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
- 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°55 S, 163°19 E, 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, J.A., 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: Adelie 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, J.A., 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 Reconds* 1(16).pp271-279

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 7(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 leonine*
Leopard seal	*Hydrurga leptonyx*
Weddell seal	*Leptyonychotes weddelli*

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

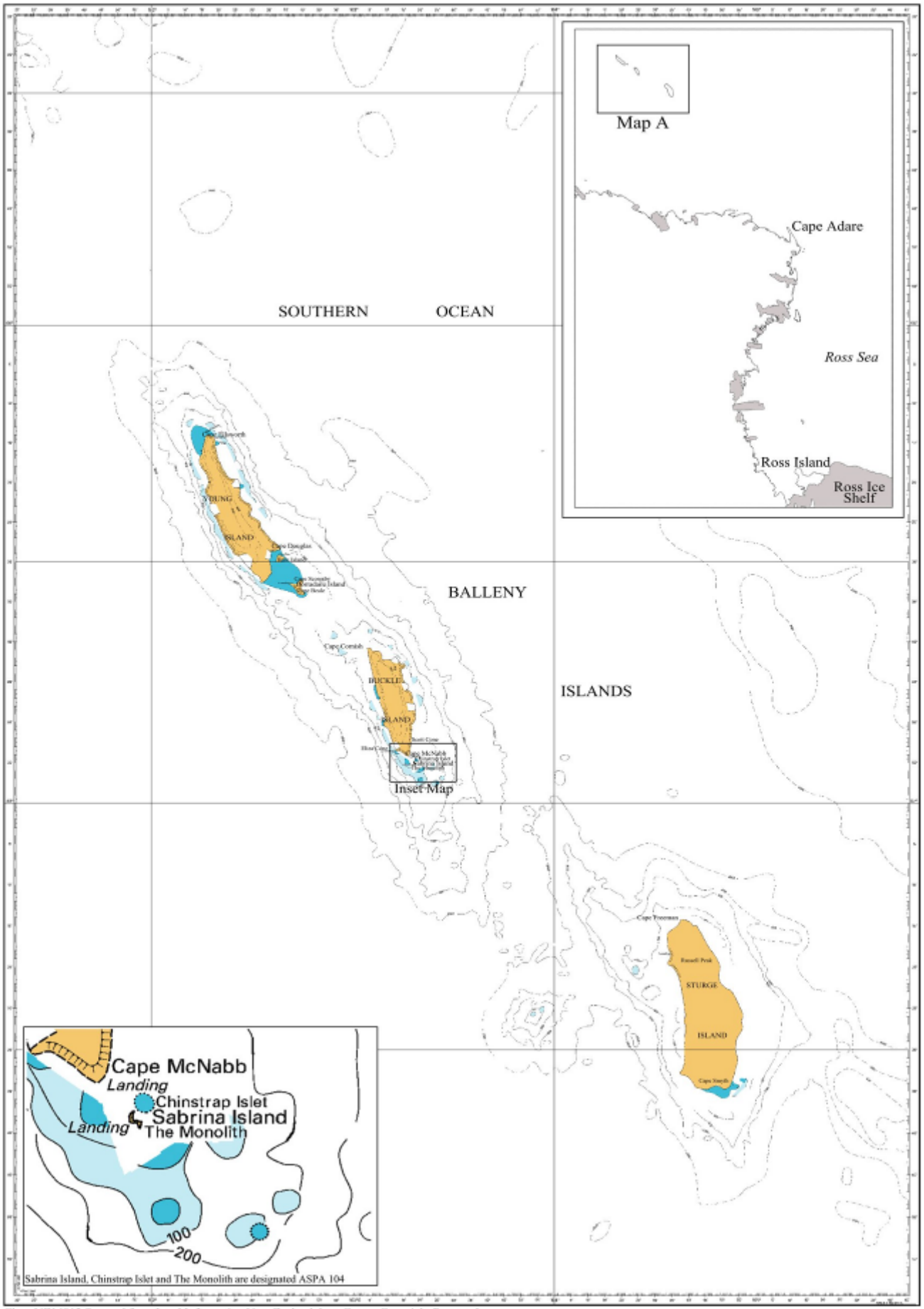
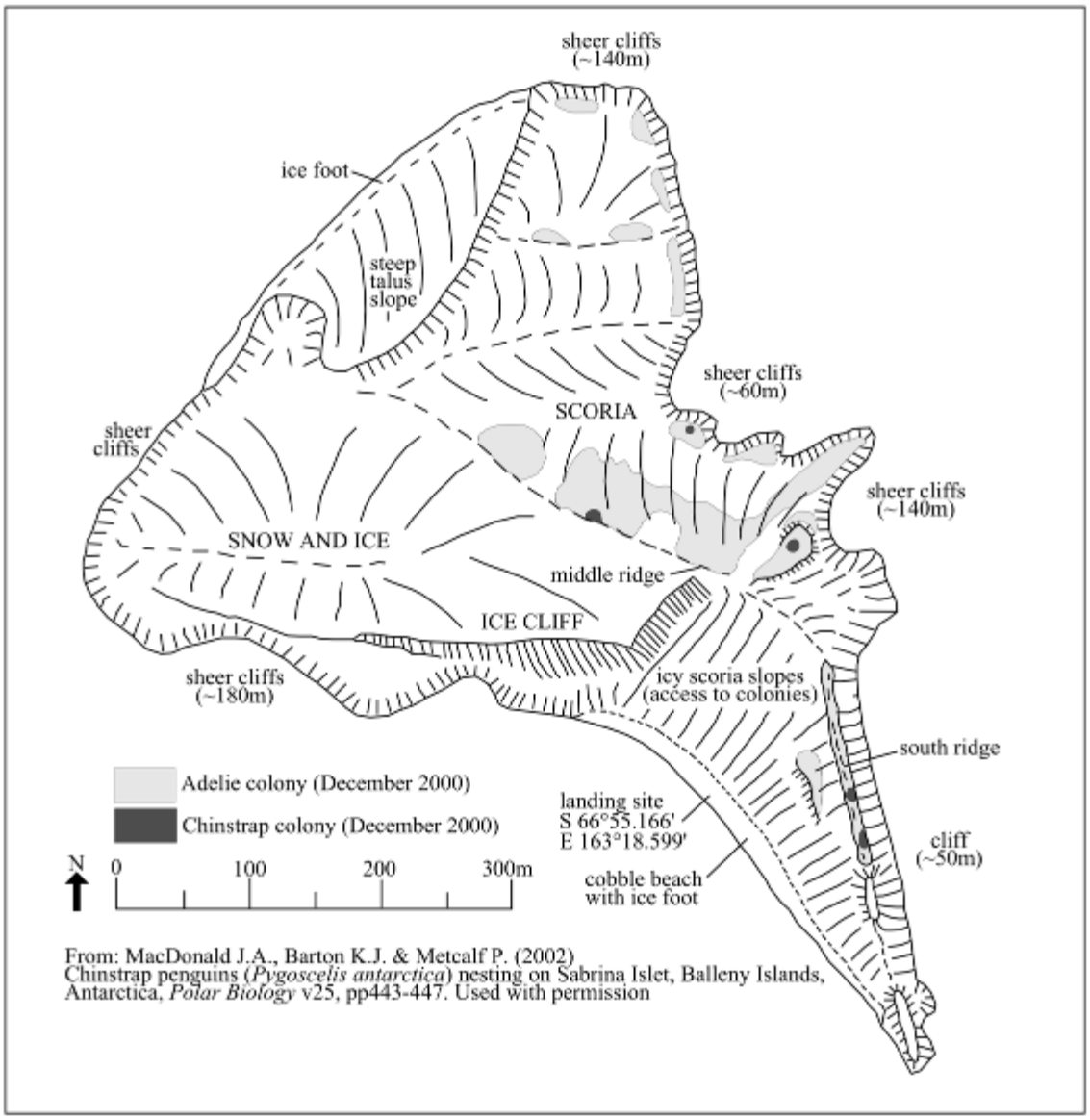


Chart NZ14912 Sourced from Land Information New Zealand data. Crown Copyright Reserved

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

II. Measures

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

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

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: 2.7 km^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, 2.7 km^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 loennbergi*), 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 1.2 m 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 - 250 m; Marine - 200 m. 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 - 5 m; Marine - 20 m; Definite coastline, topography & seal colony derived from USGS orthophotograph with a horizontal and vertical accuracy of ± 2 m (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 ± 10 m – 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, 0.35 km^2) is situated in Arthur Harbor approximately 1500 m 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 1000 m northwest to southeast and 700 m 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 30-40 m, with the maximum elevation of 48 m 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 10 m 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 10.8º C in December 2000, whilst the minimum was –26º C 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.

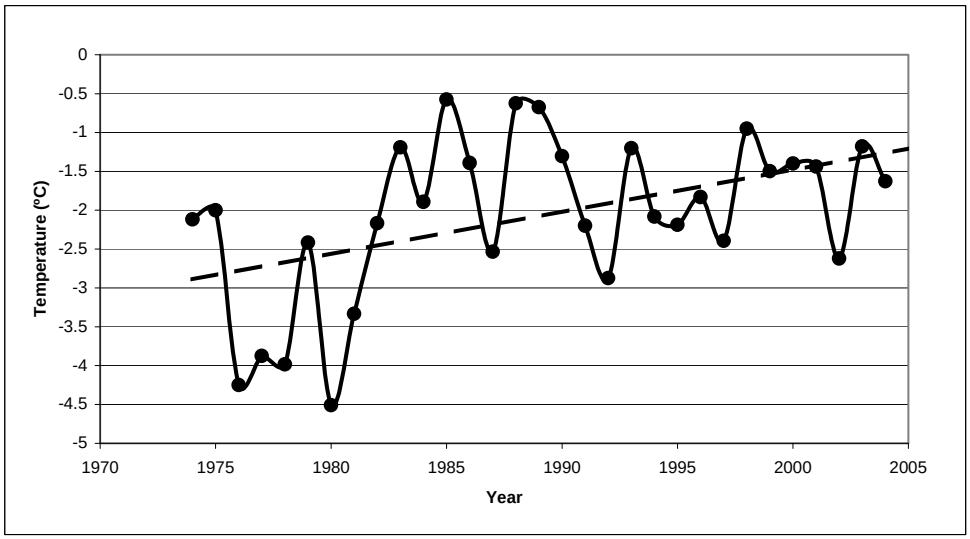


Figure 1. Mean annual surface air temperature at Palmer Station 1974 – 2004.
Data source: Palmer LTER (http://pal.lternet.edu/data/study_catalog.php#weather).

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 40 m across and trending north-south and east-west. Minor quartz, epidote, chlorite, pyrite and chalcopyrite veins of up to 8 cm 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 3 m 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 20 cm thick.

II. Measures

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 50 m 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 9x2 m 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 1.2 m 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 0.5 m 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 loennbergi*) 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 chrysotoma*) 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 15 m 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 200 m 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 *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). 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 *Bahia Paraiso* 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 100 m 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 50 m 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 48 m, about 8 m 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 100 m south of the small boat landing site.

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

II. Measures

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 16 km east of the Area adjacent to Anvers Island; South Bay (ASPA No. 146), which is approximately 27 km to the southeast at Doumer Island; and Eastern Dallmann Bay (ASPA No. 153) which is approximately 90 km 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 930 m (~1/2 nautical mile) of the Area should be avoided wherever possible. Overflight below 610 m (~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 (~35 m), on its eastern side, approximately 100 m 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.

II. Measures

- 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.

