The protection of this flora and fauna within the Area allows for valuable comparison with similar plant communities and penguin colonies closer to Casey station (approximately 5 kilometres to the south-west), which are subject to greater levels of human disturbance.

1. Description of Values to be Protected

The Clark Peninsula ASPA is designated primarily to protect the largely undisturbed terrestrial ecosystem, which supports one of the most extensive and best developed plant communities on continental Antarctica, outside the Antarctic Peninsula. The Area has rich associations of macrolichens and bryophytes that occupy very specific ecological niches. Within the relatively complex plant communities, 33 species of bryophytes and macrolichens have been found with 11 cryptogamic (soil surface) vegetation associations being identified. This vegetation forms a continuum of ecological variation along environmental gradients of soil moisture, soil chemistry and microclimate. As such, the Area has intrinsic ecological value and scientific importance, particularly in the fields of botany, microbiology, soil science and glacial geomorphology.

The Area provides baseline and comparitive data with which to compare changes in similar moss and lichen communities in the immediate surroundings of Casey station. The cryptogamic plant communities are also monitored to identify short-term microclimate fluctuations and long-term climate change in the region since deglaciation, 8000-5000 years before present.

Significant and relatively undisturbed breeding populations of Adélie penguin *Pygoscelis adeliae* and South Polar skuas *(Catharacta maccormicki)* are present within the Area at Whitney and Blakeney Points. In addition, breeding Wilson's storm petrels *Oceanites oceanicus,* and snow petrels *Pagodroma nivea* are present in most ice-free areas. The monitoring of the breeding populations of Adélie penguins at Whitney Point since 1959 provides valuable comparative data for assessing and measuring human impacts and disturbance of penguin colonies on Shirley Island which is within the station limits of Casey station. These long-term population data on Adélie penguin numbers are amongst the longest in the Antarctic.

The Area supports exceptional vegetation cover for a continental Antarctic coastal ice-free location, and exhibits a wide range of plant communities. The Area requires protection because of it's ecological importance, it's significant scientific value and the limited

geographical extent of the plant communities. The Area is vulnerable to disturbance from trampling, scientific sampling, pollution and alien introductions, while being sufficiently distant from Casey station to avoid immediate impacts and disturbances from activities undertaken there. It is because of the scientific and ecological values, and the usage of the Area for long term monitoring, that it should continue to be protected.

Clark Peninsula provides a unique and visible time sequence of the emergence of the area of the Windmill Islands from the sea since the Holocene deglaciation. Prior to the emergence of Whitney Point and Blakeney Point, the central ridge between them consisted of islets that were occupied by Adélie penguins. Penguins began to occupy the two points soon after their emergence . This historical penguin presence is understood to have lead to the current abundance and density of the plant communities in the Area, the nature of which is not seen anywhere else in the Antarctic. The obvious interaction of these two phenomena provides an exceptional stage for research.

2. Aims and Objectives

The aim of this Management Plan is provide continued protection to the features and values of Clark Peninsula. The objectives of the Plan are to:

- avoid degradation of, or substantial risk to, the values of the Area by minimising human disturbance;
- protect a part of the natural ecosystem as a reference area for the purpose of comparative studies and to assess direct and indirect effects of Casey station;
- allow scientific research on the ecosystem and elements of the ecosystem, both geological and biological, while ensuring protection from over-sampling and disturbance;
- prevent or minimise the introduction of non-native species into the Area; and
- allow visits for management purposes in support of the aims of the Management Plan.

3. Management Activities

The following management activities will be undertaken to protect the values of the Area:

- signs illustrating the location and boundaries, and clearly stating entry restrictions, shall be placed at appropriate locations at the boundaries of the Area to help avoid inadvertent entry;
- information about the Area, including a statement of the special restrictions that apply and a copy of this Management Plan, shall be displayed prominently at the adjacent abandoned Wilkes station, the "Wilkes Hilton" (unofficial name) refuge hut on Stonehocker Point (66°15’24” S, 110°32’24”E), "Jack's Donga" (unofficial name) refuge hut (66°13’42” S, 110°39’12” E) and at Casey station. Copies of this Management Plan will also be available to visiting ships;

- markers, signs or structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required;
- visits shall be made as necessary for management purposes; and
- the Management Plan shall be reviewed at least every five years and revised as required.

4. Period of Designation

Designated for an indefinite period.

5. Maps

- Map A: Antarctic Specially Protected Areas, Windmill Islands, East Antarctica
- Map B: Antarctic Specially Protected Area No. 136, Clark Peninsula, Windmill Islands, East Antarctica. *Topography and distribution of birds.*
- Map C: Antarctic Specially Protected Area No. 136, Clark Peninsula, Windmill Islands, East Antarctica. *Distribution of major vegetation types.*
- Map D: Antarctic Specially Protected Area No. 136, Clark Peninsula, Windmill Islands, East Antarctica. *Geology.*

Specifications for all Maps:

Horizontal Datum: WGS84 Projection: UTM Zone 49.

6. Description of the Area

6(i) Geographical co-ordinates, boundary markers and natural features

Clark Peninsula is an area of rock exposures and permanent ice and snow fields situated on the north side of Newcomb Bay at the east end of Vincennes Bay on Budd Coast, Wilkes Land. The Area covers approximately 9.4 km^2 and is located at 66°15' S, 110°36' E.

The Area comprises all the land on Clark Peninsula northward of the southern boundary line connecting the east side of Powell Cove at a point which originates at 66°15'15" S, 110°31'59" E, through 66°15'29"S, 110°33'26"E to 66°15'21"S, 110°34'00"E to 66°15'24"S, 110°35'09"E to 66°15'37"S, 110°34'40"E to 66°15'43"S, 110°34'45"E, thence to a point to the east-south-east on the Løken Moraines at 66°16’06”S, 110°37’11”E. The eastern boundary is the westernmost limit of the Løken Moraines as far north as a point east of Blakeney Point at (66°14'15" S, 110°38'46" E), and thence to the coast (66°14'15" S, 110°38'06" E), returning along the coast to the point of origin. The boundary of the Area will be indicated by prominent markers, and is shown on Maps A, B, C and D.

Topographically, the Clark Peninsula comprises low lying, rounded, ice-free rocky outcrops (maximum altitude approximately 40 metres above sea level). The intervening valleys are filled with permanent snow or ice, or glacial moraine and exfoliated debris and contain water catchment areas. The peninsula rises in the east to the Løken Moraines (altitude approximately 130 metres above sea level).

The Windmill Islands offshore from the Area represent one of the easternmost outcrops of a Mesoproterozoic low-pressure granulite facies terrain that extends west to the Bunger Hills and farther west to the Archaean complexes in Princess Elizabeth Land, and eastward to minor exposures in the Dumont d'Urville area and at Commonwealth Bay.

The rocks of the Windmill Islands area comprise a series of migmatitic metapelites and metapsammites interlayered with mafic to ultramafic and felsic sequences with rare calc-silicates, large partial melt bodies (Windmill Island supacrustals), undeformed granite, charnockite, gabbro, pegmatite, aplites and late dolerite dykes. Clark Peninsula distinguishes the northern transition of a metamorphic grade transition which separates the northern part of the Windmill Islands area from the southern part.

Outcrops of metapelitic rock and leucocratic granite gneiss are dominant on Clark Peninsula. The metapelitic rock is generally foliated, migmatized and fine to medium grained. Mineralogy of the metapelitic rock involves biotite-sillimanite and biotite-sillimanite±cordierite. The sillimanite is strongly lineated in the foliation and the cordierite is generally pinnitized. The early granite gneiss is white, medium grained and foliated, it comprises two felsic to intermediate intrusions which predate and/or are synchronous with the deformation in the Windmill Islands. The larger intrusion, which occupies most of central Clark Peninsula is a quartz, K-feldspar, biotite, white mica and opaque-bearing granitic augen gneiss. Small outcrops of mafics and metapsammite occur. The rock beds lie in a south-west north-east orientation. The surface geology of Clark Peninsula is shown at Map D.

Gravels and soils appear to be derived from marine sediments deposited in the Pleistocene with a thin cover of weathered rock. Subfossil penguin colonies are common along the central ridge aligned south-west to north-east on Clark Peninsula, and at both Whitney Point and Blakeney Point. In the vicinity of abandoned penguin colonies, the soils are pebbly and rich in organic matter derived from penguin guano with some silts. Melt streams and pools and small lakes are prevalent in summer. The distribution of lakes on Clark Peninsula is shown at Map B.

Conditions on Clark Peninsula, in comparison with many other continental Antarctic areas, are sufficiently mild to have allowed the formation of relatively stable, complex, well developed, and species-rich vegetation. The ice-free rocks support an extensive cover of lichen, while mosses predominate in lower lying areas. Principal factors responsible for the distribution of vegetation on Clark Peninsula are exposure to wind, availability of water and the location of abandoned penguin colonies.

To the north-east of the Peninsula, well-developed *Umbilicaria decussata, Pseudephebe minuscula, Usnea sphacelata* communities dominate. Farther from the coast, *U. sphacelata* is dominant and forms extensive carpets over the metamorphic rocks and gravel beds in association with *P. minuscula* and *U. decussata,* together with scattered bryophytes. The bryophytes comprise *Bryum pseudo triquetrum, Schistidium antarctici* and *Ceratodon purpureus*. Within these communities, well-developed bryophyte patches dominate in moist, sheltered sites and locally form closed stands comprising a moss turf up to almost 30cm depth.

In the north-western and western coastal areas where Adélie penguin colonies are present, *Xanthoria mawsonii, Candelariella flava* and *Buellia frigida* are more common. On the abandoned penguin colonies in the southern coastal areas, this community type contains a higher proportion of *U. decussata* and *U. sphacelata.*

In the centre of Clark Peninsula the vegetation is dominated by *U. decussata, P. minuscula, B. soredians* and *B. frigida,* with scattered occurrences of *Pleopsidium chlorophanum.* The vegetation distribution of Clark Peninsula is shown at Map C. The microflora comprises algae, with *Botrydiopsis constricta* and *Chlorella conglomerata* dominating, together with bacteria, yeasts and filamentous fungi.

Adélie penguins *(Pygoscelis adeliae)* colonies are present at two localities in the Area, Whitney Point and Blakeney Point. Approximately 9,000 breeding pairs were present in 2004/05 at Whitney Point, and approximately 4,600 breeding pairs were present at Blakeney Point in 1991. The breeding populations of Adélie penguins at Whitney Point and at Blakeney Point have increased since studies commenced in 1959/60. This is in contrast to nearby Shirley Island (3km to the south-west and close to Casey station), where the breeding population of Adélie penguins has remained stable since 1968. Wilson's storm petrels *(Oceanites oceanicus),* South Polar skuas *(Catharacta maccormicki*) and Snow petrels *(Pagodroma nivea)* breed within the Area as shown on Map B.

Terrestrial invertebrate microfauna comprises protozoa, nematodes, mites, rotifers and tardigrades. The invertebrates are mainly confined to the moss beds, lichen stands and moist soils.

The climate of the Windmill Islands area is frigid-Antarctic. Meteorological data from Casey station on nearby Bailey Peninsula show mean maximum temperatures for the warmest and coldest months to be 2.1° and -11.3°C, and mean minimum temperatures to be -2.6°C and -18.9°C respectively, with extreme temperatures ranging from 9.2° to -37.5°C. The climate is dry with a mean annual snowfall of 195 $mm.year^{-1}$ (rainfall equivalent). There is an annual average of 96 days with gale-force winds, which are predominantly easterly in direction, off the polar ice cap. Snowfall is common during the winter, but the exposed areas are generally scoured by extremely strong winds. Snow gathers in the lee of rock outcrops and in depressions in the substratum and forms deeper drifts farther down the slopes.

6(ii) Special Zones within the Area

There is one special zone within the Area. Over-snow access to the sea ice by oversnow vehicles for scientific research or management purposes is permitted within the Transit Zone north east of a line that runs from the ASPA boundary at the Løken Moraines at 110°38'34"E, 66°14'47"S north-west to meet the coastline at 110°36'54"E, 66°14'31"S. Vehicles must travel only on ice or snow covered ground to avoid disturbance to vegetation and relic penguin colonies. Use of this Transit Zone may be subject to specific permit conditions.

6(iii) Location of Structures within and adjacent to the Area

The only structure known to exist in the Area is a severely deteriorated wood and canvas hide, known as the "Wannigan" (colloquial name) located on "Lower Snow Slope" (unofficial place name) on the western facing slope of Whitney Point. This hide was constructed in 1959 for behavioural studies of breeding Adélie penguins by R L Penney.

There are a number of boundary markers along the southern boundary, and a number of survey markers within the Area.

The "Wilkes Hilton" refuge hut is located approximately 200 m south of the southern boundary. Approximately 1 km to the south-west is the abandoned Wilkes station on Stonehocker Point. Another refuge hut, "Jack's Donga" is located approximately 1.5 km north of the northern boundary of the Area.

6(iv) Location of other Protected Areas in the vicinity

Other protected areas within 50 km include (see Map A):

- Antarctic Specially Protected Area 135, Northeast Bailey Peninsula (66°17'S, 110°33'E): 2.5 km south-west of Clark Peninsula, across Newcomb Bay, adjacent to Casey station;
- Antarctic Specially Protected Area 103, Ardery Island (66°22'S, 110°27'E), and Odbert Island (66°22'S, 110°33'E,) Budd Coast: located in Vincennes Bay, 13 km south of the former Wilkes station; and
- Antarctic Specially Protected Area 160, Frazier Islands (66°13'S 110°11'E): approximately 16 km to the north-west in Vincennes Bay.

7. Permit Conditions

Entry into the Area is prohibited except in accordance with a permit issued by an appropriate National Authority.

A permit to enter the Area may only be issued for activities related to scientific research or essential management purposes. All activities must be consistent with the objectives and provisions of this Management Plan.

Permits shall be issued for a specified period and the permit, or an authorised copy, shall be carried within the Area. Additional conditions, consistent with the Management Plan's objectives and provisions, may be included by the issuing Authority.

7(i) Access to and Movement within or over the Area

Access into the Area should generally be from "Wilkes Hilton" refuge hut in the south-west, "Jack's Donga" refuge hut in the north-east, or from the over-snow route between Casey station and "Jack's Donga" by descending the western slope of Løken Moraines in the vicinity east of Stevenson Cove.

Access from Casey to abandoned Wilkes station is via a well-defined marked cane route to the south of the southern boundary of the Area. On approach from Casey to the ASPA, in the area east and north-east of Noonan Cove, a section of the route is split, providing two alternative routes (see Map B). The more southerly route should be used when ice conditions near Noonan Cove allow for safe access. During periods when safe access via the southerly route is not possible, the more northerly route should be followed. As the Casey-Wilkes route is very close to the Area boundary, pedestrian and vehicular traffic should take care not to stray northward.

Access to the sea ice by oversnow vehicles for scientific purposes or management activities is permitted within the Transit Zone that is north east of a line that runs from the ASPA boundary at the Løken Moraines at 110°38'34"E 66°14'47"S and runs north-west to meet the coastline at 110°36'54"E 66°14'31"S. All vehicles must travel only on ice or snow covered ground to avoid disturbance to vegetation and relic penguin colonies. Vehicles are not allowed within the remainder of the Area (except for emergency situations) and access in all other circumstances should be by foot.

Helicopters are not allowed to land within the Area, except in emergencies or for essential management activities.

Pedestrian traffic in the Area should be kept to the minimum necessary to achieve the objectives of permitted activities. As much as possible, visitors should avoid walking on visible vegetation and in areas of moist ground, where foot traffic can easily damage sensitive soils, plant or algae communities, and degrade water quality.

To avoid disturbance, breeding penguins should not be approached within 30 m during the breeding season – October to April – unless essential to the conduct of a permitted research activity.

7(ii) Activities which are or may be conducted within the Area, including restrictions on time and place

- Compelling scientific research which cannot be undertaken elsewhere and which will not jeopardise the values of the Area.
- Essential management activities, which may include monitoring.

7(iii) Installation, modification or removal of structures

No structures are to be erected or scientific equipment installed within the Area, except for essential scientific or management activities as authorised in a permit. All scientific equipment installed in the Area must be clearly identified by country, name of principal investigator, year of installation and expected date of completion of the study. Details are to be included in the visit report. All such items should be made of materials that pose minimum risk of contamination of the Area and must be removed at the completion of the study.

7(iv) Location of field camps

Camping is not allowed within the Area. Field parties should camp at either the "Wilkes Hilton" refuge hut or at "Jack's Donga" refuge hut.

7(v) Restrictions on materials and organisms that may be brought into the Area

A permit will not be issued to introduce living animals, plant material or microorganisms into the Area. To help maintain the ecological and scientific values of the plant communities found in the Area, persons entering the Area shall take special precautions against unintentional introductions. Of particular concern are microbial or vegetation introductions sourced from soils at other Antarctic sites, including stations, or from regions outside Antarctica. To minimise the risk of introductions footwear and any equipment – including carry cases, sampling equipment and markers – to be used in the Area shall be thoroughly cleaned before entering the Area.

No poultry material, poultry products, herbicides or pesticides shall be taken into the Area. All chemicals, including radio-nuclides or stable isotopes, shall be removed from the Area at or before the conclusion of the associated activity.

Fuel is not to be stored in the Area unless required for essential purposes connected with a permitted activity. Such fuel storage is to be in containers of 20 litres or less. Permanent depots are not permitted.

All material introduced to the Area shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of inadvertent release into the environment is minimised.

7(vi) Taking of or harmful interference with native flora and fauna

Taking of, or harmful interference with native flora and fauna is prohibited, except in accordance with a permit. Where authorised, the activity shall, as a minimum standard, be in accordance with the requirements of Annex II, Article 3 of the Protocol on Environmental Protection to the Antarctic Treaty, 1991.

7(vii) Collection and removal of anything not brought into the Area by the permit holder

Material may only be collected or removed from the Area as authorised under a permit and should be limited to the minimum necessary to meet scientific or management needs.

Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorised, may be removed unless the impact of the removal is likely to be greater than leaving the material *in situ.* The appropriate Authority must be notified and approval obtained before any material is moved or removed from the Area.

7(viii) Disposal of waste

All wastes generated in the Area, including human faeces and urine, shall be removed from the Area.

7(ix) Measures that may be necessary to ensure that the aims and objectives of the Management Plan can continue to be met

The following may be necessary to ensure the objectives of the Management Plan are met:

- permits may be granted to enter the Area to undertake monitoring and Area inspection activities, which may involve the collection of samples for analysis or review; the erection or maintenance of scientific equipment and structures, and signposts; or for other protective measures.
- all sites of long-term monitoring activities shall be appropriately marked and a Global Positioning System (GPS) location obtained for lodgement with the Antarctic Data Directory System through the appropriate National Authority. All GPS data are to be recorded in visit reports and lodged within 3 months of the end of field activities in which the GPS data were captured.
- to help maintain the ecological and scientific values of the plant communities found in the Area, visitors shall take special precautions against introductions.

Of particular concern are microbial or vegetation introductions sourced from soils at other Antarctic sites, including Stations, or from regions outside Antarctica. To minimise the risk of introductions, visitors shall thoroughly clean footwear and any equipment, particularly sampling equipment and markers to be used in the Area, before entering the Area.

- sampling sites must not be abandoned without being restored, as far as is possible, to the original state. Soil pits must be refilled to maintain the integrity of the area. Likewise all markers should be removed at the conclusion of their related activity.

7(x) Requirements for reports

The principal Permit Holder for each permit issued shall submit to the appropriate national authority a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of the *Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas* appended to Resolution 2 (1998). Parties should maintain a record of such activities and, in the Annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of the Plan of Management.

Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be considered in any review of the Plan of Management and in organising the use of the Area. A copy of the report should be forwarded to the National Party responsible for development of the Management Plan (Australia) to assist in management of the Area, and monitoring of bird populations. Additionally, visit reports should provide detailed information on any census data obtained, locations of any new colonies or nests not previously recorded, a brief summary of research findings and copies of photographs taken of the Area.

8. Supporting Documentation

Some of the data used within this paper and for mapping purposes was obtained from the Australian Antarctic Data Centre (IDN Node AMD/AU), a part of the Australian Antarctic Division (Commonwealth of Australia). The data regarding bird distribution are described in the metadata records of Woehler, E. J. and Olivier, F.

Adamson, E., and Seppelt, R. D., 1990. A Comparison of Airborne Alkaline Pollution Damage in Selected Lichens and Mosses at Casey Station, Wilkes Land, Antarctica. In: Kerry, K. R., and Hempel, G. (Eds.), *Antarctic Ecosystems: Ecological Change and Conservation*, Springer-Verlag, Berlin, pp. 347-353.

Azmi, O. R., and Seppelt, R. D., 1997. Fungi in the Windmill Islands, continental Antarctica. Effect of temperature, pH and culture media on the growth of selected microfungi. Polar Biology 18: 128-134.

Azmi, O. R., and Seppelt, R. D., 1998. The broad scale distribution of microfungi in the Windmill islands region, continental Antarctica. Polar Biology 19: 92-100.

Beyer, L. and Bölter, M., 2002. Geoecolgy of Antarctic Ice-Free Coastal Landscapes. Ecological Studies, Vol. 154. Springer-Verlag Berlin Heidelberg.

Beyer, L., Pingpank, K., Bolter, M. and Seppelt, R. D., 1998. Small-distance variation of carbon and nitrogen storage in mineral Antarctic Cryosols near Casey Station (Wilkes Land). Zeitschrift fur Pflanzenahrung Bodendunde 161: 211-220.

Blight, D. F., 1975. *The Metamorphic Geology of the Windmill Islands Antarctica, Volumes 1 and 2*, PhD thesis, University of Adelaide.

Blight, D. F. and Oliver, R. L., 1997. The metamorphic geology of the Windmill Islands Antarctica: a preliminary account. Journal of the Geological Society of Australia, 24: 239-262.

Blight, D. F. and Oliver, R. L.,1982. Aspects of the Geological history of the Windmill Islands, Antarctica. In: Craddock, C. (Ed.), *Antarctic Geoscience*, University of Wisconsin Press, Madison, WI, pp. 445-454.

Cowan, A. N., 1979. Giant Petrels at Casey, Antarctica. Australian Bird Watcher 8: 66-67.

Cowan, A. N., 1981. Size variation in the Snow petrel (*Pagodroma nivea*). Notornis 28: 169-188.

Emslie, S. D., Woehler, E. J., 2005. A 9000 year record of Adélie penguin occupation and diet in the Windmill Islands, East Antarctica. Antarctic Science 17, 57-66.

Giese, M., 1998. Guidelines for people approaching breeding groups of Adélie penguins (*Pygoscelis adeliae*), Polar Record 34 (191): 287-292.

Goodwin, I. D., 1993, Holocene deglaciation, sea-level change, and the emergence of the Windmill Islands, Budd Coast, Antarctica, Quaternary Research, 40: 70-80.

Heatwole, H., Saenger, P., Spain, A., Kerry, E. and Donelan, J., 1989. Biotic and chemical characteristics of some soils from Wilkes Land Antarctica, Antarctic Science 1: 225-234.

Hovenden, M. J., and Seppelt, R. D., 1995. Exposure and nutrients as delimiters of lichen communities in continental Antarctica, Lichenologist 27: 505-516.

Martin, M. R., Johnstone, G. W. & Woehler, E. J. 1990. Increased numbers of Adélie Penguins *Pygoscelis adeliae* breeding near Casey, Wilkes Land, East Antarctica. Corella 14, 119-122.

Melick, D. R., Hovenden, M. J., & Seppelt, R. D., 1994. Phytogeography of bryophyte and lichen vegetation in the Windmill Islands, Wilkes land, Continental Antarctica, Vegetatio 111: 71-87.

Melick, D. R., and Seppelt, R. D., 1990. Vegetation patterns in Relation to climatic and endogenous changes in Wilkes Land, continental Antarctica, Journal of Ecology, 85: 43- 56.

Murray, M. D., and Luders, D. J., 1990. Faunistic studies at the Windmill Islands, Wilkes Land, east Antarctica, 1959-80. ANARE Research Notes 73, Antarctic Division, Kingston.

Olivier, F., Lee, A. V. and Woehler, E. J., 2004. Distribution and abundance of snow petrels *Pagodroma nivea* in the Windmill Islands, East Antarctica. Polar Biology 27, 257-265.

Orton, M. N., 1963. A Brief Survey of the fauna of the Windmill Islands, Wilkes Land, Antarctica. The Emu 63: 14-22.

Paul, E., Stüwe, K., Teasdale, J., and Worley, B., 1995. Structural and metamorpohic geology of the Windmill Islands, east Antarctica: field evidence for repeated tectonothermal activity. Australian Journal of Earth Sciences 42: 453-469.

Roser, D. J., Melick, D. R. and Seppelt, R. D., 1992. Reductions in the polyhydric alcohol content of lichens as an indicator of environmental pollution. Antarctic Science 4: 185-189.

Roser, D. J., Melick, D. R., Ling, H. U. and Seppelt, R. D. 1992. Polyol and sugar content of terrestrial plants from continental Antarctica. Antarctic Science 4: 413- 420.

Roser, D. J., Seppelt, R. D. and Nordstrom, 1994. Soluble carbohydrate and organic content of soils and associated microbiota from the Windmill Islands, Budd Coast, Antarctica. Antarctic Science 6: 53-59.

Smith, R. I. L., 1980. Plant community dynamics in Wilkes Land, Antarctica, Proceedings NIPR Symposium of polar biology, 3: 229-224.

Smith, R. I. L., 1986. Plant ecological studies in the fellfield ecosystem near Casey Station, Australian Antarctic Territory, 1985-86. British Antarctic Survey Bulletin, 72: 81-91.

Woehler, E. J. 1990. Two records of seabird entanglement at Casey, Antarctica. Marine Ornithology 18, 72-73.

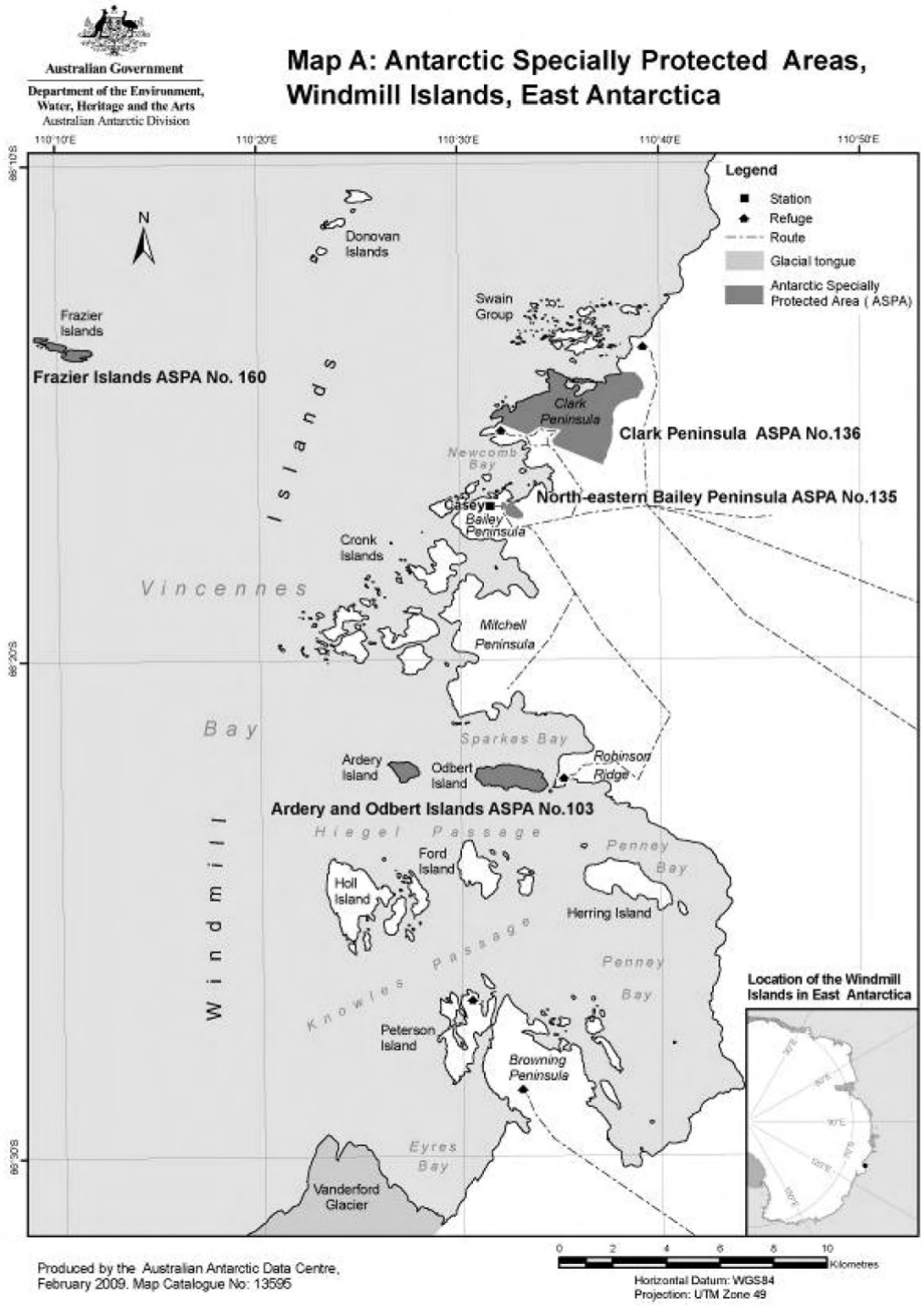
Woehler, E. J. 1993. Antarctic seabirds: their status and conservation in the AAT. RAOU Conservation Statement 9, 8pp.

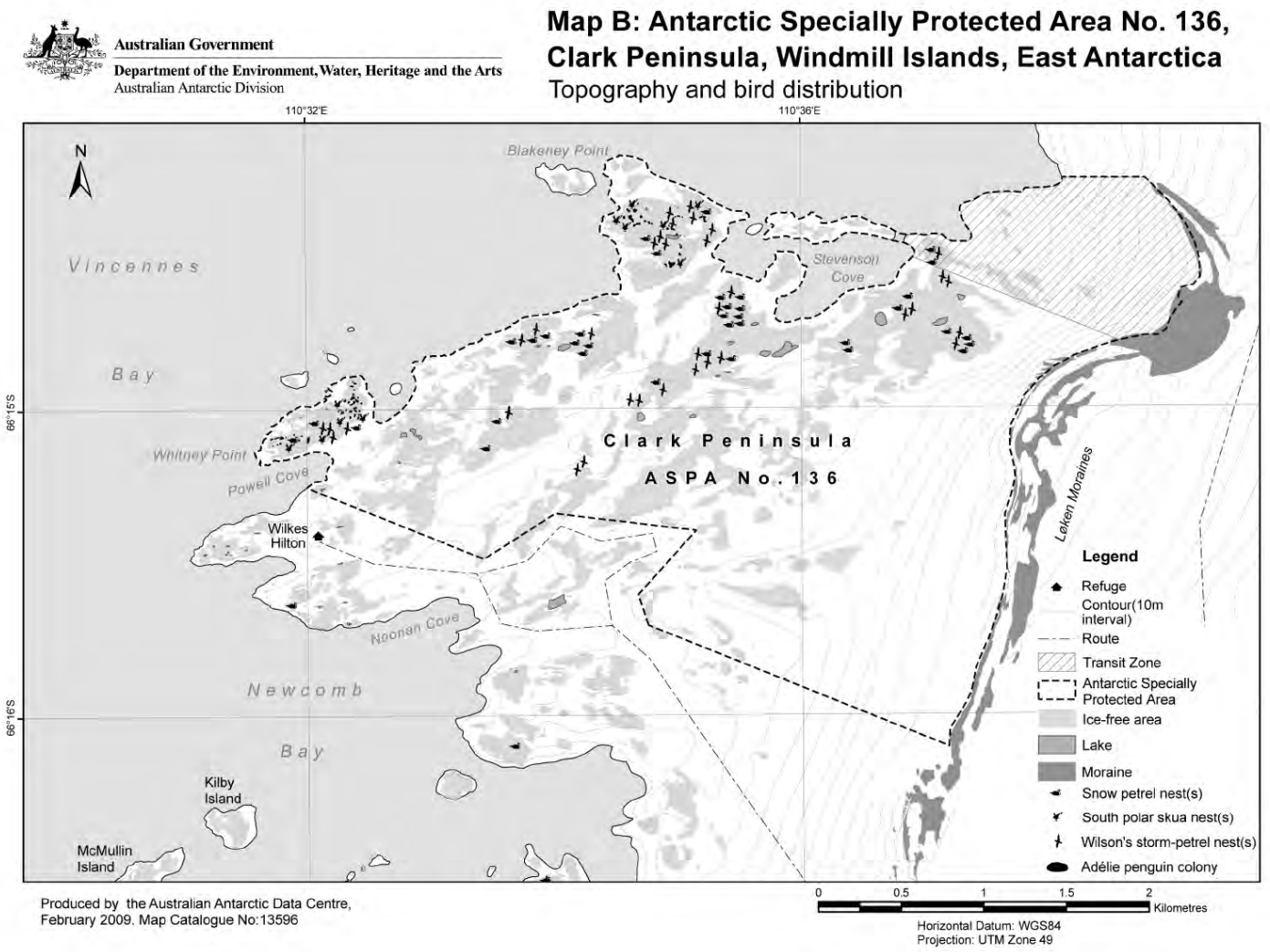
Woehler E. J., Riddle M. J. and Ribic C.A. (2003). Long-term population trends in southern giant petrels in East Antarctica. In: Huiskes AHL, Gieskes WWC, Rozema J, Schorno RML, van der Vies SM and Wolff W (eds) *Antarctic Biology in a global context*. Backhuys Publishers, Leiden, pp 290-295**.**

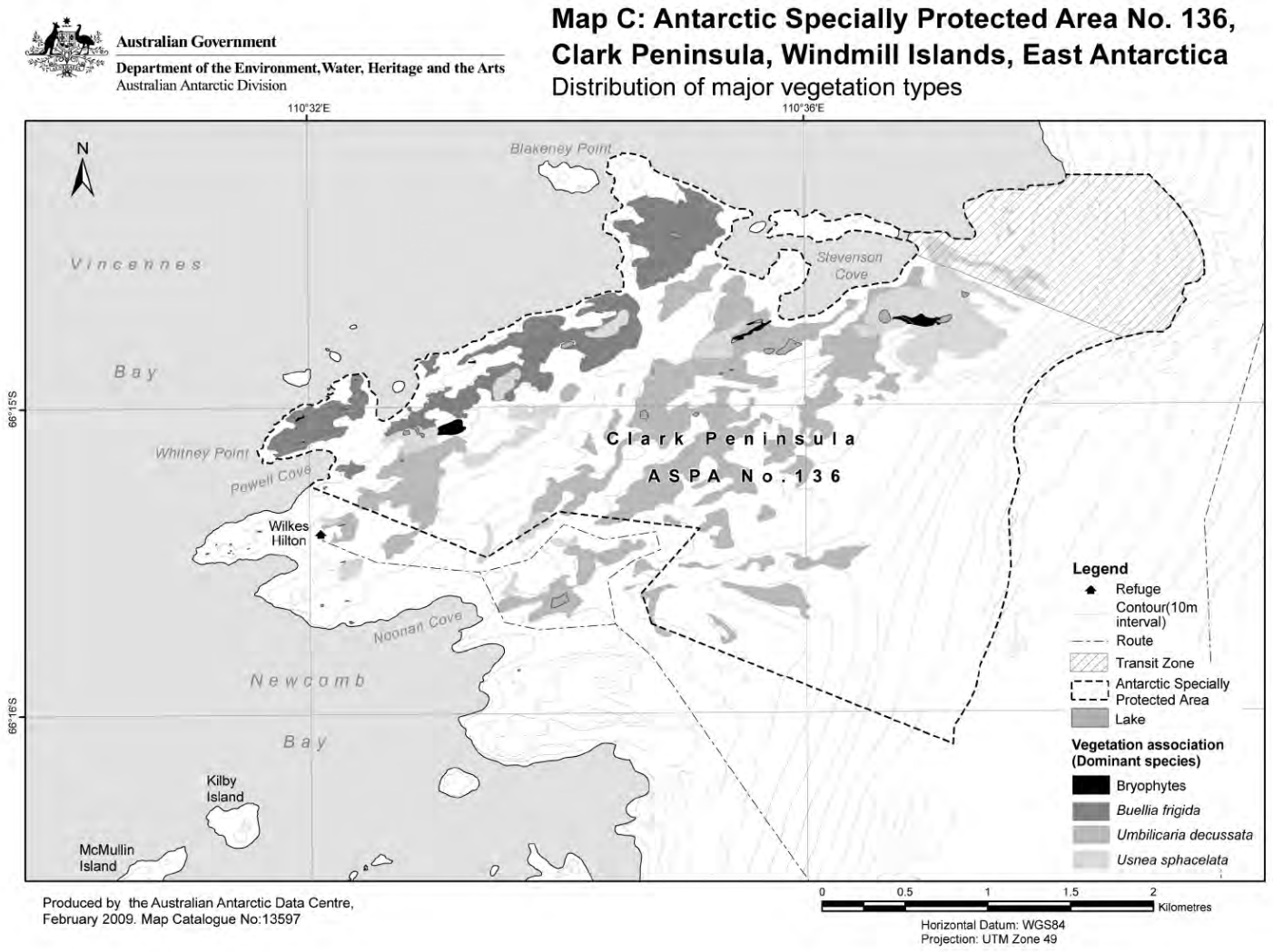
Woehler, E. J., Martin, M. R. & Johnstone, G. W. 1990. The status of Southern Giant-Petrels, *Macronectes giganteus*, at the Frazier Islands, Wilkes Land, East Antarctica. Corella 14, 101-106.

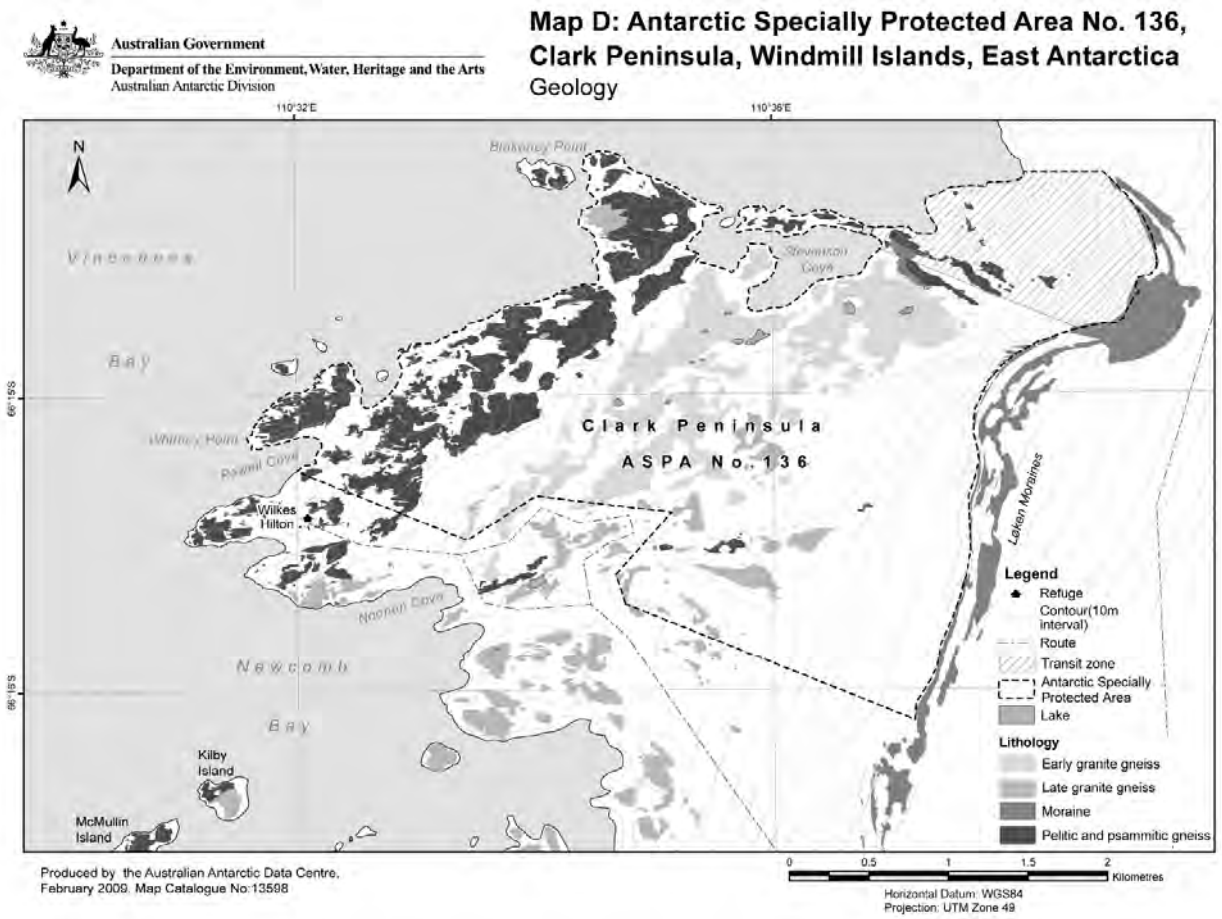
Woehler, E. J., Slip, D. J., Robertson, L. M., Fullagar, P. J. and Burton, H. R., 1991. The distribution, abundance and status of Adélie penguins *Pygoscelis adeliae* at the Windmill Islands, Wilkes Land, Antarctica, Marine Ornithology 19: 1-18.

Woehler, E. J., Penney, S. M., Creet, S. M. and Burton, H. R., 1994. Impacts of human visitors on breeding success and long-term population trends in Adélie Penguins at Casey, Antarctica, Polar Biology 14: 269-274.


Australian Government
Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division
Map A: Antarctic Specially Protected Areas, Windmill Islands, East Antarctica
110°10'E
110°20'E
110°30'E
110°40'E
110°50'E
66°10'S
66°20'S
66°30'S
N
Legend
Station
Refuge
Route
Glacial tongue
Antarctic Specially Protected Area (ASPA)
Donovan Islands
Swain Group
Frazier Islands
Frazier Islands ASPA No. 160
Windmill Islands
Clark Peninsula
Clark Peninsula ASPA No.136
Newcomb Bay
Casey
North-eastern Bailey Peninsula ASPA No.135
Bailey Peninsula
Cronk Islands
Vincennes Bay
Mitchell Peninsula
Sparkes Bay
Robinson Ridge
Ardery Island
Odbert Island
Ardery and Odbert Islands ASPA No.103
Hiegel Passage
Ford Island
Holl Island
Penney Bay
Herring Island
Knowles passage
Peterson Island
Browning Peninsula
Eyres Bay
Vanderford Glacier
Location of the Windmill Islands in East Antarctica
0 2 4 6 8 10 Kilometres
Horizontal Datum: WGS84
Projection: UTM Zone 49
Produced by the Australian Antarctic Data Centre, February 2009. Map Catalogue No: 13595


Australian Government
Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division
Map B: Antarctic Specially Protected Area No. 136,
Clark Peninsula, Windmill Islands, East Antarctica
Topography and bird distribution
110°32'E
110°36'E
66°15'S
66°16'S
N
Blakeney Point
Vincennes
Bay
Stevenson Cove
Clark Peninsula
ASPA No.136
Whitney Point
Powell Cove
Wilkes Hilton
Noonan Cove
Newcomb
Bay
Kilby Island
McMullin Island
Løken Moraines
Legend
Refuge
Contour(10m interval)
Route
Transit Zone
Antarctic Specially Protected Area
Ice-free area
Lake
Moraine
Snow petrel nest(s)
South polar skua nest(s)
Wilson's storm-petrel nest(s)
Adélie penguin colony
0
0.5
1
1.5
2
Kilometres
Produced by the Australian Antarctic Data Centre,
February 2009. Map Catalogue No:13596
Horizontal Datum: WGS84
Projection: UTM Zone 49


Australian Government
Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division
Map C: Antarctic Specially Protected Area No. 136, Clark Peninsula, Windmill Islands, East Antarctica
Distribution of major vegetation types
110°32'E
110°36'E
66°15'S
66°16'S
N
Blakeney Point
Vincennes
Bay
Stevenson Cove
Whitney Point
Powell Cove
Clark Peninsula
ASPA No.136
Wilkes Hilton
Noonan Cove
Newcomb
Bay
Kilby Island
McMullin Island
Legend
Refuge
Contour(10m interval)
Route
Transit Zone
Antarctic Specially Protected Area
Lake
Vegetation association (Dominant species)
Bryophytes
Buellia frigida
Umbilicaria decussata
Usnea sphacelata
0 0.5 1 1.5 2 Kilometres
Horizontal Datum: WGS84
Projection: UTM Zone 49
Produced by the Australian Antarctic Data Centre, February 2009. Map Catalogue No:13597


Australian Government
Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division
Map D: Antarctic Specially Protected Area No. 136, Clark Peninsula, Windmill Islands, East Antarctica
Geology
110°32'E
110°36'E
66°15'S
N
Vincennes Bay
Blakeney Point
Stevenson Cove
Clark Peninsula
ASPA No. 136
Whitney Point
Pyramid Cove
Wilkes Hilton
Leiken Moraines
Noonan Cove
Newcomb Bay
Kilby Island
McMullin Island
Legend
Refuge
Contour(10m interval)
Route
Transit zone
Antarctic Specially Protected Area
Lake
Lithology
Early granite gneiss
Late granite gneiss
Moraine
Pelitic and psammitic gneiss
0
0.5
1
1.5
2
Kilometres
Produced by the Australian Antarctic Data Centre, February 2009. Map Catalogue No:13598
Horizontal Datum: WGS84
Projection: UTM Zone 49

Measure 8 (2009)

Antarctic Specially Protected Area No 142 (Svarthamaren): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation XIV-5 (1987), which designated Svarthamaren, Mühlig Hofmannfjella, Dronning Maud Land, as Site of Special Scientific Interest ("SSSI") No 23 and annexed a management plan for the site;
- Resolution 3 (1996), which extended the expiry date of SSSI 23 from 31 December 1997 to 31 December 2000;
- Measure 1 (1999), which adopted a revised management plan for SSSI 23;
- Decision 1(2002), which renamed and renumbered SSSI 23 as Antarctic Specially Protected Area No 142;
- Measure 2 (2004), which adopted a revised management plan for ASPA 142;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 142;

Desiring to replace the existing Management Plan for ASPA 142 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 148 (Svarthamaren), which is annexed to this Measure, be approved;

2) all prior management plans for ASPA 142, namely those annexed to

   - Recommendation XIV-5 (1987) and

- Measure 2 (2004),

shall cease to be effective; and

3) Measure 1 (1999), which is not yet effective, be withdrawn.

Measure 8 (2009) - Annex

Management Plan for Antarctic Specially Protected Area No. 142 SVARTHAMAREN

Introduction

Svarthamaren nunatak (71°33'17''S -5°09'12"E to 71°55'12''S-5°15'12"E) is part of the Mühlig-Hoffmanfjella in Dronning Maud Land, Antarctica. The ASPA area is approximately 6.4 km² and consists of the ice-free areas of the Svarthamaren nunatak. Included are also the areas in immediate vicinity of the ice-free areas naturally belonging to the nunatak (i.e. rocks and boulders).

The nunatak has one unique characteristic as it holds the largest known seabird colony in the Antarctica. More than 250 000 pairs of Antarctic petrels (Thalassoica antarctica) is breeding annually here and about 500.000 non-breeding of this species are present during breeding season. In addition colonies of 500-1000 pairs of snow petrel (Pagodroma nivea) and about 80 pairs of south polar skua (Catharacta maccormicki) are found here.

Primary purpose: To avoid human induced changes to the population structure, composition and size of the seabird colonies present at the site, to allow for undisturbed research on the adaptations of the Antarctic petrel, snow petrel and south polar skua to the inland conditions in Antarctica.

1. Description of values to be protected

The Area was originally designated in Recommendation XIV-5 (1987, SSSI No. 23) after a proposal by Norway based on the following factors, which still give relevant grounds for designation:

- the fact that the colony of Antarctic petrel (*Thalassoica antarctica*) is the largest known inland seabird colony on the Antarctic continent
- the fact that the colony constitutes a large proportion of the known world population of Antarctic petrel
- the fact that the colony is an exceptional "natural research laboratory" providing for research on the Antarctic petrel, snow petrel (*Pagodroma nivea*) and south polar skua (*Catharacta maccormicki*), and their adaptation to breeding in the inland/interior of Antarctica

2. Aim and objectives

The aim of managing Svarthamaren is to:

- avoid human induced changes to the population structure, composition and size of the seabird colonies present at the site
- prevent unnecessary disturbance to the seabird colonies, as well as to the surrounding environment
- allow for undisturbed research on the adaptations of the Antarctic petrel, snow petrel and south polar skua to the inland conditions in Antarctica (Primary Research)
- allow access for other scientific reasons where the investigations will not damage the objectives of the bird research

The focus of the *Primary Research* in Svarthamaren ASPA is as follows:

- Improve the understanding of how natural as well as anthropogenic changes in the environment affect the spatial and temporal distribution of animal populations, and, furthermore, how such changes affect the interaction between key species in the Antarctic ecosystem.

3. Management activities

Management activities at Svarthamaren shall:

- ensure that the seabird colonies are adequately monitored, to the maximum extent possible by non-invasive methods
- allow erection of signs/posters, border markers, etc. in connection to the site, and ensure that these are serviced and maintained in good condition
- include visits as necessary to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate

Any direct intervention management activity in the area must be subject to an environmental impact assessment before any decision to proceed is taken.

4. Period of Designation

Designated for an indefinite period.

5. Maps and Illustrations

- *Map A*: Dronning Maud Land (showing location of Map B). Map specifications:

- Projection: Lambert Conformal Conic;
- Standard parallels: SP1 70º S, SP2 73ºS
- Central Meridian: 5ºE
- Latitude of origin: 71º30'S
- Spheroid: WGS84

- *Map B*: Svarthamaren and surroundings (showing location of Svarthamaren ASPA). Map specifications are the same as for Map A.
- *Map C*: Antarctic Specially Protected Area No. 142, protected area topographic map. Map specifications are the same as for Map A.
- *Map D*: Aerial photo of Svarthamaren (1996, Norwegian Polar Institute)

6. Description of Area

6 (i) Geographic co-ordinates, boundary markers and natural features

The Svarthamaren ASPA is situated in Mühlig-Hoffmannfjella, Dronning Maud Land, stretching from approx. 71º 33'17" S, 5º09'12" E the north-west to approx. 71º55'58"S, 5º15'12" E in the south-east. The distance from the ice front is about 200 km. The Area covers approximately 6.4 km2, and consists of the ice-free areas of the Svarthamaren nunatak, including the areas in the immediate vicinity of the ice-free areas naturally belonging to the nunatak (i.e. rocks). The Area is shown in Map B and C.

The Norwegian field station Tor is located in the Svarthamaren nunatak at lat. 71º53'S, long. 5º10'E. The station, including a 10-metre buffer zone around the station buildings, is excluded from the Svarthamaren Antarctic Specially Protected Area. Access to the station is by the shortest route from the ice.

The main rock types in the Area are coarse and medium grained charnockites with small amounts of xenoliths. Included in the charnockitoids are banded gneisses, amphibolites and granites of the amphibolite facies mineralogy. The slopes are covered by decomposed feldspathic sand. The north-eastern side of the Svarthamaren nunatak is dominated by scree slopes (slope 31º-34º), extending 240 metres upwards from the base of the mountain at about 1600 metres above sea level. The major features of this area are two rock amphitheatres inhabited by breeding Antarctic petrels. It is this area which makes up the core of the protected site.

No continuous weather observations have been carried through in the Area, but prevalent air temperature has been observed to range between -5º and -15ºC in January, with somewhat lower minimum temperatures in February.

The flora and vegetation at Svarthamaren are sparse compared with other areas in Mühlig-Hofmannfjella and Gjelsvikfjella to the west of the site. The only plant species occurring in abundance, but peripherally to the most manured areas, is the foliose green alga, *Prasiola crispa*. There are a few lichen species on glacier-borne erratics 1-2 km away from the bird colonies: *Candelariella hallettensis* (= C. *antarctica*), *Rhizoplaca* (= *Lecanora*) *melanophthalma*, *Umbilicaria* spp. and *Xanthoria* spp. Areas covered with *Prasiola* are inhabited by collembola ASPA No. 142: Svarthamaren *Cryptopygus sverdrupi*) and a rich fauna of mites (*Eupodes anghardi*, *Tydeus erebus*) protozoan, nematodes and rotifers. A shallow pond measuring about 20 x 30 m, lying below the middle and largest bird sub-colony at Svarthamaren, is heavily polluted by petrel carcasses, and supports a strong growth of a yellowish-green unicellular algae, *Chlamydomonas*, sp. No aquatic invertebrates have yet been recorded.

The colonies of breeding seabirds are the most conspicuous biological element in the Area. The north-eastern slopes of Svarthamaren are occupied by a densely populated colony of Antarctic petrels (*Thalassoica antarctica*) divided into three separate sub-colonies.

The total number of breeding pairs is estimated to be approximately 250,000 pairs. In addition, 500-1000 pairs of snow petrels (*Pagodroma nivea*) and approximately 80 pairs of south polar skuas (*Catharacta maccormicki*) breed in the area. The two main colonies of Antarctic petrels are situated in the two rocky amphitheatres. The main colonies of snow petrels are located in separate parts of the scree-slope that are characterised by larger rocks. The south polar skuas nest on the narrow strip of flat, snow-free ground below the scree-slopes.

The main concentrations of seabirds are indicated on Map C. Readers should, however, be aware that birds are also found in other areas than these densely populated areas.

Based on the Environmental Domains Analysis for Antarctica (2007, Morgan et al.) both Environments T- *Inland continental geologic* - and U- *North Victoria Land geologic* - are found to be represented at Svarthamaren (2009, Harry Keys, pers. comm.).

6 (ii) Restricted zones within the Area

None

6 (iii) Location of structures within the Area

There are no structures within the Area.

The Norwegian field station Tor is located on the Svarthamaren nunatak, at 71º53.4’S, 5º09.6’E. The station, including a 10 meter buffer zone around the station buildings, is excluded from the Area.

6 (iv) Location of other Protected Areas within close proximity

None

7. Permit Conditions

Permits may be issued only by appropriate national authorities as designated under Annex V, Article 7 of the Protocol on Environmental Protection to the Antarctic Treaty. Conditions for issuing a permit to enter the Area are that:

- the actions permitted are in accordance with this Management Plan
- the permit, or a copy, shall be carried within the area
- any permit issued shall be valid for a stated period
- a visit report is supplied to the authority named in the permit

7 (i) Access to and movement within the Area

Access to the area is restricted by the following conditions:

- No pedestrian routes are designated, but persons on foot shall at all times avoid disturbances to birds, and as far as possible also to the sparse vegetation cover in the Area.
- Vehicles should not enter the site.
- No flying of helicopters or other aircraft over the Area is allowed.
- Helicopter landings are not allowed within the boundaries of the ASPA. Landings associated with activities at the field station Tor should preferably take place at the north-eastern tip of the Svarthamaren nunatak (as marked on map C).

7 (ii) Activities that are or may be conducted within the Area, including restrictions on time and place

The following activities may be conducted within the Area in accordance with permit:

- Primary biological research programs for which the area was designated.
- Other research programs of a compelling scientific nature that will not interfere with the bird research in the Area.

7 (iii) Installation, modification or removal of structures

No structures are to be erected in the Area, or scientific equipment installed, except for equipment essential for scientific or management activities as specified in a permit, or for modification of the field station, also as specified in a permit.

7 (iv) Location of field camps

No field camps should be established within the Area. (Cf. 6 iii)

7 (v) Restrictions on materials and organisms which may be brought into the Area

- No living animals or plant material shall be deliberately introduced into the Area.
- No poultry products, including food products containing uncooked dried eggs, shall be taken into the Area.
- No herbicides or pesticides shall be brought into the Area. Any other chemicals (including fuel), which may be introduced for a compelling scientific purpose specified in the permit, shall be removed from the Area before or at the conclusion of the activity for which the permit was granted. (cf. 6 iii). Limited fuel storage at the field station Tor is acceptable, taking into account that the station and its immediate surroundings are not part of the Area.
- All materials introduced shall be for a stated period, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of their introduction into the environment is minimized.

7 (vi) Taking or harmful interference with native flora and fauna

Taking or harmful interference with native flora and fauna is prohibited, except in accordance with a permit issued in accordance with Annex II to the Protocol of Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, *SCAR Code of Conduct for Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

It is recommended that those responsible for the primary research in the Area should be consulted before a permit is granted for taking of birds for purposes not associated with the primary research. Studies requiring taking of birds for other purposes should be planned and carried through in such a manner that it will not interfere with the objectives of the bird research in the Area. ASPA No. 142: Svarthamaren

7 (vii) Collection and removal of anything not brought into the Area by the Permit holder

Material may be collected or removed from the Area only in accordance with a permit, except that debris of man-made origin should be removed and that dead specimens of fauna may be removed for laboratory examination.

7 (viii)Disposal of waste

All wastes are to be removed from the area.

7 (ix) Measures that may be necessary to ensure that the aims and objectives of the Management Plan continue to be met

Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities which may involve the collection of small amounts of plant material or small numbers of animals for analysis or audit, to erect or maintain notice boards, to maintain the field station, or to undertake protective measures.

7 (x) Requirements for reports

Parties should ensure that the principal holder of each permit issued submit to the appropriate authority a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the Visit Report form suggested by SCAR. Parties should maintain a record of such activities and, in the Annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the management plan and in organizing the scientific use of the Area.

Bibliography

Amundsen, T. 1995. Egg size and early nestling growth in the snow petrel. *Condor* 97: 345-351.

Amundsen, T., Lorentsen, S.H. & Tveraa, T. 1996. Effects of egg size and parental quality on early nestling growth: An experiment with the Antarctic petrel. *Journal of Animal Ecology* 65: 545-555.

Andersen, R., Sæther, B.E. & Pedersen, H.C. 1995. Regulation of parental investment in the Antarctic petrel *Thalassoica antarctica*: An experiment. Polar Biology 15:65-68

Andersen, R., Sæther, B.-E. & Pedersen, H.C. 1993. Resource limitation in a long-lived seabird, the Antarctic petrel *Thalassoica antarctica*: a twinning experiment. Fauna Norwegica, Serie C 16:15-18

Bech, C., Mehlum, F. & Haftorn, S. 1988. Development of chicks during extreme cold conditions: the Antarctic petrel *Thalassioca antarctica*. Proceedings of the 19'th International Ornithological Congress:1447-1456

Brooke, M.D., Keith, D. & Røv, N. 1999. Exploitation of inland-breeding Antarctic petrels by south polar skuas. *OECOLOGIA* 121: 25-31

Fauchald, P. & Tveraa, T. 2003. Using first-passage time in the analysis of area restricted search and habitat selection. Ecology 84:282-288

Fauchald P. & Tveraa T. 2006. Hierarchical patch dynamics and animal movement pattern. *Oecologia*, 149, 383-395

Haftorn, S., Beck, C. & Mehlum, F. 1991. Aspects of the breeding biology of the Antartctic petrel (*Thalassoica antarctica*) and krill requirements of the chicks, at Svarthamaren in Mühlig-Hofmannfjella, Dronning Maud Land. Fauna Norwegica, Serie C. Sinclus 14:7-22

Haftorn, S,, Mehlum, F. & Bech, C. 1988. Navigation to nest site in the snow petrel (Pagodrom nivea). Condor 90:484-486

Lorentsen, S.H. & Røv, N. 1994. Sex determination of Antarctic petrels *Thalassoica antarctica* by discriminant analysis of morphometric characters. Polar Biology 14:143-145

Lorentsen, S.H. & Røv, N. 1995. Incubation and brooding performance of the Antarctic petrel (*Thalassoica antarctica*) at Svarthamaren, Dronning Maud Land. *Ibis* 137: 345-351.

Lorentsen, S.H., Klages, N. & Røv, N. 1998. Diet and prey consumption of Antarctic petrels *Thalassoica antarctica* at Svarthamaren, Dronning Maud Land, and at sea outside the colony. *Polar Biology* 19: 414-420.

Lorentsen, S.H. 2000. Molecular evidence for extra-pair paternity and female-female pairs in Antarctic petrels. Auk 117:1042-1047

Morgan, F., Barker, G., Briggs, C. Price, R., Keys, H. 2007. Environmental Domains of Antarctica,

Landcare Research New Zealand Ltd

Nygård,T., Lie, E., Røv, N., *et al.* 2001. Metal dynamics in an Antarctic food chain. *Mar. Pollut. Bull.* 42: 598-602

Ohta, Y., Torudbakken, B.O. & Shiraishi, K. 1990. Geology of Gjelsvikfjella and Western Muhlig-Hofmannfjella, Dronning Maud Land, East Antarctica. *Polar Research* 8: 99-126.

Steele, W.K., Pilgrim, R.L.C. & Palma, R.L. 1997. Occurrence of the flea Glaciopsyllus antarcticus and avian lice in central Dronning Maud Land. *Polar Biology* 18: 292-294.

Sæther, B.E., Lorentsen, S.H., Tveraa, T. *et al*. 1997.Size-dependent variation in reproductive success of a long-lived seabird, the Antarctic petrel (*Thalassoica antarctica*). *AUK* 114 (3): 333-340.

Sæther, B.-E., Andersen, R. & Pedersen, H.C. 1993. Regulation of parental effort in a long-lived seabird: An experimental study of the costs of reproduction in the Antarctic petrel (*Thalassoica Antarctica)*. Behavioral Ecology and Sociobiology 33:147-150

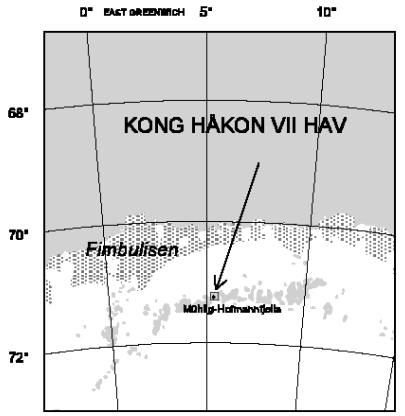
Tveraa, T., Lorentsen, S.H. & Saether, B.E. 1997. Regulation of foraging trips and costs of incubation shifts in the Antarctic petrel (*Thalassoica antarctica*). *Behavioral Ecology* 8: 465-469.

Tveraa, T. & Christensen, G.N. 2002. Body condition and parental decisions in the Snow Petrel (*Pagodroma nivea*). *AUK* 119: 266-270.

Tveraa, T., Sæther, B.E., Aanes, R. & Erikstad, K.E. 1998. Regulation of food provisioning in the Antarctic petrel; the importance of parental body condition and chick body mass. *Journal of Animal Ecology* 67: 699-704.

Tveraa, T., Sæther, B.-E., Aanes, R. & Erikstad, K.E. 1998. Body mass and parental decisions in the Antarctic petrel *Thalassoica antarctica*: how long should the parents guard the chick? Behavioral Ecology and Sociobiology 43:73-79

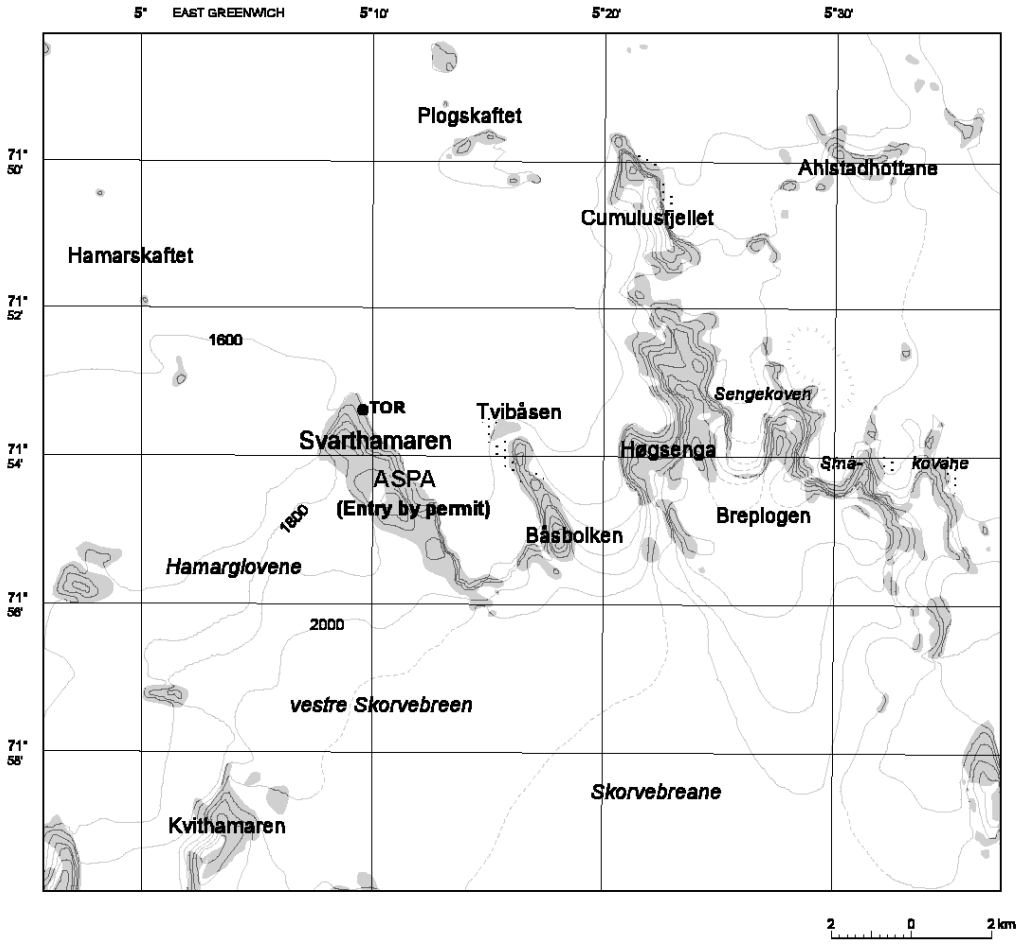
Varpe, Ø., Tveraa, T. & Folstad, I. 2004. State-dependent parental care in the Antarctic petrel: responses to manipulated chick age during early chick rearing. Oikos, in press ASPA No. 142: Svarthamaren



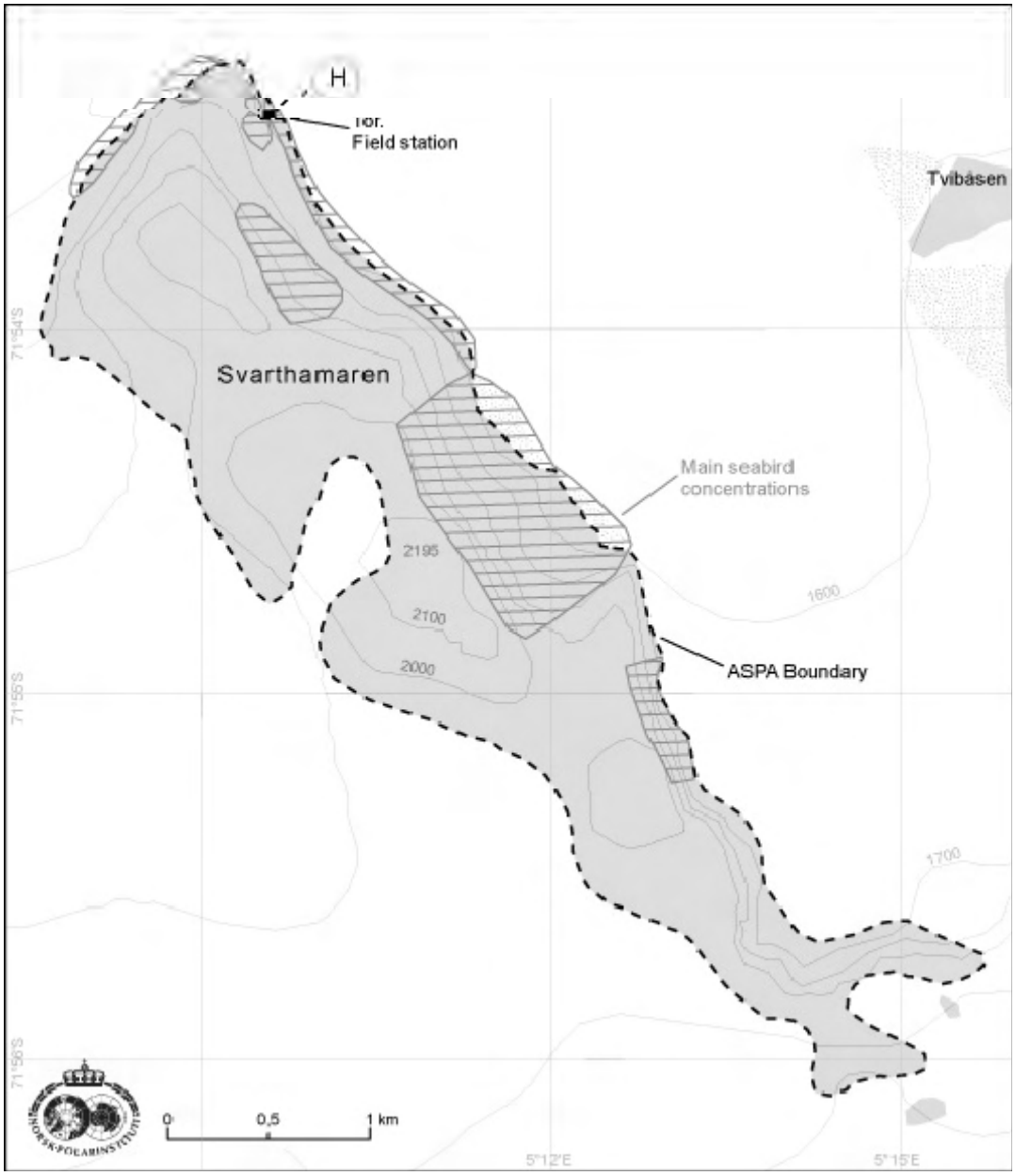
MAP A : Dronning Maud Land
Location of map B shown

100 0 100 km

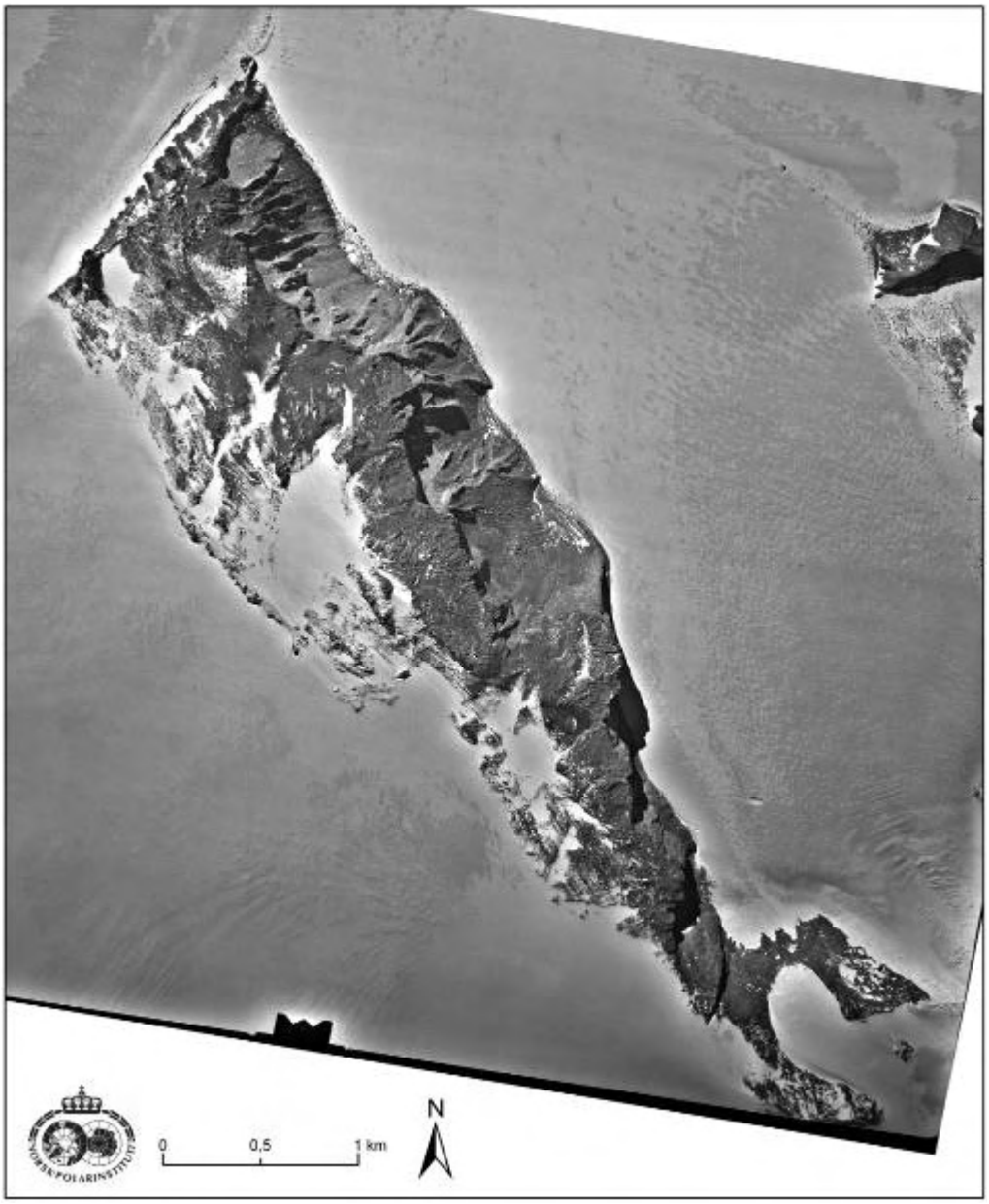
MAP B : Svarthamaren and surrondings
Svarthamaren, ASPA No. 142 sligthly left of centre



Map C: Svarthamaren – ASPA No. 142. Boundaries and Main Seabird Concentrations.