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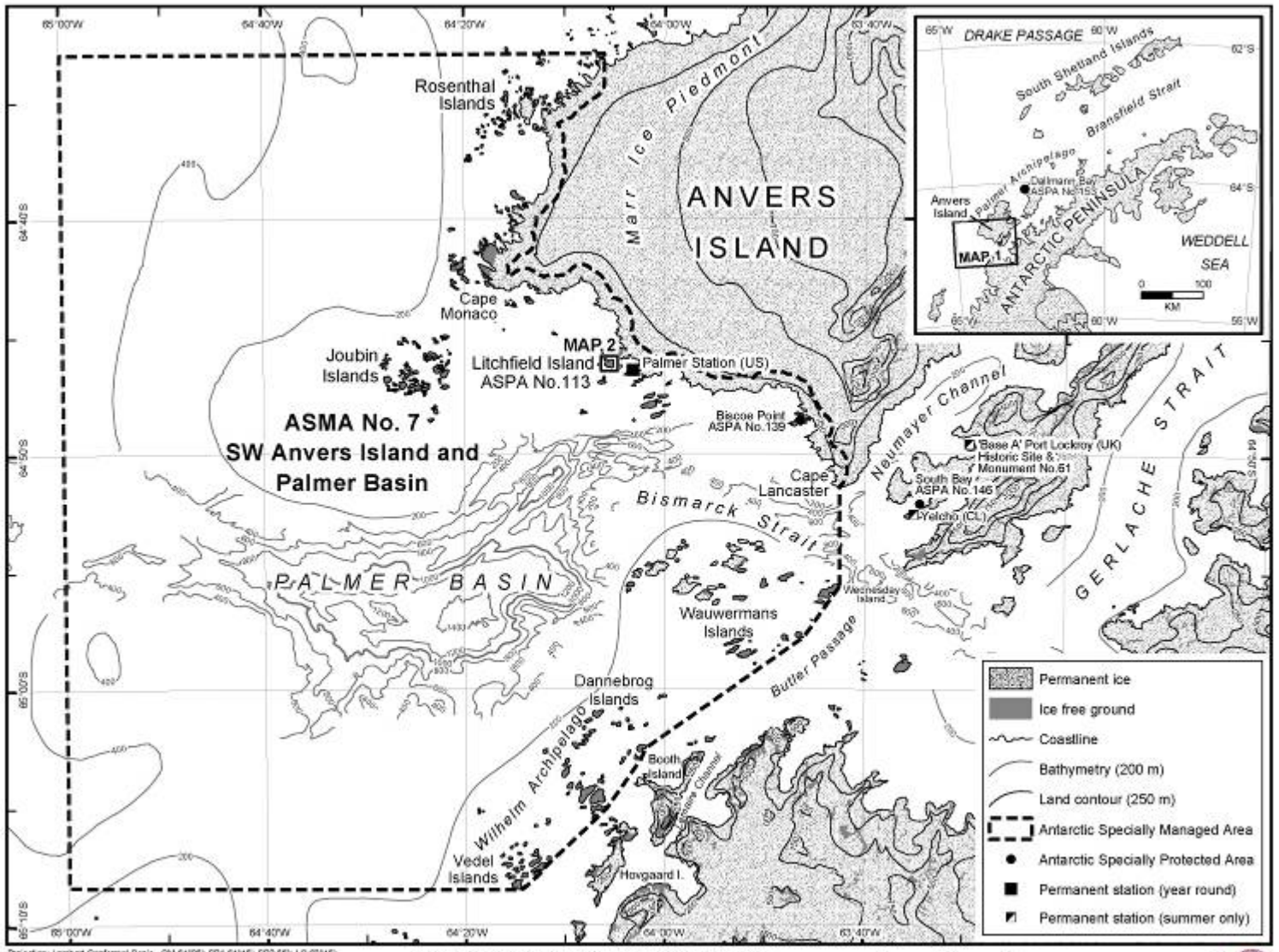
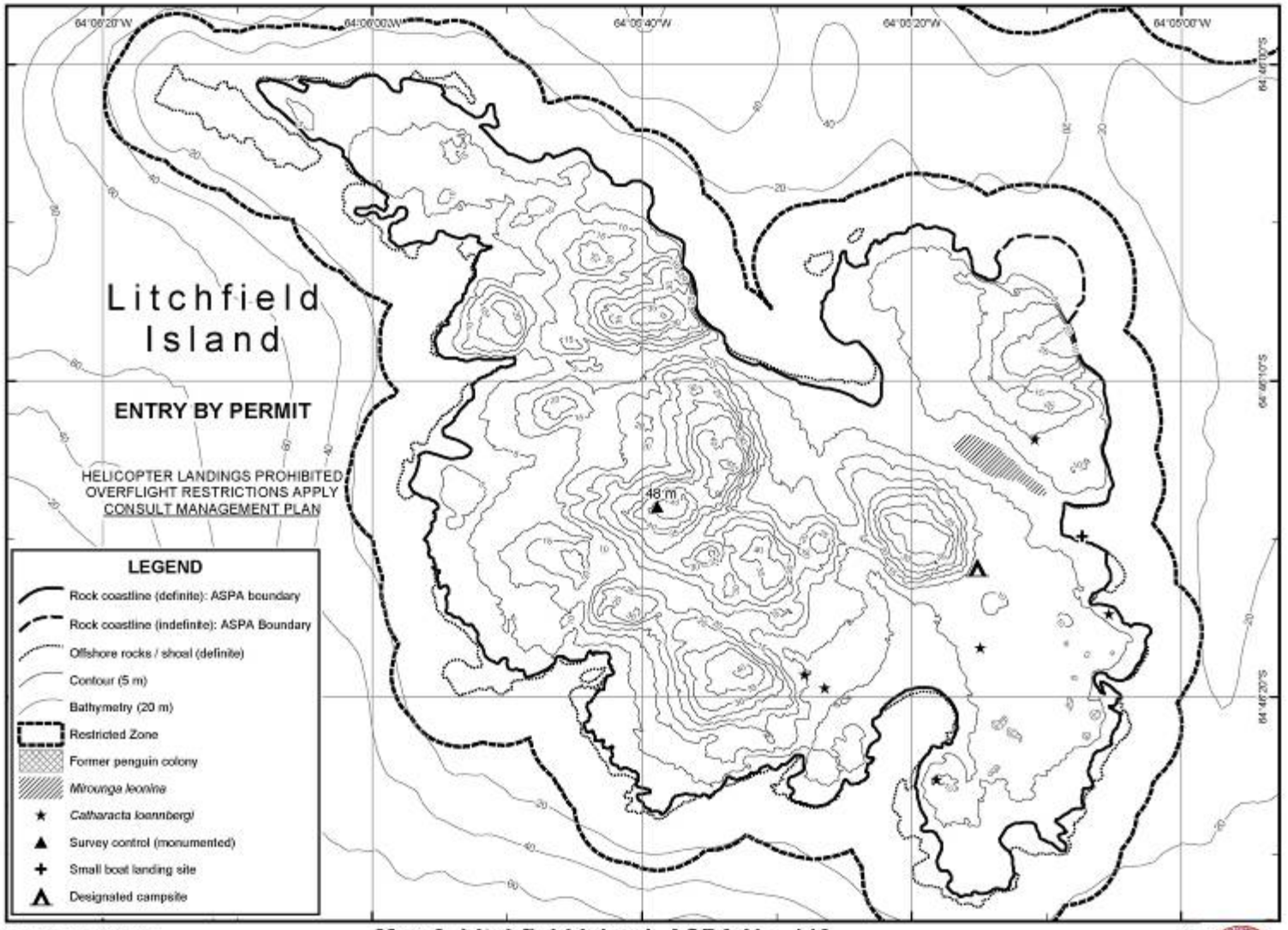


Map 1: Litchfield Island, ASPA No. 113
Arthur Harbor, Anvers Island, Palmer Archipelago



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

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: 0.62 km^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 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 300 m^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 programs. 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 500 m–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 (DOM) 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 xx (2009) – *include if adopted*].

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 ±5.0 m (horizontal) and ±5.0 m (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

GENERAL DESCRIPTION

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

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 8 km 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 350 m 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 45 m 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 10 m east from IT2 to a signpost (166°09'34.8" E, 77°33'11.1"S), thence a further 80 m 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 114 m 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 86 m 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 500 m of the mean high water coastline of Flagstaff Point, with the boundary extending 500 m 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 500 m from the shore to 166°08'10"E, 77°33'11.8"S, thence due east 500 m 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 10-20 m 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 54 km 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).

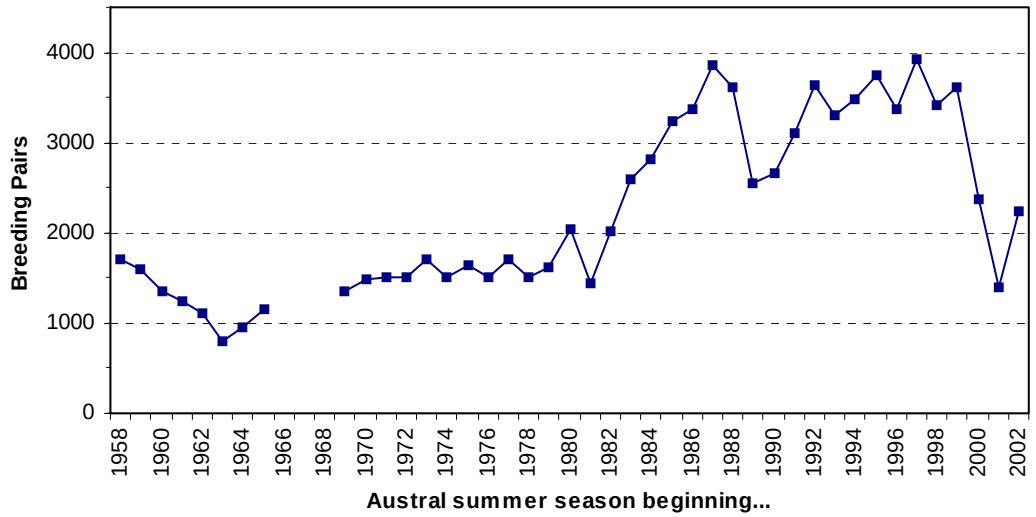


Figure 1. Numbers of breeding pairs of Adélie penguins at Cape Royds 1958/59 – 2002/03.

In addition to specific influences of sea ice extent, Adélie population expansion at Cape Royds has been attributed to the broader affects 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 Adelie 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 9.70 km and 12.09 km (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 35 km 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 -4.7 ºC 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 –41.5 ºC, recorded in August 1978, whilst the maximum temperature attained was –1.6º C 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 500 m 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 100 m 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 170 m 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 70 m from the NE boundary sign of the terrestrial component of the Area, 100 m 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 45 m 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) 10 km to the south, Tramway Ridge (ASPA No.130) close to the summit of Mount Erebus situated 20 km east, New College Valley (ASPA No.116) 35 km to the north at Cape Bird, and Arrival Heights (ASPA No.122) which is adjacent to McMurdo Station 35 km to the south. Cape Crozier (ASPA No.124) is 75 km to the east on Ross Island. Antarctic Specially Managed Area No. 2 McMurdo Dry Valleys is located approximately 70 km 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 610 m (~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), 250 m 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 175 m 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 200 m 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;

II. Measures

- 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.

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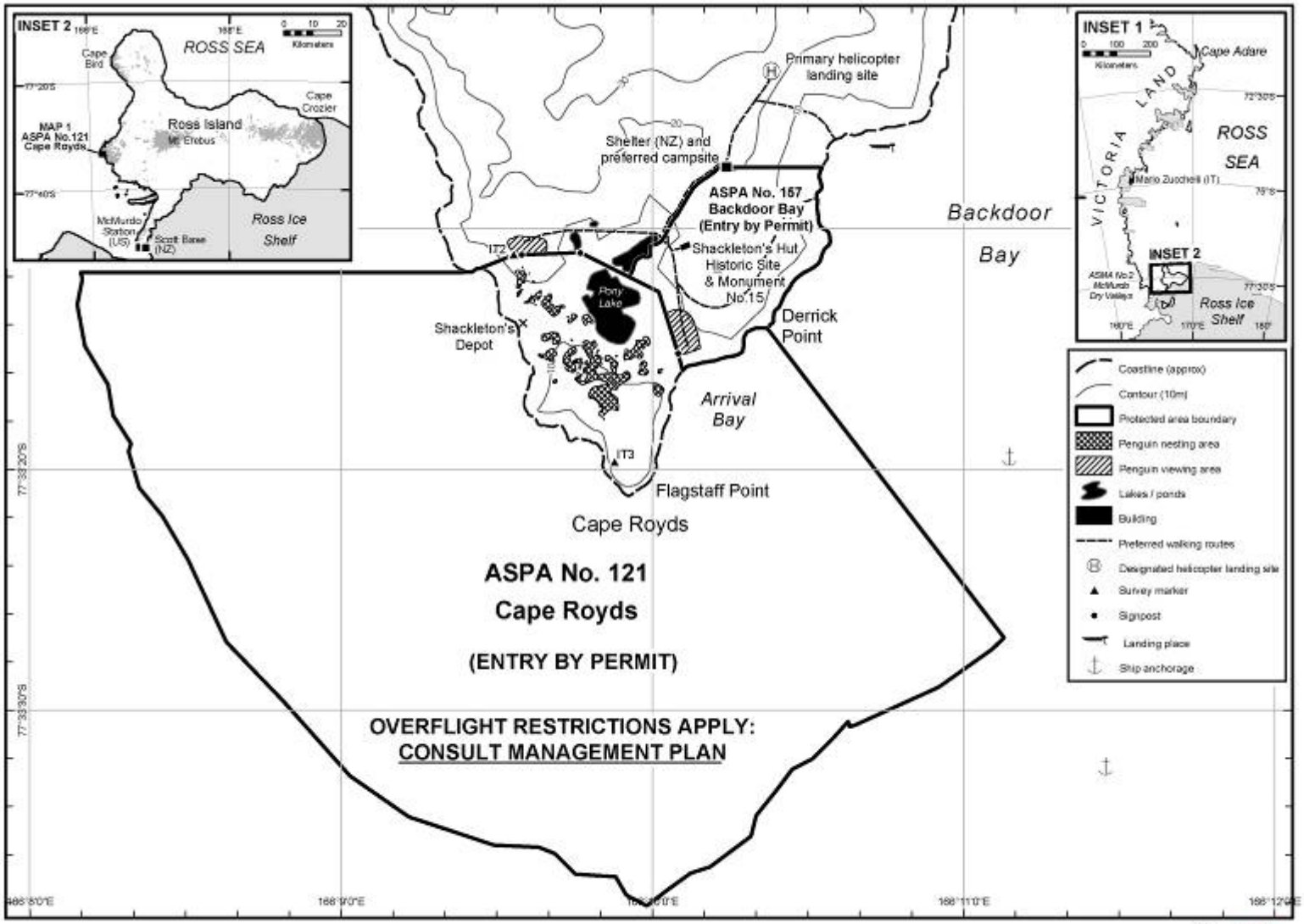
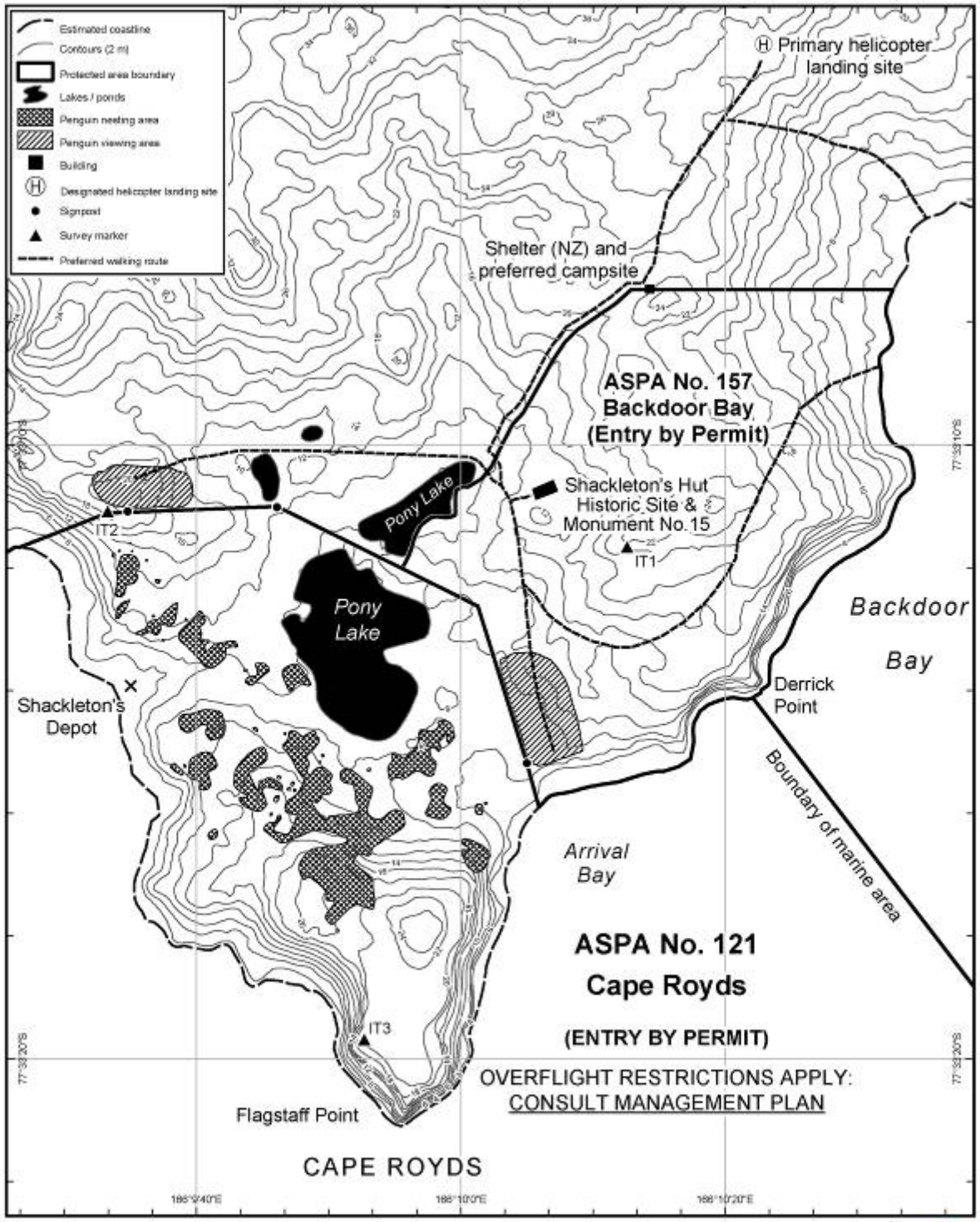

INSET 2
ROSS SEA
Cape Bird
Cape Crozier
Ross Island
Mt. Erebus
MAP 1
ASPA No.121
Cape Royds
McMurdo Station (US)
Scott Base (NZ)
Ross Ice Shelf
Primary helicopter landing site
Shelter (NZ) and preferred campsite
ASPA No. 157
Backdoor Bay
(Entry by Permit)
Shackleton's Hut
Historic Site
& Monument
No.15
Backdoor
Bay
Pony Lake
Shackleton's Depot
Derrick Point
Arrival Bay
IT2
IT3
Flagstaff Point
Cape Royds
ASPA No. 121
Cape Royds
(ENTRY BY PERMIT)
OVERFLIGHT RESTRICTIONS APPLY:
CONSULT MANAGEMENT PLAN
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
166°50'0"E
166°59'0"E
167°8'0"E
167°17'0"E
167°26'0"E
77°33'30"S
77°33'20"S
Projection: Lambert Conformal Conic
Central Meridian: 166°10'00" E;
Standard parallels: 77°23'14"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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19 February 2008
United States Antarctic Program
Environmental Research & Assessment

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 managment 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.