Map D: Aerial Photograph of Svarthamaren ASPA 142 (1996, Norwegian Polar Institute)



Measure 9 (2009)

Antarctic Specially Protected Area No 150 (Ardley Island, Maxwell Bay, King George Island): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation XVI-2 (1991), which designated Ardley Island, Maxwell Bay, King George Island as Site of Special Scientific Interest ("SSSI") No 33 and annexed a management plan for the site;
- Measure 3 (2001), which extended the expiry date of SSSI 33 from 31 December 2001 to 31 December 2005;
- Decision 1 (2002) which renamed and renumbered SSSI 33 as Antarctic Specially Protected Area No 150;
- Measure 4 (2005), which extended the expiry date of ASPA 150 until 31 December 2010;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 150;

Desiring to replace the existing Management Plan for ASPA 150 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 150 (Ardley Island, Maxwell Bay, King George Island), which is annexed to this Measure, be approved;

2) the Management Plan for ASPA 150 annexed to Recommendation XVI-2 (1991), which is not yet effective, be withdrawn.

Management Plan for Antarctic Specially Protected Area No. 150

ARDLEY ISLAND, MAXWELL BAY, KING GEORGE ISLAND (25 DE MAYO)

Introduction

Ardley Island (62º13' S; 58º54' W) is located on the southwest coast of King George Island (25 de Mayo), nearly 500 m east of the coast of Fildes Peninsula, Maxwell Bay (Fildes Bay). The island is about 2 km long and 1.5 km at its widest, and rises to about 65 m altitude. In geomorphological terms, the area comprises mainly tertiary andesitic-basaltic lavas and tuffs, and there are some raised beach terraces.

It is free from snow and ice in summer. A small freshwater pond about 100 m long is formed by melting snow on the southwest part of the island between November and February.

After a proposal by Chile, Ardley Island was designated a Site of Special Scientific Interest, SSSI No. 33, under Recommendation XVI-2 (1991). The aim was to protect the diverse range of bird species that breed on the island. Initially, the Area was under protection until 2001. In that same year, protection was extended until 2005 under Measure 3 (2001). Under Measure 4 (2005), protection of the Area was extended until December 2010.

In 1991, Chile proposed to the Antarctic Treaty System that Ardley Island be protected in view of the site's biological interest due to the diverse range of sea birds that inhabit the area, either to breed (11 species), or to moult. The island also possesses some of the best developed and most extensive plant communities in the South Shetland Islands, notably the peaks, dominated by macrolichens. Such vegetation is extremely sensitive to human disturbance and is very easily damaged.

Studies carried out on Ardley Island since the 1970s on the three populations of Pygoscelid penguins that breed there show major seasonal fluctuations and a decrease in the colonies of giant petrels that nest on the island. Over the last few years, one vascular plant have begun to colonize the island, which has led to an increase in the number of species present in the Area.

The current Management Plan has changed the borders of the Area designated in Recommendation XVI-2 (1991), leaving out one part of what was originally classified as a "tourist area", located on the beach between Faro Point (62º12'34" S; 58º55'34" W) and the beginning of Braillard Point (62º12'40" S; 58º55'4" W). This section has often been visited by tourists and non-scientific staff from stations neighbouring Ardley Island. Visits by tourists are limited exclusively to this area, with groups of no more than 20 people.

It is necessary to maintain protection over the area in order to understand the effects of environmental pressure, both anthropogenic and natural, on the flora and fauna of the site because some of the studies conducted have shown that human activity is contributing to a decrease in flying bird populations on Ardley Island, and to detect the potential effects on

the ecosystem and the ecology of the populations locally and regionally due to the increased sea and air temperature recorded in the Antarctic Peninsula region.

1. Description of values to be protected

The island was designated as a protected area on account of the diverse assemblage of bird species that breed on it, and in order to allow a study of their ecology and the factors that affect their populations.

Ardley Island also possesses a developed and outstanding flora, with several species of lichens, mosses and vascular plants. The main species of lichens that inhabit the area belong to the genera *Himantormia* and *Usnea*, which dominate the highlands of Ardley Island, and *Placopsis*, *Xanthoria*, *Haematomma*, *Rinodina*, *Caloplaca* and *Buellia* in the coastal sectors. Both the flora and fauna are thought to be extremely sensitive to human disturbance. The vascular plant *Deschampsia antarctica* has gradually colonized the island from the 90's, mainly in the north part.

Seals have been recorded hauling out and moulting on the beach. The most common type is the Weddell seal (*Leptonychotes weddellii*). During the last few seasons, Chilean researchers have reported the occurrence of leopard seals (*Hydrurga leptonyx*) preying on penguins in the Area.

2. Aims and Objectives

The Management Plan of ASPA No. 150 aims to:

- protect the bird community and the terrestrial ecosystem;
- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance in the Area;
- allow scientific research, with the least possible interference, on marine Antarctic birds, and the ecosystem and physical environment associated with the values for which the Area is protected;
- allow other scientific research in the Area, provided it does not compromise the values for which the Area is protected;
- minimize the possibility of the introduction of non-native plants, animals and microbes to the Area;
- allow visits for management purposes, and in support of the aims of the Management Plan.

3. Management activities

The following management activities will be undertaken to protect the values of the Area:

- Copies of this Management Plan, including maps of the area, shall be made available at the following locations:

1) Julio Escudero Station, Fildes Peninsula, King George Island (25 de Mayo)
2) Eduardo Frei Station, Fildes Peninsula, King George Island (25 de Mayo)
3) Bellingshausen Station, Fildes Peninsula, King George Island (25 de Mayo)
4) Great Wall Station, Fildes Peninsula, King George Island (25 de Mayo)
5) King Seyong Station, King George Island (25 de Mayo)
6) Artigas Station, King George Island (25 de Mayo)
7) Jubany Station, King George Island (25 de Mayo)

- The staff to be posted at Ardley Island shall be specifically trained on all matters concerning this Management Plan and the measures established in the Madrid Protocol;
- The pilots of the airplanes that flight to King George Island (25 de Mayo) must know and have a copy of the management plan before travel to Antarctica, to secure the knowledge of the restrictions to protect the values of the Area.
- When even possible, before visit the area the clothing, footwear and equipment, must be clean and disinfected to avoid the introduction of micro organisms.
- Signposts (markers, signs or any other information structures) will be allowed on sites where they do not disturb the protected values or research activities, for scientific, management or information purposes, and shall be maintained in good condition;
- Scientific research shall be allowed in order to study and monitor anthropogenic and natural impacts that could affect the protected values in the Area;
- Visits shall be made as necessary to assess whether the Area continues to serve the purposes for which it was designed and to ensure adequate management and maintenance measures;
- Entry into the Area by vehicles of any kind is strictly forbidden.
- New standards for the management of tourism in the northern section of the island, not included in the boundaries of the ASPA, will be developed as Guidelines for Visitors to the Antarctic Treaty Area. The objective is to ensure that the visits carried out are in strict compliance with the Management Plan and with the protection of its values, given its adjacency to ASPA No 150.

4. Period of designation

Designated for an indefinite period.

5. Maps and figures

Three maps are enclosed to this Management Plan as Annexes:

- Map 1. Location of Ardley Island in relation to King George Island (25 de Mayo) and the Fildes Peninsula.
- Map 2. Location of Ardley Island in relation to the Fildes Peninsula, King George Island (25 de Mayo), showing the stations present in the region.
- Map 3. Ardley Island and Antarctic Specially Protected Area No 150. Permanent structures are shown, as area the demarked route (terrestrial access), exclusive for those whom carry on a permit, and disembarking points (maritime access). The Protected Area is marked out with a dotted line.
- Figure 1. Sketch with the distribution of the main nesting birds on Ardley Island, based in Peter *et al*., 2008.
- Figure 2. Sketch of the distribution and coverage of the plant species present on Ardley Island, based in Peter *et al*., 2008.

6. Description of the area

i. Geographical coordinates, boundary markers and natural features

GENERAL DESCRIPTION

Ardley Island (62º13' S; 58º54' W) is about 2 km southeast of the Bellingshausen Station (Russian Federation) and of the Escudero and Frei Stations (Chile), and about 2 km east of the Great Wall Station (China).

The Area comprises most of the island, and is linked to King George Island (25 de Mayo) by an isthmus that remains submerged at high tide. The eastern part of the isthmus, that remain dry during the high tide, is included in the Area due it is part of Ardley island. However, the western part of the isthmus is outside the Area, as the beach below the 1 m contour line in the north-eastern part of the island, from Faro Point (62º12'34" S; 58º55'34" W) until the beginning of Braillard Point (62º12'40" S; 58º55'4" W) (see Map 3). Below this contour line, there is a section that is 5 m wide, on average, and which may be freely visited without the authorization requirements required for entry into ASPA No 150. The geography of the area restricts pedestrian traffic to the protected Area and also permits an appropriate protection of the values if the Management Plan is followed.

A footpath of 2 m of wide, often used by researchers working in the Area, is marked out in the western part of the island, from the isthmus connecting it with King George Island (25 de Mayo). There are no special markings to indicate this path - it is evident from the well-trodden ground.

Geologically, it consists mainly of Tertiary andesitic and basaltic lavas and tuffs together with raised beach terraces. The topography is plain, with the highest elevation at 65 m.

BREEDING BIRDS

The seabird community of Ardley Island is diverse and of exceptional biological interest. Of particular importance are the breeding colonies of Pygoscelid penguins, as it is one of the few places where the three species breed sympatrically. In addition to the penguin species, the area is also the breeding ground for flying birds such as the southern giant petrels (*Macronectes giganteus*), Wilson's storm petrels (*Oceanites oceanicus*), Antarctic terns (*Sterna vittata*) and brown skuas (*Catharacta antarctica lonnbergi*) (Table 1). Figure 1 shows the general distribution of the main groups of birds that nest on Ardley Island.

Gentoo penguins (*Pygoscelis papua*), of which there were closer to 5,000 breeding pairs in the last breeding seasons, make up one of the largest breeding colonies of Gentoo penguins recorded in the South Shetland Islands, and probably in the Antarctic. There are currently around 300 breeding pairs of Adelie penguins (*P. adeliae*) and only a very few Chinstrap penguins (*P. antarctica*) (Table 2).

Table 1: List of bird species breeding on Ardley Island

Common Spanish name	Common English name	Species
Pingüino Adelia	Adelie penguin	*Pygoscelis adeliae*
Pingüino de barbijo	Chinstrap penguin	*Pygoscelis antarctica*
Pingüino papúa	Gentoo penguin	*Pygoscelis papua*
Skúa o salteador pardo	Brown skua	*Catharacta antarctica lonnbergi*
Skúa o salteador polar	South polar skua	*Catharacta maccormicki*
Petrel gigante	Southern giant petrel	*Macronectes giganteus*
Petrel de Wilson	Wilson's storm petrel	*Oceanites oceanicus*
Golondrina de mar de vientre negro	Blackbellied storm petrel	*Fregetta tropica*
Petrel damero o del cabo	Cape petrel	*Daption capense*
Gaviota dominicana	Kelp gull	*Larus dominicanus*
Gaviotín antártico	Antarctic tern	*Sterna vittata*

Table 2. Breeding populations of penguins on Ardley Island from 1973/74 to 2005/06

	Breeding pairs		
Season	***P. antarctica***	***P. adeliae***	***P. papua***
1973/74 [1]	18	230	1850
1980/81 [2]	244	1056	3809
1981/82 [3]	141	1314	2580
1983/84 [4]	91	1074	1656
1984/85 [5]	110	1331	3105
1985/86 [6]	39	929	3522
1986/87 [7]		1160	3410
1994/95	45	1095	3772
1995/96	49	1226	2985
1996/97	72	923	2974
1997/98	33	1173	3146
1998/99	43	1192	3349
1999/00	34	974	3911
2000/01	26	880	4472
2001/02	22	780	4444
2002/03	35	771	5131
2003/04	29	559	4957
2004/05	13	409	4798
2005/06	9	334	4635

Data obtained by the INACH "Ecology of three species of penguins" project led by Dr. J. Valencia, except: 1 and 4: Yañez *et al*. (1984); 2: Trivelpiece *et al*. (1987); 2, 5 and 7: Woehler (1993) (only *P. papua*); 3: Bannasch *et al*. (1983); 5: Peter *et al.* (1998 y 2008) (only *P. antarctica*), and 6: Rauschert *et al*. (1987)

Detailed ornithological and botanical research has been undertaken on Ardley Island for many years, mainly by Chilean and German scientists, with brief studies also made by scientists from Russia, Korea and China. German studies indicate that the giant petrel breeding population has declined by about 80% since research began in 1979. They point to strong evidence that numerical fluctuations of these particular populations are a direct response to disturbances produced by large numbers of visitors, aircraft overflights and station constructions. Disturbed pairs have moved their breeding sites to less affected areas. In the case of the breeding population of skuas, human and natural impacts can be linked to the recorded fluctuations caused by variable food availability and weather conditions. The effects of these impacts will continue to be monitored as an integral part of the long-term ornithological research being undertaken at this site.

MARINE MAMMALS

Seals are usual visitors of Ardley Island. Weddell seals (*Leptonychotes weddellii*) breed near the area between September and November on beaches and on the sea ice in Maxwell Bay (Fildes Bay). Crabeater seal (*Lobodon carcinophagus*) has been recorded in winter months in the sea ice in Maxwell Bay (Fildes Bay), in the vicinities of the Area, sometimes in big numbers. During December and March, some elephant seals *(Mirounga leonina*), Weddell seals and Antarctic fur seals (*Arctocephalus gazella*) visit the area to haul out or to moult.

Over the last few seasons, Chilean researchers have reported the occurrence of leopard seals (*Hydrurga leptonyx*), probably preying on penguins, in the vicinity of Ardley Island and mainly in the eastern part of the Area.

VEGETATION

The island has some of the best developed and most extensive plant communities in the South Shetland Islands, with around 250 species of lichens, 130 mosses and liverworts and 1 species of vascular plants. The climax fell field ecosystem is dominated by macrolichens such as *Himantormia lugubris* and several species of the genus *Usnea.* Such vegetation is extremely sensitive to human disturbance and is very easily damaged. In the coastal regions of Ardley Island it is possible to find many different lichens, mainly of the genera *Placopsis*, *Xanthoria*, *Haematomma*, *Rinodina*, *Caloplaca* and *Buellia*.

The presence of the Antarctic grass *Deschampsia antarctica* shows a significant increase in the size and number of recorded colonies. It is suggested that this population of vascular plants increases as a response to warmer and longer growing seasons, caused by regional warming. Figure 2 shows the distribution of the vegetation on Ardley Island.

ii. Special and managed zones within the Area

There are no special zones within the Area.

iii. Structures within and near the Area

There are two Chilean semi-permanent summer-only research shelters. Ripamonti I (62°12' S; 58°53' W) was established in 1982, in the northern coast of Ardley, and Ripamonti II (former Alfred Wegener Institute hut, ceded to Chile by Germany in 1997) lies almost 100 metres southwest from Braillard Point on the south-eastern part, inside the penguin breeding colonies. There are also two Argentinean buildings in the area that make up the Ballvé Refuge, set up in 1953, approximately 50 meters east of Ripamonti I.

An Argentinean radio beacon facilitates navigation, looking towards Maxwell Bay (Fildes Bay).

All the structures described remain in the Area year round.

iv. Location of other protected areas within close proximity of the Area

There are four protected areas in Nelson and King George (25 de Mayo) Islands, close to Ardley Island. The nearest one is Fildes Peninsula, ASPA No 125, about 1 km west and north-northwest of Ardley Island. ASPA No 128, on the western shore of Admiralty Bay, is located about 25.3 km northeast of Ardley Island. Also in King George Island (25 de Mayo), ASPA No 132, Potter Peninsula, is approximately 14.5 km east of Ardley Island. Finally, Harmony Point, ASPA No 133, is located around 18.6 km southwest of Ardley Island.

7. Permit conditions

Entry into the Area is prohibited except in accordance with a permit issued by an appropriate national authority. Conditions for issuing a permit to enter the Area are that:

- it is issued only for scientific or essential management purposes, consistent with plan objectives such as inspection, maintenance or review activities, which cannot be served elsewhere;
- the actions permitted will not jeopardize the scientific and ecological values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- during the stated period, scientific staff present within the Area must carry the permit or an authorized copy thereof;
- at the end of the stated period, a report shall be submitted to the appropriate national authority named in the permit, including any activities undertaken that were not explicitly mentioned in the permit.

i. Access to and movement within the Area

Access to Ardley Island shall be by small boat or on foot. Movement within the Area shall be only on foot.

Work crews should consist of no more than 10 persons during critical stages of birds' breeding cycles (incubation, hatching and early chick rearing between October and January each year), and of no more than 20 at any other time.

Boat access

The northern coast of Ardley Island is the appropriate area to land. Small zodiac boats may land on the Island. Recommended and preferred landing sites are the beach in front of Ripamonti I, in the Luis Point area, and the beach at Faro Point. Groups of 10-20 visitors are allowed to land at a time, depending on the stage of the birds' breeding cycle.

On foot

Only permit holders with authorized entry into the Area shall be permitted to access the Area on foot.

The island may be reached on foot, crossing the isthmus from the Fildes Peninsula at low tide. Pedestrian activity should be restricted to the marked path (see Map 3) avoiding transit through areas with vegetation, as well as areas close to the seabird breeding sites, unless strictly necessary for scientific research in the Area.

Vehicle access

Entry into the Area by vehicles of any kind is strictly forbidden.

Overflights

Due to the presence of breeding seabirds on the island, aircraft landings are prohibited within the Area and any necessary overflights shall be conducted according to guidelines established in Resolution 2 (2004), Guidelines for Aircraft near concentrations of birds:

- Bird colonies are not to be over flown below 2000ft (~ 610 m) Above Ground Level
- Landings within 1/2 nautical mile (~ 930 m) of bird colonies should be avoided wherever possible.
- Maintain a vertical separation distance of 2000 ft (~ 610 m) AGL and a horizontal separation of 1/4 nautical mile (~ 460 m) from the coastline where possible.
- Cross the coastline at right angles and above 2000ft (~610 m) AGL where possible.
- Never hover or make repeated passes over wildlife concentrations or fly lower than necessary.

Aircraft landing at and taking off from Teniente Marsh airfield or from any other takeoff site or pad should avoid overflying the island.

ii. Activities that are or may be conducted within the Area, including restrictions on time or place

Scientific research that will not jeopardize the ecosystem or scientific values of the Area or in any way diminish the value of the Area as a reference site.

Essential management activities, including monitoring.

iii. Installation, modification or removal of structures

No additional structures shall be erected in the Area, except for essential scientific or management activities, and with a proper permit for a specified period. All scientific equipment installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator or agency and year of installation. All such items shall be made from materials that pose minimal risk of harming fauna or contaminating the Area.

Installation, maintenance, modification or removal of structures shall be undertaken in such a way as to minimize disturbance to flora and fauna. The permit shall also indicate that structures, equipment or signposts be taken down once the period established therein has expired.

iv. Location and regulation of field camps

Camping is not permitted in the Area.

v. Restrictions on materials and organisms that can be brought into the Area

No living animals or plant material, or parts thereof, shall be deliberately brought into the Area. For that, is required, where ever possible, the inspection and thorough cleaning of all clothing, footwear and equipment before entry to the Area.

No poultry products shall not be brought into the Area as food for researchers in order to protect the bird life on the island.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, which may be introduced for scientific or management purposes specified in the permit, shall be properly stored during the stated period, to minimise risks inherent to their introduction into the environment. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is likely to be greater than that of leaving the material *in situ*.

Fuel, food and other materials brought into the Area to support the conducting of scientific or management activities for which a permit has been issued shall be stored in the shelters, taking every care not to release them inadvertently into the environment. They should be removed from the Area at or before the end of the stated period. An emergency cache may be kept in the shelters.

vi. Taking or harmful interference with native flora or fauna

Taking or harmful interference of native flora and fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II to the Madrid Protocol. Where the activity involves removing or tampering with native flora or fauna, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes should be used as a minimum standard.

vii. Collection or removal of anything not brought into the Area by the permit holder

Material not brought into the Area by the permit holder may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs. Removal of dead biological specimens or geological samples for scientific purposes must not exceed levels that affect the other species or values in the Area, and may only be taken for scientific studies.

Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ.* If this is the case the appropriate authority should be notified.

viii. Disposal of waste

All wastes shall be removed from the Area. However, human organic waste may be disposed of into the sea, in accordance with Article 5 of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty.

Waste generated as a consequence of the activities developed in the area should be temporarily stored near the shelters in a place where they cannot be accidentally lost. Such waste should be properly labelled as garbage. At the end of the period, it should be removed from the Area and from the Treaty Area.

ix. Measures that are necessary to ensure that the aims and objectives of the management plan can continue to be met

- Permits may be granted to enter the area to carry out biological monitoring and site inspection activities, which may involve the collection of limited samples of plant material and animals for scientific purposes, for analyses or review, or for protection measures, as specified in a permit.
- Any specific sites of long-term monitoring that are vulnerable to inadvertent disturbance should be appropriately marked and informed to other Parties thought appropriate channels.
- To avoid interference with long-term research and monitoring activities or possible overlapping of efforts, anyone planning new projects within the Area should consult established national programmes working at Ardley Island before commencing the work.
- Parties conducting long-term research and monitoring programmes should cooperate closely, facilitate communication among scientists working in the Area, and conduct regular joint assessments of their research lines and products.
- Visitors shall follow the guidelines in this Management Plan strictly to help maintain the scientific values found at Ardley Island.

x. Requirements for reports

The principal holder of each permit issued shall submit a report to the appropriate national authority describing the activities undertaken in the area once the stated period has ended. This report must be submitted within two months. Such reports should include the information identified in the visit report form, recommended by SCAR, attaching the permit.

The national authority should keep the reports in order to provide summary descriptions of the activities conducted in the annual exchange of information or to provide the necessary information on human activities within the Area to all the interested Parties in the management of the Area, and further maintain a record of usage which may serve the review processes of the management plan, improve the scientific use of the Area and contribute to its best environmental protection.

8. References

Andreev, M. P. 1989. Lichens in the vicinity of Bellingshausen Station, King George Island. Polar Geography and Geology 13: 42-45.

Bost, C. & P. Jouventin. 1990. Evolutionary ecology of Gentoo penguins (*Pygoscelis papua*). In: Penguin Biology. LS. Davis & JT. Darby (Eds.). Academic Press, NY.

Chen, J.-B. & Ahti, T.: Lichens from Ardley Island and Fildes Peninsula in King George Island, Antarctica. II. The genus Cladonia. Mycosystema 18 (1999) 1-8.

Chupin, I.: Human Impact and breeding success in Southern Giant Petrel, *Macronectes giganteus*, on King George Island (South Shetland Islands). Korean Journal of Polar Research 8: 113-116.

Golowash, J., H. Núñez & JL. Yáñez. 1991. La victoria del Pingüino antártico en la Isla Ardley: ¿ventaja física o mayor agresividad? *Boletín del Museo Nacional de Historia Natural* 42: 97-103.

Guzmán, G. & Redon, J. 1981. Los líquenes de Península Ardley y zonas adyacentes, Isla Rey Jorge, Antártica Occidental. *Serie Científica INACH* 27: 19-37

Liu, X., L. Sun, Z. Xie, X. Yin &Y. Wang. 2005. A 1300-year Record of Penguin Populations at Ardley Island in the Antarctic, as Deduced from the Geochemical Data in the Ornithogenic Lake Sediments. *Arctic, Antarctic, and Alpine Research* 37(4):490-498.

Novoatti, R. 1993. Birds and mammals of Ardley Island, South Shetland Islands. *Polar Record* 11: 338f.

Núñez, H. & J. Yánez. 1989. Ontogenia temprana de *Pygoscelis papua* (Forster) en Isla Ardley: Parámetros biológicos y aspectos conductuales (Sphenisciformes: Spheniscidae). *Serie Científica INACH* 39: 159-165.

Peter, H.-U., Kaiser, M. & Gebauer, A. 1988. Untersuchungen an Vögeln und Robben auf King George Island (South Shetland Islands, Antarktis). Geodätische und geophysikalische Veröffentlichungen Reihe 1: 1-127.

Peter, H-U., C. Büβer, O. Mustafa & S. Pfeiffer. 2005. Preliminary results of the Research Project "Risk assessment for the Fildes Peninsula and Ardley Island and the development of management plans for designation as Antarctic Specially Protected or Manager Areas". University of Jena, Institute of Ecology. 14 p.

Peter, H-U., C. Buesser, O. Mustafa & S. Pfeiffer. 2008. Risk assessment for the Fildes Peninsula and Ardley Island and the development of management plans for designation as Antarctic Specially Protected or Managed Areas. Federal Envirnonmental Agency, Texte 20/08, 508 pp.

Pfeiffer, S., E. Böhm, C. Büβer, I. Chupin, M. Flores, C. Godoy, O. Mustafa & H-U. Peter. 2005. Environmental risk assessment of ASPA Nº 150, Ardley Island (King George Island, South Shetlands). 22d Internationale Polartagung, Jena, Alemania, 18 al 24 de septiembre de 2005.

Planeta Vivo. 2003. Isla Ardley, archipiélago de las Shetland del Sur. Diaporama Documental. Planeta Vivo Publicaciones. 10 p. (Acceso URL: http://www.planetavivo.org/drupal/files/IslaArdley.pdf)

Roby, DD., M. Salaberry & K. Brink. 1986. Notes of Petrels (Procellariiformes) breeding on Ardley Island. South Shetland Island. *Serie Científica INACH* 34: 67-72.

Roselló, MJ. 2001. Estudio del éxito reproductivo y fluctuaciones de la población nidificante del Pingüino Papúa (*Pygoscelis papua*) en Isla Ardley (Shetland del Sur). Seminario de Investigación, Carrera de Biología Marina, Universidad de Valparaíso. 110 p.

Saez, D. 1999. Influencia del tamaño de los grupos de nidificación sobre el éxito reproductivo de *Pygoscelis papua* en Isla Ardley, Shetland del Sur, Antártica. Memoria para optar al título profesional de Médico Veterinario. Facultad de Ciencias Veterinarias y Pecuarias. Universidad de Chile. Santiago. 130 p.

Shuford, W. D. & Spear, L. B. 1988. Surveys of breeding chinstrap penguins in the South Shetland Islands, Antarctica. *British Antarctic Survey Bulletin*. 81: 19-30.

Soave G.E., N.R. Coria, D. Montalti & A. Curtosi. 2000. Breeding flying birds in the region of the Fildes Peninsula, King George Island, South Shetland Islands, Antarctica, 1995/96. *Marine Ornithology* 28: 37-40.

Soto-Gamboa, M. & RF. Néspolo. 1997. Desarrollo posteclosional de la homeotermia en polluelos de dos especies de aves antárticas: *Pygoscelis papua* y *Daption capense* en península Ardley, isla Rey Jorge. *Serie Científica INACH* 47: 31-37

Trivelpiece, W. & S. Trivelpiece. 1990. Courtship period in Adélie, Gentoo and Chinstrap penguins. In: Penguin Biology. LS. Davis & JT. Darby (Eds.) Academic Press, NY.

Trivelpiece, W., S. Trivelpiece & N. Volkman. 1987. Ecological segregation of Adélie, Gentoo and Chinstrap penguins at King George Island, Antarctica. *Ecology* 68 (2):351-361.

Valencia, J. & M . Sallaberry. 1983. Censos de pingüinos en isla Ardley (Shetland del Sur). *Serie Científica INACH* 30:93-96.

Valencia, J. & H. Torres. 1996. Avances en el desarrollo del proyecto Ecología de tres especies de pingüinos pigoscélidos. *Boletín Antártico Chileno* 15 (1): 2-5.

Wilson, RP. 2002. Movements in Adélie penguins foraging for chicks at Ardley Island, Antarctica; circles within spirals, wheels within wheels. *Polar Bioscience* 15:75–87

Wilson, R.P. & G. Peters. 1999. Foraging behaviour of the chinstrap penguin *Pygoscelis antarctica* at Ardley Island, Antarctica. *Marine Ornithology* 27: 85-95.

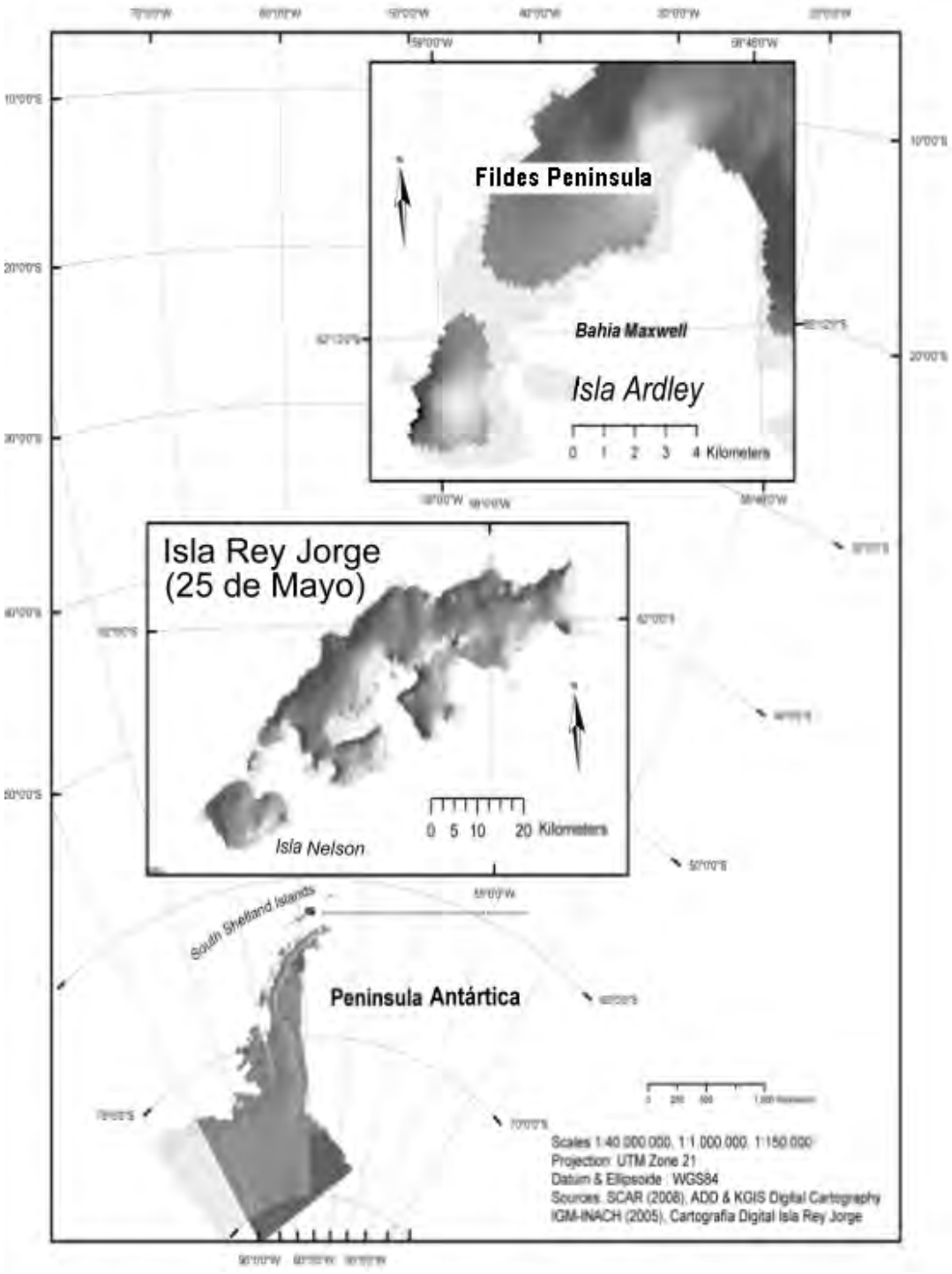
Wilson, RP., B. Alvarrez, L. Latorre, D. Adelung, B. Culik & R. Bannasch. 1998. The movements of Gentoo penguins *Pygoscelis papua* from Ardley Island, Antarctica. *Polar Biology* 19: 407-413.

Woehler, E. 1993. The distribution and abundance of Antarctic and Sub-Antarctic penguins. SCAR. Australia. 76 p.

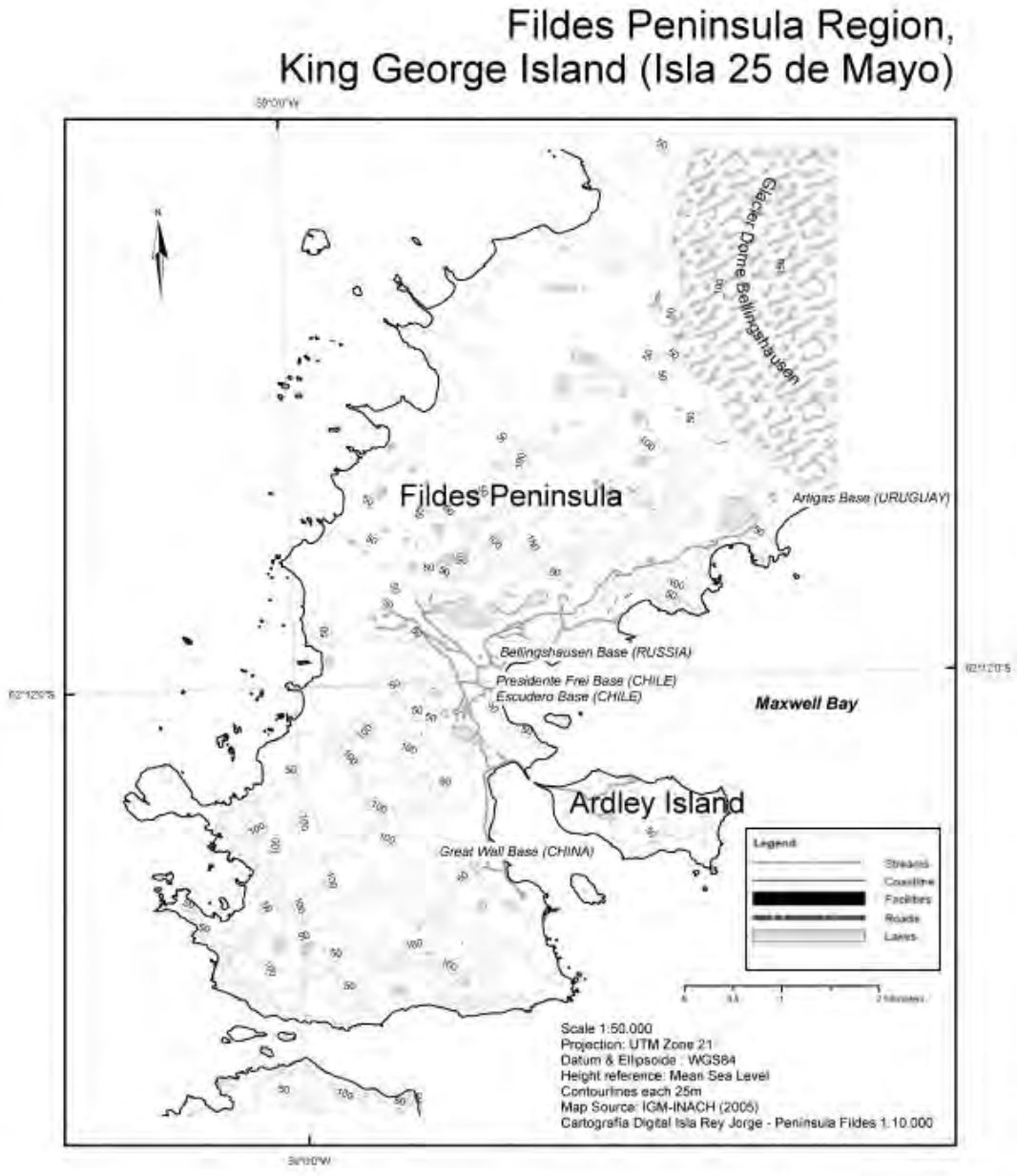
Woehler, E.J., Cooper, J., Croxall, J.P., Fraser, W.R., Kooyman, G.L., Miller, G.D., Nel, D.C., Patterson, D.L., Peter, H.-U., Ribic, C.A., Salwicka, K., Trivelpiece, W.Z. & Weimerskirch, H. 2001. A statistical assessment of the status and trends of Antarctic and Subantarctic seabirds. Report on SCAR BBS Workshop on Southern Ocean seabird populations. SCAR. 44 p.

Yañez, J., H. Nuñez, J. Valencia & RP. Schlatter. 1984. Aumento de las poblaciones de pingüinos pigoscélidos en isla Ardley, Shetland del Sur. *Serie Científica INACH* 31:97-101.

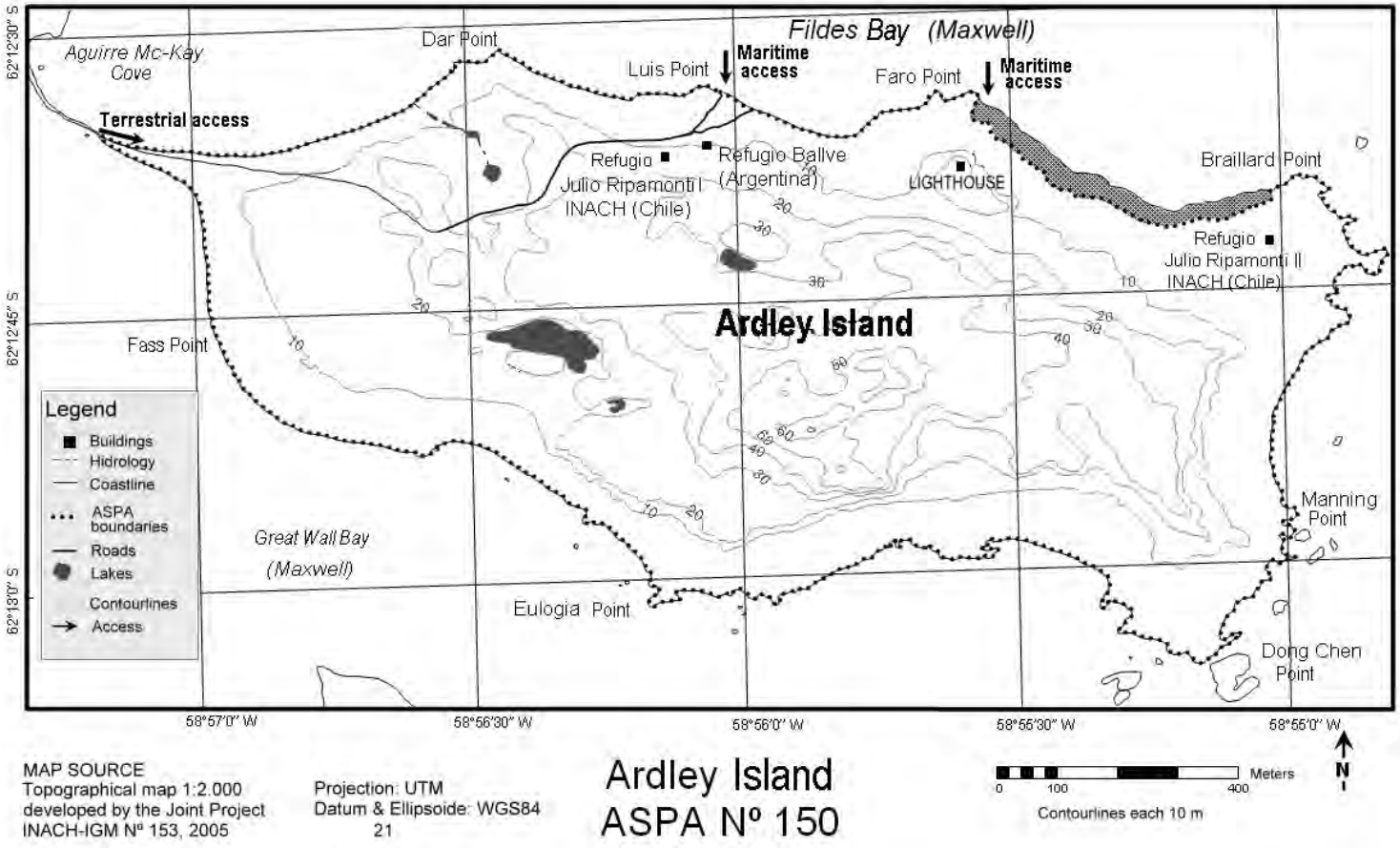
ANNEXES: Maps and Figures



Map 1. Location of Ardley Island in relation to King George Island (25 de Mayo) and the Fildes Peninsula,
(Map Database, Project 153, IGM-INACH, Mapping and GIS of South Shetland Islands)



Map 2. Location of Ardley Island in relation to the Fildes Peninsula, King George Island (25 de Mayo), showing the stations present in the region.
(Map Database, Project 153, IGM-INACH, Mapping and GIS of South Shetland Islands)



Map 3. Ardley Island and Antarctic Specially Protected Area No 150. Permanent structures are shown, as the demarked route (terrestrial access) , exclusive for those whom carry on a permit, and disembarking points (maritime access).
The Protected Area is marked out with a dotted line.
(Map Database 1:2000, Project IGM-INACH No. 153, Mapping and GIS of South Shetland Islands 2005)

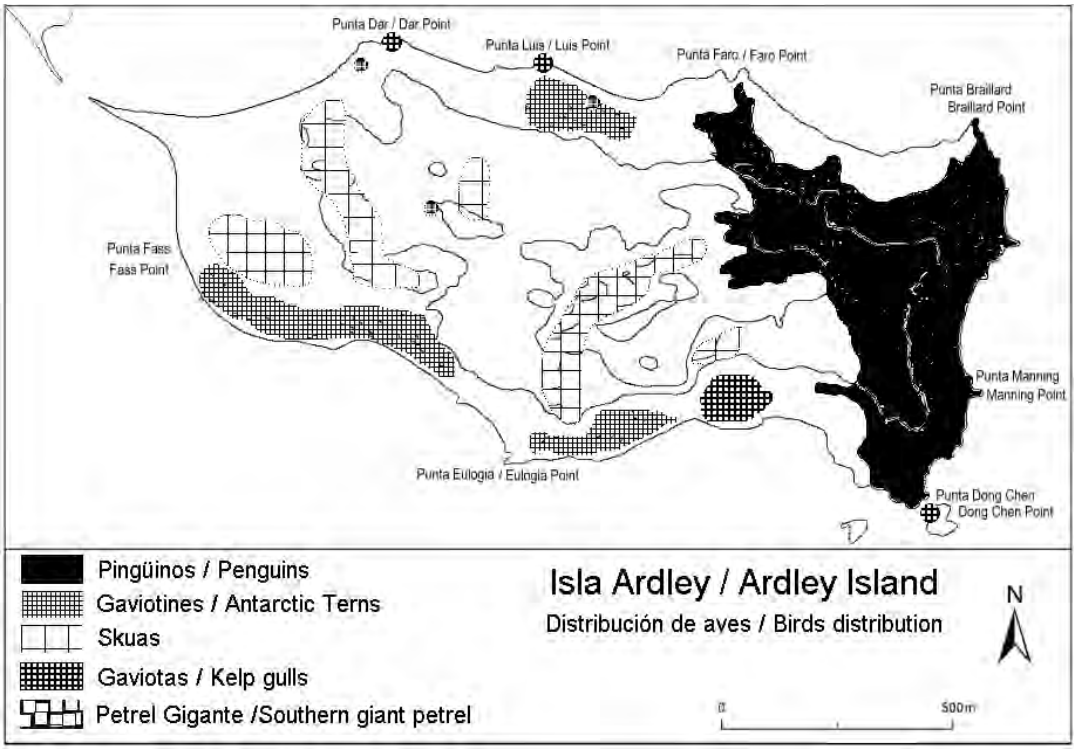


Figure 1. Sketch with the distribution of the main nesting birds on Ardley Island, based in Peter *et al*., 2008.

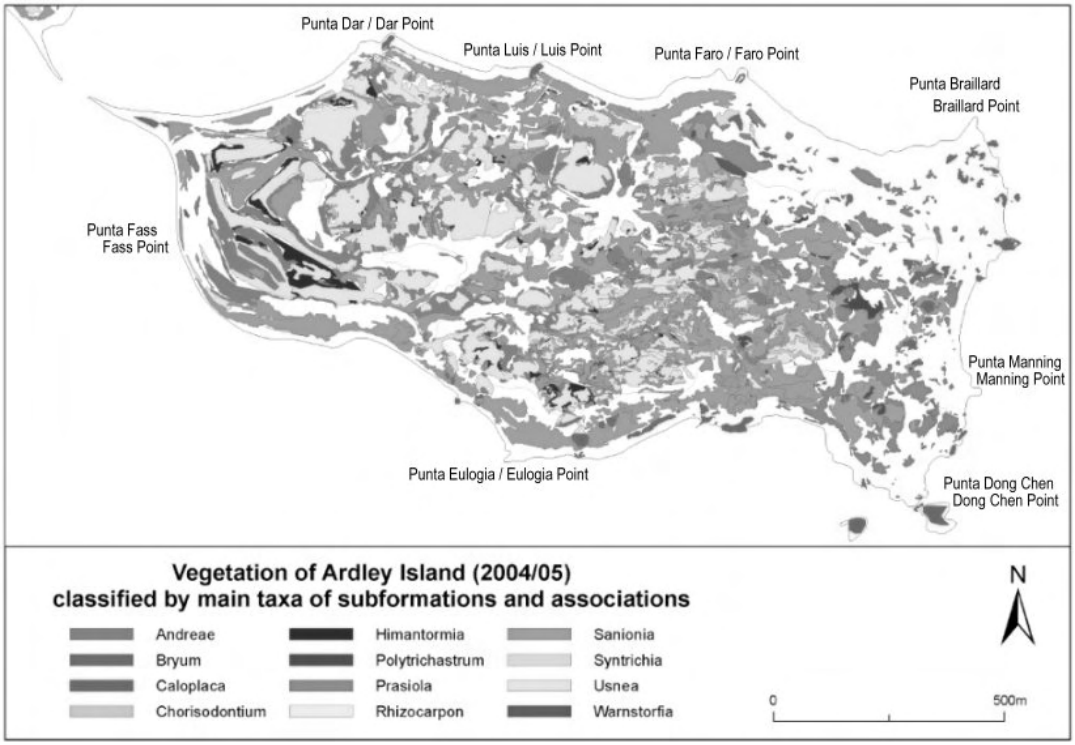


Figure 2. Sketch of the distribution and coverage of the plant species present on Ardley Island, based in Peter *et al*., 2008.

Measure 10 (2009)

Antarctic Specially Protected Area No 152 (Western Bransfield Strait): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation XVI-3 (1991), which designated Western Bransfield Strait, off Low Island, South Shetland Islands, as Site of Special Scientific Interest ("SSSI") No 35 and annexed a management plan for the site;
- Measure 3 (2001), which extended the expiry date of SSSI 35 from 31 December 2001 to 31 December 2005;
- Decision 1 (2002), which renamed and renumbered SSSI 35 as Antarctic Specially Protected Area No 152;
- Measure 2 (2003), which adopted a revised management plan for ASPA 152;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 152;

Desiring to replace the existing Management Plan for ASPA 152 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 152 (Western Bransfield Strait), which is annexed to this Measure, be approved;

2) the Management Plan for ASPA 152 annexed to Measure 2 (2003) shall cease to be effective; and

3) Recommendation XVI-3 (1991), which is not yet effective, be withdrawn

Management Plan for Antarctic Specially Protected Area No. 152

WESTERN BRANSFIELD STRAIT

Introduction

This marine ASPA lies off the western and southern coasts of Low Island, South Shetland Islands, between 63°15'S and 63°30'S; 62°00'W and 62°45'W. Approximate area: 1021km^2. Designation on the grounds that the shallow shelf in this region near Low Island is one of only two known sites in the vicinity of Palmer Station (USA) that are suitable for bottom trawling for fish and other benthic organisms (see also ASPA No 153 Eastern Dallmann Bay). The site offers unique opportunities to study the composition, structure and dynamics of several accessible marine communities. Proposed by the United States of America: adopted by Recommendation XVI-3 (Bonn, 1991: SSSI No 35); date of expiry extended by Measure 3 (2001); renamed and renumbered by Decision 1 (2002); revised management plan adopted by Measure 2 (2003).

1. Description of values to be protected

Western Bransfield Strait (between latitudes 63°20'S and 63°35'S and longitudes 61°45'W and 62°30'W, approximately 910km^2) was originally designated as a Site of Special Scientific Interest through Recommendation XVI-3 (1991, SSSI No 35) after a proposal by the United States of America. It was designated on the grounds that "the shallow shelf south of Low Island is one of only two known sites in the vicinity of Palmer Station that are suitable for bottom trawling for fish and other benthic organisms. From an ecological standpoint, the Low Island site offers unique opportunities to study the composition, structure, and dynamics of several accessible marine communities. The Site, and in particular, its benthic fauna, is of exceptional scientific interest and requires long-term protection from potential harmful interference". Together with Eastern Dallmann Bay (ASPA No 153), the Area is used in over 90 percent of specimen collections carried out by US researchers who are actively studying such fish communities within the region (Detrich pers. comm. 2009).

The boundaries of the Area were revised by Measure 2 (2003) to include all of the shallow shelf down to 200m depth to the west and south of Low Island, while the deeper water of Bransfield Strait to the east was excluded. The boundaries of the Area at Western Bransfield Strait are between latitudes 63°15'S and 63°30'S and longitudes 62°00'W and 62°45'W and are defined in the north-east by the shoreline of Low Island, encompassing an area of approximately 1021km^2 (Map 1).

The Area continues to be considered important for studies of the composition, structure and dynamics of the marine communities, and the original reasons for designation are reaffirmed in the current Management Plan. In addition, the Area is recognized as an important spawning ground for several fish species, including the rockcod *Notothenia coriiceps* and the icefish *Chaenocephalus aceratus*. Fish have been collected from the Area by scientists from Palmer Station since the early 1970s. The Area is within the research area of the Palmer Long Term Ecological Research (LTER) Program; fish collected from the Area are used in the study of biochemical and physiological adaptations to low temperatures. Some of the fish collected have been used for comparative studies with the

more heavily impacted Arthur Harbor area. Scientific research is also being undertaken on the benthic faunal communities.

2. Aims and objectives

Management at Western Bransfield Strait aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance;
- allow scientific research on the marine environment while ensuring protection from over-sampling;
- allow other scientific research within the Area provided it will not compromise the values for which the Area is protected;
- allow visits for management purposes in support of the aims of the management plan.

3. Management activities

The following management activities shall be undertaken to protect the values of the Area:

- A map showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently and copies of this Management Plan shall be made available at Palmer Station (US).
- Copies of this Management Plan shall be made available to vessels travelling in the vicinity of the Area.
- Buoys, or other markers or structures installed within the Area for scientific or management purposes shall be secured and maintained in good condition.
- Visits shall be made as necessary to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No 152 Western Bransfield Strait bathymetric map. Coastline data are derived from the SCAR Antarctic Digital Database (ADD) Version 5.0 (2007). Bathymetry is derived from published and unpublished depth data gridded by P. Morris (British Antarctic Survey, pers. comm. 2000) to the same specifications described in Schenke *et al.* (1998), which was gridded to cell sizes of between 1 and 4.6km. Contours manually adjusted along eastern coast of Low Island to align with ADD v5.0 coastal change update. Faunal data are from Harris (2006). Map specifications: Projection: Lambert Conformal

Conic; Standard parallels: 1st 63°21'S; 2nd 63°30'S; Central Meridian: 62°08'W; Latitude of Origin: 61°00'S; Spheroid: WGS84; Horizontal accuracy: maximum error of ±300m. Contour interval – Marine 100m, vertical accuracy to within ±50m.

Inset: the location of Map 1, ASPA No 152 Western Bransfield Strait, Antarctic Peninsula, showing the nearest protected area, ASPA No 153, Eastern Dallmann Bay, and the location of Palmer Station (US).

6. Description of the Area

6(i) Geographical coordinates, boundary markers and natural features

General description

Bransfield Strait is a deep water passage approximately 220km long and 120km wide between the Antarctic Peninsula and the numerous islands that comprise the South Shetland Islands. The Drake Passage is to the north and to the west is the Bellinghausen Sea. The Area lies approximately 80km west of the Antarctic Peninsula, mostly within the 200m isobath directly south and west of Low Island (Map 1). Low Island is the southern-most of the South Shetland Islands, lying 60km south-west of Deception Island and 25km south-east of Smith Island. To the west and south of Low Island, and for approximately 20km from the shore, the sea floor slopes gently from the intertidal zone to depths of approximately 200m. The sea floor slopes steeply to the east of Low Island, reaching depths of up to 1200m in this part of Bransfield Strait. Cores collected as part of the BENTART research programme during the austral summers of 2003 and 2006 indicate that the sea floor within the Area is generally composed of muddy sediments containing gravel or small stones, and of sessile epifaunal communities (Troncoso *et al.* 2008), which either remain firmly attached to substrates or move very slowly (Robinson *et al.* 1996).

Boundaries

The boundaries of the Area at Western Bransfield Strait are defined in the north as the line of latitude at 63°15'S and in the south at 63°30'S; in the east the boundary is defined as the line of longitude at 62°00'W and in the west 62°45'W (Map 1). The northeastern boundary is defined as the shoreline of Low Island, extending from 62°00'W, 63°20'S in the southeast (approximately two kilometers from Cape Hooker) to 62°13'30"W, 63°15'S in the northwest (Cape Wallace). The coastline boundary on the western and southern shores of Low Island is defined as the high tide level, and the intertidal zone is included within the Area. The Area extends a maximum of 27.6km north-south and a maximum of 37.15km east-west, encompassing an area of approximately 1021km^2. Boundary markers have not been installed because in the marine area this is impractical, while at Low Island the coast itself is a clearly defined and visually obvious boundary feature.

Oceanography, climate and marine geology

There is considerable year-to-year variation in sea ice within the Bransfield Strait region, although coverage appears to be less than 100 days per year (Parkinson 1998). Rates of sea ice advance and retreat along the northwestern Antarctic Peninsula are also variable. Sea ice advance is for approximately five months followed by approximately seven months of retreat. Ice growth is fastest in June and July and the fastest decay is in December and January (Stammerjohn and Smith 1996). Measurements made within the Bransfield Strait

between 20th January and 9th February 2001 indicate that ocean temperatures in the Area averaged between 1.7 and 1.8ºC at 5m depth and 0.2 to 0.3ºC at the 150m contour (Catalan *et al.* 2008). Water salinity within the Area ranged between 34.04 and 34.06psu at 5m, whilst at 150m depth salinity reached 34.40psu.

Wind is predominantly from the NNW direction, resulting in a southward flowing coastal current along the western Antarctic Peninsula (Hofmann *et al.* 1996). Coupled with the northward flow of the Antarctic Circumpolar Current, this results in a predominantly clockwise circulation in Bransfield Strait (Dinniman and Klinck 2004; Ducklow *et al.* 2007), dominated by the Gerlache Strait Current and the Bransfield Strait Current (Zhou *et al.* 2002 and 2006). Drifters deployed as part of RACER (Research on Antarctic Coastal Ecosystems and Rates) between 1988 and 1990 indicate that eddie formation within the Area is minimal and that a strong north-easterly flow originates to the south of Low Island (Zhou *et al.* 2002). The current bifurcates to the west of Low Island, with water flowing to the north-east to merge with the Bransfield Strait Current and to the north-west, towards Smith Island. Local circulation is also influenced by tides, with tide records obtained at Low Island during a six-week period in December 1992 to January 1993 recording a maximum level variation of 1.70m (López *et al.* 1994).

Seismic measurements from the Seismic Experiment in Patagonia and Antarctica (SEPA) monitoring station, located on the north-eastern coast of Low Island, have detected significant earthquake activity within the Area, which is thought to result from the intersection of the Hero Fracture Zone with the South Shetland Platform at Smith Island (Maurice *et al.* 2003). During the Spanish Antarctic campaign of 2006/07, an additional seismic monitoring station was installed on the southern coast of Low Island, in order to extend geodetic monitoring within the Bransfield Strait area (Berrocoso *et al*. 2007).

Marine biology

The predominantly soft sand / mud / cobbled-rock substrate of the Area supports a rich benthos with numerous fish species, invertebrates (sponges, anemones, annelids, molluscs, crustaceans, asteroids, ophiuroids, echinoids, holothurioids, brachiopods, tunicates), and marine plants, in several distinct communities.

Fish species commonly collected near Low Island at depths of 80 to 200m include *Chaenocephalus aceratus, Harpagifer bispinis, Notothenia coriiceps, Gobionotothen gibberifrons (*formerly *N. gibberifrons), Parachaenichthys charcoti* and *Trematomus newnesi* (Grove and Sidell 2004; Lau *et al.* 2001). Species rarely found at Low Island include *Champsocephalus gunnari, Chionodraco rastrospinosus* and *Pseudochaenichthys georgianus*. In addition, the Low Island shelf appears to be a spawning ground for several fish species, for example the ice fish *Chaenocephalus aceratus* and *N. coriiceps*, with the family *Nototheniidae*, representing the bulk of fish larvae and juveniles captured in the area (Catalan *et al.* 2008). Other juvenile fish species collected close to Low Island include *Trematomus lepidorhynus and Notothenia kempi*. The Area is a mating ground for yellowbelly rockcod (*Notothenia coriiceps*) (indicated by eggs) (Kellermann 1996). The fish spawn in May / June. The large eggs, around 4.5mm in diameter, are pelagic after fertilization and ascend to the surface waters where they incubate during the winter. Larval species recorded in the Area include *Bathylagus antarcticus*, *Electrona antarctica*, *Gymnodraco acuticeps*, *Nototheniops larseni*, *Notothenia kempi* and *Pleuragramma antarcticum* (Sinque *et al.* 1986; Loeb *et al.* 1993; Morales-Nin *et al.* 1995).

The following benthic amphipod species have been recorded within the Area: *Ampelisca barnardi, A. bouvieri, Byblis subantarctica, Epimeria inermis, E. oxicarinata, E. walkeri, Eusirus antarcticus, E. perdentatus, Gitanopsis squamosa, Gnathiphimedia sexdentata, Jassa* spp., *Leucothoe spinicarpa, Liljeborgia georgiana, Melphidippa antarctica, Oediceroides calmani, O. lahillei, Orchomenella zschaui, Parharpinia obliqua, Parepimeria bidentata, Podocerus septemcarinatus*, *Prostebbingia longicornis, Shackeltonia robusta, Torometopa perlata, Uristes georgianus* and *Waldeckia obesa* (Wakabara *et al.* 1995).

Molluscan assemblages have been analysed at four sample sites within the Area as part of an integrated study of the benthic ecosystem of Bransfield Strait, which was carried out between 24 January and 3 March 2003 (BENTART 03) and from 2 January to 17 February 2006 (BENTART 06) (Troncoso *et al.* 2008). The most abundant species in the Area was the bivalve *Lissarca notorcadensis*, distantly followed by *Pseudamauropsis aureolutea*, which was the most widely distributed. Other species collected included *Marseniopsis conica*, *Onoba gelida*, *Yoldiella profundorum*, *Anatoma euglypta*, *Chlanidota signeyana* and *Thyasira debilis*.

No information is available on the zooplankton or marine flora within the Area.

Marine mammals

Satellite tracking studies carried out between January 2004 and 2006 suggest that humpback whales (*Megaptera novaeangliae*) pass close to the Area and may enter it during foraging (Dalla Rosa *et al.* 2008). Southern elephant seals (*Mirounga leonina*) were tracked within the Area using satellite transmitters between December 1996 and February 1997 (Bornemann *et al.* 2000).

Birds

Approximately 295,000 pairs of chinstrap penguins (*Pygoscelis antarctica*) were breeding at five locations on Low Island in 1987 (Woehler 1993). The largest colonies were immediately to the north of the Area at Cape Wallace (approximately 150,000 pairs) and on the eastern boundary of the Area at Cape Garry (approximately 110,000 pairs) and Jameson Point (25,000) (Map 1). It is expected that the chinstrap penguins influence the Area, particularly near Cape Garry. Small colonies of Antarctic shags (*Phalacrocorax* [atriceps] *bransfieldensis)* have been observed at Cape Garry, on an island within the Area between Cape Garry and Jameson Point, and on an island several kilometers NE of Cape Wallace (Poncet and Poncet, unpublished data from Feb 1987, in Harris 2006) (Map 1).

Human activities / impacts

Fish collected within the Area have been used for a variety of biochemical, genetic and physiological research, including: studies of the adaptations in fish that enable proteins to function at low temperatures (Detrich *et al.* 2000; Cheng and Detrich 2007); the adaptations of muscle and energy metabolism, including the processing of fatty acids to low temperatures (Hazel and Sidell 2003; Grove and Sidell 2004); efficient genome transcription in cold water (Lau *et al.* 2001; Magnoni *et al.* 1998); the influence of hydrostatic pressure on enzyme function within fish livers (Ciardiello *et al.* 1999); and the cardiovascular adaptations of icefishes, in compensation for their complete lack of haemoglobin (Sidell and O'Brien 2006).

Specimens collected during trawls in March and April 1991, 1992, and 1993 were used in comparative studies of Polynuclear Aromatic Hydrocarbon (PAH) contamination in fish with those collected from Arthur Harbor and the effects of Diesel Fuel Arctic (DFA) on *Notothenia gibberifrons* (now *Gobionotothen gibberifrons*) (McDonald *et al.* 1995; Yu *et al.* 1995). The former study found levels of contamination in fish sampled from the Area were considerably lower than those sampled from the vicinity of the 1989 *Bahía Paraíso* wreck in Arthur Harbor and that fish captured near US scientific stations are exposed to PAH, albeit low levels (McDonald *et al.* 1992 and 1995). However, concentrations of PAH were higher than had been expected in fish collected from within the Area, with levels found to be similar to those in fish sampled from near Old Palmer Station.

6(ii) Restricted and managed zones within the Area

None.

6(iii) Structures within and near the Area

There are no structures known to be within or near the Area. The nearest scientific stations are Decepción (Argentina) and Gabriel de Castilla (Spain), both approximately 70km to the northeast on Deception Island.

6(iv) Location of other protected areas within close proximity of the Area

The nearest protected areas to Western Bransfield Strait are Eastern Dallmann Bay (ASPA No 153), which lies about 45km to the SSE, and Port Foster and other parts of Deception Island (ASPAs No 140 and 145 respectively), which are approximately 70km to the north-east (Map 1, Inset).

7. Permit conditions

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit are that:

- it is issued for scientific study of the marine environment in the Area, or for other scientific study which will not compromise the values for which the Area is protected, or for essential management purposes consistent with plan objectives such as inspection, maintenance or review;
- the actions permitted will not jeopardize the ecological or scientific values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the Permit, or a copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the Permit;
- permits shall be issued for a stated period;

7(i) Access to and movement within the Area

Access into the Area shall be by sea, over sea ice or by air. There are no specific restrictions on routes of access to or movement within the Area, although movements should be kept to the minimum necessary consistent with the objectives of any permitted activity. Every reasonable effort should be made to minimize disturbance. Anchoring should be avoided within the Area. There are no special overflight restrictions and aircraft may land by Permit when sea ice conditions allow.

7(ii) Activities that are or may be conducted in the Area, including restrictions on time or place

- Scientific research that will not jeopardize the values of the Area;
- Essential operational activities of vessels that will not jeopardize the values of the Area, such as transit through, or stationing within, the Area in order to facilitate science or other activities, including tourism, or for access to sites outside of the Area;
- Essential management activities, including monitoring.

7(iii) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit and permanent structures or installations are prohibited;
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be made of materials that pose minimal risk of contamination of the Area;
- Installation (including site selection), maintenance, modification or removal of structures shall be undertaken in a manner that minimizes disturbance to flora and fauna.
- Removal of specific equipment for which the permit has expired shall be the responsibility of the authority which granted the original Permit, and shall be a condition of the permit.

7(iv) Location of field camps

None.

7(v) Restrictions on materials and organisms which can be brought into the Area

- No living animals, plant material, pathogens or microorganisms shall be deliberately introduced into the Area, and the precautions listed below shall be taken against accidental introductions;
- To help maintain the ecological and scientific values derived from the relatively low level of human impact within Western Bransfield Strait, visitors shall take special precautions against introductions. Of concern are pathogenic, microbial, or plant introductions sourced from other Antarctic sites, including stations, or from regions outside Antarctica. Visitors shall ensure that sampling equipment or markers brought into the Area are clean. To the maximum extent practicable, equipment used or brought into the Area shall be thoroughly cleaned before use within the Area.

- No herbicides or pesticides shall be brought into the Area;
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted;
- All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of their introduction into the environment is minimized;
- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

7(vi) Taking or harmful interference with native flora or fauna

Taking or harmful interference of native flora and fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II by the appropriate national authority specifically for that purpose.

7(vii) Collection or removal of anything not brought into the Area by the Permit holder

- Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs.
- Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed from any part of the Area, unless the impact of removal is likely to be greater than leaving the material *in situ.* If this is the case the appropriate authority should be notified.

7(viii) Disposal of waste

All wastes, including human wastes, shall be removed from the Area.

7(ix) Measures that are necessary to ensure that the aims and objectives of the Management Plan can continue to be met

1. Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities, which may involve the collection of limited samples for analysis or review, or for protective measures.
2. Any specific sites of long-term monitoring that are vulnerable to inadvertent disturbance should, where practical, be appropriately marked on site and on maps of the Area.

7(x) Requirements for reports

- Parties should ensure that the principal holder of each permit issued submit to the appropriate authority a report describing the activities undertaken. Such report should include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of Resolution 2 (1998)(CEP I).

- Parties should maintain a record of such activities, and, in the annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organizing the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures undertaken, and/or of any materials released and not removed, that were not included in the authorized permit.

References

Berrocoso, M., Ramírez, M.E., Fernández-Ros, A., Pérez-Peña, A. & Salamanca, J.M. 2007. Tectonic deformation in South Shetlands Islands, Bransfield Sea and Antarctic Peninsula environment from GPS surveys, in Antarctica: a keystone in a changing world. Online Proceedings of the 10th ISAES X, Cooper A.K. and Raymond C.R. *et al.* (eds) USGS Open-File Report 2007-1047, Extended Abstract **085**: 4.

Bornemann, H., Kreyscher, M., Ramdohr, S., Martinz, T., Carlinp, A.,Sellmann, L. & Plötz, J. 2000. Southern elephant seal movements and Antarctic sea ice. *Antarctic Science* **12**(1): 3-15.

Catalan, I.A., Morales-Nin, B., Company J. B. Rotllant G. Palomera I. & Emelianov M. 2008. Environmental influences on zooplankton and micronekton distribution in the Bransfield Strait and adjacent waters. *Polar Biology* **31**:691–707. [doi 10.1007/s00300-008-0408-1]

Cheng, C.C.H. & Detrich III, H.W. 2007. Molecular ecophysiology of Antarctic notothenioid fishes. *Philosophical Transactions of the Royal Society B* **362** (1488): 2215-32.

Ciardiello, M.A., Schmitt B., di Prisco G. & Hervé, G. 1999. Influence of hydrostatic pressure on l-glutamate dehydrogenase from the Antarctic fish *Chaenocephalus aceratus*. *Marine Biology* **134** (4): 631-36.

Dalla Rosa. L., Secchi, E. R., Maia Y. G., Zerbini A. N. & Heide-Jørgensen, M. P. 2008. Movements of satellite-monitored humpback whales on their feeding ground along the Antarctic Peninsula. *Polar Biology* **31**:771–81.

Detrich III, H.W., Parker, S.K., Williams, R.B. Jr, Nogales, E. & Downing, K.H. 2000. Cold adaptation of microtubile assembly and dynamics. *Journal of Biological Chemistry* **275** (47): 37038–47.

Dinniman, M.S. & Klinck, J.M. 2004. A model study of circulation and cross-shelf exchange on the west Antarctic Peninsula continental shelf. *Deep-Sea Research II* **51**: 2003–22.

Ducklow, H.W., Baker, K., Martinson, D.G., Quetin, L. G., Ross, R.M., Smith, R.C., Stammerjohn, S.E., Vernet, M. & Fraser, W. 2007. Marine pelagic ecosystems: the

West Antarctic Peninsula. *Philosophical Transactions of the Royal Society B* **362**: 67–94. [doi:10.1098/rstb.2006.1955]

Fisk, M.R. 1990. Volcanism in the Bransfield Strait, Antarctica. *Journal of South American Earth Sciences* **3**(2/3):91-101.

Grove, T.J. & Sidell, B.D. 2004. Fatty acyl CoA synthetase from Antarctic notothenioid fishes may influence substrate specificity of fat oxidation. *Comparative Biochemistry and Physiology* Part B **139**:53–63.

Harris, C.M. 2006. *Wildlife Awareness Manual: Antarctic Peninsula, South Shetland Islands and South Orkney Islands*. Environmental Research & Assessment, Cambridge.

Hazel, J.R. & Sidell, B.D. 2003. The substrate specificity of hormone-sensitive lipase from adipose tissue of the Antarctic fish *Trematomus newnesi*. *Journal of Experimental Biology* **207:** 897-903.

Hofmann, E.E., Klinck, J.M., Lascara, C.M. & Smith, D.A. 1996. Water mass distribution and circulation west of the Antarctic Peninsula and including Bransfield Strait. In Ross, R.M., Hofmann, E.E. & Quetin, L.B. (eds) *Foundations for ecological research west of the Antarctic Peninsula. Antarctic Research Series* **70**: 61-80.

Kellermann, A.K. 1996. Midwater fish ecology. In Ross, R.M., Hofmann, E.E. & Quetin, L.B. (eds) *Foundations for ecological research west of the Antarctic Peninsula. Antarctic Research Series* **70**: 231-56.

Lau, D.T., Saeed-Kothe, A., Parker, S.K. & Detrich III, H.W. 2001. Adaptive evolution of gene expression in Antarctic fishes: divergent transcription of the 59-to-59 linked adult a1- and b-globin genes of the Antarctic teleost *Notothenia coriiceps* is controlled by dual promoters and intergenic enhancers. *American Zoologist* **41**:113–32.

Loeb, V.J., Kellermann, A.K., Koubbi, P., North, A.W. & White, M.G. 1993. Antarctic larval fish assemblages: a review. *Bulletin of Marine Science* **53**(2): 416-49.

López, O., García, M.A. & Arcilla, A.S. 1994. Tidal and residual currents in the Bransfield Strait, Antarctica. *Annales Geophysicae* **12** (9): 887-902.

Magnoni, J.L. 2002. Antarctic Notothenioid fishes do not display metabolic cold adaptation in hepatic gluconeogenesis. Masters thesis, Department of Marine Biology, University of Maine.

McDonald, S., Kennicutt II, M., Foster-Springer, K. & Krahn, M. 1992. Polynuclear aromatic hydrocarbon exposure in Antarctic fish. *Antarctic Journal of the United States* **27**(5): 333-35.

McDonald, S.J.,. Kennicutt II M. C., Liu H., & Safe S. H. 1995. Assessing aromatic hydrocarbon exposure in Antarctic fish captured near Palmer and McMurdo Stations, Antarctica. *Archives of Environmental Contamination and Toxicology* **29**: 232-40.

Morales-Nin, B., Palomera, I & Schadwinkel, S. 1995. Larval fish distribution and abundance in the Antarctic Peninsula region and adjacent waters. *Polar Biology* **15**: 143-54.

Parkinson, C.L. 1998. Length of the sea ice season in the Southern Ocean, 1988-1994. In Jeffries, M.O. (ed) *Antarctic sea ice: physical processes, interactions and variability. Antarctic Research Series* **74**: 173-86.

Robinson, C.L.K., D. E. Hay, J. Booth & J. Truscott. 1996. Standard methods for sampling resources and habitats in coastal subtidal regions of British Columbia: Part 2 - Review of Sampling with Preliminary Recommendations. *Canadian Technical Report of Fisheries and Aquatic Sciences XXXX*.

Robertson Maurice, S.D., Wiens D.A., Shore P.J., Vera E. & Dorman L.M. 2003. Seismicity and tectonics of the South Shetland Islands and Bransfield Strait from a regional broadband seismograph deployment. *Journal of Geophysical Research* **108** (B10): 2461.

Schenke H.W., Dijstra, S., Neiderjasper F., Schone, T., Hinze H. & Hoppman, B. 1998. The new bathymetric charts of the Weddell Sea: AWI BCWS. In Jacobs, S.S. & Weiss, R.F (eds) *Ocean, ice and atmosphere: interactions at the Antarctic continental margin. Antarctic Research Series* **75**: 371-80.