II. Measures

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.

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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).

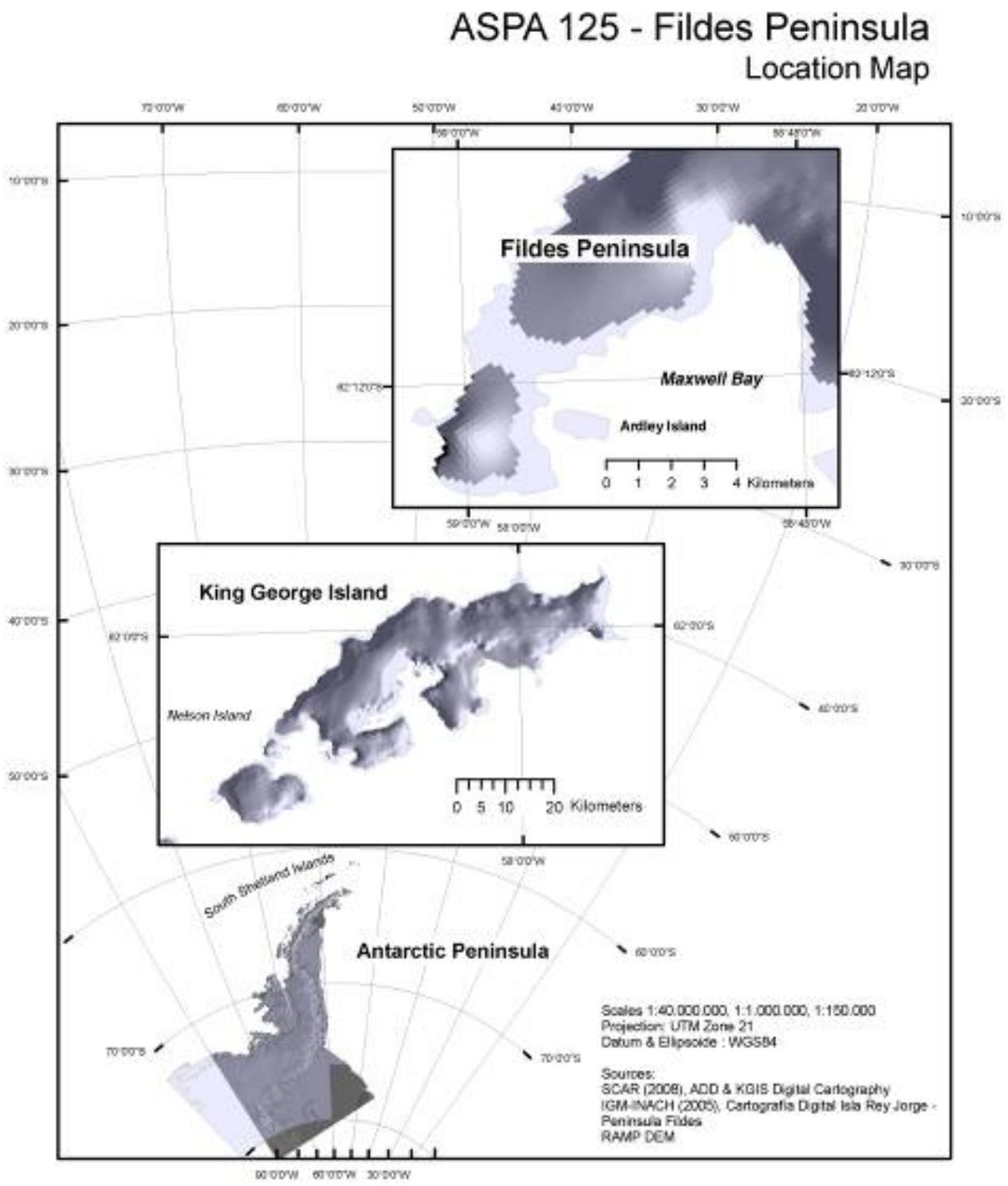
Map 5: Location of zone 125c, Glacier Dome Bellingshausen (Collins glacier).

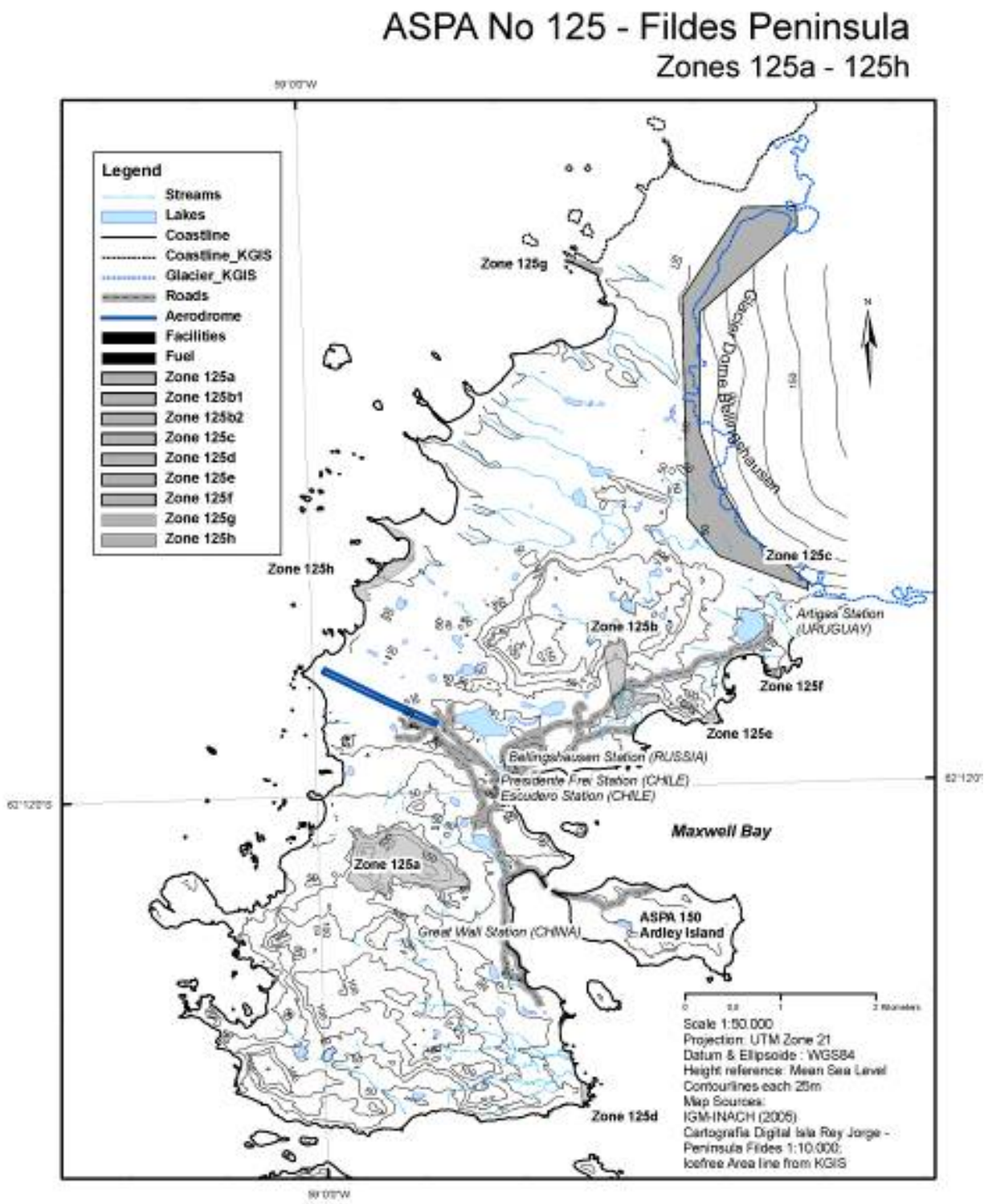
Map 6: Location of zone 125d, Halfthree Point.

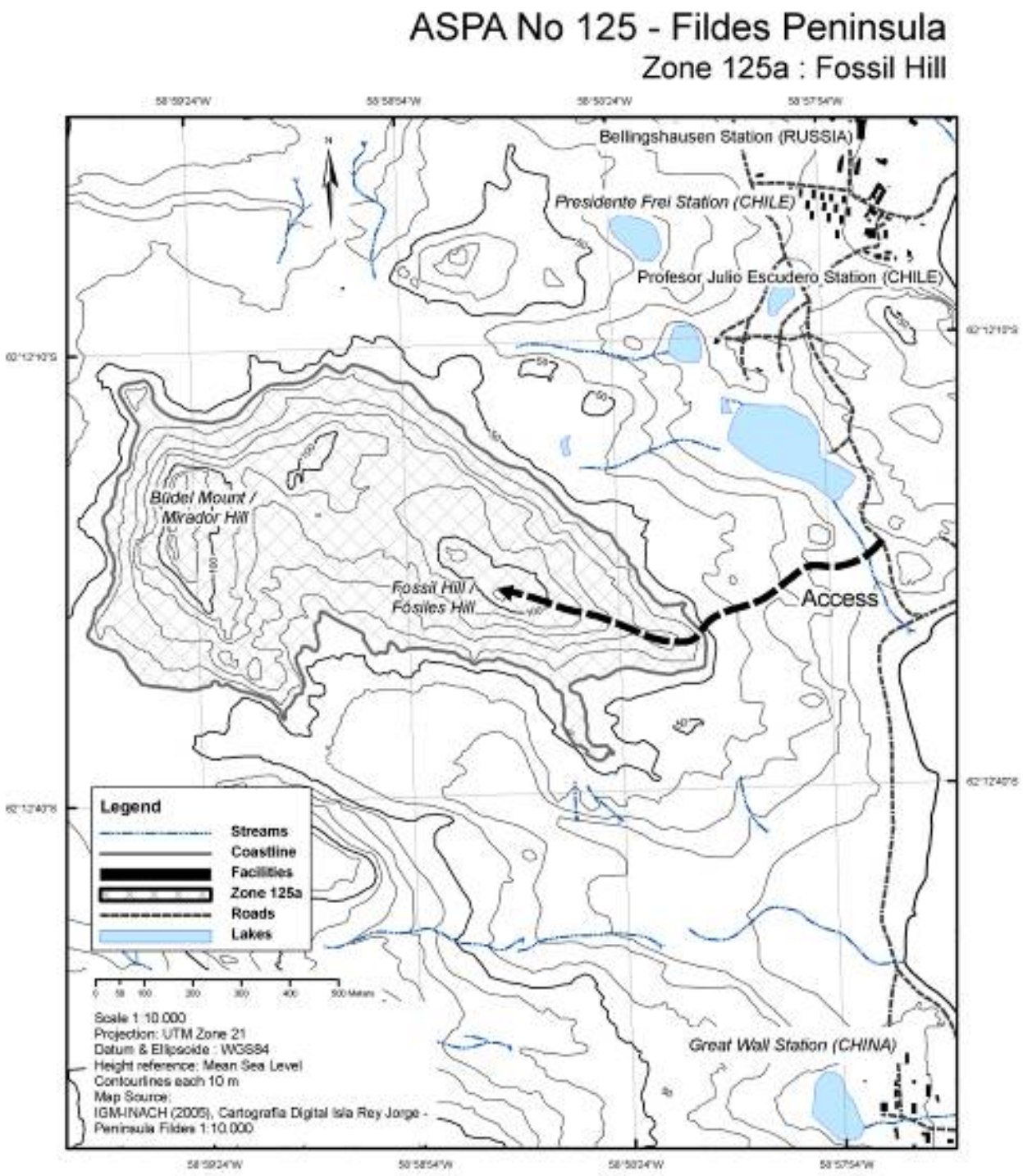
Map 7: Location of zones 125e and 125f, Suffield and Fossil Points, respectively.

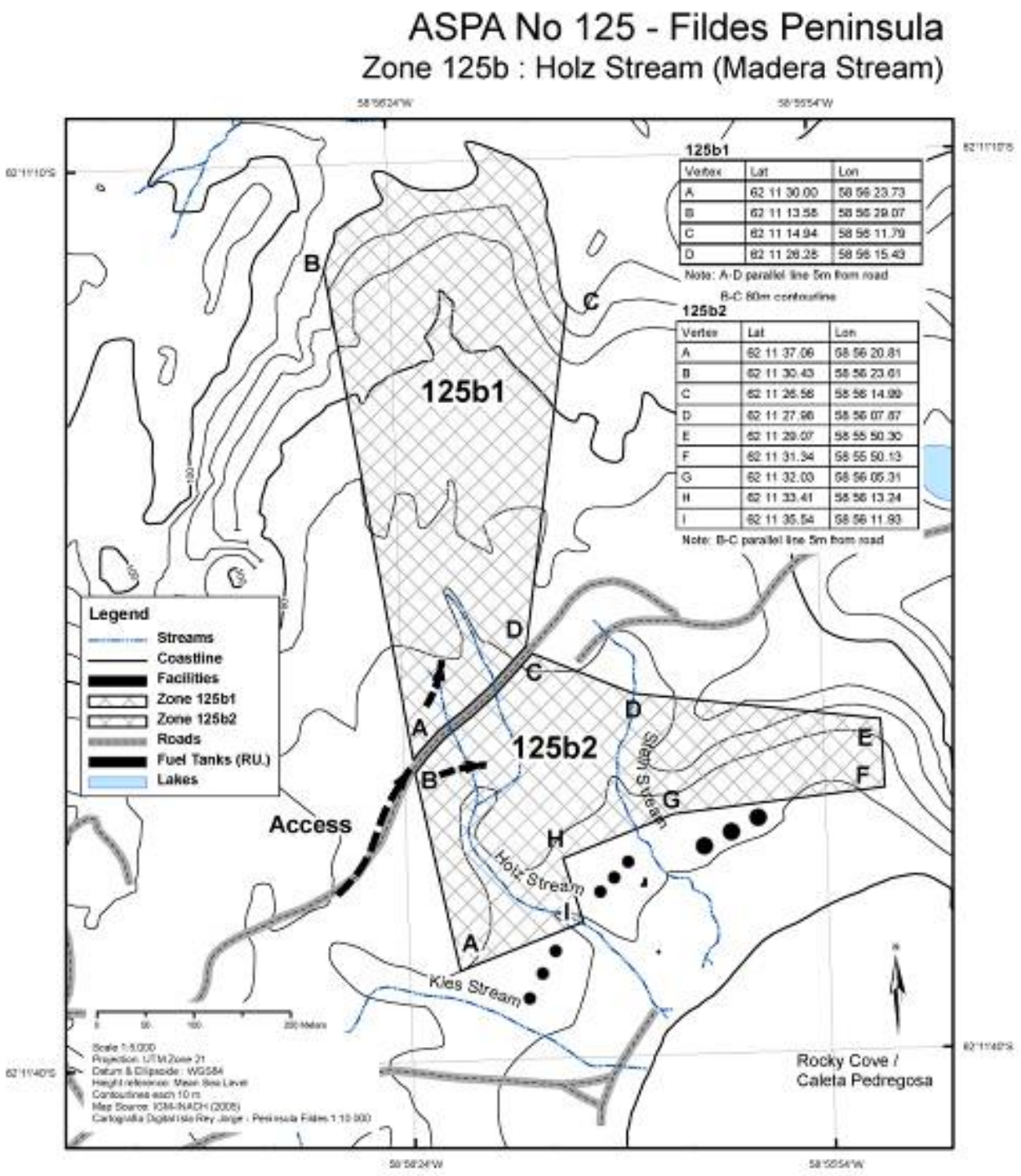
Map 8: Location of zone 125g, Gradzinski Cove.

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

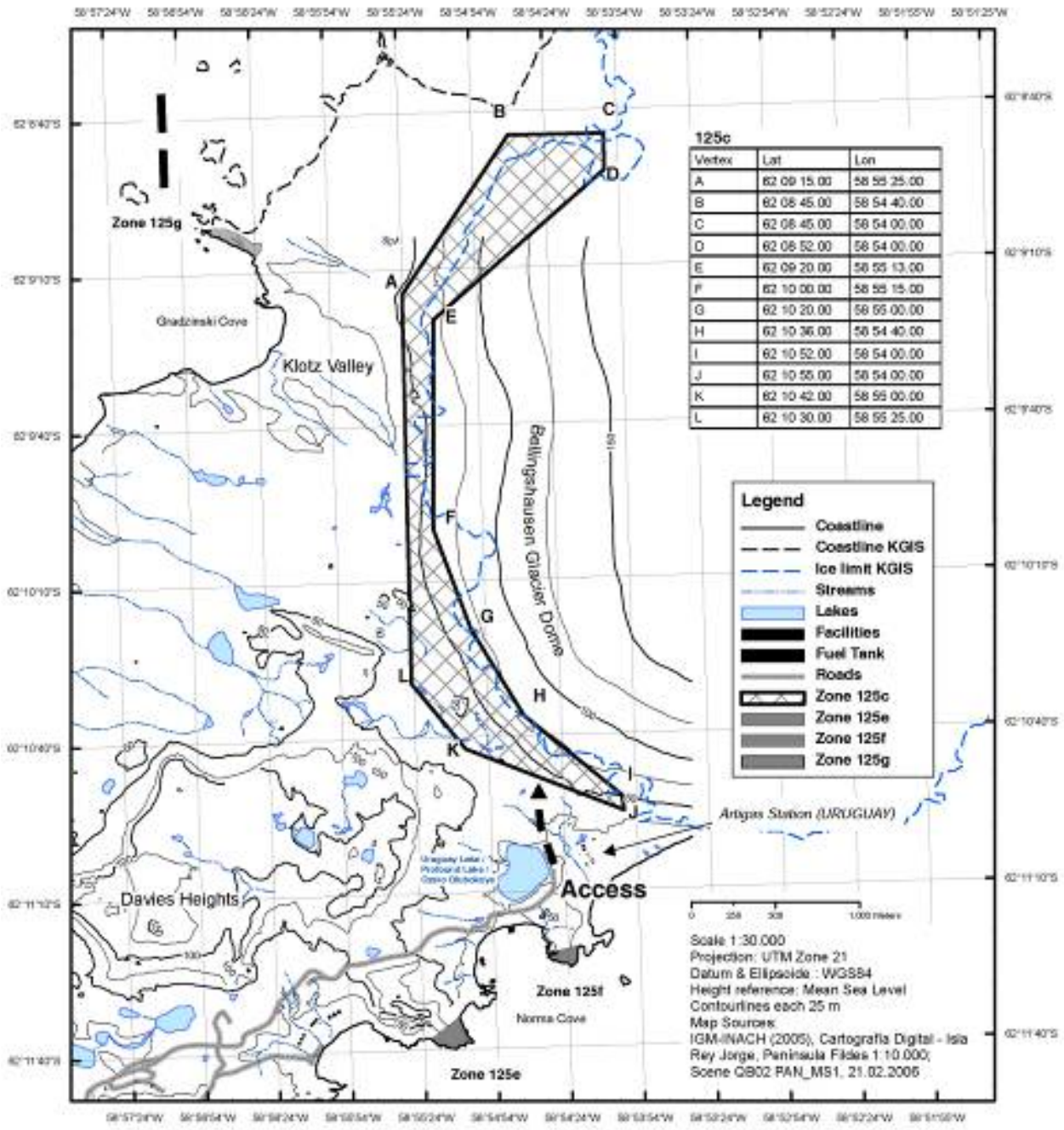

ASPA 125 - Fildes Peninsula
Location Map
Fildes Peninsula
Maxwell Bay
Ardley Island
0 1 2 3 4 Kilometers
King George Island
Nelson Island
0 5 10 20 Kilometers
South Shetland Islands
Antarctic Peninsula
Scales 1:40.000.000, 1:1.000.000, 1:150.000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Sources:
SCAR (2008), ADD & KGIS Digital Cartography
IGM-INACH (2005), Cartografia Digital Isla Rey Jorge - Peninsula Fildes
RAMP DEM

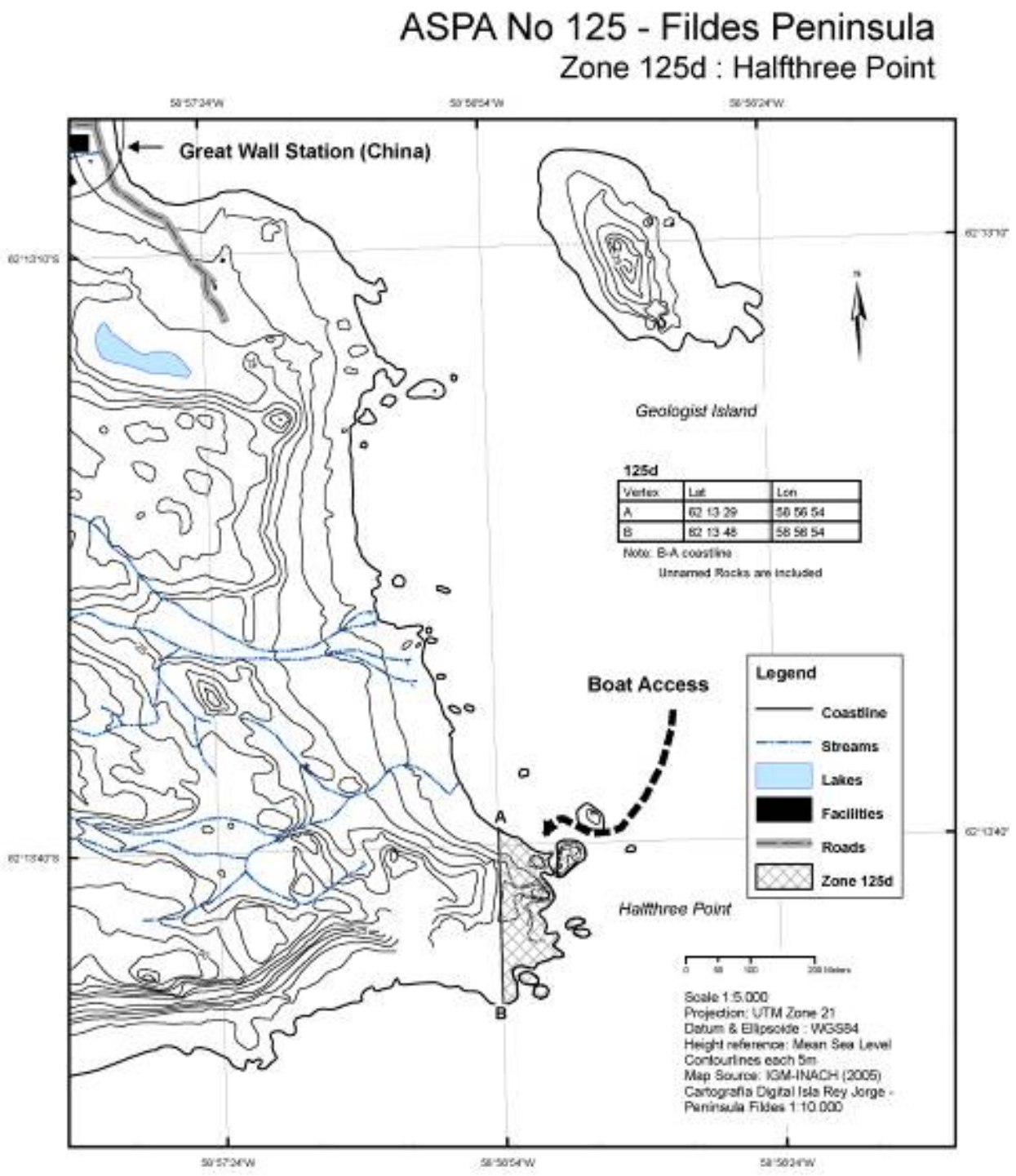

ASPA No 125 - Fildes Peninsula
Zones 125a - 125h
Legend
Streams
Lakes
Coastline
Coastline_KGIS
Glacier_KGIS
Roads
Aerodrome
Facilities
Fuel
Zone 125a
Zone 125b1
Zone 125b2
Zone 125c
Zone 125d
Zone 125e
Zone 125f
Zone 125g
Zone 125h
Zone 125g
Glacier Dome Bellingshausen
Zone 125c
Zone 125h
Zone 125b
Artigas 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°12'18"S
62°12'48"S
Bellingshausen Station (RUSSIA)
Presidente Frei Station (CHILE)
Profesor Julio Escudero Station (CHILE)
Büdel Mount / Mirador Hill
Fossil Hill / Fosiles 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)
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 28.28 | 58 56 15.49
Note: A-D parallel line 5m from road
B-C 60m 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 26.58 | 58 56 14.89
D | 62 11 27.98 | 58 56 07.67
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
Holz Stream
Slash Stream
Kiles 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

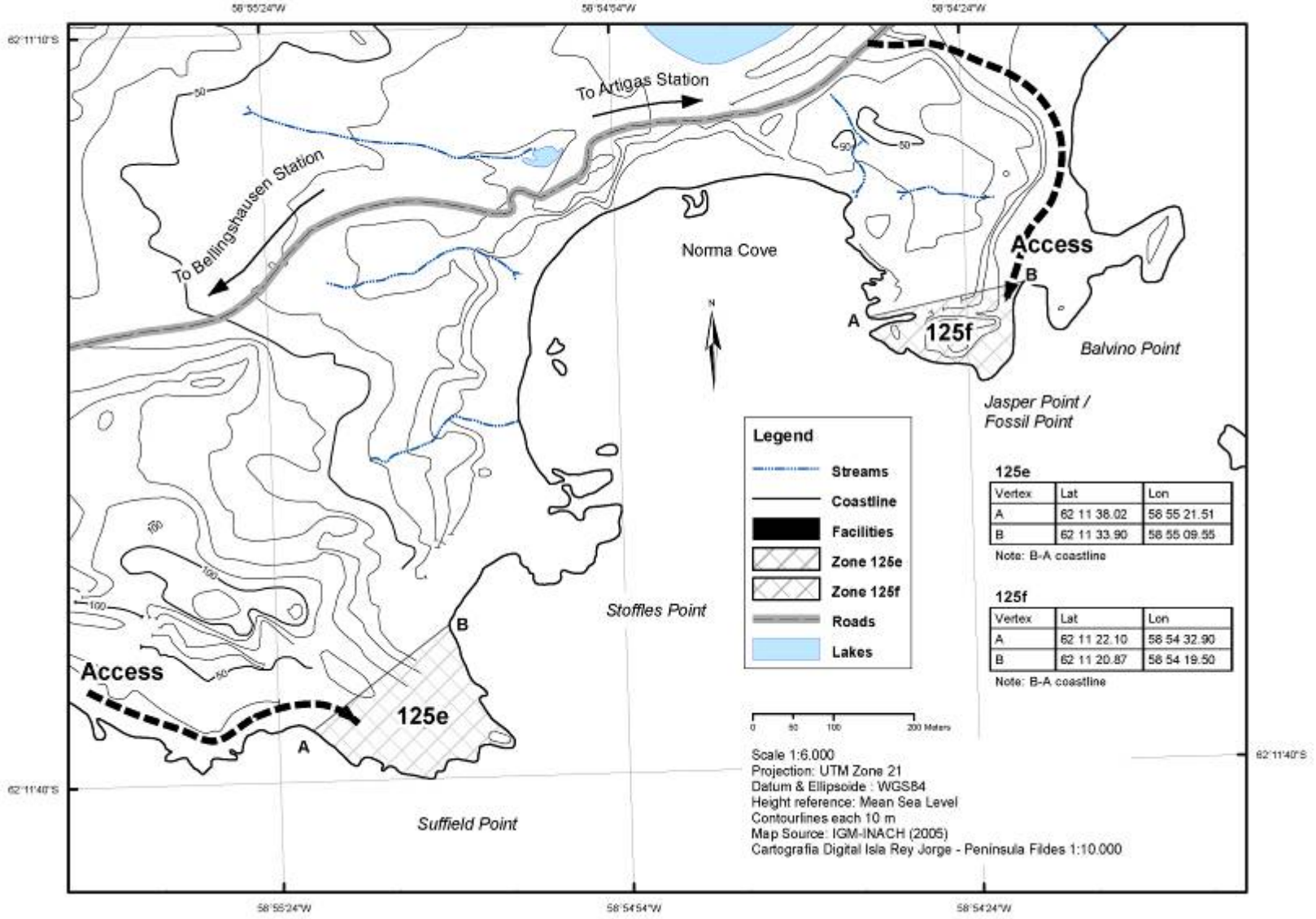
ASPA No 125 - Fildes Peninsula
Zone 125c : Bellingshausen Glacier Dome