Sidell, B.D. & O'Brien, K.M. 2006. When bad things happen to good fish: the loss of hemoglobin and myoglobin expression in Antarctic icefishes. *Journal of Experimental Biology* **209**: 1791-1802.

Sinque, C., Koblitz, S. & Marília Costa, L. 1986. Ichthyoplankton of Bransfield Strait – Antarctica. *Nerítica* **1**(3): 91-102.

Stammerjohn, S.E. & Smith, R.C. 1996. Spatial and temporal variability of western Antarctic Peninsula sea ice coverage. In Ross, R.M., Hofmann, E.E. and Quetin, L.B. (eds) *Foundations for ecological research west of the Antarctic Peninsula. Antarctic Research Series* **70**: 81-104.

Troncoso, J.S. & Aldea, C. 2008. Macrobenthic mollusc assemblages and diversity in the West Antarctica from the South Shetland Islands to the Bellingshausen Sea. *Polar Biology* **31**:1253–65.

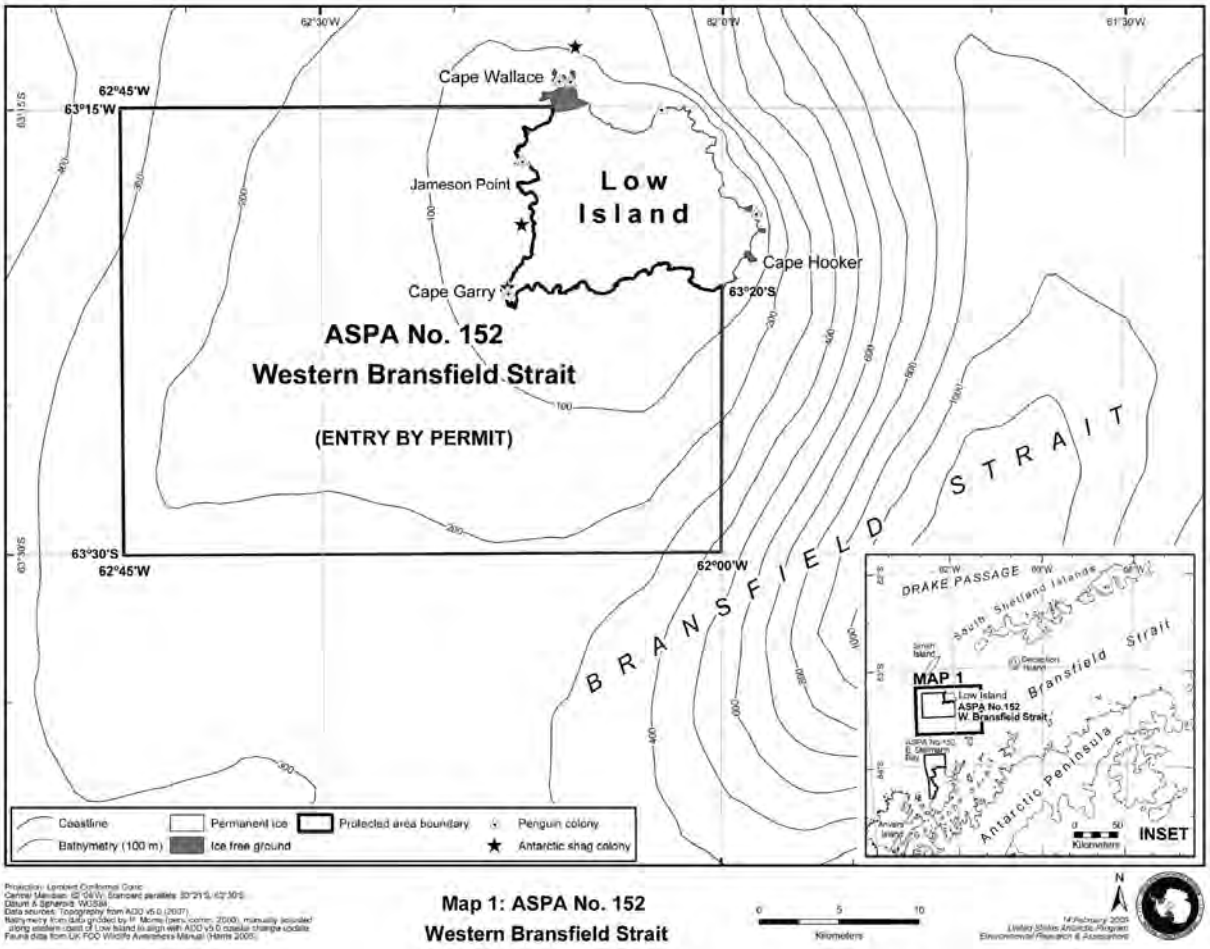
Wakabara, Y., Tararam, A.S. & Miyagi, V.K. 1995. The amphipod fauna of the west Antarctic region (South Shetland Islands and Bransfield Strait). *Polskie Archiwum Hydrobiologii* **42** (4): 347-65.

Woehler, E.J. (ed) 1993. *The distribution and abundance of Antarctic and sub-Antarctic penguins*. SCAR, Cambridge.

Yu, Y., Wade T. L., Fang J., McDonald S. & Brooks J. M. 1995. Gas chromatographic-mass spectrometric analysis of polycyclic aromatic hydrocarbon metabolites in Antarctic fish (*Notothenia gibberifrons*) injected with Diesel Fuel Arctic. *Archives of Environmental Contamination and Toxicology* **29**: 241-6.

Zhou, M., Niiler, P.P. & Hi, J.H. 2002.Surface currents in the Bransfield and Gerlache Straits,Antarctica. *Deep-Sea Research I* **49**:267–80.

Zhou, M., Niiler, P.P., Zhu, Y. & Dorland, R.D. 2006. The western boundary current in the Bransfield Strait, Antarctica. *Deep-Sea Research I* **53**:1244–52.



Map 1: ASPA No. 152
Western Bransfield Strait

Measure 11 (2009)

Antarctic Specially Protected Area No 153 (Eastern Dallmann Bay): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Recommendation XVI-3 (1991), which designated East Dallmann Bay, off Brabant Island as Site of Special Scientific Interest ("SSSI") No 36 and annexed a management plan for the site;
- Measure 3 (2001), which extended the expiry date of SSSI 36 from 31 December 2001 to 31 December 2005;
- Decision 1 (2002), which renamed and renumbered SSSI 36 as Antarctic Specially Protected Area No 153;
- Measure 2 (2003), which adopted a revised Management Plan for ASPA 153;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 153;

Desiring to replace the existing Management Plan for ASPA 153 with the revised Management Plan;

Noting that Measure 10 (2009) withdraws Recommendation XVI-3 (1991);

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 153 (Eastern Dallmann Bay), which is annexed to this Measure, be approved;

2) the Management Plan for ASPA 153 annexed to Measure 2 (2003) shall cease to be effective.

Management Plan for Antarctic Specially Protected Area No. 153

EASTERN DALLMANN BAY

Introduction

This marine ASPA lies off the western and northern coasts of Brabant Island, Palmer Archipelago, between 64°00'S and 64°20'S; 62°50'W and the western coast of Brabant Island. Approximate area: 676km^2. Designation on the grounds that the shallow shelf in this region near Brabant Island is one of only two known sites in the vicinity of Palmer Station (US) that are suitable for bottom trawling for fish and other benthic organisms (see also ASPA No 152 Western Bransfield Strait). The benthic fauna of the site is of exceptional scientific interest and the area provides an important habitat for juvenile fish. Proposed by the United States of America: adopted by Recommendation XVI-3 (Bonn, 1991: SSSI No 36); date of expiry extended by Measure 3 (2001); renamed and renumbered by Decision 1 (2002); revised management plan adopted by Measure 2 (2003).

1. Description of values to be protected

Eastern Dallmann Bay (between latitudes 64°00'S and 64°20'S and from longitude 62°50'W eastward to the western shore of Brabant Island, approximately 676km^2) was originally designated as a Site of Special Scientific Interest through Recommendation XVI-3 (1991, SSSI No 36) after a proposal by the United States of America. It was designated on the grounds that "the shallow shelf west of East Dallmann Bay is one of only two known sites near Palmer Station that are suitable for bottom trawling for fish and other benthic organisms. The Site and, in particular, its benthic fauna, are of exceptional scientific interest and require long-term protection from harmful interference". Together with Western Bransfield Strait (ASPA No 152), the Area is used in over 90 percent of specimen collections carried out by US researchers who are actively studying such fish communities within the region (Detrich pers. comm. 2009).

The boundaries of the Area revised by Measure 2 (2003) focus more specifically on the shallow shelf down to 200m depth to the west and north of Brabant Island, while the deeper water of Dallmann Bay to the west has been excluded. The boundaries of the Area at Dallmann Bay are between latitudes 63°53'S and 64°20'S and longitudes 62°16'W and 62°45'W and are defined in the east by the shoreline of Brabant Island, encompassing an area of approximately 676km^2 (Map 1).

The Area continues to be considered important for obtaining scientific samples of fish and other benthic organisms, and the original reasons for designation are reaffirmed in the current Management Plan with the amended boundaries. In addition, the Area is an important habitat for juvenile fish species, including the rockcod *Notothenia coriiceps* and the icefish *Chaenocephalus aceratus*. Fish have been collected from the Area by scientists from Palmer Station since the early 1970s. The Area is within the research area of the Palmer Long Term Ecological Research (LTER) Program. Fish collected from the Area are used in the study of biochemical and physiological adaptations to low temperatures. Some of the fish collected have been used for comparative studies with the more heavily impacted Arthur Harbour area scientific research is also being undertaken on the benthic faunal communities.

2. Aims and objectives

Management at Eastern Dallmann Bay aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance;
- allow scientific research on the marine environment while ensuring protection from over-sampling;
- allow other scientific research within the Area provided it will not compromise the values for which the Area is protected;
- allow visits for management purposes in support of the aims of the management plan.

3. Management activities

The following management activities shall be undertaken to protect the values of the Area:

- A map showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently and copies of this Management Plan shall be made available at Palmer Station (US);
- Copies of this Management Plan shall be made available to vessels travelling in the vicinity of the Area;
- Buoys, or other markers or structures installed within the Area for scientific or management purposes shall be secured and maintained in good condition;
- Visits shall be made as necessary to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No 153 Eastern Dallmann Bay bathymetric map. Coastline and terrestrial contour data are derived from the SCAR Antarctic Digital Database Version 5.0 (2007). Bathymetric data are derived from published and unpublished depth data gridded by P. Morris (pers. comm. 2000) to the same specifications described in Schenke *et al*. (1998), which was gridded to cell sizes of between 1 and 4.6km. Faunal data are from Harris (2006). Map specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 64°10'S; 2nd 64°17'S; Central Meridian: 62°38'W; Latitude of Origin: 61°00'S; Spheroid: WGS84; Horizontal accuracy: maximum error of ±300m. Vertical contour interval 100m, vertical accuracy to within ±50m.

Inset: the location of Map 1, ASPA No 153 Eastern Dallmann Bay, Antarctic Peninsula, showing the nearest protected area and the location of Palmer Station (US).

6. Description of the Area

6(i) Geographical coordinates, boundary markers and natural features

General description

Dallmann Bay (between latitudes 64°00'S and 64°20'S and from longitude 63°15'W eastward to the western shore of Brabant Island) is situated approximately 65km west of the Antarctic Peninsula, between Brabant Island and Anvers Island, with Bransfield Strait to the north and Gerlache Strait to the south (Map 1). Brabant Island is predominantly ice-covered, with a high north-south mountain chain, which rises to 2520m at Mount Parry and falls steeply to the sea on the western coast (Smellie *et al.* 2006). The western coastline is characterized by rock and ice cliffs and ice-free headlands, interspersed by steep boulder and narrow pebble beaches. Rock platforms are exposed at low tide in various locations north of Driencourt Point (Map 1), which field surveys carried out in January 2002 suggest are part of a much larger outcrop of volcanic rock, which extends approximately 10km from Brabant Island and was formed by two phases of phreatomagmatic volcanism during the Late Quaternary (Smellie *et al.* 2006). Numerous rocky islets extend several kilometers offshore, including Astrolabe Needle (104m) which stands one kilometer offshore, two kilometers south of Claude Point. West of Brabant Island the sea floor slopes moderately from the intertidal zone to depths of approximately 200m before the slope eases to depths of 400-500m beyond the western boundary of the Area. The gradient from the shore down to 200m slopes more gently in the north of the Area. The Area lies mostly within the 200m depth contour west and north of Brabant Island (Map 1). The sea floor in the Area is generally composed of a matrix of soft sand, mud and cobbled-rock.

Boundaries

The designated Area is defined in the south by latitude 64°20'S, extending from Fleming Point westward for two kilometers to 62°40'W. From this location, the western boundary extends due north on longitude 62°40'W for 18.5km to 64°10'S, SSW of Astrolabe Needle. The western boundary then extends NNW almost 19km to 62°45'W, 64°00'S. The western boundary then extends approximately 13km due north on longitude 62°45'W to latitude 63°53'S, the northern boundary of the Area. The northern boundary extends along latitude 63°53'S from 62°45'W to 62°16'W, being a distance of approximately 23.4km. The eastern boundary extends due south approximately 16km from 62°16'W, 63°53'S to the eastern extremity of Pasteur Peninsula, Brabant Island, at 62°16'W, 64°02'S. From there, the eastern boundary is defined as the mean high water mark of the northern and western coastline of Brabant Island, which includes the intertidal zone within the Area. The Area is 50km from north to south and extends up to a maximum of 23.4km east-west. West of Brabant Island the width of the Area ranges between 10km (at Guyou Bay) and 1.5km (near Claude Point). The total area is approximately 676km^2.

Oceanography, marine geology and climate

Regional winds are predominantly from the NNW, resulting in a southward flowing coastal current along the western Antarctic Peninsula (Hofmann *et al.* 1996). Coupled with the northward flow of the Antarctic Circumpolar Current, this results in a generally clockwise oceanic circulation along the western Antarctic Peninsula (Dinniman and Klinck 2004; Ducklow *et al.* 2007). Within Bransfield Strait, a cyclonic circulation predominates, with the two main currents (the Gerlache Strait Current and the Bransfield Strait Current)

originating from the south of Brabant Island (Zhou *et al.* 2002 and 2006). Drifters deployed as part of RACER (Research on Antarctic Coastal Ecosystems and Rates) between 1988 and 1990 suggest an east-west flow within the northern area of the ASPA and the formation of eddies between Metchnikoff Point and Astrolabe Needle (Zhou *et al*. 2002). Tidal variation on Brabant Island is almost two meters and observations made while fishing indicate strong near-shore currents (Furse 1986).

Measurements made between 20th January and 9th February 2001 indicated that ocean temperatures in the Area were 1.8 to 1.9ºC at a depth of 5m and at 150m depth, temperatures reached 0.3 to 0.45ºC (Catalan *et al.* 2008). Measurements carried out between 11th June and 16th July 2001 suggested that water temperatures in the Area ranged between –0.8 to –1.1°C at depths of 100–200m (Eastman and Lannoo 2004). Water salinity within the Area ranged between 33.84 and 34.04 practical salinity units (psu) at 5m, whilst at 150m depth salinity values were 34.42 - 34.45psu (Catalan *et al.* 2008). Sea ice coverage averages approximately 140 days per year within Eastern Dallmann Bay and persists for approximately 82% of the winter period (Stammerjohn *et al.* 2008). Sea ice concentrations show considerable interannual variabilty, which has been linked to phase changes in ENSO and the Southern Annular Mode (SAM) (Stammerjohn *et al.* 2008).

Seismic measurements from the Seismic Experiment in Patagonia and Antarctica (SEPA) geodetic monitoring network indicate a significant earthquake activity within the Area, particularly to the north of Brabant Island, which is thought to result from the intersection of the Hero Fracture Zone with the South Shetland Platform at Smith Island (Maurice *et al.* 2003).

Marine biology

The Area supports a rich benthic community including numerous fish species, invertebrates, and marine plants and the Area is an important habitat for juvenile fish species. Fish commonly collected within a depth range of 80 to 200m at Eastern Dallmann Bay include *Gobionotothen gibberifrons (*formely *Notothenia gibberifrons), Chaenocephalus aceratus, Champsocephalus gunnari*, *Pseudochaenichthys georgianus* and *Chionodraco rastrospinosus* (Eastman and Lannoo 2004; Dunlap *et al.* 2002). In addition to more common species, trawls carried out between 15th June and 4th July 2001 collected numerous specimens of *Lepidonotothen larseni, Lepidonotothen nudifrons, Notothenia rossii* and *Notothenia coriiceps* and examples of *Parachaenichthys charcoti, Chaenodraco wilsoni, Dissostichus mawsoni, Trematomus eulepidotus* and *Lepidonotothen squamifrons* (Eastman and Sidell 2002; Grove and Sidell 2004). Specimens of *Trematomus newnesi* and *Gymnodraco acuticeps* have been collected occasionally within the Area (Hazel and Sidell 2003; Wujcik *et al*. 2007). Larval species recorded in the Area include *Artedidraco skottsberg, Gobionotothen gibberifrons, Lepidonotothen nudifrons* and *Pleuragramma antarcticum* (Sinque *et al.* 1986; Loeb *et al.* 1993).

Invertebrates collected within the Area have included varieties of sponge, anemone, annelid, mollusc, crustacean, asteroid, ophiuroid, echinoid, holothurioid and tunicate. Acoustic echo-sounding was used to measure aggregations of Antarctic krill (*Euphausia superba*) within the Area during cruises between 1985 and 1988 (Ross *et al.* 1996). Aggregations were generally recorded in the upper 120m of the water column. The lowest numbers of aggregations were observed in early spring, increasing to a maximum in late summer and early winter and spawning occurs from November to March (Zhou *et al*. 2002). The Area provides a food-rich nursery for krill, which may become entrained within the Area by eddy currents.

Birds

Two colonies of chinstrap penguins (*Pygoscelis antarctica*) have been recorded on the northwestern coast of Brabant Island immediately adjacent to the Area. Approximately 5000 breeding pairs were counted at Metchnikoff Point in 1985 and approximately 250 pairs at Claude Point in 1985 (Woehler 1993). Colonies of Antarctic fulmars (*Fulmarus glacialoides*) have been observed at three locations along the coast of Brabant Island (Poncet and Poncet, unpublished data: in Harris 2006) and 1000 breeding pairs were estimated to be nesting along Cape Cockburn cliffs in 1987, at the northeastern boundary of the Area (Creuwels *et al*. 2007). Antarctic shag (*Phalacrocorax* [atriceps] *bransfieldensis)* have been observed to nest at four locations along the western coast of Brabant Island (Poncet and Poncet, unpublished data from Jan-Feb 1987, in Harris 2006). Other birds observed breeding on the western coast of Brabant Island and frequenting the Area are: Antarctic terns (*Sterna vittata*), black-bellied storm petrels (*Fregetta tropica*), brown skuas (*Catharacta lonnbergi*), cape pigeons (*Daption capense*), greater sheathbills (*Chionis alba*), kelp gulls (*Larus dominicanus*), snow petrels (*Pagodroma nivea*), south polar skuas (*Catharacta maccormicki*) and Wilson's storm petrels (*Oceanites oceanicus*) (Parmelee and Rimmer 1985; Furse 1986). Antarctic petrel (*Thalassoica antarctica*), black-browed albatross (*Diomedea melanophris*), southern giant petrel (*Macronectes giganteus*) commonly forage in the Area (Furse 1986).

Marine mammals

Numerous marine mammals were observed in Dallmann Bay between January 1984 and March 1985 (Furse 1986). Humpback whales (*Megaptera novaeangliae*) were the most frequently sighted whale species, with possible sightings of killer whales (*Orcinus orca*) off Metchnikoff Point in May and June 1985. Satellite tracking of humpback whales between January 2004 and January 2006 indicated that numerous animals passed through the Area and foraged within it, with the broader Gerlache Strait region being identified as an important feeding ground for humpback whales (Dalla Rosa *et al.* 2008). Minke whales have been sighted within the Area, to the north of Brabant Island, during the austral summer (Dec – Feb) (Scheidat *et al.* 2008).

Crabeater seals (*Lobodon carcinophagus*), southern elephant seals (*Mirounga leonina*), numerous Antarctic fur seals (*Arctocephalus gazella*), leopard seals (*Hydrurga leptonyx*) and Weddell seals (*Leptonychotes weddellii*), were observed in the Area from Metchnikoff Point (Furse 1986).

Human activities / impacts

Numerous research cruises along the western Antarctic Peninsula have included sampling stations within the Area for oceanographic and/or biological research. Fish collected within the Area have been used for a variety of biochemical, genetic and physiological research. Studies of icefish biochemical processes have included: studies of the adaptations in fish that enable proteins to function at low temperatures (Dunlap *et al.* 2002; Cheng and Detrich 2007); the adaptations of muscle structure and energy metabolism, including the processing of fatty acids to low temperatures (Hazel and Sidell 2003; Grove and Sidell 2004; O'Brien *et al.* 2003); the influence of hydrostatic pressure on enzyme function within fish livers (Ciardiello *et al*. 1999) and efficient genome transcription at low water temperatures (Lau *et al*. 2001; Magnoni *et al*. 2002). Numerous studies have investigated icefish morphology, including; research into the cardiovascular adaptations of icefish, in compensation for their complete lack of haemoglobin (Wukcik *et al*. 2007; Sidell and

O'Brien 2006); the histology and anatomy of the sense organs and brains of icefish (Eastman and Lannoo 2004); and neutral buoyancy of icefish in relation to their life histories and skeletal structure (Eastman and Sidell 2002).

Specimens collected during trawls in March and April 1991, 1992, and 1993 were used in comparative studies of polynuclear aromatic hydrocarbon (PAH) contamination in fish with those collected from Arthur Harbor and the effects of Diesel Fuel Arctic (DFA) on *Notothenia gibberifrons* (now *Gobionotothen gibberifrons*) (McDonald *et al.* 1995; Yu *et al*. 1995). The former study found levels of contamination in fish sampled from the Area were considerably lower than those sampled from the vicinity of the 1989 *Bahía Paraíso* wreck in Arthur Harbor and that fish captured near US scientific stations are exposed to PAH, albeit low levels (McDonald *et al*. 1992 and 1995). However concentrations of PAH were higher than had been expected in fish collected from within the Area, with levels found to be similar to those in fish sampled from near Old Palmer Station.

A British Joint Services Expedition involving 35 team members spent one year on Brabant Island from January 1984 to March 1985 (Furse 1986). Several camps and numerous caches were established along the western coastline, including a main base camp at Metchnikoff Point. Some of the camp structures and possibly caches were abandoned following the expedition, although their status in 2009 is unknown. The level of impact of the expedition on the adjacent marine environment is also unknown.

The Brabant Island – Anvers Island region is a popular destination for tourism. Data on tourist visits compiled by the US National Science Foundation show that since the Area was first designated in 1991 a number of tour vessels have visited Dallmann Bay, and more specifically Metchnikoff Point. Tourist activity in the vicinity since original designation is summarised in Table 1. It is not clear where in Dallmann Bay the reported tourist visits took place, although it is thought that ship activity occurs predominantly within western Dallmann Bay, specifically along the coast of Anvers Island and close to the Melchior Islands (Crosbie pers. comm. 2008). It remains necessary, however, to move through the Area to gain access to Metchnikoff Point by sea.

Table 1. Tourism activity in the vicinity of ASPA No 153, Eastern Dallmann Bay, 1991–92 to 2007–08. Numbers given in brackets indicate activity at Metchnikoff Point.

Year	No. of vessels	Total No. of Tourists	Small-boat cruise (pax)	Small-boat landing (pax)	Kayaking
1991-92	(1)		(12)		
1992-93					
1993-94	1		84		
1994-95					
1995-96	2		104		
1996-97	1		70		
1997-98	(1)			(55)	
1998-99	(1)			(2)	
1999-00	2		102		
2000-01	0		0		
2001-02	(1)		0 (96)		
2002-03	0		0		
2003-04	0	0	0	0	0
2004-05	1	56	0	0	0
2005-06	7	1506	467	0	107
2006-07	8	1333	318	0	101
2007-08	8	13,754	61	0	0

6(ii) Restricted and managed zones within the Area

None.

6(iii) Structures within and near the Area

There are no structures known to be within the Area. Structures and other material from the UK Joint Services Expedition to Brabant Island (January 1984 to March 1985) may remain on the western shores of Brabant Island, particularly at Metchnikoff Point. The nearest stations are President González Videla (Chile), approximately 55km south in Paradise Harbour; Port Lockroy (UK), approximately 75km south-west on Goudier Island, Yelcho (Chile), approximately 80km south-west on Doumar Island; and Palmer (US), approximately 90km WSW on Anvers Island.

6(iv) Location of other protected areas within close proximity of the Area

The nearest protected area to Eastern Dallmann Bay is Western Bransfield Strait (ASPA No 152), which lies about 55km to the NNW. Antarctic Specially Managed Area No. 7 Southwest Anvers Island and Palmer Basin lies approximately 80km to the south-west on the southern coast of Anvers Island (Map 1).

7. Permit conditions

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit are that:

- it is issued for scientific study of the marine environment in the Area, or for other scientific study which will not compromise the values for which the Area is protected, or for essential management purposes consistent with plan objectives such as inspection, maintenance or review;
- the actions permitted will not jeopardize the ecological or scientific values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the Permit, or a copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the Permit;
- permits shall be issued for a stated period;

7(i) Access to and movement within the Area

Access into the Area shall be by sea, over sea ice or by air. There are no specific restrictions on routes of access to or movement within the Area, although movements should be kept to the minimum necessary consistent with the objectives of any permitted activity. Every reasonable effort should be made to minimize disturbance. Anchoring should be avoided within the Area. There are no special overflight restrictions and aircraft may land by Permit when sea ice conditions allow.

7(ii) Activities that are or may be conducted in the Area, including restrictions on time or place

- Scientific research that will not jeopardize the values of the Area;
- Essential operational activities of vessels that will not jeopardize the values of the Area, such as transit through, or stationing within, the Area in order to facilitate science or other activities or for access to sites outside of the Area;
- Essential management activities, including monitoring.

7(iii) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit and permanent structures or installations are prohibited.
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be made of materials that pose minimal risk of contamination of the Area.
- Installation (including site selection), maintenance, modification or removal of structures shall be undertaken in a manner that minimizes disturbance to flora and fauna.
- Removal of specific equipment for which the permit has expired shall be the responsibility of the authority which granted the original Permit, and shall be a condition of the permit.

7(iv) Location of field camps

None.

7(v) Restrictions on materials and organisms which can be brought into the Area

- No living animals, plant material, pathogens or microorganisms shall be deliberately introduced into the Area, and the precautions listed below shall be taken against accidental introductions.
- To help maintain the ecological and scientific values derived from the relatively low level of human impact within Eastern Dallmann Bay, visitors shall take special precautions against introductions. Of concern are pathogenic, microbial, or plant introductions sourced from other Antarctic sites, including stations, or from regions outside Antarctica. Visitors shall ensure that sampling equipment or markers brought into the Area are clean. To the maximum extent practicable, equipment used or brought into the Area shall be thoroughly cleaned before use within the Area.
- No herbicides or pesticides shall be brought into the Area.
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted.
- All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of their introduction into the environment is minimized.
- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

7(vi) Taking or harmful interference with native flora or fauna

Taking or harmful interference of native flora and fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II by the appropriate national authority specifically for that purpose.

7(vii) Collection or removal of anything not brought into the Area by the Permit holder

- Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs.
- Permits shall not be granted if there is a reasonable concern that the sampling proposed would take, remove or damage such quantities of substrate, native flora or fauna that their distribution or abundance within the Area would be significantly affected.
- Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed from any part of the Area, unless the impact of removal is likely to be greater than leaving the material *in situ.* If this is the case the appropriate authority should be notified.

7(viii) Disposal of waste

All wastes, including human wastes, shall be removed from the Area.

7(ix) Measures that are necessary to ensure that the aims and objectives of the Management Plan can continue to be met

1. Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities, which may involve the collection of limited samples for analysis or review, or for protective measures.
2. Any specific sites of long-term monitoring that are vulnerable to inadvertent disturbance should, where practical, be appropriately marked on site and on maps of the Area.

7(x) Requirements for reports

- Parties should ensure that the principal holder of each permit issued submit to the appropriate authority a report describing the activities undertaken. Such report should include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of Resolution 2 (1998)(CEP I).
- Parties should maintain a record of such activities, and, in the annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organizing the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures undertaken, and/or of any materials released and not removed, that were not included in the authorized permit.

References

Catalan, I.A., Morales-Nin, B., Company J. B. Rotllant G. Palomera I. *&* Emelianov M. 2008. Environmental influences on zooplankton and micronekton distribution in the Bransfield Strait and adjacent waters. *Polar Biology* **31**: 691–707.

Cheng, C.C.H. *&* Detrich III, H.W. 2007. Molecular ecophysiology of Antarctic notothenioid fishes*. Philosophical Transactions of the Royal Society B* **362** (1488): 2215-32.

Ciardiello, M.A., Schmitt B., di Prisco G. *&*. Hervé G. 1999. Influence of hydrostatic pressure on l-glutamate dehydrogenase from the Antarctic fish *Chaenocephalus aceratus*. *Marine Biology* **134** (4): 631-36.

Creuwels, J.C.S., Poncet, S., Hodum, P.J. *&* van Franeker. J.A. 2007. Distribution and abundance of the southern fulmar *Fulmarus glacialoides*. *Polar Biology* **30**:1083–97. [doi 10.1007/s00300-007-0276-0]

Dalla Rosa. L., Secchi, E.R., Maia Y.G., Zerbini A.N. & Heide-Jørgensen, M.P. 2008. Movements of satellite-monitored humpback whales on their feeding ground along the Antarctic Peninsula. *Polar Biology* **31**: 771–81. [doi 10.1007/s00300-008-0415-2]

Detrich III, H.W., Parker, S.K., Williams, R.B. Jr, Nogales, E. & Downing, K.H. 2000. Cold adaptation of microtubile assembly and dynamics. *Journal of Biological Chemistry* **275** (47): 37038–47.

Dinniman, M.S. & Klinck, J.M. 2004. A model study of circulation and cross-shelf exchange on the west Antarctic Peninsula continental shelf. *Deep-Sea Research II* **51**: 2003–22.

Ducklow, H.W., Baker, K., Martinson, D.G., Quetin, L. G., Ross, R.M., Smith, R.C., Stammerjohn, S.E., Vernet, M. & Fraser, W. 2007. Marine pelagic ecosystems: the West Antarctic Peninsula. *Philosophical Transactions of the Royal Society B* **362**: 67–94. [doi:10.1098/rstb.2006.1955]

Dunlap, W.C., Fujisawa A., Yamamoto, Y., Moylan, T.J. & Sidell, B.D. 2002. Notothenioid fish, krill and phytoplankton from Antarctica contain a vitamin E constituent (a-tocomonoenol) functionally associated with cold-water adaptation. *Comparative Biochemistry and Physiology Part B* **133**: 299–305.

Eastmann, J.T. & Lannoo, M.J. 2004. Brain and sense organ anatomy and histology in hemoglobinless Antarctic icefishes (Perciformes: Notothenioidei: Channichthyidae). *Journal of Morphology* **260**: 117–40.

Eastman, J.T. & Sidell, B.D. 2002.Measurements of buoyancy for some Antarctic notothenioid fishes from the South Shetland Islands. *Polar Biology* **25**: 753–60. [doi 10.1007/s00300-002-0398-3]

Furse, C. 1986. *Antarctic year: Brabant Island expedition*. Croom Helm, Australia.

Grove. T.J. & Sidell, B.D. 2004. Fatty acyl CoA synthetase from Antarctic notothenioid fishes may influence substrate specificity of fat oxidation. *Comparative Biochemistry and Physiology, Part B* **139**: 53–63.

Hazel, J.R. & Sidell, B.D. 2003. The substrate specificity of hormone-sensitive lipase from adipose tissue of the Antarctic fish *Trematomus newnesi. Journal of Experimental Biology* **207**: 897-903.

Harris, C.M. 2006. *Wildlife Awareness Manual: Antarctic Peninsula, South Shetland Islands and South Orkney Islands*. Environmental Research & Assessment, Cambridge.

Hofmann, E.E., Klinck, J.M., Lascara, C.M. & Smith, D.A. 1996. Water mass distribution and circulation west of the Antarctic Peninsula and including Bransfield Strait. In Ross, R.M., Hofmann, E.E. & Quetin, L.B. (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**: 61-80.

Lau, D.T., Saeed-Kothe, A., Paker, S.K. & Detrich III, H.W. 2001. Adaptive evolution of gene Expression in Antarctic fishes: divergent transcription of the 59-to-59 linked adult a1- and b-globin genes of the Antarctic teleost *Notothenia coriiceps* is

controlled by dual promoters and intergenic enhancers. *American Zoologist* **41**: 113–32.

Loeb, V.J., Kellermann, A.K., Koubbi, P., North, A.W. & White, M.G. 1993. Antarctic larval fish assemblages: a review. *Bulletin of Marine Science* **53**(2): 416-49.

Magnoni, J.L. 2002. Antarctic notothenioid fishes do not display metabolic cold adaptation in hepatic gluconeogenesis. Unpublished Masters thesis, Department of Marine Biology, University of Maine.

McDonald, S., Kennicutt II, M., Foster-Springer, K. & Krahn, M. 1992. Polynuclear aromatic hydrocarbon exposure in Antarctic fish. *Antarctic Journal of the United States* **27**(5): 333-35.

McDonald, S.J., Kennicutt II, M.C., Liu H. & Safe S.H. 1995. Assessing Aromatic Hydrocarbon Exposure in Antarctic Fish Captured near Palmer and McMurdo Stations, Antarctica. *Archives of Environmental Contamination and Toxicology***29**: 232-40.

O'Brien, K.M, Skilbeck, C., Sidell, B.D. & Egginton, S. 2002. Muscle fine structure may maintain the function of oxidative fibres in haemoglobinless Antarctic fishes. *Journal of Experimental Biology* **206**: 411-21.

Parmelee, D.F. & Rimmer, C.C. 1985. Ornithological observations at Brabant Island, Antarctica. *British Antarctic Survey Bulletin* **67**: 7-12.

Robertson Maurice, S.D., Wiens D.A., Shore P.J., Vera E. & Dorman L.M. 2003. Seismicity and tectonics of the South Shetland Islands and Bransfield Strait from a regional broadband seismograph deployment. *Journal of Geophysical Research* **108**(B10) 2461. [doi:10.1029/2003JB002416]

Ross, R.M. & Quetin, L.B. 1996. Distribution of Antarctic krill and dominant zooplankton west of the Antarctic Peninsula. In Ross, R.M., Hofmann, E.E. & Quetin, L.B. (eds) *Foundations for ecological research west of the Antarctic Peninsula*. *Antarctic Research Series* **70**: 199-217.

Scheidat, M., Bornemann, H., Burkahardt, E., Flores, H., Friedlaender, A. Kock, K.-H, Lehnert, L., van Franekar, J. & Williams, R. 2008. Antarctic sea ice habitat and minke whales. Annual Science Conference in Halifax, 22-26 September, 2008, Halifax, Canada.

Schenke H. W., S. Dijstra, F. Neiderjasper, T. Schone, H. Hinze, & B. Hoppman. 1998. The new bathymetric charts of the Weddell Sea: AWI BCWS. In Jacobs, S.S. & Weiss, R.F. (eds). *Ocean, ice and atmosphere: interactions at the Antarctic continental margin*. *Antarctic Research Series* **75**: 371-80.

Sidell, B.D. & O'Brien, K.M. 2006. When bad things happen to good fish: the loss of hemoglobin and myoglobin expression in Antarctic icefishes. *Journal of Experimental Biology* **209:** 1791-1802.

Smellie J.L., McIntosh W.C. & Esser, R. 2006. Eruptive environment of volcanism on Brabant Island: Evidence for thin wet-based ice in northern Antarctic Peninsula during the Late Quaternary. *Palaeogeography, Palaeoclimatology, Palaeoecology* **231**: 233–52.

Sinque, C., Koblitz, S. & Marília Costa, L. 1986. Ichthyoplankton of Bransfield Strait – Antarctica. *Nerítica* **1**(3): 91-102.

Stammerjohn, S.E., Martinson, D.G, & Iannuzzi, R.A. 2008. Sea ice in the western Antarctic Peninsula region: Spatio-temporal variability from ecological and climate change perspectives. *Deep-Sea Research II* **55**: 2041–58.