ASPA No 125 - Fildes Peninsula
Zone 125d : Halfthree Point
Great Wall Station (China)
Geologist Island
125d
Vertex | Lat | Lon
A | 62 13 29 | 58 56 54
B | 62 13 48 | 58 58 54
Note: B-A coastline
Unnamed Rocks are included
Boat Access
Legend
Coastline
Streams
Lakes
Facilities
Roads
Zone 125d
Halfthree Point
A
B
Scale 1:5.000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Height reference: Mean Sea Level
Contourlines each 5m
Map Source: IGM-INACH (2005)
Cartografía Digital Isla Rey Jorge -
Península Fildes 1:10.000

ASPA No 125 - Fildes Peninsula

Zone 125e :Suffield Point & Zone 125f : Fossil Point



125e

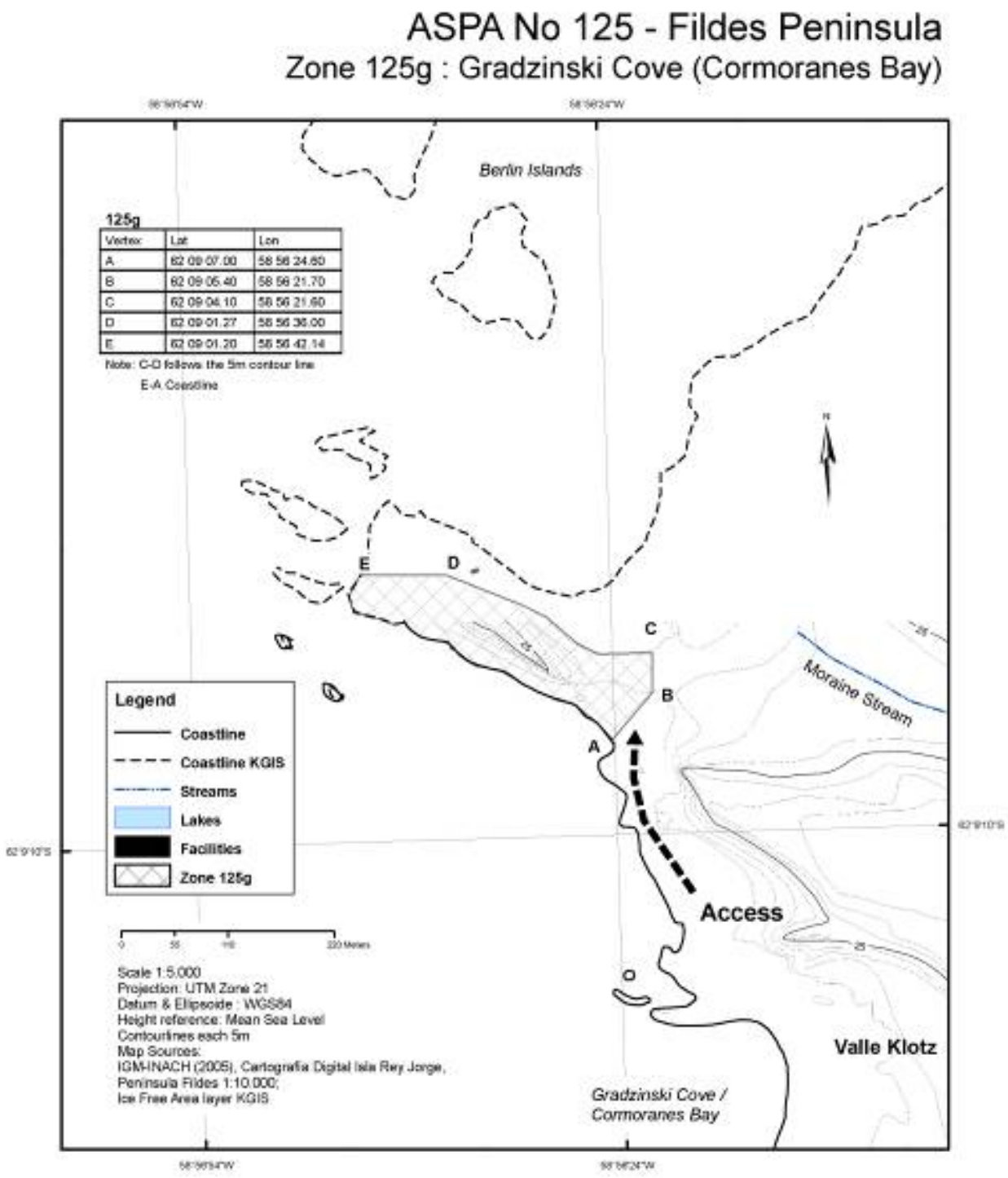
Vertex	Lat	Lon
A	62 11 38.02	58 55 21.51
B	62 11 33.90	58 55 09.55

Note: B-A coastline

125f

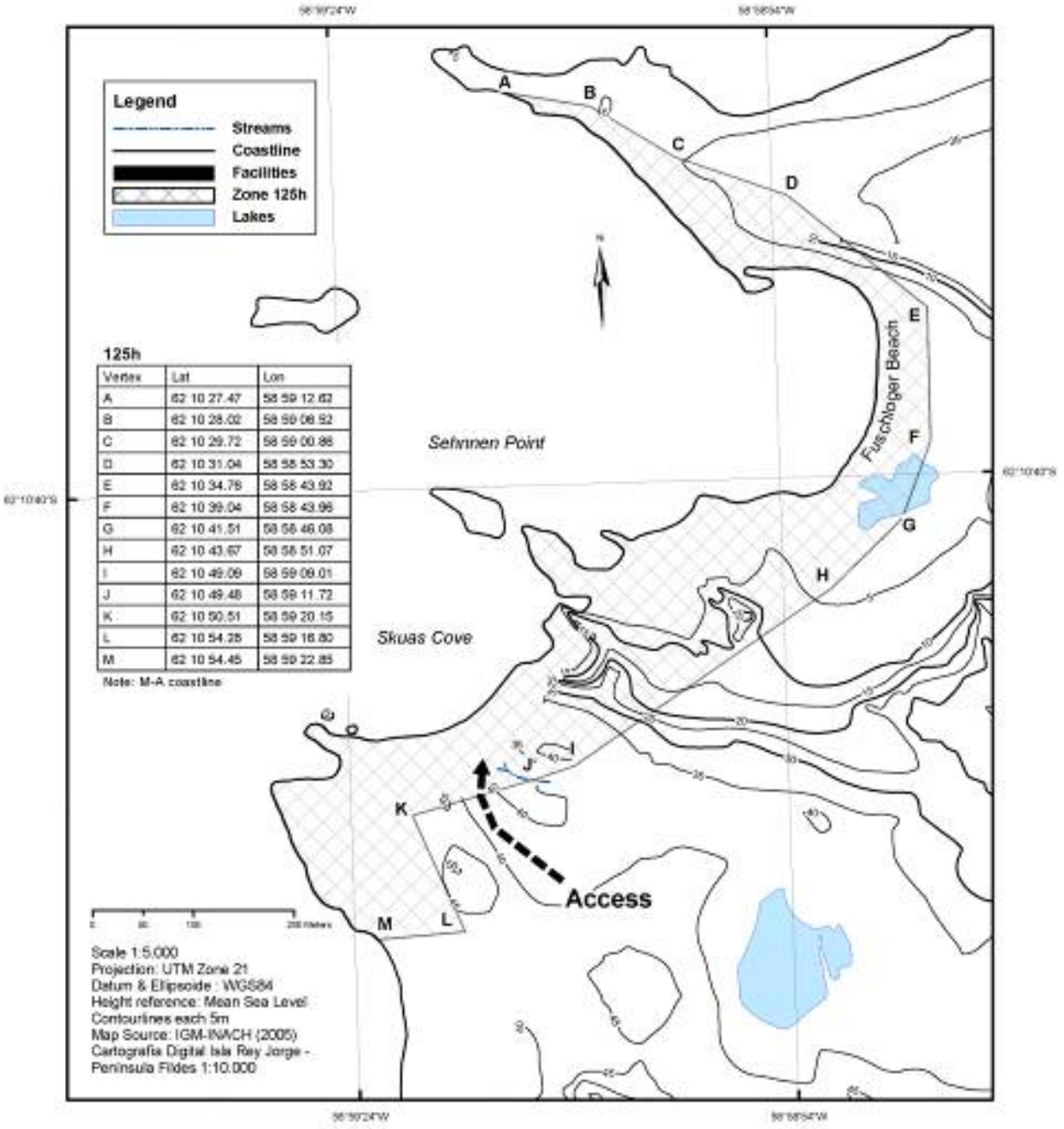
Vertex	Lat	Lon
A	62 11 22.10	58 54 32.90
B	62 11 20.87	58 54 19.50

Note: B-A coastline


ASPA No 125 - Fildes Peninsula
Zone 125g : Gradzinski Cove (Cormoranes Bay)
Berlin Islands
125g
Vertex | Lat | Lon
A | 62 09 07.00 | 58 56 24.60
B | 62 09 05.40 | 58 56 21.70
C | 62 09 04.10 | 58 56 21.60
D | 62 09 01.27 | 58 56 36.00
E | 62 09 01.20 | 58 56 42.14
Note: C-D follows the 5m contour line
E-A Coastline
Legend
Coastline
Coastline KGIS
Streams
Lakes
Facilities
Zone 125g
Moraine Stream
Access
Valle Klotz
Gradzinski Cove / Cormoranes Bay
Scale 1:5.000
Projection: UTM Zone 21
Datum & Ellipsoide : WGS84
Height reference: Mean Sea Level
Contourlines each 5m
Map Sources:
IGM-INACH (2005), Cartografía Digital Isla Rey Jorge,
Península Fildes 1:10.000;
Ice Free Area layer KGIS

ASPA No 125 - Fildes Peninsula

Zone 125h : Skuas Cove



125h

Vertex	Lat	Lon
A	62 10 27.47	58 59 12.62
B	62 10 28.02	58 59 08.52
C	62 10 29.72	58 59 00.86
D	62 10 31.04	58 58 53.30
E	62 10 34.78	58 58 43.92
F	62 10 39.04	58 58 43.96
G	62 10 41.51	58 58 46.08
H	62 10 43.67	58 58 51.07
I	62 10 49.09	58 59 09.01
J	62 10 49.48	58 59 11.72
K	62 10 50.51	58 59 20.15
L	62 10 54.28	58 59 16.80
M	62 10 54.45	58 59 22.85

Note: M-A coastline

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 to trigonometrical station G7 at latitude 66°15'29" S, 110°33'23" E, thence to a point to the east-south-east on the Løken Moraines. 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.

II. Measures

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.

II. Measures

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.