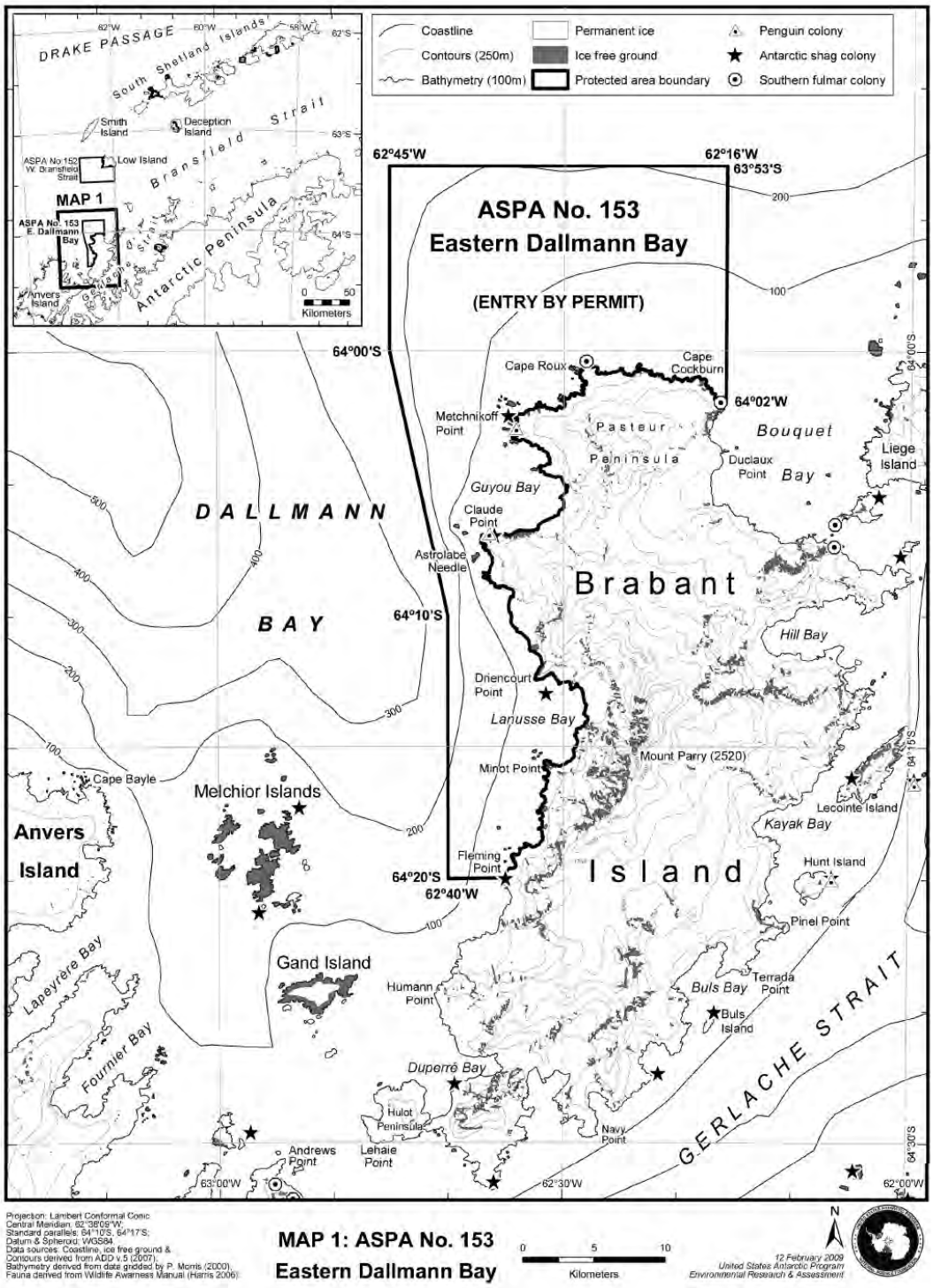
Woehler, E.J. (ed) 1993. *The distribution and abundance of Antarctic and sub-Antarctic penguins*. Cambridge, SCAR.

Wujcik, J.M. Wang, G., Eastman, J.T. & Sidell, B.D. 2007. Morphometry of retinal vasculature in Antarctic fishes is dependent upon the level of hemoglobin in circulation. *Journal of Experimental Biology* **210**: 815-24.

Yu, Y., Wade T. L., Fang J., McDonald S. & Brooks J. M. 1995. Gas chromatographic – mass spectrometric analysis of Polycyclic Aromatic Hydrocarbon metabolites in Antarctic fish *(Notothenia gibberifrons) i*njected with Diesel Fuel Arctic. *Archives of Environmental Contamination and Toxicology* **29**: 241-46.

Zhou, M., Niiler, P.P. & Hi, J.H. 2002.Surface currents in the Bransfield and Gerlache Straits, Antarctica. *Deep-Sea Research I* **49**: 267–80.

Zhou, M., Niiler, P.P., Zhu, Y. & Dorland, R.D. 2006. The western boundary current in the Bransfield Strait, Antarctica. *Deep-Sea Research I* **53:** 1244–52.



Projection: Lambert Conformal Conic
Central Meridian: 62°38'05"W;
Standard parallels: 64°10'S, 64°17'S;
Datum & Spheroid: WGS84
Data sources: Coastline, ice free ground & Contours derived from ADD v.5 (2007);
Bathymetry derived from data gridded by P. Morris (2000);
Fauna derived from Wildlife Awareness Manual (Harris 2006)

MAP 1: ASPA No. 153 Eastern Dallmann Bay

0 5 10 Kilometers

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12 February 2009
United States Antarctic Program
Environmental Research & Assessment

Measure 12 (2009)

Antarctic Specially Protected Area No 162 (Mawson's Huts, Cape Denison, Commonwealth Bay, George V Land, East Antarctica): Revised Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas ("ASPA") and approval of Management Plans for those Areas;

Recalling

- Measure 2 (2004), which designated Mawson's Huts, Commonwealth Bay, George V Land, East Antarctica, as Antarctic Specially Protected Area No 162, and annexed a management plan for the site;
- Measure 3 (2004), which added Historic Site and Monument No 77 (Cape Denison), located within ASPA 162, to the List of Historic Sites and Monuments;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 162;

Noting Measure 1 (2009), dealing with Antarctic Specially Managed Area No 3 (Cape Denison, Commonwealth Bay, George V Land, East Antarctica), within which ASPA No 162 is located;

Desiring to replace the existing Management Plan for ASPA 162 with the revised Management Plan;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) the revised Management Plan for Antarctic Specially Protected Area No 162 (Mawson's Huts, Cape Denison, Commonwealth Bay, George V Land, East Antarctica), which is annexed to this Measure, be approved;

2) the Management Plan for ASPA 162 annexed to Measure 2 (2004) shall cease to be effective.

Management Plan for
Antarctic Specially Protected Area No. 162

MAWSON'S HUTS, CAPE DENISON, COMMONWEALTH BAY, GEORGE V LAND, EAST ANTARCTICA

Latitude 67º00'30"S, Longitude 142º39'40"E

Introduction

Mawson's Huts are four timber huts that served as the winter base of the Australasian Antarctic Expedition of 1911–14 organised and led by geologist Dr Douglas Mawson. An important symbol of the so-called 'heroic age' of Antarctic exploration (1895-1917), the huts at Cape Denison are the least disturbed and altered of those structures remaining from the era. The achievements of the Mawson expedition include some of the earliest and most comprehensive studies of Antarctic geology, glaciology, oceanography, geography, terrestrial magnetism, astronomy, meteorology, biology, zoology and botany.

In recognition of the rarity and richness of this social, cultural and scientific resource, the Mawson's Huts site was designated under Measure 2 (2004) as Antarctic Specially Protected Area (ASPA) No. 162, to protect the important historical, technical, architectural and aesthetic value of the four Australasian Antarctic Expedition huts. The ASPA also contains part of the site designated under Measure 3 (2004) as Historic Site and Monument No. 77 Cape Denison, Commonwealth Bay, George V Land, and is embedded within Antarctic Specially Managed Area (ASMA) No. 3 Cape Denison, Commonwealth Bay, George V Land, designated under Measure 1 (2004).

1. Description of values to be protected

The ASPA is primarily designated to protect Mawson's Huts which is a site of considerable historic, archaeological, technical, social and aesthetic values.

Historic value

Mawson's Huts at Cape Denison, Commonwealth Bay was the main base of the Australasian Antarctic Expedition (AAE) of 1911–14, led by Dr Douglas Mawson. Mawson's Huts is one of a group of only six sites of 'heroic age' huts where pragmatic consideration of the need to provide permanent shelter in the Antarctic environment resulted in an expedition hut form suitable for polar regions.

Mawson's Huts were built in January, February and March 1912 and May 1913. In their surviving form and setting the huts illustrate the isolation and harsh environment of Cape Denison. They also demonstrate the cramped internal conditions endured by expedition members. The living quarters in the Main Hut, for example, a single space measuring 7.3m x 7.3m, provided sleeping and kitchen facilities for 18 men.

The external form and internal structure of the largest hut, the Main Hut, are a simple but strong architectural concept: a square base topped by a pyramid roof (to prevent damage by blizzards), with skylights to provide natural lighting. Following the decision to combine two expedition bases into one, a hip-roofed accommodation hut measuring 5.5m x 4.9m was adjoined to the living quarters and equipped as a workshop. A 1.5m wide verandah

surrounded the structure on three sides, under the same roof. The verandah was used as a storage space that also assisted in insulating the hut from the weather.

The two huts that form the Main Hut were built of Oregon timber frames clad with Baltic pine tongue-and-groove boards. They were prefabricated in Australia, and on-site construction was assisted by a branded letter code on framing members and coded colours painted on board ends. (None of the expedition party had any previous construction experience). The survival of the Main Hut at one of the windiest sites on Earth is testimony to the strength of its design and care of its construction.

Mawson's Huts contain numerous significant and relatively untouched artefacts from the 'heroic age', which form a rich resource of material available for research and interpretation, and potentially yielding information about aspects of expeditioner life not included in official written accounts.

The three other AAE huts are:

- The Absolute Magnetic Hut, constructed during February 1912. It measured 1.8m x 1.8m in plan with a skillion roof and had an Oregon timber frame to which boards of remnant timber were fixed. The hut was used in association with, and as a reference point for, observations made in the Magnetograph House. Today is it considered to be a standing ruin.
- The Magnetograph House was erected in March 1912 to house equipment used to measure variations in the South Magnetic Pole. It measures 5.5m x 2m with a shallow pitched skillion roof and no windows. After the first building attempt was demolished by high winds, large rocks were heaped against the new hut to provide a wind barrier. Sheepskin and hessian attached to the roof also assisted in keeping the internal temperature constant and in minimising the ingress of drift snow. These innovations may have contributed to the relatively intact condition of the hut today.
- Construction of the Transit Hut commenced in May 1913, with packing case timbers being affixed to an Oregon frame. The structure was also clad in sheepskin and canvas. Originally known as the Astronomical Observatory, the hut housed the theodolite used to take star sights to determine the exact longitude of Cape Denison. It is now considered to be a standing ruin.

Aesthetic values

Mawson's Huts are of aesthetic value; the building form of the huts themselves shows the functional and efficient planning that was undertaken in response to the site position and the elements endured by the expedition members. The weathering of the huts and the decay of the remains gives a feeling of time elapsed and exposure to the elements.

2. Aims and objectives

The aim of the Management Plan is to provide protection for the huts so that their values can be preserved. Management of the Area aims to:

- avoid degradation of, or substantial risk to, the values of the Area;

- maintain the historic values of the Area through planned conservation[1] and archaeological work programmes;
- allow management activities which support the protection of the values and features of the Area;
- allow scientific research; and
- prevent unnecessary human disturbance to the Area, its features and artefacts by means of managed access to the four Australasian Antarctic Expedition huts.

3. Management activities

The following management activities may be undertaken to protect the values of the Area:

- programmes of conservation and archaeological work and environmental monitoring work on Mawson's Huts and any artefacts contained within the huts and an area within five (5) metres around the huts;
- visits made as necessary for management purposes;
- review of the Management Plan at least once every five (5) years, and update as required;
- consultation among national Antarctic programs operating in the region, or those with an interest or experience in Antarctic historic site management, with a view to ensuring the above provisions are implemented effectively; and
- installation of signage to indicate the boundaries of the ASPA.

4. Period of designation

This ASPA is designated for an indefinite period.

5. Description of the Area

5(i) Geographical coordinates, boundary markers and natural features

Cape Denison is a 1.5km-wide peninsula projecting into the centre of Commonwealth Bay, a 60km-wide stretch of coast in George V Land, East Antarctica. The topography of Cape Denison is defined by a series of four rocky ridges, running south-southeast to north-northwest, and three valleys filled with ice, snow, and glacial moraine. The largest, most westerly of these valleys contain the four Australasian Antarctic Expedition huts. At the seaward end of this valley is Boat Harbour, a 400m long indentation in the coast.

Mawson's Main Hut is located about 65m from the harbour (Map A). The Transit Hut is located 40m northeast of the Main Hut; the Magnetograph House is approximately 310m

[1] In the context of this Management Plan the term *conservation* "means all the processes of looking after a place so as to retain its cultural significance", as defined in Article 1.4 , of The Burra Charter: The Australian ICOMOS Burra Charter, 1999.

north-northeast of the Main Hut; and the Absolute Magnetic Hut is about 275m northeast of the Main Hut.

The ASPA covers four areas. Each area consists of one hut and an area extending five (5) metres from the perimeter of the hut. The huts are located at:

- Main Hut: 67º00'31"S, 142º39'39"E;
- Transit Hut: 67°00'30"S, 142°39'42"E;
- Absolute Magnetic Hut: 67°00'23"S, 142°39'48"E; and
- Magnetograph House: 67°00'21"S, 142°39'37"E.

Cape Denison is the summer habitat for breeding Adélie penguins, Wilson's storm-petrels, snow petrels and South Polar skuas. Several colonies are located close to the ASPA, and the ASPA areas may from time to time be traversed by penguins returning to their nests. Weddell seals, southern elephant seals and leopard seals have been recorded hauling out and, in the case of elephant seals, moulting at Cape Denison. However, the presence of seals within the immediate ASPA boundaries is not recorded.

The only flora evident near the huts are lichens and non-marine algae. Although the non-marine algae have yet to be studied, a list of lichen species is included at Appendix A.

5(ii) Access to the Area

Sea, land and air access to Mawson's Huts is difficult due to the rugged topography and climate of the area. Sea ice extent and uncharted bathymetry may constrain ship access to approximately 3nm from the coastline. Access can be gained either by small watercraft or by helicopter, although attempts to land are frequently hampered by heavy seas and prevailing north-westerly or katabatic winds. Boat landings can be made at Boat Harbour and due north of Sørensen Hut (within ASMA 3). The helicopter landing site and approach and departure flight paths are indicated on Map C.

Onshore access to and within the ASPA is on foot. With the exception of a short boardwalk close to the Main Hut, there are no roads or other transportation infrastructure on shore. The boardwalk is frequently covered by snow and therefore unusable for all but a few weeks of the year.

5(iii) Location of structures and other anthropogenic objects within and near to the Area

The ASPA is located within the Cape Denison ASMA No. 3, which features several other structures from this expedition, including survey markers and the mast atop Anemometer Hill; and six non-historic structures, including temporary field shelters. The non-historic structure located closest to the ASPA is Granholm Hut, situated some 160m northwest of the Main Hut. It contains building materials, some field equipment and limited provisions.

Objects left by the Australasian Antarctic Expedition are strewn within the Area. Of particular note is the artefact scatter located immediately north of the Main Hut. Due to their significant cultural heritage value, these artefacts have been included within the Cape Denison ASMA and Historic Site and Monument (HSM) No. 77.

5(iv) Location of other protected areas in or near to the Area

ASPA 162 is located within the Cape Denison ASMA No. 3. For further details about ASMA 3, refer to the management plan pertaining to this Area. Cape Denison is also listed as a Historic Site and Monument under the Antarctic Treaty.

6. Zones within the Area

There are no zones within ASPA 162.

7. Maps of the Area

Map A: Cape Denison Management Zones.

The map shows the boundaries of the ASMA, the Historic Site, the Visual Protection Zone, ASPA No. 162, and significant topographic features of the Area. The inset map indicates the location in relation to the Antarctic continent.

Map B: Cape Denison Visual Protection Zone.

The map shows the boundaries of the Visual Protection Zone and indicates the position of significant historic artefacts, including the four Australasian Antarctic Expedition huts, the Memorial Cross, and Anemometer Hill, the site of the BANZARE Proclamation Pole.

Map C: Cape Denison Flight Paths and Bird Colonies.

The map indicates the approaches, departures and landing site for helicopters, as well as the location of bird colonies in the vicinity.

Specification for all maps:

Projection: UTM Zone 54
Horizontal Datum: WGS84

8. Permit conditions

Annex V of the Protocol on Environmental Protection to the Antarctic Treaty prohibits entry into an ASPA except in accordance with a Permit. Permits shall only be issued by appropriate national authorities and may contain general and specific conditions. A Permit may be issued by a national authority to cover a number of visits in a season by the same operator. Parties operating in the Commonwealth Bay area shall consult together and with non-government operators interested in visiting the Area to ensure that visitors are managed appropriately.

General conditions for issuing a Permit to enter the ASPA may include:

- activities related to conservation, inspection, maintenance, research and/or monitoring purposes;

- management activities consistent with and/or in support of the management objectives of the ASPA Management Plan objectives; and
- educational purposes and activities, including tourism, consistent with the aims and objectives of this Management Plan.

The Permit should be issued for a stated period and shall be carried within the Area. A visit report must be supplied to the authority named in the Permit within three (3) months of the expiry date of the Permit.

8(i) Access to and movement within or over the Area

Onshore access to and within the huts is on foot. Depending on snow conditions, a short boardwalk close to the Main Hut may be accessible and should be used whenever practicable so as to avoid potential impact on the artefact scatter to the north of the Main Hut.

Authorised work parties, when undertaking conservation work on the huts, may use small all-terrain vehicles within the Area to assist with the transport of materials and equipment to and from the buildings.

8(i). 1 Visitor management

Day visits to Mawson's Huts may be permitted, provided that:

- each group is accompanied by a person with cultural heritage skills (to the satisfaction of the permitting Party) who remains in the Area for the duration of the visit;
- briefings on this Management Plan and the values of the ASPA are conducted prior to visits and adequate site interpretation materials are made available to each visitor;
- visitors accessing the Area avoid sensitive historic artefacts, such as the artefacts scatter to the immediate north of the Main Hut, and other sensitive areas, such as lichen communities; and
- visitors do not touch the exterior fabric of the buildings or any artefacts.

Visitors may enter the Main Hut and Magnetograph House provided that:

- a person who has approved cultural heritage skills accompanies all visitors inside the huts;
- visitation of the interior of the huts is limited to up to four (4) persons (including the guide) at any one time inside the Main Hut, and up to three (3) persons (including the guide) in the Magnetograph House; and
- artefacts, scientific and related conservation management equipment and the interior building fabric are not touched.

Authorised work parties undertaking approved conservation and/or archaeological work programmes are exempt from the provisions of this sub-section.

8(ii) Activities which are or may be conducted within the Area

- Activities related to the regular programme of conservation work, and

activities for inspection, maintenance, research and/or monitoring purposes;

- scientific research;
- visitation for educational purposes, including tourism; and
- visitation to assess the effectiveness of the Management Plan and management activities.

8(iii) The installation, modification, or removal of structures

Other than to preserve the values of Mawson's Huts, no new structures or equipment should be installed.

No alteration to Mawson's Huts shall be made, or structures installed, except for those required for the conservation, research, monitoring or maintenance activities specified above.

Cape Denison is also designated as a Historic Site. In accordance with Annex V, Article 8 (4) of the Protocol, no historic structure or other artefact at Cape Denison (including Mawson's Huts) should be damaged, removed or destroyed except in accordance with an approved conservation and/or archaeological work programme. A historic artefact may only be removed from the Area for the purposes of conservation and/or preservation and then only in accordance with a Permit issued by a national authority.

The repatriation of the artefact to its original location at Cape Denison is generally preferable unless further damage or deterioration may result from repatriation.

8(iv) The location of field camps

- Camping is not allowed within the Area.
- Use of Mawson's Huts for accommodation is not permitted.
- Existing non-historic infrastructure within the ASMA should be used by Parties undertaking activities in accordance with this Management Plan, in preference to establishing new infrastructure.
- Tents should be pitched on the wooden platform adjacent to Sørensen Hut.

8(v) Restrictions on materials and organisms that may be brought into the Area

- No living animals, plant material, micro-organisms or soils shall be deliberately introduced into the Area, and all reasonable precautions shall be taken to prevent accidental introductions.
- No poultry or poultry products, with the exception of sterilised egg powder, may be brought into the Area.
- No polystyrene packaging materials may be brought into the Area.
- No pesticides or herbicides may be brought into the Area, except those used for the purposes of conservation or preservation of historic structures or artefacts, which shall be allowed into the Area in accordance with a Permit, and then removed from the Area at or before the conclusion of the activity for which the Permit was granted.
- Fuel, food and other materials are not to be deposited in the Area, unless

required for essential purposes connected with the activity for which the Permit has been granted.

- Use of combustion-type lanterns is not permitted inside the Area under any circumstances.
- Smoking in the Area is not permitted.

8(vi) Taking or harmful interference with native flora or fauna

Taking or harmful interference with native flora and fauna is prohibited, except in accordance with a separate Permit issued under Article 3 of Annex II (of the Protocol on Environmental Protection to the Antarctic Treaty) by the appropriate national authority specifically for that purpose.

8(vii) The collection or removal of anything not brought into the Area by the Permit holder

- No historic structure or other artefact in the Area may be handled, disturbed or removed from the Area unless for conservation, preservation or protection purposes, or for scientific reasons, and then only in accordance with a Permit issued by an appropriate national authority.
- The repatriation of the artefact to the location at Cape Denison from which it was removed is generally preferable unless further damage or deterioration may result from repatriation.
- If an artefact is to be removed, the Australian national program should be informed so that documentation regarding that program's archaeological research at Mawson's Huts may be amended accordingly.
- Material of human origin that is likely to compromise the values of the Area, and which was not brought into the Area by the Permit holder or otherwise authorised, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ*. If material is to be removed, the appropriate Authority must be notified and approval obtained.

8(viii) Disposal of wastes

All wastes, including human wastes, should be removed from the Area.

8(ix) Measures that may be necessary to ensure aims and objectives of the Plan can continue to be met

- The provision of information for tourists and other visitors to the Area, including a briefing video and interpretative literature;
- a post-visit survey to assist in the formal monitoring of visitor impact (with primary regard to conservation requirements, rather than visitor access);
- off-site interpretation of the Area that maximises the use of available media, including the internet; and
- the development of skills and resources, particularly those related to the excavation of artefacts from ice, to assist in the protection of the Area's values.

8(x) Reports to be made to the appropriate authority regarding visits to the Area

To enhance cooperation and the coordination of activities in the Area, to allow for effective site monitoring and management, to facilitate the consideration of cumulative impacts, and to fulfil the aims and objectives of this Management Plan, Parties should ensure that the principal holder for each Permit issued submits a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the Visit Report Form contained in Appendix 4 of Resolution 2 (1998).

9. Exchange of information

Parties should maintain a record of activities approved for this ASPA and, in the Annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of this Management Plan.

Parties should, wherever possible, deposit originals or copies in a publicly accessible archive to maintain a record of visitation of the Area, to be used both in any review of this Management Plan and in organising further visitation and/or use of the Area.

10. Supporting documentation

Australian Antarctic Division 2007. *Mawson's Huts Historic Site Management Plan 2007-2012*. Kingston, Tas.

Angela Bender, mapping officer, Australian Antarctic Division, pers. comm. 9 April 2003; 16 April 2003.

Dodge, CW. 1948. *BANZARE Reports*, Series B, Vol. VII. British Australia New Zealand Antarctic Expedition.

Godden Mackay Logan 2001. *Mawson's Huts Historic Site, Cape Denison Commonwealth Bay Antarctica: Conservation Management Plan 2001*. Sydney: Godden Mackay Logan: 36, 41–43, 110, 146, 147, passim.

Godfrey, I. 2006. *Mawson's Huts Conservation Expedition 2006*. Mawson's Huts Foundation, Sydney

Hayes, J. Gordon 1928. *Antarctica: a treatise on the southern continent*. London: The Richards Press Ltd.: 212.

McIntyre, D, and M. McIntyre 1996. "Weddell seal survey in Boat Harbour". In: Australian Antarctic Division 1997. *Initial Environmental Evaluation: AAP Mawson's Huts Foundation Conservation Program 1997–98*: Attachment D.

Mawson, D. 1996 (reprint). *The Home of the Blizzard*. Adelaide: Wakefield Press: 53, 54, 62, 68.

Mawson's Huts Foundation 2005. *Mawson's Huts Conservation Expedition 2005*. Sydney

Mawson's Huts Foundation 2008. *Mawson's Huts Conservation Expedition 2007-08*. Sydney

Patterson, D. 2003. *Mawson's Huts Conservation Expedition 2002: Field Leader's Report.*

Secretariat of the Antarctic Treaty, *Environmental Protection, Protected Areas* http://www.ats.aq/e/ep_protected.htm (Accessed 16 February 2009).

Professor Rod Seppelt, botanist, Australian Antarctic Division, pers. comm. 19 February 2003.

Appendix A

Flora recorded at Cape Denison, Commonwealth Bay

The following taxa were recorded at Cape Denison by the Australasian Antarctic Expedition (AAE) of 1911–14 and the British Australian New Zealand Antarctic Research Expedition (BANZARE) in 1929–31 and published by Carroll W. Dodge in BANZARE Reports, Series B, Vol. VII, July 1948.

LICHENS

Lecideaceae

Lecidea cancriformis Dodge & Baker
Toninia johnstoni Dodge

Umbilicaiaceae

U*mbilicaria decussata* (Vill.) Zahlbr.

Lecanoraceae

Rhizoplaca melanophthalma (Ram.) Leuck. & Poelt
Lecanora expectans Darb.
Pleopsidium chlorophanum (Wahlenb.) Zopf

Parmeliaceae

Physcia caesia (Hoffm.) Th. Fr.

Usnaeceae

Pseudephebe minuscula (Nyl. ex Arnold) Brodo & D. Hawksw.
Usnea antarctica Du Rietz

Blasteniaceae

Candelariella flava (C.W. Dodge & Baker) Castello & Nimis
Xanthoria elegans (Link) Th. Fr.
Xanthoria mawsonii Dodge

Buelliaceae

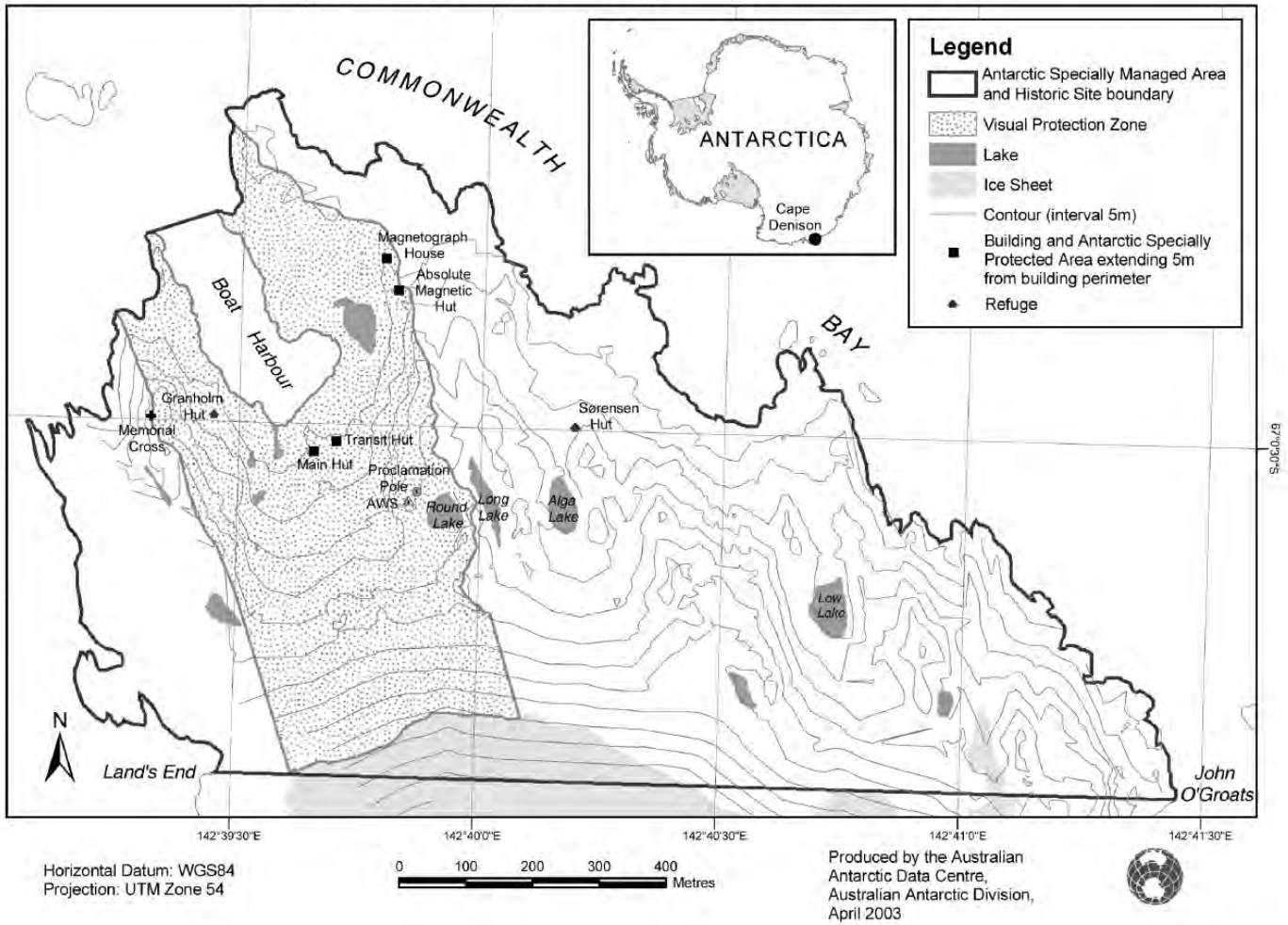
Buellia frigida Darb.

BRYOPHYTES

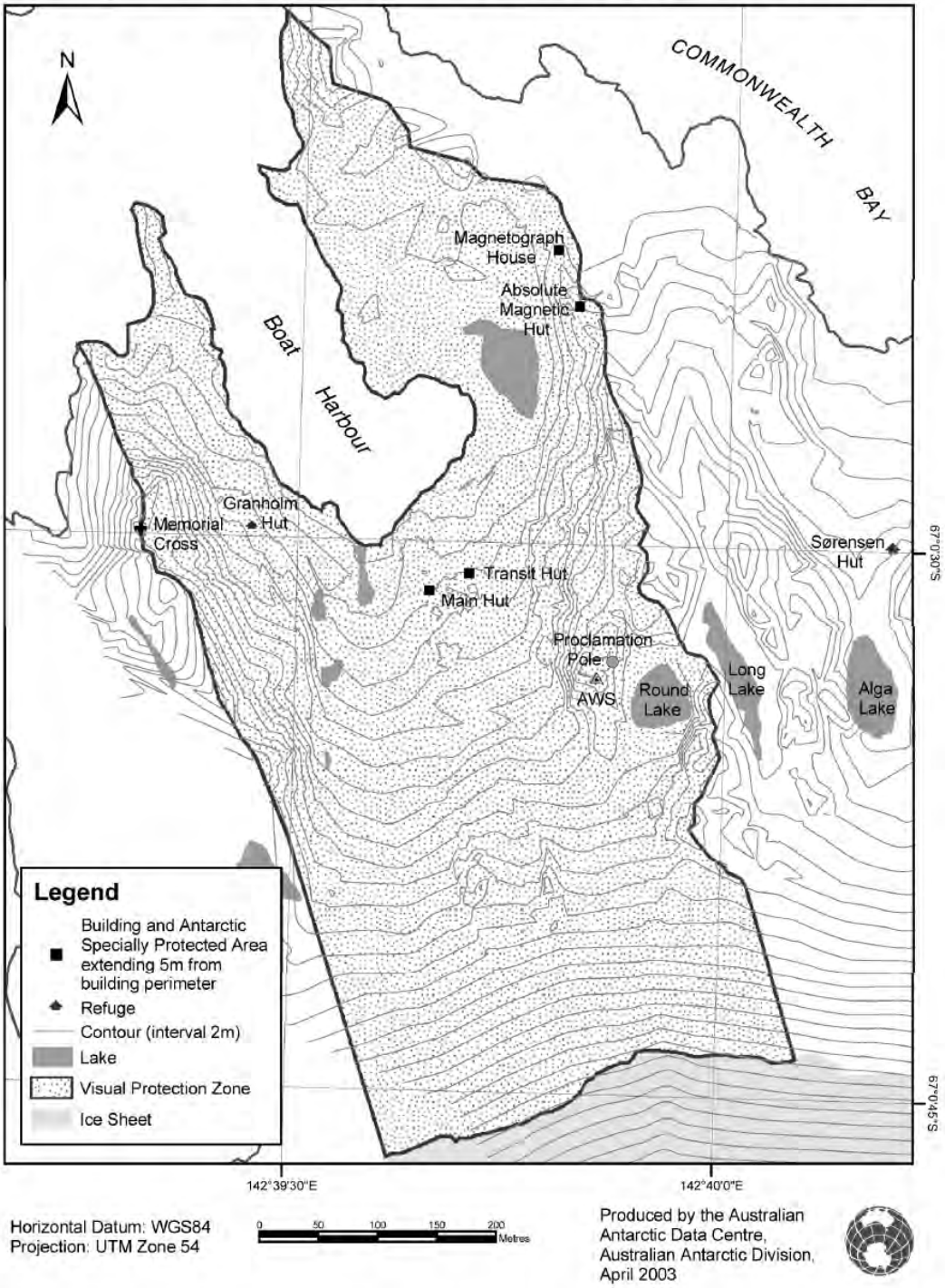
No bryophytes evident at Cape Denison.

There are numerous non-marine algae; however, no surveys have been undertaken.

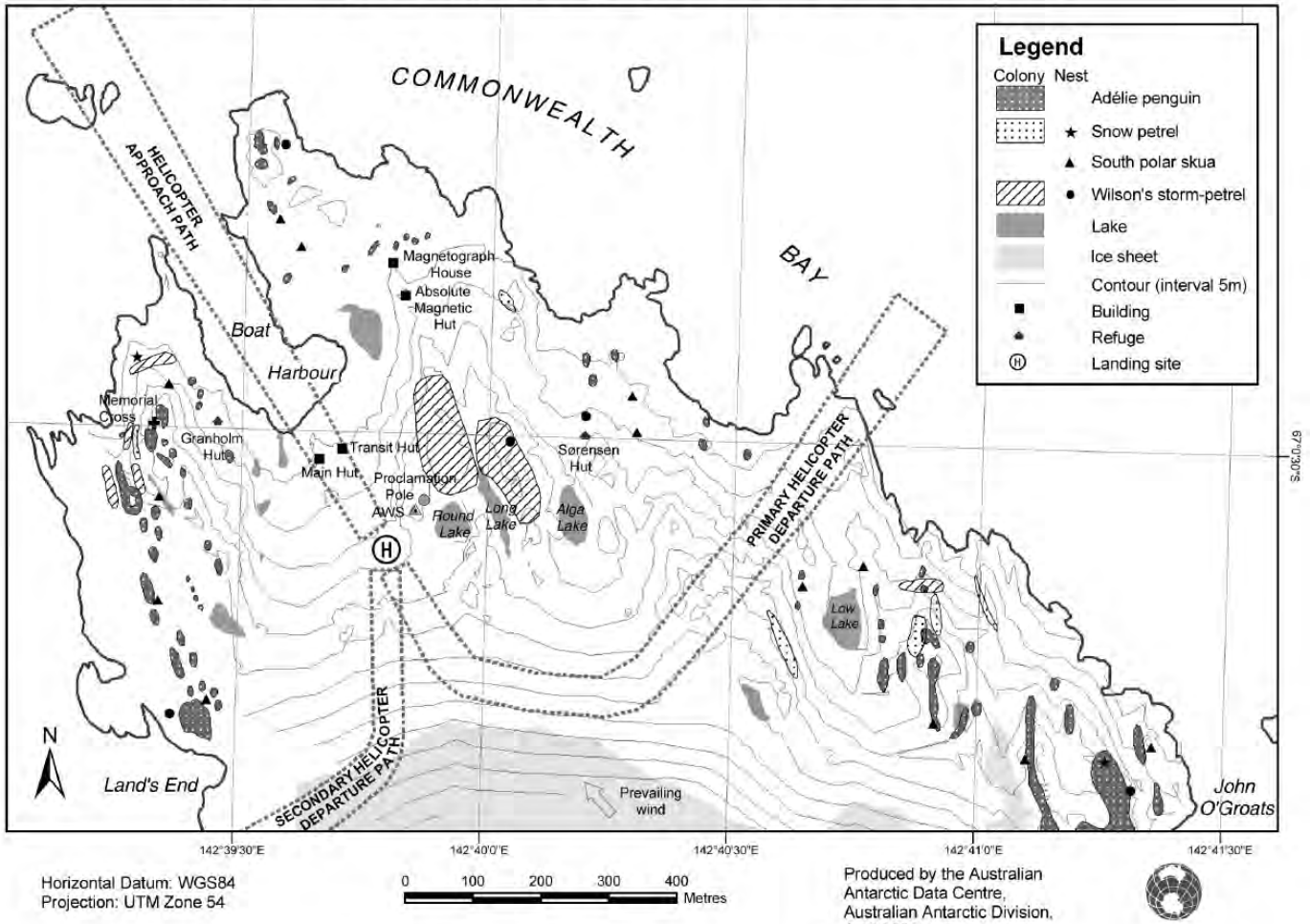
Map A Cape Denison Management Zones



Map B Cape Denison Visual Protection Zone



Map C Cape Denison Flight Paths and Bird Colonies



Measure 13 (2009)

Antarctic Specially Protected Area No 171 (Narębski Point, Barton Peninsula, King George Island): Management Plan

The Representatives,

Recalling Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas and approval of Management Plans for those Areas;

Noting that the Committee for Environmental Protection has recommended that Narębski Point, Barton Peninsula, King George Island, be designated as a new Antarctic Specially Protected Area, and has endorsed the Management Plan for this area annexed to this Measure;

Recognising that this area supports outstanding environmental, scientific, historic, aesthetic or wilderness values, or ongoing or planned scientific research, and would benefit from special protection;

Desiring to designate Narębski Point, Barton Peninsula, King George Island, as an Antarctic Specially Protected Area and to approve the Management Plan for this Area;

Recommend to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1) Narębski Point, Barton Peninsula, King George Island, be designated as Antarctic Specially Protected Area No 171; and

2) the Management Plan which is annexed to this Measure be approved.