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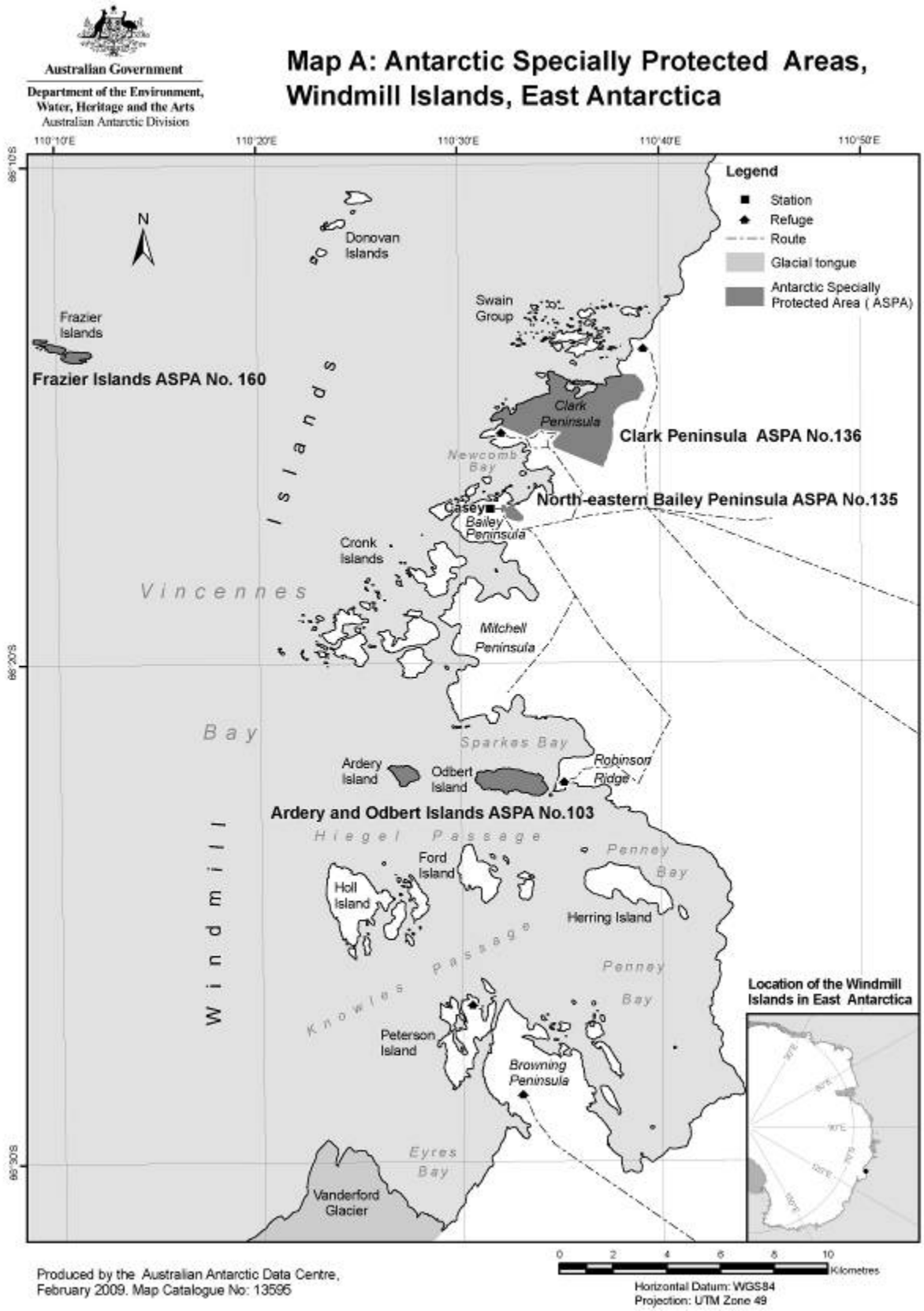
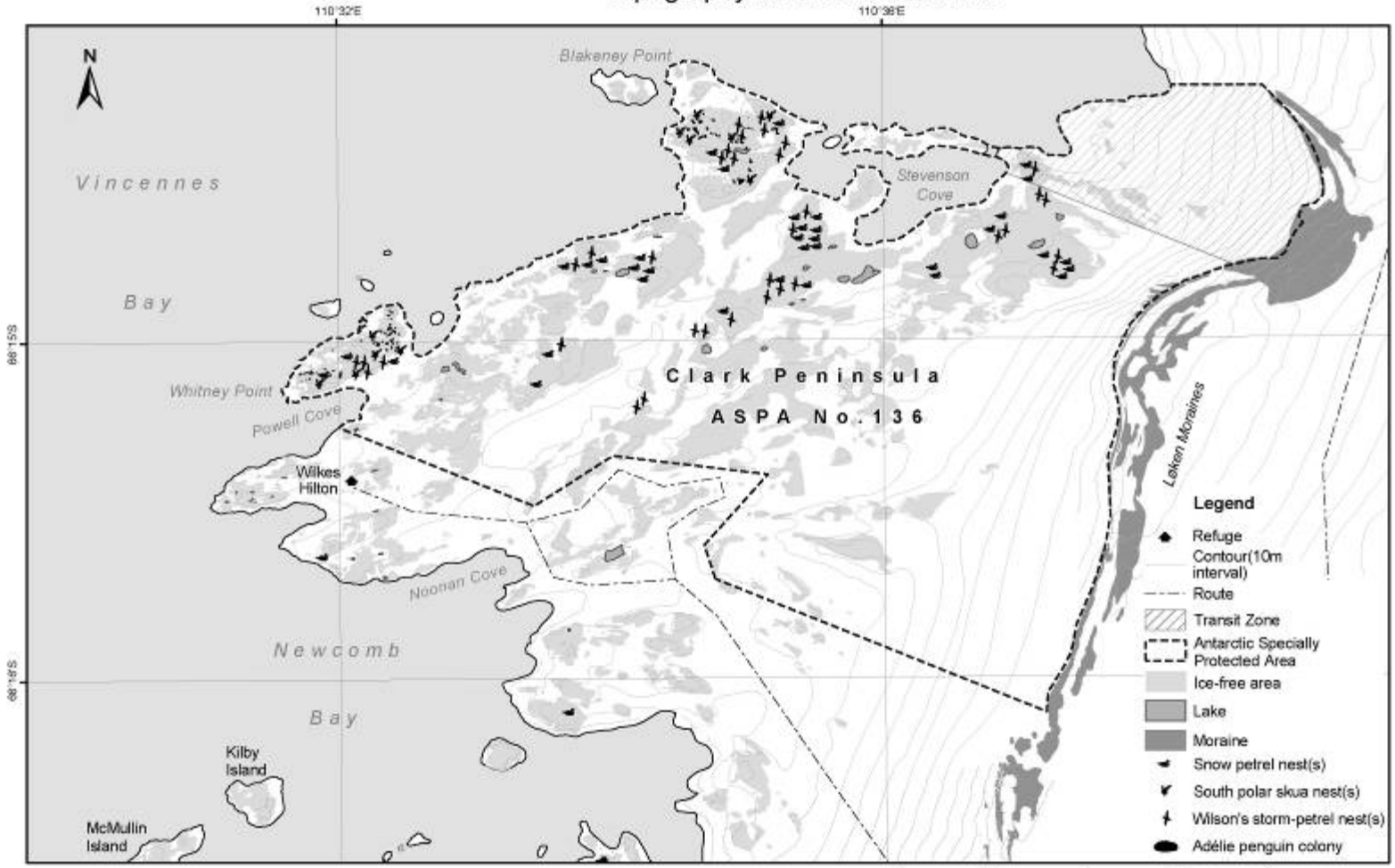

Australian Government
Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division
Map A: Antarctic Specially Protected Areas, Windmill Islands, East Antarctica
110°10'E
110°20'E
110°30'E
110°40'E
110°50'E
66°10'S
66°20'S
66°30'S
N
Legend
Station
Refuge
Route
Glacial tongue
Antarctic Specially Protected Area (ASPA)
Donovan Islands
Swain Group
Frazier Islands
Frazier Islands ASPA No. 160
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
Ardery Island
Odbert Island
Robinson Ridge
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
Windmill Islands
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

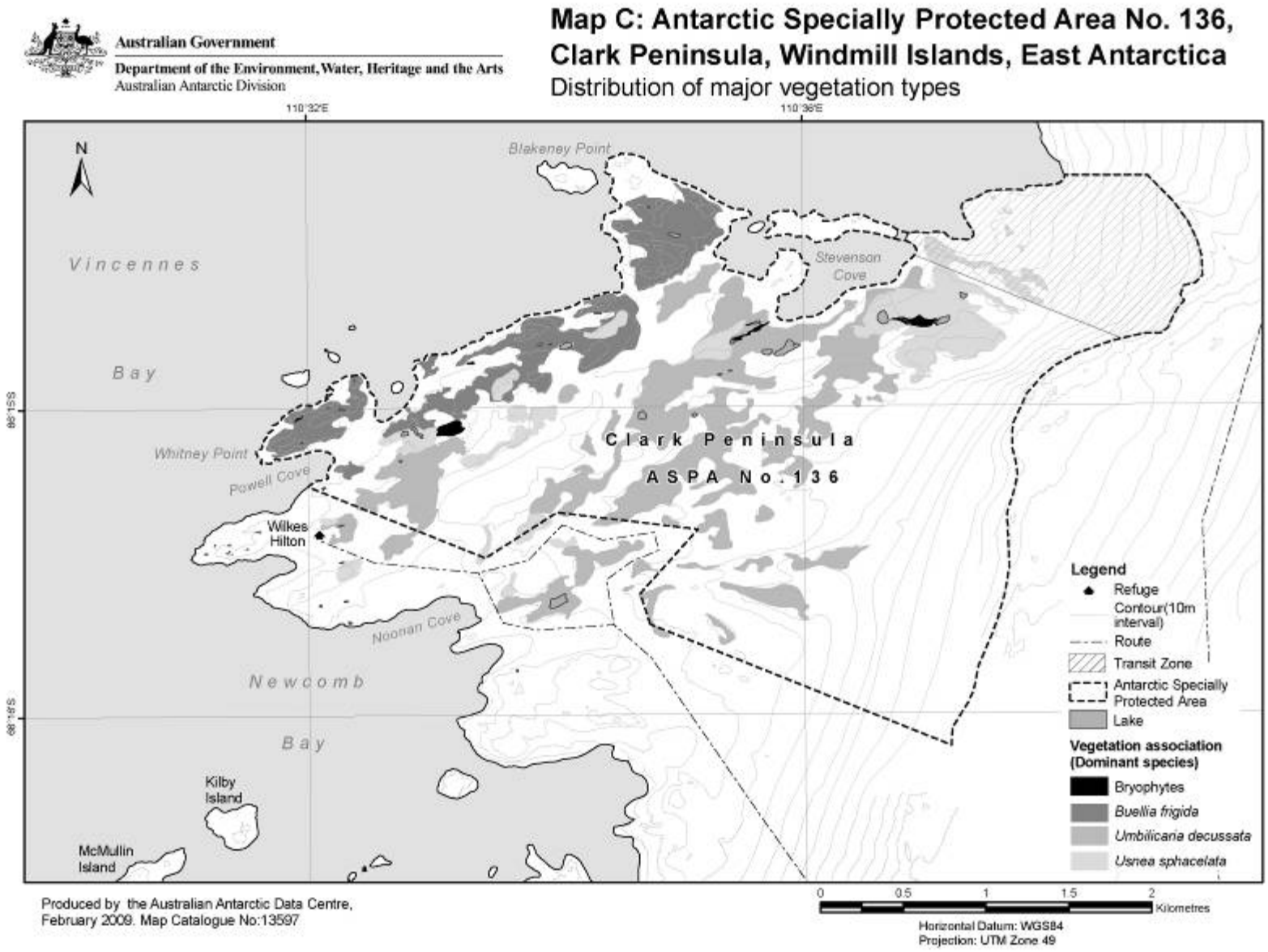
Map B: Antarctic Specially Protected Area No. 136, Clark Peninsula, Windmill Islands, East Antarctica

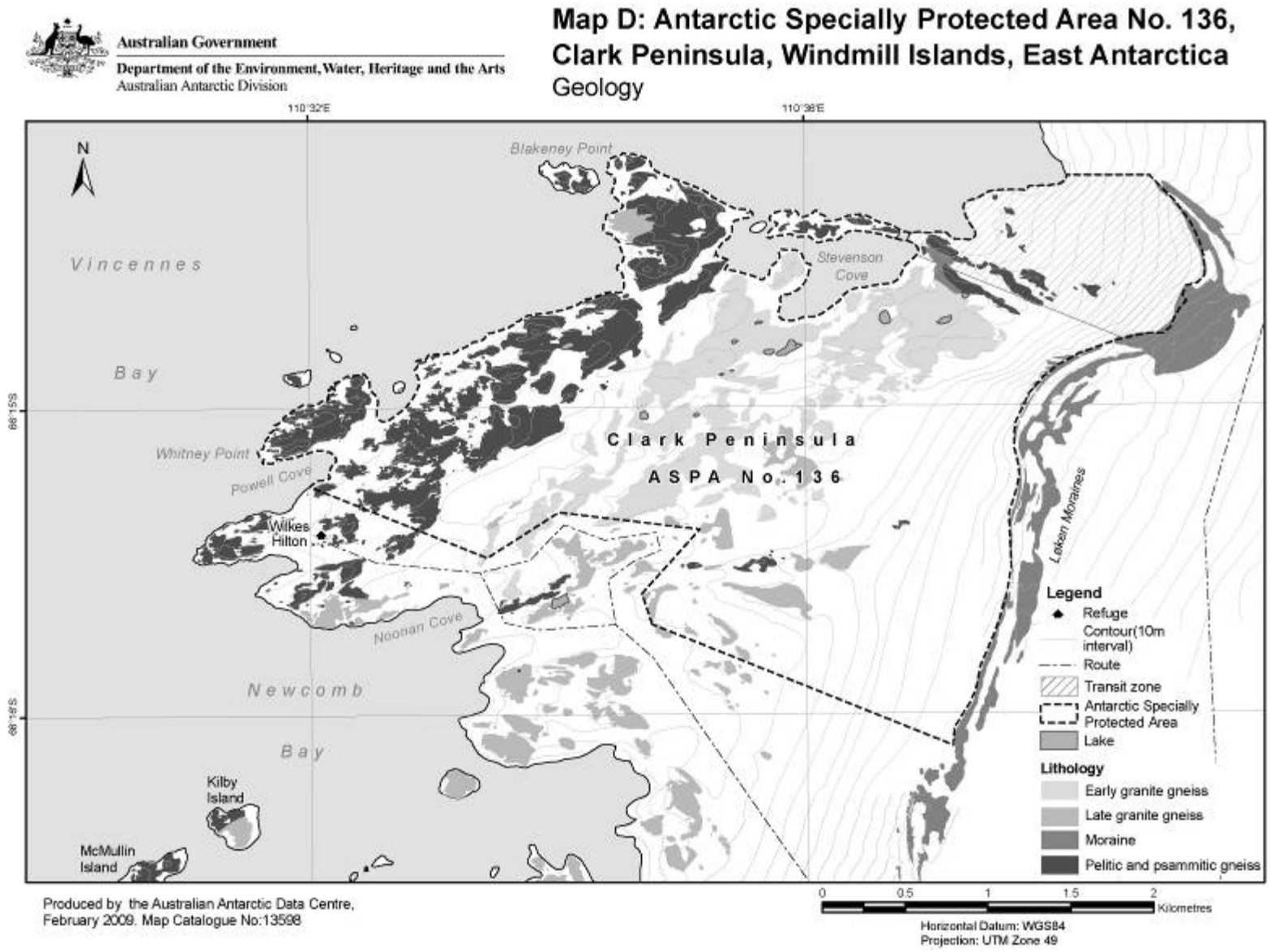
Topography and bird distribution



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°18'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
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
66°18'S
N
Blakeney Point
Vincennes
Bay
Stevenson Cove
Whitney Point
Powell Cove
Clark Peninsula
ASPA No. 136
Wilkes Hilton
Leker 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
Horizontal Datum: WGS84
Projection: UTM Zone 49
Produced by the Australian Antarctic Data Centre,
February 2009. Map Catalogue No:13598

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.

II. Measures

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.

II. Measures

- 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.

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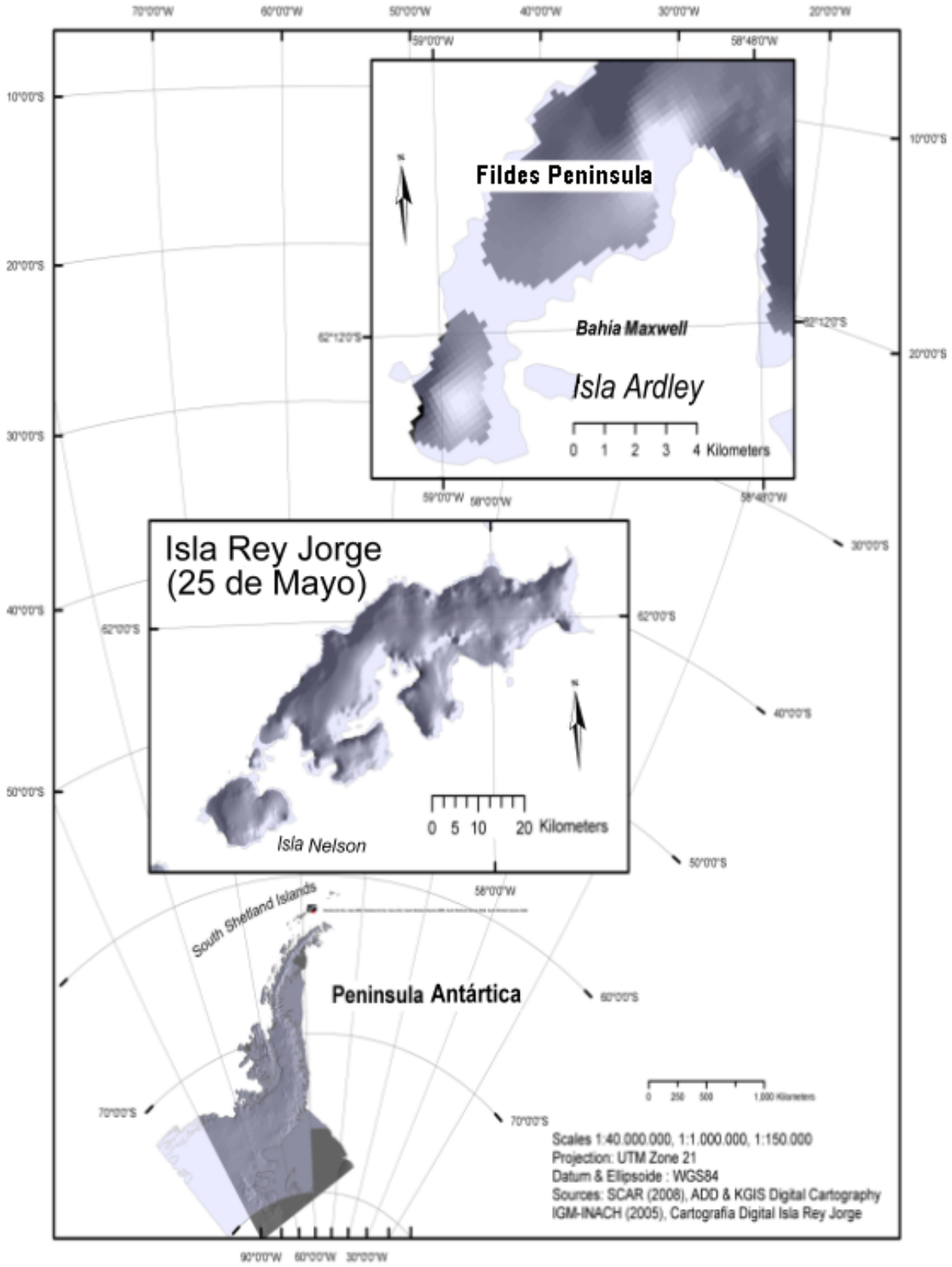
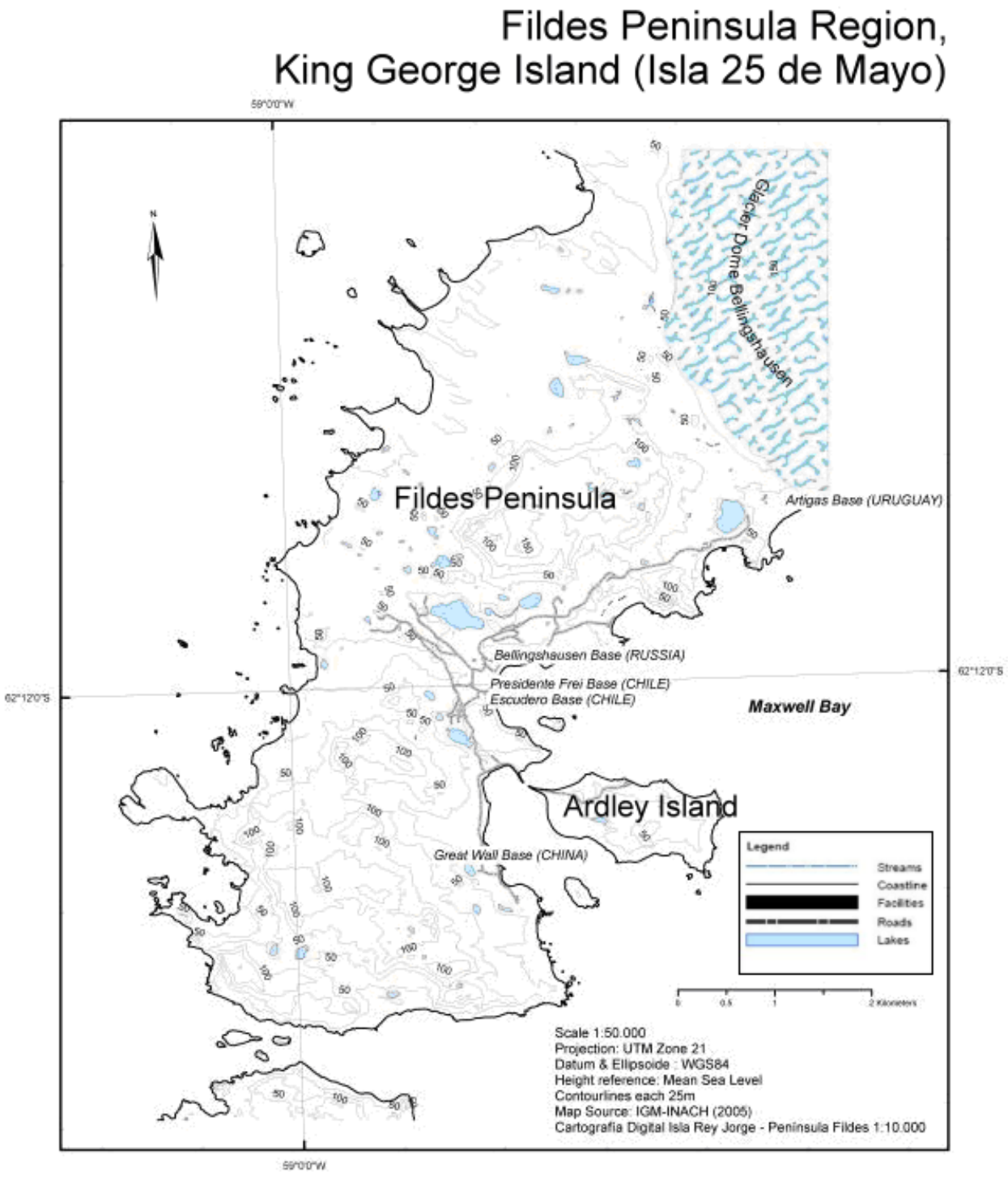
ANNEXES: Maps and Figures

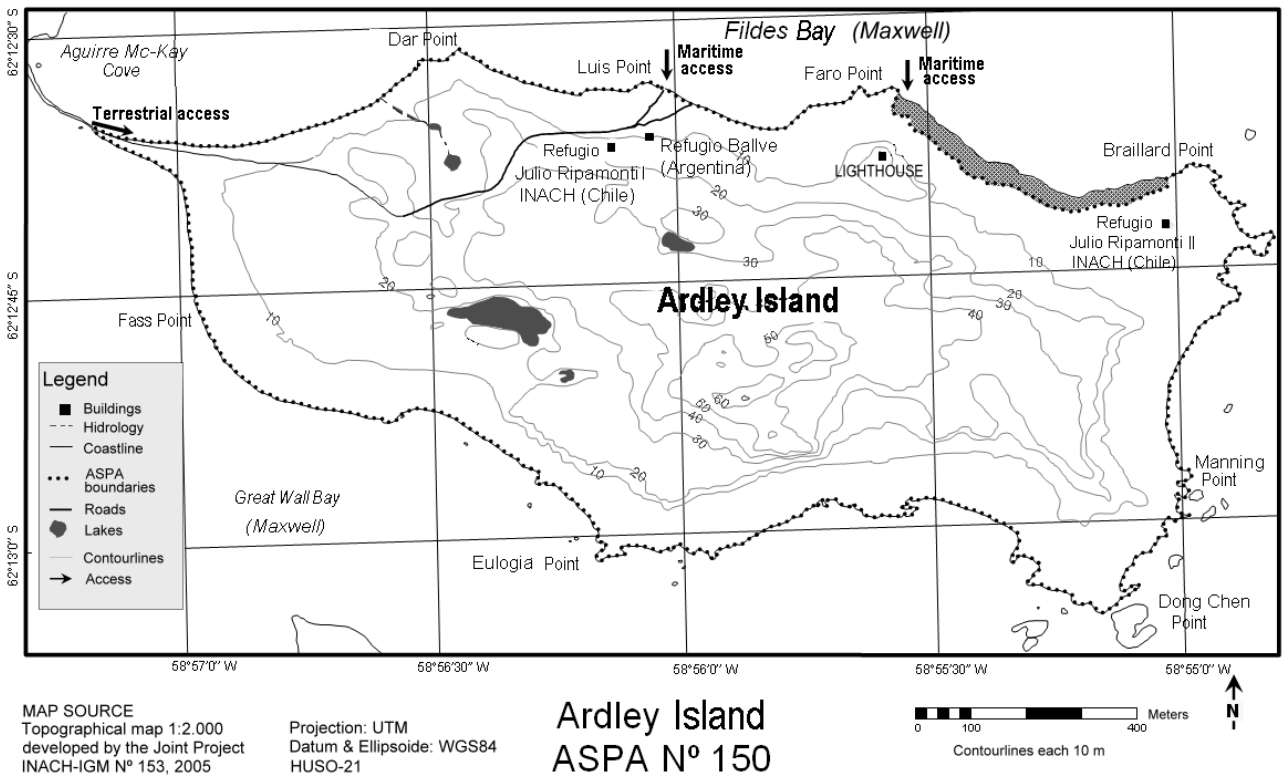


Map 1. Location of Ardley Island in relation to King George Island (25 de Mayo) and the Fildes Peninsula, (Map Database, Project 153, IGM-INACH, Mapping and GIS of South Shetland Islands)



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)

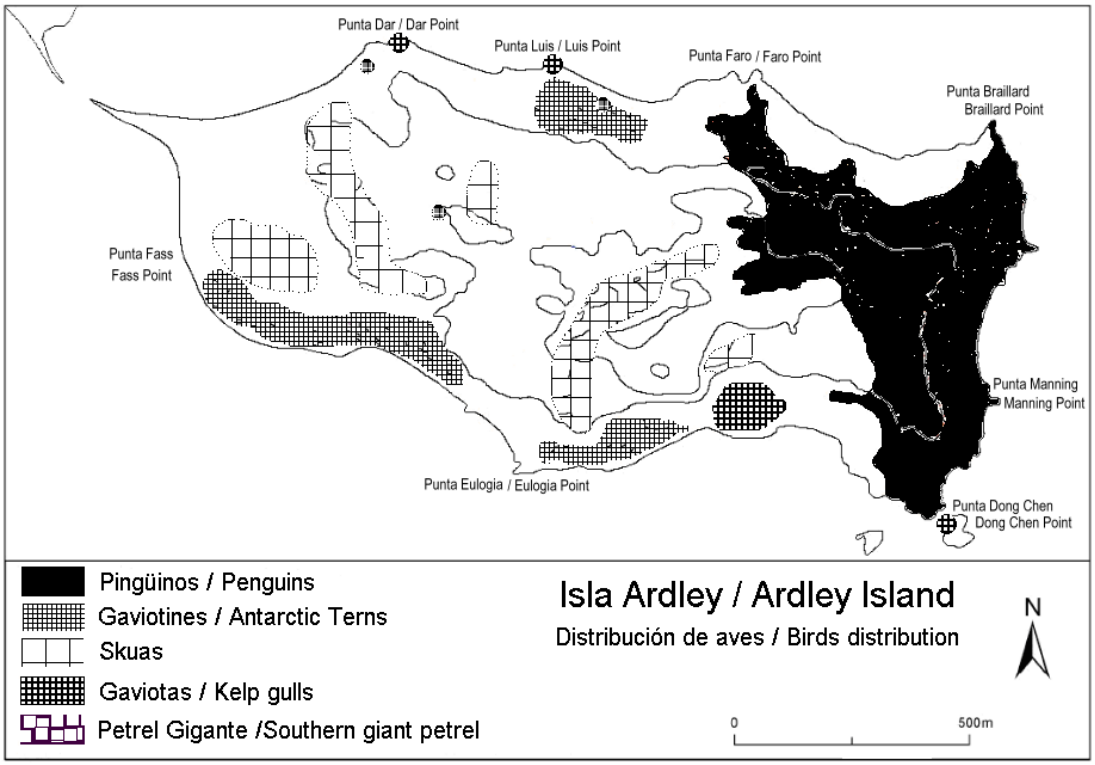


Figure 1. Sketch with the distribution of the main nesting birds on Ardley Island, based in Peter *et al*., 2008.

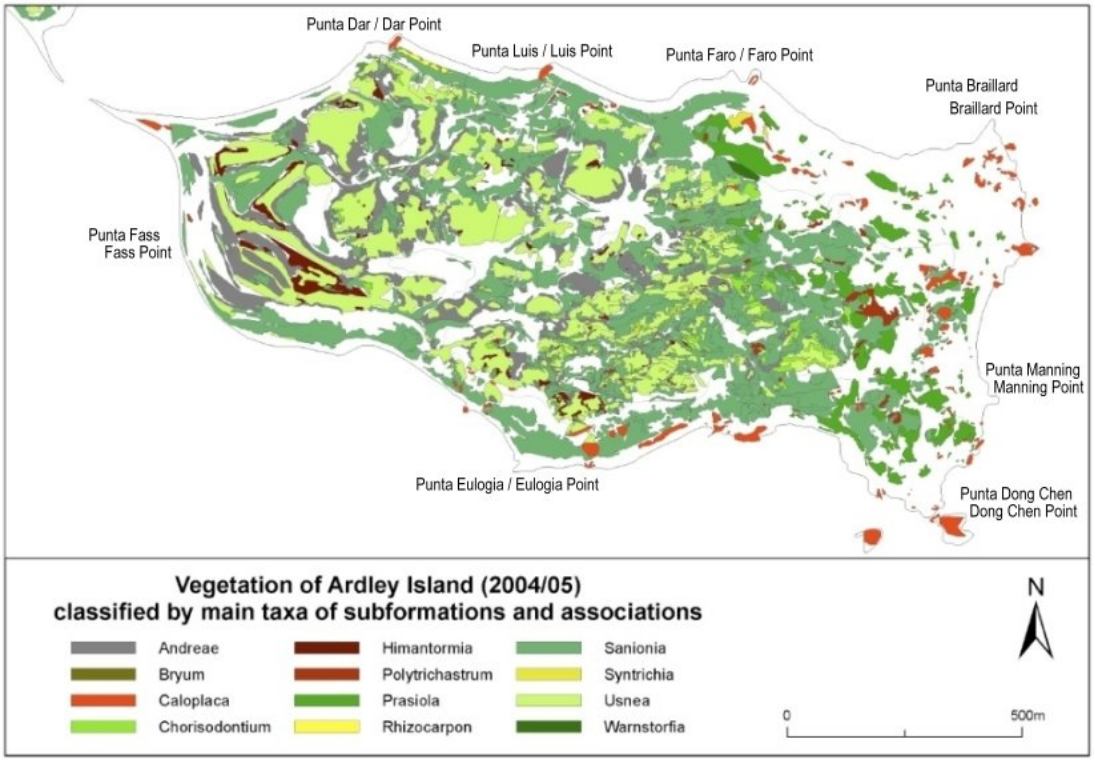


Figure 2. Sketch of the distribution and coverage of the plant species present on Ardley Island, based in Peter *et al*., 2008.