Management Plan for Antarctic Specially Protected Area No. 171

NARĘBSKI POINT, BARTON PENINSULA, KING GEORGE ISLAND

Introduction

Narębski Point is located on the southeast coast of Barton Peninsula, King George Island. The Area is delimited as latitude 62° 13' 40"S - 62° 14' 23"S and longitude 58° 45' 25"W - 58° 47' 00"W, and easily distinguished by mountain peaks on the north and the east boundaries and coastline on the southwest boundary.

The unique topography of the Area gives the outstanding aesthetic beauty with panoramic views, and the Area provides exceptional opportunities for scientific studies of terrestrial biological communities with high diversity and complexity of ecosystem. In particular, the coverage of mosses and lichens is very extensive. The most conspicuous vegetal communities are the associations of lichens and the moss turf dominated by *Usnea-Himantormia.* The present flora includes 1 Antarctic flowering plant species (only 2 flowering plant species were found as yet in the Antarctica), 51 lichen species, 29 moss species, 6 liverwort species, and 1 algae species.

Another noticeable feature in the Area is that over 2,900 pairs of Chinstrap Penguins – the largest number in King George Island – and over 1,700 pairs of Gentoo Penguins inhabit in the Area (Kim, 2002). There are also 12 other bird species (7 breeding and 5 non-breeding species). Among them, the 7 breeding birds include the Brown Skua (*Catharacta lonnbergi*), South Polar Skua (*Catharacta maccormicki*), Kelp Gull (*Larus dominicanus*), Antarctic Tern (*Sterna vittata*), Wilson's Storm Petrel (*Oceanites oceanicus*), Palefaced Sheathbill (*Chionis alba*), and the Southern Giant Petrel (*Macronectes giganteus*).

The Area also includes water-shed systems, such as lakes and creeks, where dense microbial and algal mats with complex species assemblages are frequently found. These fresh water resources are essential to the diverse life forms in this Area. The high biodiversity of terrestrial vegetation with complexity of habitats enhance the potential values of the Area to be protected.

Through the Korea Antarctic Research Program, scientists have visited the Area regularly since 1980s in order to study its fauna and flora and geology. In recent years, however, Narębski Point has been frequented by visitors from the nearby stations with purposes other than scientific research, particularly during the reproductive season, and vulnerability to human interference has been increasing. Some studies note that King George Island has the potential for tourism development (ASOC, 2007 & 2008; Peter *et al*., 2005) and visitors to the King Sejong Station have increased from less than 20 people a year in the late 1980s to over 110 in recent years.

The primary reason for designation of the Area as an Antarctic Specially Protected Area is to protect its ecological, scientific, and aesthetic values from human interference. Long-term protection and monitoring of diverse range of species and assemblages at Narębski Point will contribute to the development of appropriate regional and global conservation strategies for the species and will provide information for comparisons with elsewhere.

1. Description of Values to be Protected

The Narębski Point area is designated as an Antarctic Specially Protected Area to protect its outstanding environmental values and to facilitate ongoing and planned scientific research.

The Area provides exceptional opportunities for scientific studies of terrestrial biological communities. Scientific research, including the monitoring of penguin colonies, has been carried out by several countries since the early 1980s. Outcomes of the research revealed the potential value of the Area as a reference site, particularly in relation to global warming and the impacts from human activities.

The unique topography of the Area, together with the abundance and diversity of fauna and flora, gives the Area an exceptional aesthetic value. Among others, the mountain peaks and the southernmost peaks provide breathtaking panoramic views.

For above reasons, the Area should be protected and subject to minimal disturbance by human activities with the exception of occasional monitoring studies including vegetation, bird populations, geological and geomorphologic studies.

2. Aims and Objectives

Management of Narębski Point aims to:

- Avoid degradation of or substantial risk to the values of the Area by preventing unnecessary human disturbance to the Area;
- Allow scientific research that cannot be carried out elsewhere, as well as the continuity of ongoing long term biological studies established in the Area;
- Protect the Area's aesthetic and scientific values.

3. Management Activities

The following management activities are to be undertaken to protect the values of the Area:

- Personnel accessing the site shall be specifically instructed, by their national program (or competent authority) as to the content of the Management Plan;
- Signs illustrating the location and boundaries, with clear statements of entry restrictions, shall be placed at appropriate locations at the boundaries of the Area;

- All signs as well as scientific equipments and markers erected in the Area will be secured and maintained in proper conditions;
- The biological condition of the Area will be adequately monitored, including census on penguins and other birds populations;
- Visits shall be made as necessary (no less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure that maintenance and management measures are adequate;
- National Antarctic Programs operating in the region are encouraged to consult with each other and exchange information to ensure that activities in the Area are undertaken in a manner consistent with the aims and objectives of this Management Plan.

4. Period of Designation

Designated for an indefinite period.

5. Maps

Maps 1 to 6 are attached at the end of this management plan as Annex II.

- Map 1: The location of Narębski Point in relation to the King George Island and the existing protected areas
- Map 2: Boundary of the ASPA
- Map 3: Distribution of bird colonies and seal haul-out sites within the ASPA
- Map 4: Distribution of the plant communities in the ASPA
- Map 5: Geomorphologic details of the ASPA
- Map 6: Access routes to the ASPA

6. Description of the Area

6(i) Geographical co-ordinates, limits, and natural features

Narębski Point is located on the southeast coast of Barton Peninsula, King George Island and the Area is delimited as latitude 62° 13’ 40”S - 62° 14’ 23”S and longitude 58° 45’ 25” W - 58° 47’ 00” W. Boundaries are delimited by mountain peaks on the north and the east and coastline on the southwest. The southwest boundary can be easily recognized due to its distinguished geomorphology. The Area includes only the terrestrial area, excluding the intertidal zone. The total size of the Area is approximately 1 km^2.

The Area is rich in flora and fauna, of which the abundance of some species is exceptional. The cover of mosses and lichens is very extensive. There are large numbers of Chinstrap and Gentoo Penguins and the breeding areas of seven other birds including the nests of the Southern Giant Petrel. The high diversity in relief and coastal forms, due to the presence of different geologies and a prominent system of fractures, in addition to an extensive and varied vegetation cover, provides unusual scenic diversity in the Antarctic environment.

Climate

Meteorological data for the Area are confined entirely to observations at the King Sejong Station (1998- 2007), about 2 km northwest of Narębski point. The climate is humid and relatively mild because of a strong maritime effect. The Area has an annual average temperature of -1.8 °C (maximum 9.8°C, minimum - 23.1°C), relative humidity of 89%, total precipitation of 597.2 mm, and cloud cover of 6.8 Octas. The mean wind velocity is 7.1 m/s (37.6 m/s at the greatest), predominantly from the northwest and east throughout the year. The occurrence of blizzards in 2007 was 26 (total duration time 190 hours).

Geology

The lowermost lithostratigraphic unit in Barton peninsula is the Sejong formation (Yoo *et al*., 2001), formally regarded as a lower volcanic member. The Sejong formation is distributed in the southern and southeastern cliffs of Barton Peninsula (Lee *et al*., 2002). It is largely composed of volcaniclastic constituents gently dipping to the south and southwest. Mafic to intermediated volcanic lavas overlying the Sejong formation are widespread in Barton Peninsula, including the Area. They are mostly plagioclasephyric or plagioclase- and clinopyroxene-phyric basaltic andesite to andesite with rare massive andesite.

Some thick-bedded lapilli tuffs are intercalated with the lava flows. Mafic dikes, Narębski Point being one of them, cut the Sejong formation along the southern coast of the peninsula. Soils of the peninsula are subdivided into four suites based on bedrock type, namely those on granodiorite, basaltic andesite, lapilli tuff, and the Sejong formation (Lee *et al*., 2004). Soils are generally poor in organic materials and nutrients, except for those near seabird colonies.

Penguins

Colonies of Chinstrap Penguin (*Pygoscelis antarctica*) and Gentoo Penguin (*Pygoscelis papua*) are distributed on rocky inclines and hill crests of Narębski Point.

The Chinstrap Penguin is the most abundant breeding species at the site, with a total of 2,961 pairs observed in 2006/07. Chinstrap Penguins begin to lay eggs in early November and incubate for 32-43 days and the peak seasons of laying and hatching are estimated to be mid-November and mid-December, respectively (Kim, 2002). The maximum number of breeding Chinstrap Penguins was estimated at 7,306 pairs in 1986/87 (Trivelpiece *et al*., 1987), though their breeding population plummeted to 1,161 pairs in 1989/90 (Yoon, 1990). Since 1989/90, however, breeding pairs of Chinstrap Penguins have gradually increased and maintained its population at about 3,000 pairs from 1994/95 to 2006/07 (see Figure 1).

Breeding pairs of Gentoo Penguins have increased steadily from 556 pairs since 1986/87. A total of 1,719 pairs of Gentoo Penguins were counted in 2006/07 (see Figure 1). Gentoo Penguins start to lay eggs during mid-October, with the peak season occurring in late October. They incubate for 33-40 days and hatch in early December (Kim, 2002).

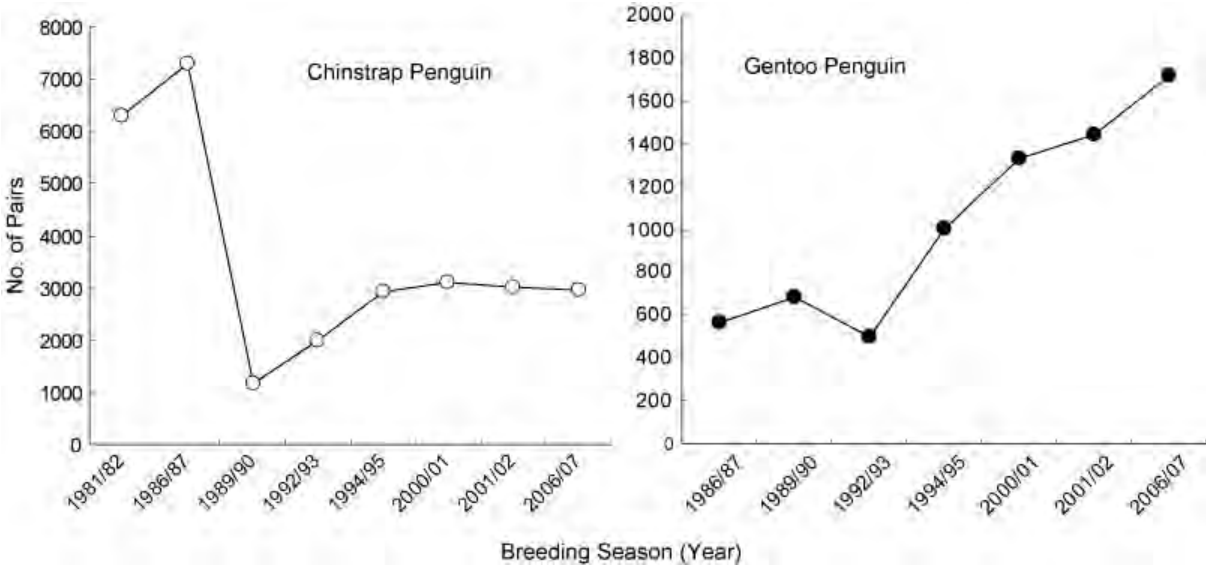


Figure 1. Breeding populations of Chinstrap Penguin and Gentoo Penguin at the Narębski Point (Jablonski, 1984; Trivelpiece *et al*., 1987; Yoon, 1990; MOST, 1993; MAF, 1997; Kim, 2002; MEV, 2007)

Other birds

There are 7 nesting bird species in the Area, including the Brown Skua (*Catharacta lonnbergi*), South Polar Skua (*Catharacta maccormicki*), Kelp Gull (*Larus dominicanus*), Antarctic Tern (*Sterna vittata*), Southern Giant Petrel (*Macronectes giganteus*), Wilson's Storm Petrel (*Oceanites oceanicus*), and Pale-faced Sheathbill (*Chionis alba*). In addition, there are 5 non-breeding bird species in the Area, including the Adelie Penguin (*Pygoscelis adelie*), Antarctic Shag (*Phalacrocorax bransfieldensis*), Arctic Tern (*Sterna paradisaea*), Cape Petrel (*Daption capense*), and Black-Bellied Storm-Petrel (*Fregatta tropica*). A summary of the estimated number of nests by species is presented in Table 1.

Brown Skuas and South Polar Skuas prey on penguin eggs and chicks, and some pairs of skuas occupy penguin sub-colonies as feeding territory during breeding season (Trivelpiece *et al*., 1980; Hagelin and Miller, 1997; Pezzo *et al*., 2001; Hahn and Peter, 2003). South Polar Skuas nesting in the Area do not depend on penguin eggs and chicks for their chick-rearing. On the contrary, during the 2006/07 season, all Brown Skua pairs (4 pairs) breeding in this Area were observed to occupy their own feeding territory in penguin sub-colonies and defend them.

Two pairs of Pale-faced (or Snowy) Sheathbill bred near penguin rookery in Narębski Point (2006/07). Palefaced Sheathbills are omnivores and forage for food around the breeding colonies of seabirds. They feed on penguin faeces, eggs, and dead chicks, and also steal krill from penguins at the site.

Table 1. Estimated number of nests, by species (2006/07)

Species		Number of nests
Gentoo Penguin	*Pygoscelis papua*	1719
Chinstrap Penguin	*Pygoscelis antarctica*	2961
Brown Skua	*Catharacta lonnbergi*	4
South Polar Skua	*Catharacta maccormicki*	27
Kelp Gull	*Larus dominicanus*	6
Antarctic Tern	*Sterna vittata*	41
Southern Giant Petrel	*Macronectes giganteus*	9
Wilson's Storm Petrel	*Oceanites oceanicus*	19
Pale-faced Sheathbill	*Chionis alba*	2

Vegetation

Most of the ice-free areas of Barton Peninsula are covered by relatively rich vegetation, dominated by cryptogamic species. The cover of mosses and lichens is very extensive within the Area. The most conspicuous vegetal communities are the associations of dominant lichens *Usnea-Himantormia* and the moss turf dominated by *Sanionia-Chorisodontium*. The algal community is dominated by the green fresh water alga *Prasiola crispa,* which is established around penguin colonies. The present flora includes 1 Antarctic flowering plant species, 51 lichen species, 29 moss species, 6 liverwort species, and 1 algae species. In the case of algae, only the species forming macroscopically detectable stands were recorded. No information on cyanobacteria and mycobiota occurring in this Area is available, as studies have not been undertaken. The detailed vegetation list is shown in Annex I.

6(ii) Restricted zones within the Area

None.

6(iii) Location of structures within the Area

There are no structures within the Area. A refuge facility is located about 100m away from the Area toward the Southeastern coast. The King Sejong Station (Republic of Korea), which is located 2 km to the northwest of Narębski Point, is the closest major facility.

6(iv) Location of other Protected Areas within close proximity

- ASMA No. 1, Admiralty Bay, King George Island, South Shetland islands lies about 8 km northeast.
- ASPA No. 125, Fildes Peninsula, King George Island, South Shetland islands lies about 11 km west.
- ASPA No. 128, Western Shore of Admiralty Bay, King George Island, South Shetland islands lies about
- 17 km east.
- ASPA No. 132, Potter Peninsula, King George Island, South Shetland islands lies about 5 km east.
- ASPA No. 133, Harmony Point, Nelson Island, South Shetland islands lies about 25 km southwest.

- ASPA No. 150, Ardley Island, King George Island, South Shetland islands lies about 9 km to the west.
- ASPA No. 151, Lions Rump, King George Island, South Shetland islands lies about 35km northeast.
- HSM No. 36, Replica of a metal plaque erected by Eduard Dallmann at Potter Cove, King George Island, lies about 5 km east.
- HSM No. 50, Plaque to commemorate the research vessel Professor Siedlecki which landed in February 1976, Fildes Peninsula, King George Island lies about 10 km west.
- HSM No. 51, Grave of W. Puchalski, an artist and a producer of documentary films, who died on 19 January 1979, lies about 18 km northeast.
- HSM No. 52, Monolith erected to commemorate the establishment on 20 February 1985 of Great Wall Station (China), Fildes Peninsula, King George Island lies about 10 km west.
- HSM No. 82, Plaque at the foot of the monument commemorating the Signatories to the Antarctic Treaty and successive IPYs, lies about 12 km west.

7. Permit Conditions

Entry into the Area is prohibited except in accordance with a permit issued by appropriate national authorities as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty. Conditions for issuing a permit to enter the Area are that:

- It is issued only for scientific purposes that cannot be met elsewhere;
- The actions permitted will not jeopardize the natural ecological system of the Area;
- The actions permitted are in accordance with this Management Plan;
- Any management activities are in support of the objectives of the Management Plan;
- The permit, or an authorized copy, must be carried within the Area;
- Permits shall be valid for a stated period and identify the competent authority;
- A report regarding the visit shall be submitted to the competent national authority named in the permit.

7(i) Access to, and movements within or over, the Area

- Access to the Area is possible on foot along the coast or by small boat without anchoring. The access routes and the landing site are shown in Map 6.
- Pedestrian movements should be kept with caution so as to minimize disturbance to flora and fauna, and should walk on snow or rocky terrain if practical, but taking care not to damage lichens.
- Vehicle traffic of any type is not permitted inside the Area.

- The operation of aircraft over the Area will be carried out, as a minimum requirement, in compliance with Resolution 2 (2004), "Guidelines for the Operation of Aircraft near Concentrations of Birds." As a general rule, no aircraft should fly over the ASPA at less than 610 meters, except in cases of emergency or aircraft security. Over flights, however, should be avoided.

7(ii) Activities which are or may be conducted within the Area, including restrictions on time and place

- Scientific research activities that cannot be conducted elsewhere and that do not jeopardize the ecosystem of the Area;
- Essential management activities, including monitoring;
- Constraints may be placed on the use of motor-driven tools and any activity likely to generate noise and thereby cause disturbances to nesting birds during the breeding period (from October 1 to March 31).

7(iii) Installation, modification, or removal of structures

- No structures will be built and no equipment installed within the Area, with the exception of scientific or management activities, as specified in the permit.
- Any scientific equipment installed in the Area should be approved by a permit and clearly identify the permitting country, name of the principal investigator, and year of installation and date of expected removal. All the equipment should pose a minimum risk of pollution to the Area or a minimum risk of causing disturbances to the flora or to the fauna.
- Signs of investigation should not remain after the permit expires. If a specific project cannot be finished within the allowed time period, an extension should be sought that authorizes the continued presence of any object in the Area.

7(iv) Location of field camps

- Camping is prohibited within the Area except in an emergency, but if necessary, the use of the refuge facility located on the shore near the eastern boundary of the Area is strongly encouraged (see Map 2).

7(v) Restriction on material and organisms which may be brought into the Area

- No living animals or plant material shall be deliberately introduced into the Area.
- No uncooked poultry products or fresh fruit and vegetables are to be taken into the Area.
- To minimize the risk of microbial or vegetation introductions from soils at other Antarctic sites, including the station, or from regions outside Antarctica, footwear and any equipment (particularly sampling equipment and markers) to be used in the Area shall be thoroughly cleaned before entering the Area (any terrestrial activity should be consistent with the 'Environmental code of conduct for terrestrial scientific field research in Antarctica').

- No herbicides or pesticides shall be introduced into the Area. Any other chemical product, which shall be introduced with the corresponding permit, shall be removed from the Area upon conclusion of the activity for which the permit was granted. The use and type of chemical products should be documented, as clearly as possible, for the knowledge of other researchers.
- Fuel, food, and other material are not to be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted, provided it is securely stored so that wildlife cannot have access to it.

7(vi) Taking or harmful interference with native flora and fauna

- Any taking or harmful interference, except in accordance with a permit, is prohibited and should be consistent with the *SCAR Code of Conduct for the use of Animals for Scientific Purposes* in Antarctica as a minimum requirement.
- Information on taking or harmful interference will be exchanged through the System of Information Exchange of the Antarctic Treaty.

7(vii) Collection or removal of anything not brought into the Area by the permit holder

- Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs.
- Anything of human origin likely to compromise the values of the Area, which were not brought into the Area by the permit holder or otherwise authorized, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ*: if this is the case, the appropriate authority should be notified.

7(viii) Disposal of waste

- All wastes, including all human wastes, shall be removed from the Area. Human waste may be disposed of into the sea in accordance with Article 5 of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty.

7(ix) Measures that may be necessary to ensure that the aims and objectives of the Management Plan continue to be met

- Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities, which may involve the collection of a small number of samples for scientific analysis, to erect or maintain signboards, or to carry out protective measures.

7(x) Requirements for reports

The principal permit holder for each issued permit shall submit a report of activities undertaken in the Area. Such reports should include the information identified in the Visit Report form suggested by SCAR. This report shall be submitted to the authority named in the permit as soon as practicable, but not later than 6 months after the visit has taken place. Records of such reports should be stored indefinitely and made accessible to any interested

Party, SCAR, CCAMLR, and COMNAP if requested, so as to provide necessary information of human activities in the Area to ensure adequate management of the Area.

Bibliography

Aguirre, C.A. & Acero, J.M. (1995) Distribution and abundance of birds in the Errera Channel, Antarctic Peninsula during the 1992/93 breeding season. Mar. Ornithol. 23, 129-134.

ASOC (2007) Implementing the Madrid Protpcol: A case study of Fildes Peninsula, King George Island, XXX ATCM/IP136

ASOC (2008) Some land-based facilities used to support/manage Antarctic tourism in King George Island, XXXI ATCM/IP41

Bednarek-Ochyra, H., Vana, R. & Lewis-Smith, R.I. (2000) The liverwort flora of Antarctica. Polish Academy of Sciences, Institute of Botany, Cracow.

Chang, S.K. (2004) Preliminary report on the ecology of the penguins observed in the cold years and a less cold year in the vicinity of King Sejong Station, King George Island off the Antarctic Peninsula. In: Annual report of environmental monitoring on human impacts at the King Sejong Station, Antarctica. KORDI, ECPP 03 102.

Esponda, C.M.G. Coria, N.R. & Montalti, D. (2000) Breeding birds at Halfmoon Island, South Shetland Islands, Antarctica, 1995/96. Mar. Ornithol. 28, 59-62.

Hagelin, J.C., and Miller, G.D. (1997) Nest-site selection in South polar skuas: Balancing nest safty and access to recources. Auk 114, 638-546.

Hahn, S., Peter, H-U., Quillfeldt, P. & Reinhardt, K. (1998) The birds of the Potter Peninsula, King George Island, South Shetland, Antarctica, 1965–1998, Mar. Ornithol. 26, 1-6.

Jablonski, B. (1984) Distribution and number of penguins in the region of King George Island, South Shetland Islands in the breeding season 1980/81. Polish Polar Research 5, 17-30.

Kim, D. (2002) Effect of variation in food supply on reproduction in Gentoo (*Pygoscelis papua*) and Chinstrap penguins (*P. antarctica*). p.195-222. In: Annual report of environmental monitoring on human impacts at the King Sejong Station, Antarctica. KORDI EC PP 01 001-B2

Kim, J.H. Ahn, I.Y., Lee , K.S., Chung, H. & Choi, H.-G. (2007) Vegetation of Barton Peninsula in the neighbourhood of King Sejong Station (King George Island, Maritime Antarctic). Polar Biol. 30, 903- 916.

Kim J.H., Chung, H., Kim, J.H., Yoo, J.C. & Ahn, I.Y. (2005) Nest distribution of skuas on Barton and Weaver peninsulas of the King George Island, the Antarctic. Ocean and Polar Research 27(4), 443-450.

KORDI (1998-2007) Annual Weather Report at King Sejong Station.

Lee, J.I., Hur, S.D., Yoo, C.M., Ueo, J.P., Kim, H., Hwang J., Choe, M.Y., Nam, S.H., Kim. Y., Park, B-K., Zheng X. & López- Martínez, J. (2002) Explanatory text of the geological map of Barton and Weaver Peninsulas, King George Island, Antarctica. Korea Ocean Research and Development Institute.

Lee YI, Lim HS & Yoon HI (2004) Geochemistry of soils of King George Island, South Shetland Islands, West Antarctica: implication for pedogenesis in cold polar regions. Geochim Cosmochim Acta 68, 4319– 4333.

Lewis-Smith, R.I. and Poncet, S. (1985) New southernmost record for Antarctic flowering plants. Polar Record 22, 425-427.

López- Martínez, J., Serrano, E. & Lee, J.I. (2002) Geomorphological map of Barton and Weaver Peninsulas, King George Island, Antarctica. Korea Ocean Research and Development Institute.

Lumper, P., and Weidinger, K. (2000) Distribution, numbers and breeding of birds at the Northern Ice-free areas of Nelson Island, South Shetland Islands, 1990–1992. Mar. Ornithol. 28, 41-56. Ministry of Environment (MEV) (2007) The fundamental study for designation of Antarctic Specially Protected Area. BSPN07030-71-3.

Ministry of Maritime Affairs and Fisheries (MAF) (1997) Overwintering Report of the 8th Korea Antarctic Research Program at King Sejong Station (November 1994-December 1995). BSE 520001-982-7.

Ministry of Science and Technology (MOST) (1989) A study on Natural Environment in the area around the Korea Antarctic Station, King George Island (II). BSPG00081-246-7.

Ministry of Science and Technology (MOST) (1992) The Research on Natural Environments and Resources of Antarctica. BSPG 00169-5-485-7.

Ministry of Science and Technology (MOST) (1993) Overwintering Report of the 4th Korea Antarctic Research Program at King Sejong Station (December 1991-December 1992). BSPN 00221-1-678-7.

Ochyra, R. (1998) The moss flora of King George Island Antarctica. Polish Academy of Sciences, W. Szafer Institute of Botany, Cracow.

Øvstedal, D.O. & Lewis-Smith. R.I. (2001) Lichens of Antarctica and South Georgia: a guide to their identification and ecology. Cambridge University Press, Cambridge, P. 411.

Peter, H., Busser, C., Mustafa, O & Pfeiffer, S. (2005) Preliminary Results of the Research Project "Risk assessment for the Fildes Peninsula and Ardley Island and the development management plans for designation as ASMA (unpublished survey results presented at the Fildes meeting at INACH)

Pezzo, F.,Olmastroni, S., Corsolini, S., and Focardi, S. (2001) Factors affecting the breeding success of the south polar skua *Catharacta maccormicki* at Edmonson Point, Victoria Land, Antarctica. Polar Biol 24, 389-393.

Schroeter, B., Kappen, L. Green, T.G.A. & Seppelt, R.D. (1997) Lichens and the Antarctic environment: effect of temperature and water availability on phytosynthetisis. In

Ecosystem processes in Antarctic icefree landscapes, ed. W.B. Lyons, C. Howard-Williams & I. Hawes, pp. 103-117. Rotterdam, Balkema.

Shuford, W.D. & Spear, L.B. (1988) Survey of Breeding Penguins and other seabirds in the South Shetland Islands, Antarctica, January-February 1987. NOAA Technical Memorandum NMFS-F/NEC-59.

Takahashi, A., Kokubun N., Mori, Y. & Shin, H-C. (2008) Krill-feeding behaviour of gentoo penguins as shown by animal-borne camera loggers. Polar Biol. in press.

Trivelpiece, W, Butler, R.G. & Volkman, N.J. (1980) Feeding territoties of brown skuas (*Catharacta lonnbergi*). Auk 97, 669-676.

Trivelpiece, W.Z., Trivelpiece, S.G. & Volkman, N.J. (1987) Ecological segregation of adelie, gentoo, Chinstrap penguins at King George Island, Antarctica. Ecology 68, 351-361.

Yoon, M.B. (1990) Observation of birds around King Sejong Station during 1989/90 austral summer. In A study on Natural Environment in the Area Around the Korean Antarctic Station, King George Island (III). pp.433-459. MOST BSPG-00111-317-7.

Yoo, C.M., Choe, M.Y., Jo, H.R., Kim, Y. & Kim, K.H. (2001) Vocaniclastic sedimentation of the Sejong Formation (Late Paleocene-Eocene), Barton Peninsula, King George Island, Antarctica. Ocean and Polar Research, 23, 97-107.

Vaughan, D.G. Marshall G.J. Connolley W.M. King J.C. & Mulvaney R. (2001) Devil in the detail. Science, 293, 1777-1779.

ANNEX I. List of flora in the Site

Taxa

Lichens
Acrospora austroshetlandica (C.W. Dodge) Øvstedal
Bryoria sp.
Buellia anisomera Vain.
Buellia russa (Hue)Darb.
Caloplaca lucens (Nyl.) Zahlbr.
Caloplaca sublobulata (Nyl.) Zahlbr.
Cetraria aculeata (Schreb.) Fr.
Cladonia borealis S. Stenroos
Cladonia chlorophaea (Flörke ex Sommerf.) Spreng.
Cladonia furcata (Huds.) Schaer.
Cladonia gracilis (L.) Willd.
Cladonia merochlorophaea var *novochlorophaea* Sipman
Cladonia pleurota (Flörke) Schaer.
Cladonia pyxidata (L.) Hoffm.
Cladonia scabriuscula (Delise) Nyl.
Haematomma erythromma (Nyl.) Zahlbr
Himantormia lugubris (Hue.) I. M. Lamb
Huea coralligera (Hue) C. W. Dodge & G. E. Baker
Lecania brialmontii (Vain.) Zahlbr.
Lecania gerlachei (Vain.) Darb.
Lecanora polytropa (Hoffm.) Rabenh.
Lecidea cancriformis C.W. Dodge and G.E. Baker
Lecidella carpathica Körb.
Massalongia carnosa (Dicks.) Körb.
Ochlorechia frigida (Sw.) Lynge
Pannaria austro-orcadensis Øvstedal
Pertusaria excudens Nyl.
Physcia caesia (Hoffm.) Fürnr.
Physcia dubia (Hoffm.) Lettau
Physconia muscigena (Ach.) Poelt
Placopsis contourtuplicata I. M. Lamb
Porpidia austrosheltandica Hertel
Pseudophebe pubescens (L.) M. Choisy
Psoroma cinnamomeum Malme
Psoroma hypnorum (Vahl) Gray
Ramalina terebrata Hook f, & Taylor
Rhizocarpon geographicum (L.) DC.
Rhizoplaca aspidophora (Vain.) Redón
Rhizoplaca melanophthalma (Ram.) Leuckert & Poelt
Rinodina olivaceobrunnea C.W. Dodge & G. B. Baker
Sphaerophorus globosus (Huds.) Vain.
Stereocaulon alpinum Laurer
Tephromela atra (Huds.) Hafellmer ex Kalb
Tremolecia atrata (Ach.) Hertel
Turgidosculum complicatulum (Nyl.) J. Kohlm. & E. Kohlm
Umbilicaria antarctica Frey & I. M. Lamb
Umbilicaria decussata (Vill.) Zahlbr.

Usnea antarctica Du Rietz
Usnea aurantiaco-atra (Jacq.) Bory
Xanthoria candelaria (L.) Th. Fr.
Xanthoria elegans (Link) Th. Fr.

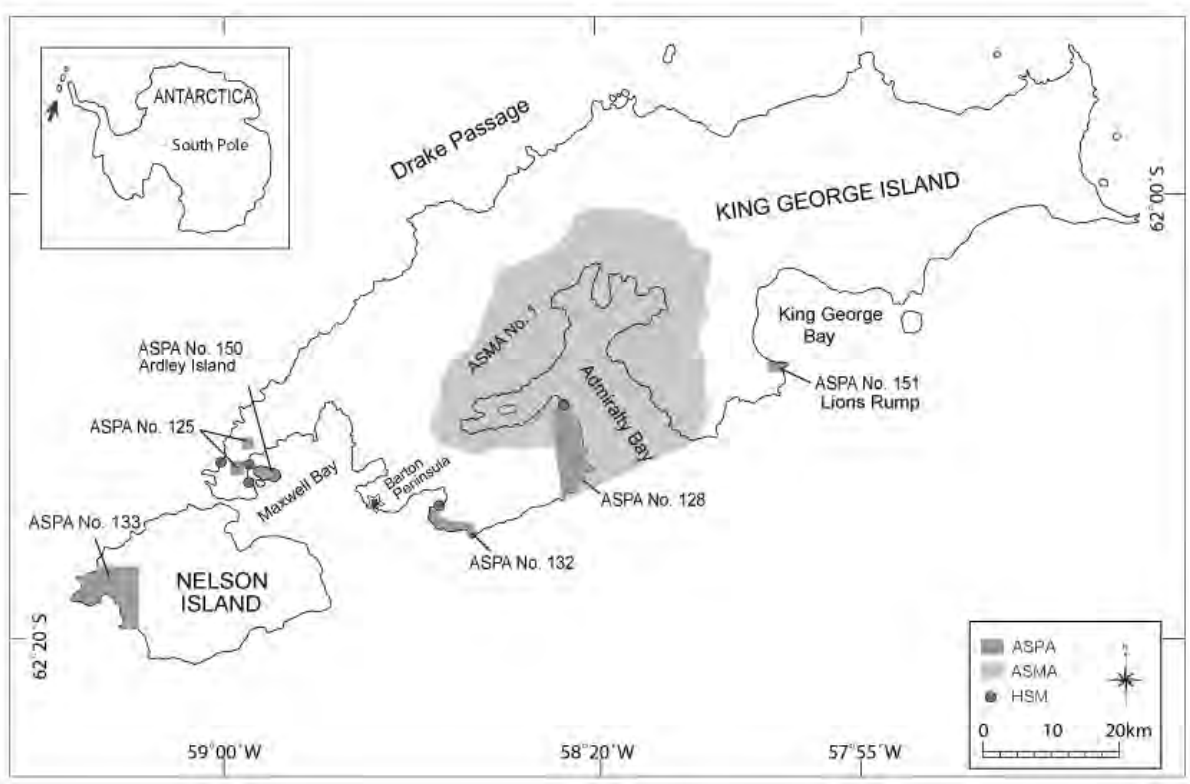
Mosses
Andreaea depressinervis Cardot
Andreaea gainii Cardot
Andreaea regularis Müll. Hal.
Bartramia patens Brid.
Bryum argenteum Hedw.
Bryum orbiculatifolium Cardot & Broth.
Bryum pseudotriquetrum (Hedw.) C.F. Gaertn. et al.
Ceratodon purpureus (Hedw.) Brid.
Chorisodontium aciphyllum (Hook. f. & Wils.)
Dicranoweisia brevipes (Müll. Hal.) Cardot
Dicranoweisia crispula (Hedw.) Lindb. Ex Milde
Ditrichum hyalinum (Mitt.) Kuntze
Ditrichum lewis-smithii Ochyra
Encalypta rhaptocarpa Schwägr.
Hennediella antarctica (Ångstr.) Ochyra & Matteri
Notoligotrichum trichodon (Hook. f. Wils.) G. L. Sm.
Pohlia drummondii (Müll. Hal.) A. K. Andrews
Pohlia nutans (Hedw.) Lindb.
Pohlia wahlenbergii (Web. & Mohr) A. L. Andrews
Polytrichastrum alpinum (Hedw.) G. L. Sm.
Polytrichum strictum Brid.
Racomitrium sudeticum (Funck) Bruch & Schimp.
Sanionia georgico-uncinata (Müll. Hal.) Ochyra & Hedenäs
Sanionia uncinata (Hedw.) Loeske
Schistidium antarctici (Card.) L. I. Savicz & Smirnova
Syntrichia filaris (Müll. Hal.) Zand.
Syntrichia princeps (De Not.) Mitt.
Syntrichia saxicola (Card.) Zand.
Warnstorfia sarmentosa (Wahlenb.) Hedenäs

Liverworts
Barbilophozia hatcheri (A. Evans) Loeske
Cephalozia badia (Gottsche) Steph.
Cephaloziella varians (Gottsche) Steph.
Herzogobryum teres (Carrington & Pearson) Grolle
Lophozia excisa (Dicks.) Dumort.
Pachyglossa disstifidolia Herzog & Grolle

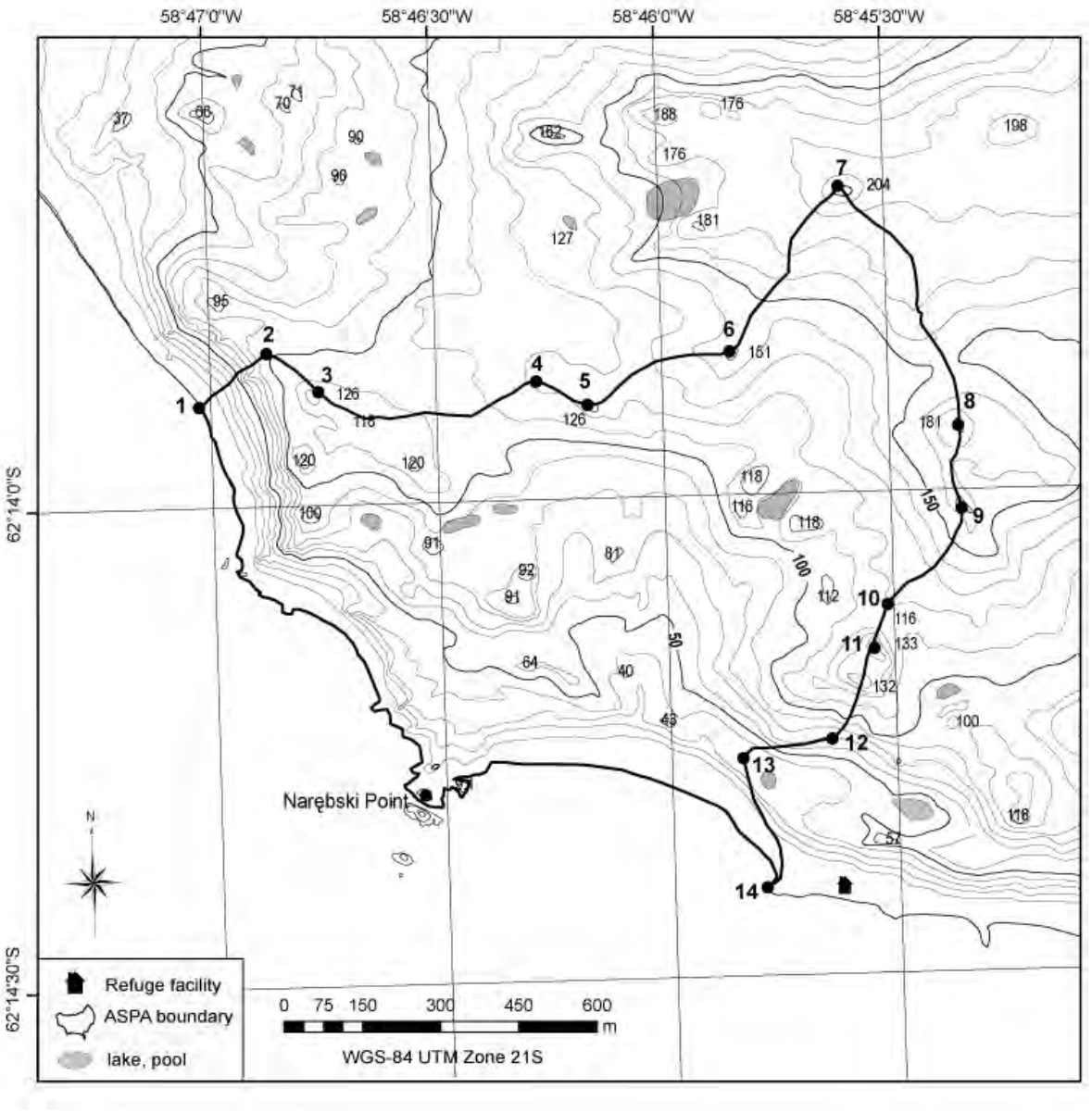
Algae
Prasiola crispa (Ligtf.) Menegh.

Flowering plant
Deschampsia antarctica Desv.

ANNEX II. Maps

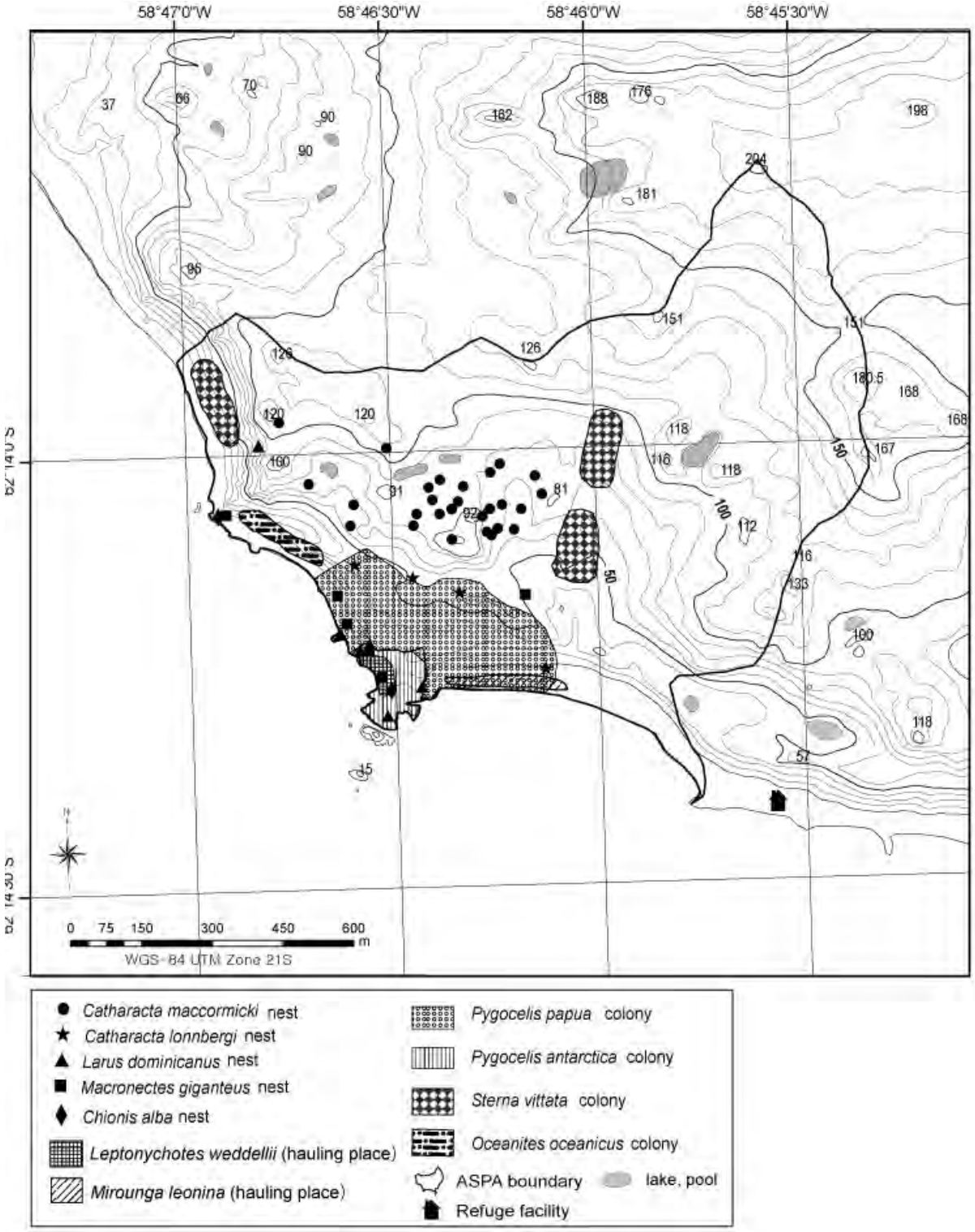


Map 1. Location of Narębski Point (*) in relation to King George Island and the existing protected areas (ASMA, ASPAs, HSMs)

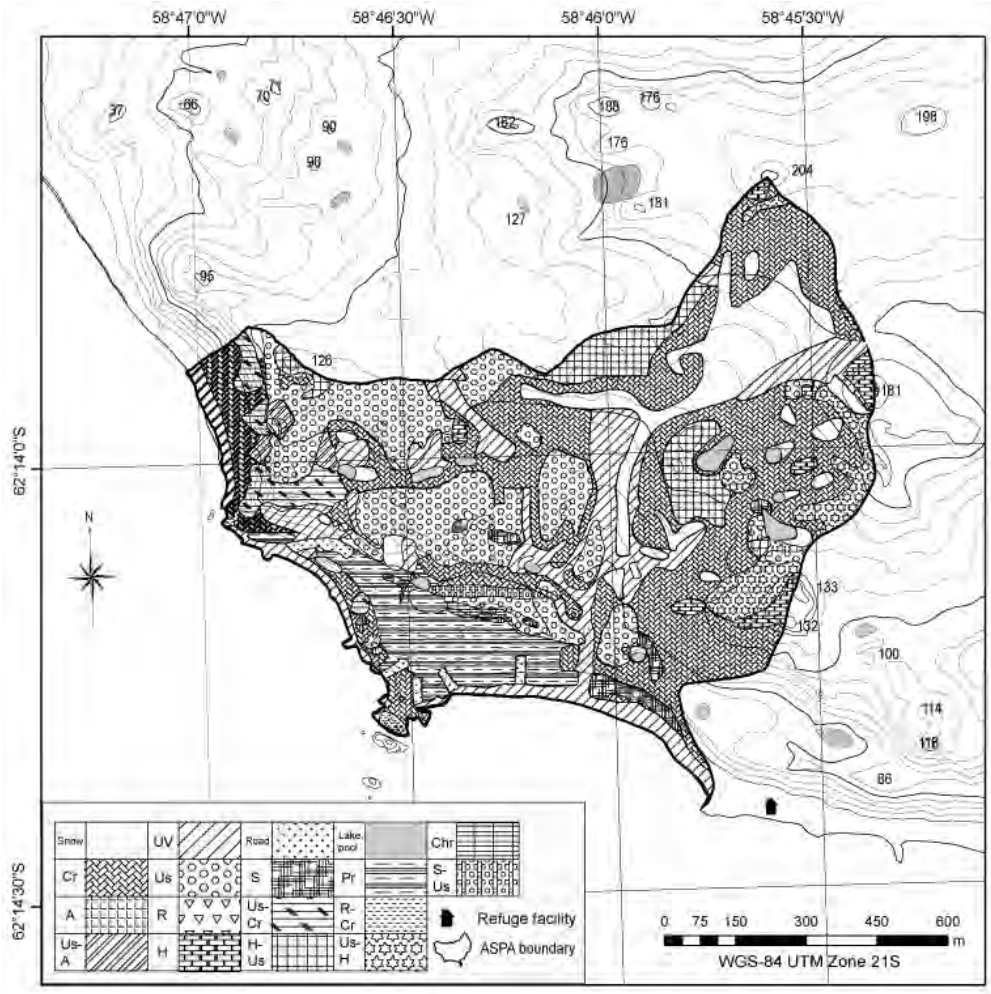


	Latitude	Longitude		Latitude	Longitude
1	62°13′53.69″S	58°47′01.31″W	9	62°14′00.86″S	58°45′20.85″W
2	62°13′50.48″S	58°46′52.37″W	10	62°14′06.96″S	58°45′30.62″W
3	62°13′52.85″S	58°46′45.84″W	11	62°14′09.73″S	58°45′33.08″W
4	62°13′52.53″S	62°13′54.18″S	12	62°14′15.30″S	58°45′38.87″W
5	58°46′16.62″W	58°46′09.53″W	13	62°14′16.43″S	58°45′50.37″W
6	62°13′51.11″S	58°45′50.64″W	14	62°14′24.55″S	58°45′48.00″W
7	62°13′40.97″S	58°45′35.60″W	NP	62°14′18.17″S	58°46′32.99″W
8	62°13′55.95″S	58°45′20.71″W			

Map 2. Boundary of the ASPA



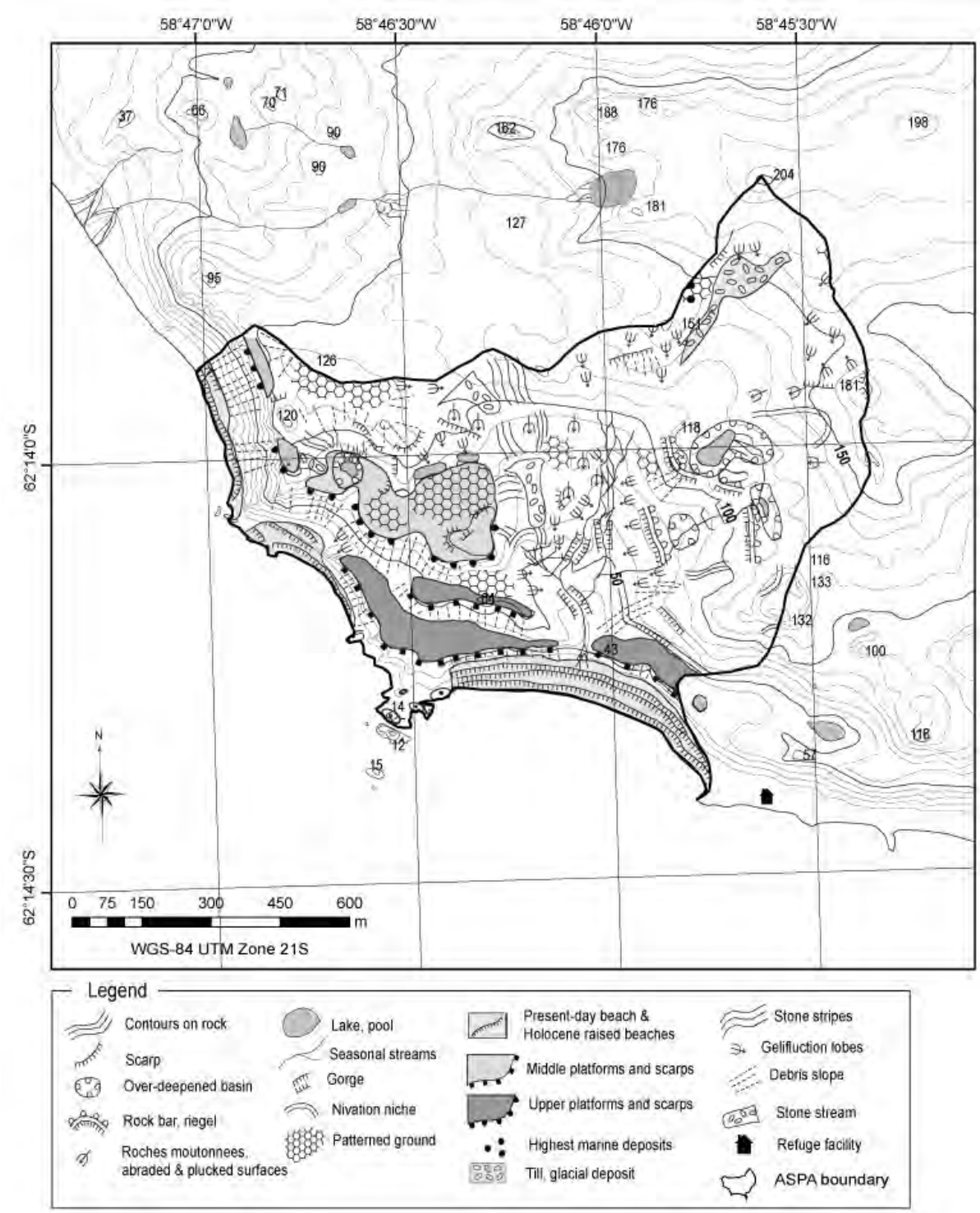
Map 3. Distribution of bird colonies and seal haul-out sites within the ASPA



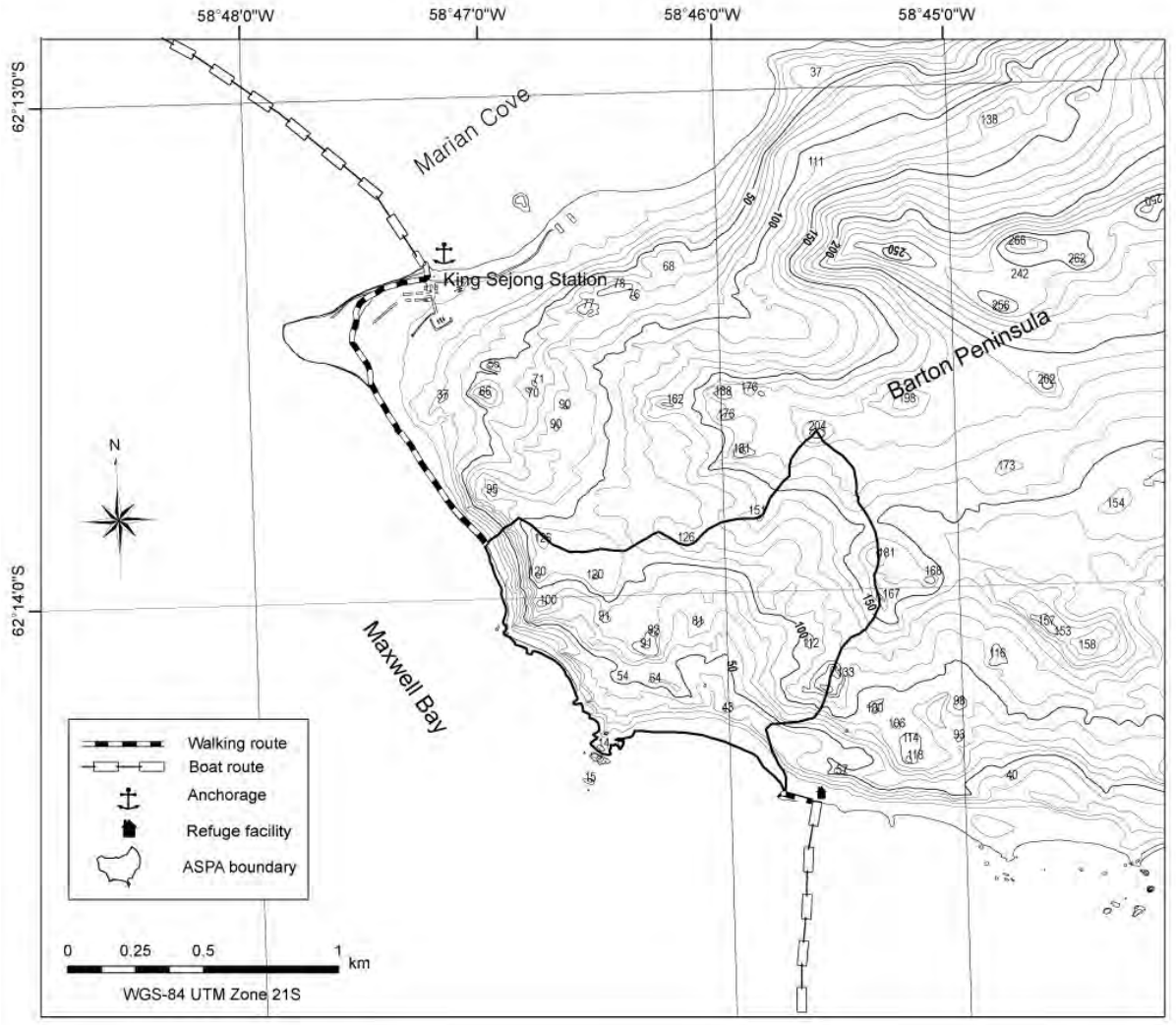
Community abbreviations
UV: unvegetated area
Cr: Crustose lichens
S: Sanionia spp., Pr: Prasiola
Chr: Chorisodontium aciphyllum
A: Andreaea, Us: Usnea spp.
R: Ramalina terebrata
Us-Cr: Usnea-Crustose lichens
R-Cr: Ramalina-Crustose lichens
S-Us: Sanionia-Usnea spp.
Us-A: Usnea-Andreaea
H: Himantormia lugubris
H-Us: Himantormia-Usnea
Us-H: Usnea-Himantormia

Total coverage of each community (%)
Cr: 75.2 S: 99.9 Pr: 86.8
Chr: 100 A: 93.8 Us: 95.4
R: 100 Us-Cr: 93.1
R-Cr: 100 S-Us: 98.2
Us-A: 98 H: 100
H-Us: 99.6 Us-H: 98.8

Map 4. Distribution of plant communities in the ASPA



Map 5. Geomorphologic details of the ASPA



Map 6. Access routes to the ASPA

Measure 14 (2009)

Antarctic Historic Sites and Monuments: Base "W" and Hut at Damoy Point

The Representatives,

Recalling the requirements of Article 8 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty to maintain a list of current Historic Sites and Monuments, and that such sites shall not be damaged, removed or destroyed;

Recalling Measure 3 (2003), which revised and updated the "List of Historic Sites and Monuments", as subsequently amended;

Desiring to add two further historic sites to the List of Historic Sites and Monuments;

Recommend to their Governments the following Measure for approval in accordance with paragraph 2 of Article 8 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty;

That the following sites be added to the "List of Historic Sites and Monuments" annexed to Measure 3 (2003):

No 83: Base "W", Detaille Island, Lallemand Fjord, Loubet Coast

Base "W" is situated on a narrow isthmus at the northern end of Detaille Island, Lallemand Fjord, Loubet Coast. The site consists of a hut and a range of associated structures and outbuildings including a small emergency storage building, bitch and pup pens, anemometer tower and two standard tubular steel radio masts (one to the south west of the main hut and the other to the east).

Base "W" was established in 1956 as a British science base primarily for survey, geology and meteorology and to contribute to the IGY in 1957. As a relatively unaltered base from the late 1950s, Base "W" provides an important reminder of the science and living conditions that existed when the Antarctic Treaty was signed 50 years ago.

Location: 66°52'S, 66°48'W
Original proposing Party: United Kingdom
Party undertaking management: United Kingdom

No 84: Hut at Damoy Point, Dorian Bay,
Wiencke Island, Palmer Archipelago

The site consists of a well-preserved hut and the scientific equipment and other artefacts inside it. It is located at Damoy Point on Dorian Bay, Wiencke Island, Palmer Archipelago.

The hut was erected in 1973 and used for a number of years as a British summer air facility and transit station for scientific personnel. It was last occupied in 1993.

Location: 64° 49’S, 63°31’W
Original proposing Party: United Kingdom
Party undertaking management: United Kingdom

Measure 15 (2009)

Landing of Persons from Passenger Vessels in the Antarctic Treaty Area

The Representatives,

Noting the increasing trend in tourist activities in the Treaty area and the possible impacts of such activities on the Antarctic environment, including its wildlife, and on the conduct of scientific research;

Conscious of their responsibilities to ensure that tourism is conducted in a safe and environmentally responsible manner consistent with the objectives of the Antarctic Treaty;

Acknowledging the tourism industry's collaboration in efforts to ensure that its activities are sustainable and compatible with the objectives of the Antarctic Treaty;

Aware of hazards confronting passenger vessels operating in the Antarctic Treaty area and desiring to promote the safety of life at sea;

Wishing to minimize the likelihood of marine oil spills due to incidents involving large tourist vessels in Antarctica;

Recalling Resolution 4 (2007);

Recalling the existence of resolutions which set site-specific recommendations;

Recommend to their Governments the following Measure for approval in accordance with paragraph 4 of Article IX of the Antarctic Treaty:

That:

1) Parties shall require their operators organizing tourist or other non-governmental activities in the Antarctic Treaty area, for which advance notification is required in accordance with Article VII(5) of the Antarctic Treaty,

   a) to refrain from making any landings in Antarctica from vessels carrying more than 500 passengers unless a lower number is otherwise specified in applicable ATCM measures; and

   b) in the case of vessels carrying 500 or fewer passengers,

      i. to coordinate with each other with the objective that not more than one tourist vessel is at a landing site at any one time;

ii. to restrict the number of passengers on shore at any one time to 100 or fewer, unless a lower number is otherwise specified in applicable ATCM Measures and to maintain a 1:20 guide-to-passenger ratio, unless a more restrictive ratio is otherwise specified in applicable ATCM measures.

2) nothing in this Measure shall derogate from the rights and obligations of any Party with respect to environmental impact assessments and restrictions on the activities of their nationals in accordance with Article 8 and other relevant provisions of the Protocol on Environmental Protection to the Antarctic Treaty.

3) this Measure, including the specific restrictions in paragraph 1 above, shall be subject to further discussion in future ATCMs to take account of possible changes in circumstance, including with respect to specific sites in Antarctica.

Measure 16 (2009)

Amendment of Annex II to the Protocol on Environmental Protection to the Antarctic Treaty: Conservation of Antarctic Fauna and Flora

The Representatives,

Recalling the Protocol on Environmental Protection to the Antarctic Treaty, including its Annex II on Conservation of Antarctic Fauna and Flora;

Noting that the functions of the Committee for Environmental Protection under Article 12 of the Protocol include providing advice and formulating recommendations in connection with the operation of the Annexes to the Protocol;

Mindful that the Antarctic Treaty Consultative Meeting endorsed the proposal of the Committee for Environmental Protection in 2001 to undertake a review of Annex II to the Protocol;

Recalling also the procedure for amending Annex II as set out in Article 9(3) of the Protocol and Article 9 of Annex II;

Recalling further that the words 'All species of the genus Arctocephalus, Fur Seals' were removed from Appendix A to Annex II by Measure 4 (2006), which became effective on 23 June 2007;

Recommend to their Governments that:

1) Annex II to the Protocol on Environmental Protection to the Antarctic Treaty: Conservation of Antarctic Fauna and Flora be replaced by the amended version of Annex II attached to this Measure;

2) the replacement of the current version of Annex II with the amended version becomes effective in accordance with Article 9 of Annex II.

Attachment: Amended version of Annex II to the Protocol on Environmental Protection to the Antarctic Treaty.

Annex II to the Protocol on Environmental Protection to the Antarctic Treaty

Conservation of Antarctic Fauna and Flora

ARTICLE 1

DEFINITIONS

For the purposes of this Annex:

(a) "native mammal" means any member of any species belonging to the Class Mammalia, indigenous to the Antarctic Treaty area or occurring there naturally through migrations;

(b) "native bird" means any member, at any stage of its life cycle (including eggs), of any species of the Class Aves indigenous to the Antarctic Treaty area or occurring there naturally through migrations;

(c) "native plant" means any member of any species of terrestrial or freshwater vegetation, including bryophytes, lichens, fungi and algae, at any stage of its life cycle (including seeds, and other propagules), indigenous to the Antarctic Treaty area;

(d) "native invertebrate" means any member of any species of terrestrial or freshwater invertebrate, at any stage of its life cycle, indigenous to the Antarctic Treaty area;

(e) "appropriate authority" means any person or agency authorised by a Party to issue permits under this Annex;

(f) "permit" means a formal permission in writing issued by an appropriate authority;

(g) "take" or "taking" means to kill, injure, capture, handle or molest a native mammal or bird, or to remove or damage such quantities of native plants or invertebrates that their local distribution or abundance would be significantly affected;

(h) "harmful interference" means:

  (i) flying or landing helicopters or other aircraft in a manner that disturbs concentrations of native birds or seals;

  (ii) using vehicles or vessels, including hovercraft and small boats, in a manner that disturbs concentrations of native birds or seals;

(iii) using explosives or firearms in a manner that disturbs concentrations of native birds or seals;

(iv) wilfully disturbing breeding or moulting native birds or concentrations of native birds or seals by persons on foot;

(v) significantly damaging concentrations of native terrestrial plants by landing aircraft, driving vehicles, or walking on them, or by other means; and

(vi) any activity that results in the significant adverse modification of habitats of any species or population of native mammal, bird, plant or invertebrate.

(i) "International Convention for the Regulation of Whaling" means the Convention done at Washington on 2 December 1946.

(j) "Agreement on the Conservation of Albatrosses and Petrels" means the Agreement done at Canberra on 19 June 2001.

ARTICLE 2

CASES OF EMERGENCY

1. This Annex shall not apply in cases of emergency relating to the safety of human life or of ships, aircraft, or equipment and facilities of high value, or the protection of the environment.

2. Notice of activities undertaken in cases of emergency that result in any taking or harmful interference shall be circulated immediately to all Parties and to the Committee.

ARTICLE 3

PROTECTION OF NATIVE FAUNA AND FLORA

1. Taking or harmful interference shall be prohibited, except in accordance with a permit.

2. Such permits shall specify the authorised activity, including when, where and by whom it is to be conducted and shall be issued only in the following circumstances:

(a) to provide specimens for scientific study or scientific information;

(b) to provide specimens for museums, herbaria and botanical gardens, or other educational institutions or uses;

(c) to provide specimens for zoological gardens but, in respect of native mammals or birds, only if such specimens cannot be obtained from existing captive collections elsewhere, or if there is a compelling conservation requirement; and

(d) to provide for unavoidable consequences of scientific activities not otherwise authorised under sub-paragraphs (a), (b) or (c) above, or of the construction and operation of scientific support facilities.

3. The issue of such permits shall be limited so as to ensure that:

(a) no more native mammals, birds, plants or invertebrates are taken than are strictly necessary to meet the purposes set forth in paragraph 2 above;

(b) only small numbers of native mammals or birds are killed, and in no case more are killed from local populations than can, in combination with other permitted takings, normally be replaced by natural reproduction in the following season; and

(c) the diversity of species, as well as the habitats essential to their existence, and the balance of the ecological systems existing within the Antarctic Treaty area are maintained.

4. Any species of native mammals, birds, plants and invertebrates listed in Appendix A to this Annex shall be designated "Specially Protected Species", and shall be accorded special protection by the Parties.

5. Designation of a species as a Specially Protected Species shall be undertaken according to agreed procedures and criteria adopted by the ATCM.

6. The Committee shall review and provide advice on the criteria for proposing native mammals, birds, plants or invertebrates for designation as a Specially Protected Species.

7. Any Party, the Committee, the Scientific Committee on Antarctic Research or the Commission for the Conservation of Antarctic Marine Living Resources may propose a species for designation as a Specially Protected Species by submitting a proposal with justification to the ATCM.

8. A permit shall not be issued to take a Specially Protected Species unless the taking:

(a) is for a compelling scientific purpose; and

(b) will not jeopardise the survival or recovery of that species or local population;

9. The use of lethal techniques on Specially Protected Species shall only be permitted where there is no suitable alternative technique.

10. Proposals for the designation of a species as a Specially Protected Species shall be forwarded to the Committee, the Scientific Committee on Antarctic Research and, for native mammals and birds, the Commission for the Conservation of Antarctic Marine

Living Resources, and as appropriate, the Meeting of the Parties to the Agreement on the Conservation of Albatrosses and Petrels and other organisations. In formulating its advice to the ATCM on whether a species should be designated as a Specially Protected Species, the Committee shall take into account any comments provided by the Scientific Committee on Antarctic Research, and, for native mammals and birds, the Commission for the Conservation of Antarctic Marine Living Resources, and as appropriate, the Meeting of the Parties to the Agreement on the Conservation of Albatrosses and Petrels and other organisations.

11. All taking of native mammals and birds shall be done in the manner that involves the least degree of pain and suffering practicable.

ARTICLE 4

INTRODUCTION OF NON-NATIVE SPECIES AND DISEASES

1. No species of living organisms not native to the Antarctic Treaty area shall be introduced onto land or ice shelves, or into water, in the Antarctic Treaty area except in accordance with a permit.

2. Dogs shall not be introduced onto land, ice shelves or sea ice.

3. Permits under paragraph 1 above shall:

   (a) be issued to allow the importation only of cultivated plants and their reproductive propagules for controlled use, and species of living organisms for controlled experimental use; and

   (b) specify the species, numbers and, if appropriate, age and sex of the species to be introduced, along with a rationale, justifying the introduction and precautions to be taken to prevent escape or contact with fauna or flora.

4. Any species for which a permit has been issued in accordance with paragraphs 1 and 3 above shall, prior to expiration of the permit, be removed from the Antarctic Treaty area or be disposed of by incineration or equally effective means that eliminates risk to native fauna or flora. The permit shall specify this obligation.

5. Any species, including progeny, not native to the Antarctic Treaty area that is introduced into that area without a permit that has been issued in accordance with paragraph 1 and 3 above, shall be removed or disposed of whenever feasible, unless the removal or disposal would result in a greater adverse environmental impact. Such removal or disposal may include by incineration or by equally effective means, so as to be rendered sterile, unless it is determined that they pose no risk to native flora or fauna. In addition, all reasonable steps shall be taken to control the consequences of that introduction to avoid harm to native fauna or flora.

6. Nothing in this Article shall apply to the importation of food into the Antarctic Treaty area provided that no live animals are imported for this purpose and all plants and

animal parts and products are kept under carefully controlled conditions and disposed of in accordance with Annex III to the Protocol.

7. Each Party shall require that precautions are taken to prevent the accidental introduction of micro-organisms (e.g., viruses, bacteria, yeasts, fungi) not present naturally in the Antarctic Treaty area.

8. No live poultry or other living birds shall be brought into the Antarctic Treaty area. All appropriate efforts shall be made to ensure that poultry or avian products imported into Antarctica are free from contamination by diseases (such as Newcastle's Disease, tuberculosis, and yeast infection) which might be harmful to native fl ora and fauna. Any poultry or avian products not consumed shall be removed from the Antarctic Treaty area or disposed of by incineration or equivalent means that eliminates the risks of introduction of micro-organisms (e.g. viruses, bacteria, yeasts, fungi) to native fl ora and fauna.

9. The deliberate introduction of non-sterile soil into the Antarctic Treaty area is prohibited. Parties should, to the maximum extent practicable, ensure that non-sterile soil is not unintentionally imported into the Antarctic Treaty area.

ARTICLE 5

INFORMATION

Each Party shall make publicly available information on prohibited activities and Specially Protected Species to all those persons present in or intending to enter the Antarctic Treaty area with a view to ensuring that such persons understand and observe the provisions of this Annex.

ARTICLE 6

EXCHANGE OF INFORMATION

1. The Parties shall make arrangements for:

   (a) collecting and annually exchanging records (including records of permits) and statistics concerning the numbers or quantities of each species of native mammal, bird, plant or invertebrate taken in the Antarctic Treaty area; and

   (b) obtaining and exchanging information as to the status of native mammals, birds, plants, and invertebrates in the Antarctic Treaty area, and the extent to which any species or population needs protection.

2. As early as possible, after the end of each austral summer season, but in all cases before 1 October of each year, the Parties shall inform the other Parties as well as the Committee of any step taken pursuant to paragraph 1 above and of the number and nature of permits issued under this Annex in the preceding period of 1 April to 31 March.

ARTICLE 7

RELATIONSHIP WITH OTHER AGREEMENTS OUTSIDE THE ANTARCTIC TREATY SYSTEM

Nothing in this Annex shall derogate from the rights and obligations of Parties under the International Convention for the Regulation of Whaling.

ARTICLE 8

REVIEW

The Parties shall keep under continuing review measures for the conservation of Antarctic fauna and flora, taking into account any recommendations from the Committee.

ARTICLE 9

AMENDMENT OR MODIFICATION

1. This Annex may be amended or modified by a measure adopted in accordance with Article IX (1) of the Antarctic Treaty. Unless the measure specifies otherwise, the amendment or modification shall be deemed to have been approved, and shall become effective, one year after the close of the Antarctic Treaty Consultative Meeting at which it was adopted, unless one or more of the Antarctic Treaty Consultative Parties notifies the Depositary, within that time period, that it wishes an extension of that period or that it is unable to approve the measure.

2. Any amendment or modification of this Annex which becomes effective in accordance with paragraph 1 above shall thereafter become effective as to any other Party when notice of approval by it has been received by the Depositary.

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