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: 1021 km^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 910 km^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 200 m 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 1021 km^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 (USA).
- 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 4.6 km. 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 ±300 m. Contour interval – Marine 100 m, vertical accuracy to within ±50 m.

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 220 km long and 120 km 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 Αρεα lies approximately 80 km west of the Antarctic Peninsula, mostly within the 200 m isobath directly south and west of Low Island (Map 1). Low Island is the southern-most of the South Shetland Islands, lying 60 km south-west of Deception Island and 25 km south-east of Smith Island. To the west and south of Low Island, and for approximately 20 km from the shore, the sea floor slopes gently from the intertidal zone to depths of approximately 200 m. The sea floor slopes steeply to the east of Low Island, reaching depths of up to 1200 m 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 27.6 km north-south and a maximum of 37.15 km east-west, encompassing an

area of approximately 1021 km^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 1.8 ºC at 5 m depth and 0.2 to 0.3ºC at the 150 m contour (Catalan *et al.* 2008). Water salinity within the Area ranged between 34.04 and 34.06 psu at 5 m, whilst at 150 m depth salinity reached 34.40 psu.

Wind is predominantly from the NNW direction, resulting in a southward flowing coastal current along the western Antarctic Peninsula (Hofman *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 1.70 m (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 4.5 mm 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 *Bahia Paraiso* 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 70 km 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 45 km to the SSE, and Port Foster and other parts of Deception Island (ASPAs No. 140 and No. 145 respectively), which are approximately 70 km 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.

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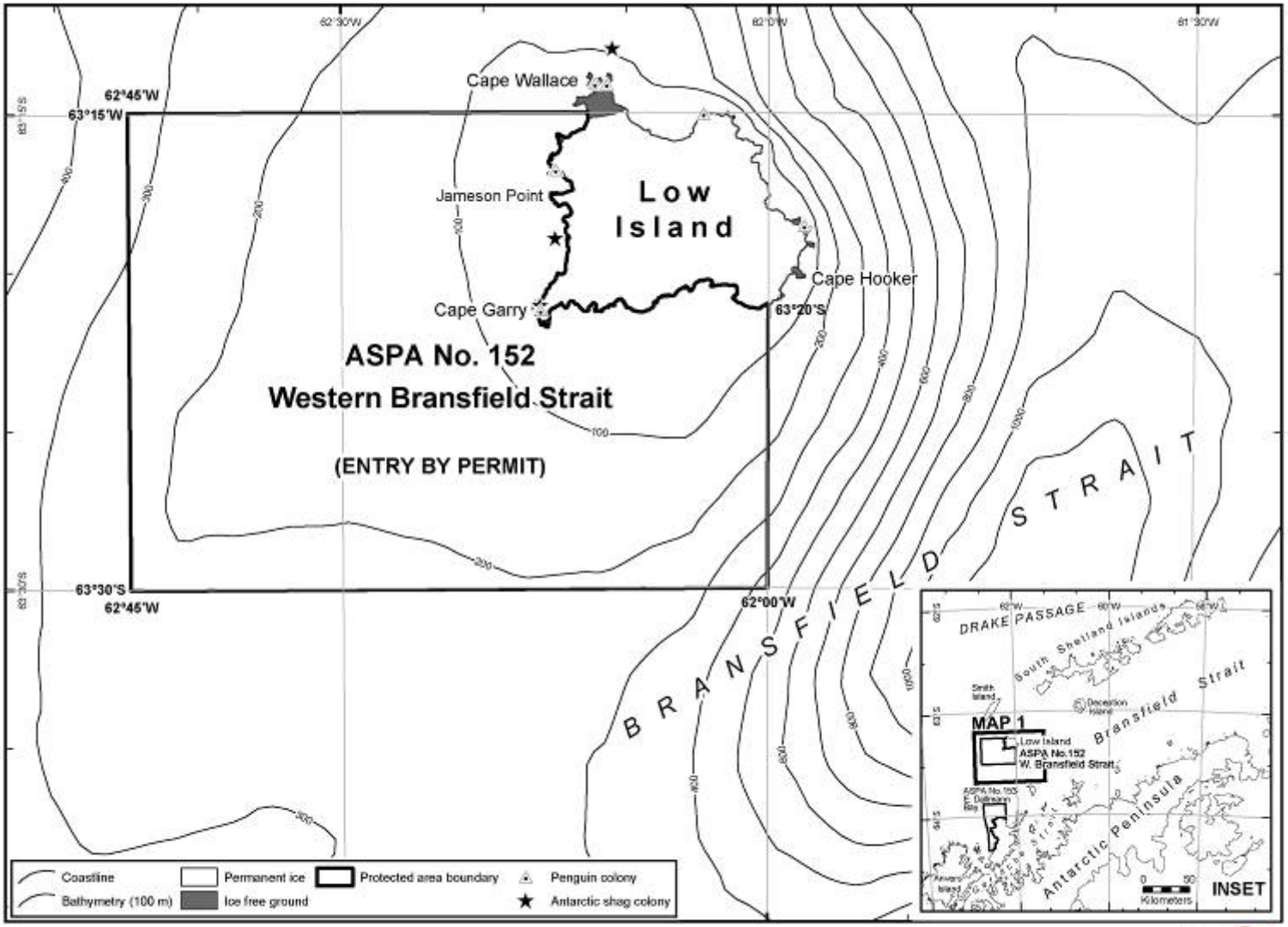

Projection: Lambert Conformal Conic
Central Meridian: 62°00'W; Standard parallels: 63°21'S, 63°30'S;
Datum: & Spheroid: WGS84;
Data sources: Topography from ADD v5.0 (2007);
Bathymetry from data gridded by P. Morris (pers. comm. 2000), manually adjusted along eastern coast of Low Island to align with ADD v5.0 coastal change update;
Fauna data from UK FCO Wildlife Awareness Manual (Harris 2006)

Map 1: ASPA No. 152
Western Bransfield Strait

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Kilometers

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14 February 2009
United States Antarctic Program
Environmental Research & Assessment

II. Measures

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: 676 km^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 676 km^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 200 m 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 676 km^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 traveling 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 4.6 km. 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 ±300 m. Vertical contour interval 100 m, vertical accuracy to within ±50 m.

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 65 km 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 2520 m 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 10 km 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 (104 m) 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 200 m before the slope eases to depths of 400-500 m beyond the western boundary of the Area. The gradient from the shore down to 200 m slopes more gently in the north of the Area. The Area lies mostly within the 200 m 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 18.5 km to 64°10'S, SSW of Astrolabe Needle. The western boundary then extends NNW almost 19 km to 62°45'W, 64°00'S. The western boundary then extends approximately 13 km 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 23.4 km. The eastern boundary extends due south approximately 16 km 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 50 km from north to south and extends up to a maximum of 23.4 km east-west. West of Brabant Island the width of the Area ranges between 10 km (at Guyou Bay) and 1.5 km (near Claude Point). The total area is approximately 676 km^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 1.9 º C at a depth of 5 m and at 150 m depth, temperatures reached 0.3 to 0.45 ºC (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 100–200 m (Eastman and Lannoo 2004). Water salinity within the Area ranged between 33.84 and 34.04 psu at 5 m, whilst at 150 m depth salinity values were 34.42 -34.45 psu (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 120 m 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 (*Fulmaris 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 loennbergi*), 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 weddelli*), 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 *Bahia Paraiso* 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.

II. Measures

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 55 km south in Paradise Harbour; Port Lockroy (UK), approximately 75 km south-west on Goudier Island, Yelcho (Chile), approximately 80 km south-west on Doumar Island; and Palmer (US), approximately 90 km 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 55 km to the NNW. Antarctic Specially Managed Area No. 7 Southwest Anvers Island and Palmer Basin lies approximately 80 km 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

II. Measures

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.

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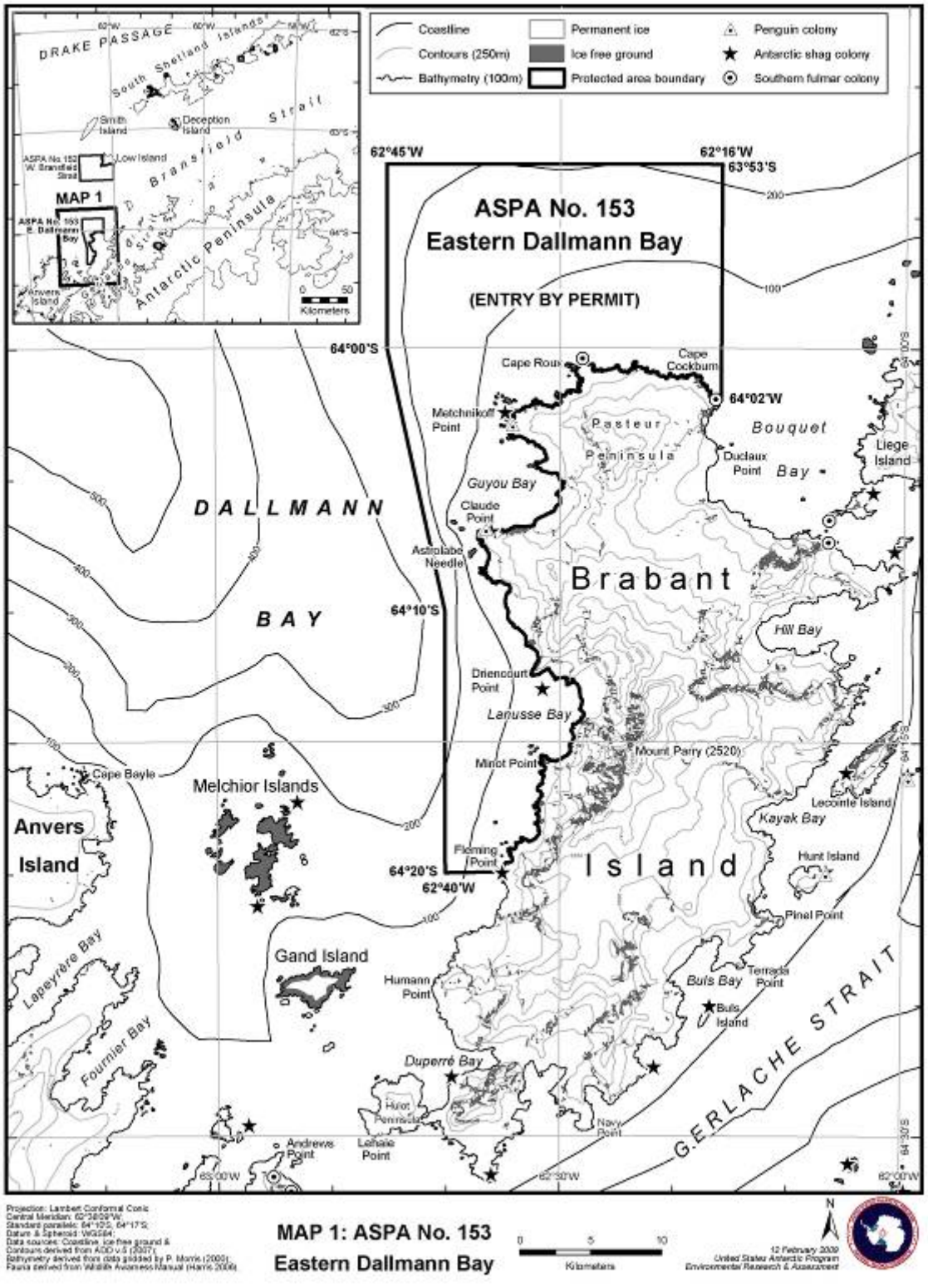
DRAKE PASSAGE
South Shetland Islands
Smith Island
Deception Island
Bransfield Strait
ASPA No.152 W. Bransfield Strait
Low Island
MAP 1
ASPA No. 153 E. Dallmann Bay
Antarctic Peninsula
Anvers Island
Kilometers
Coastline
Contours (250m)
Bathymetry (100m)
Permanent ice
Ice free ground
Protected area boundary
Penguin colony
Antarctic shag colony
Southern fulmar colony
62°45'W
62°16'W
63°53'S
ASPA No. 153
Eastern Dallmann Bay
(ENTRY BY PERMIT)
64°00'S
Cape Roux
Cape Cockburn
64°02'W
Metchnikoff Point
Pasteur Peninsula
Bouquet Bay
Liege Island
Ducloux Point
Guyou Bay
Claude Point
DALLMANN BAY
Astrolabe Needle
64°10'S
Brabant Island
HW Bay
Driencourt Point
Lanusse Bay
Mount Parry (2520)
Minot Point
Cape Bayle
Melchior Islands
Anvers Island
Lecointe Island
Kayak Bay
Fleming Point
64°20'S
62°40'W
Hunt Island
Pinel Point
Lapeyrère Bay
Gand Island
Humann Point
Buls Bay
Terrada Point
Buls Island
Fournier Bay
Duperré Bay
Hurot Peninsula
Navy Point
GERLACHE STRAIT
Andrews Point
Lehaie Point
65°00'W
62°30'W
62°00'W
64°30'S
Projection: Lambert Conformal Conic
Central Meridian: 62°38'09"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 (2003)
Fauna derived from Wildlife Awareness Manual (Harris 2006)
MAP 1: ASPA No. 153
Eastern Dallmann Bay
0 5 10
Kilometers
N
12 February 2009
United States Antarctic Program
Environmental Research & Assessment

Management Plan for

Antarctic Specially Protected Area No. 162

MAWSON'S HUTS, CAPE DENISON, COMMONWEALTH BAY, GEORGE V LAND, EAST ANTARCTICA

Latitude 67º 00' 30" S, Longitude 142º 39' 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 7.3 m x 7.3 m, 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 5.5 m x 4.9 m was adjoined to the living quarters and equipped as a workshop. A 1.5 m 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.

II. Measures

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 1.8 m x 1.8 m 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 5.5 m x 2 m 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 programs;
- 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.

[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.

3. Management Activities

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

- programs 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) metre 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

5.1 Geographical coordinates, boundary markers and natural features

Cape Denison is a 1.5 km-wide peninsula projecting into the centre of Commonwealth Bay, a 60 km-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 400 m long indentation in the coast.

Mawson's Main Hut is located about 65 m from the harbour (Map A). The Transit Hut is located 40 m northeast of the Main Hut; the Magnetograph House is approximately 310 m north-northeast of the Main Hut; and the Absolute Magnetic Hut is about 275 m 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: 67º 00' 31" S, 142º 39' 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.

5.2 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.

5.3 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 160 m 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.

5.4 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.

8.1 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.

8.1.1 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 programs are exempt from the provisions of this sub-section.

8.2 Activities which are or may be conducted within the Area

- Activities related to the regular program 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.

8.3 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 program. 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.

8.4 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.

8.5 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.

8.6 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.

8.7 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.

8.8 Disposal of wastes

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

8.9 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.

8.10 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

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Angela Bender, mapping officer, Australian Antarctic Division, pers. comm. 9 April 2003; 16 April

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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

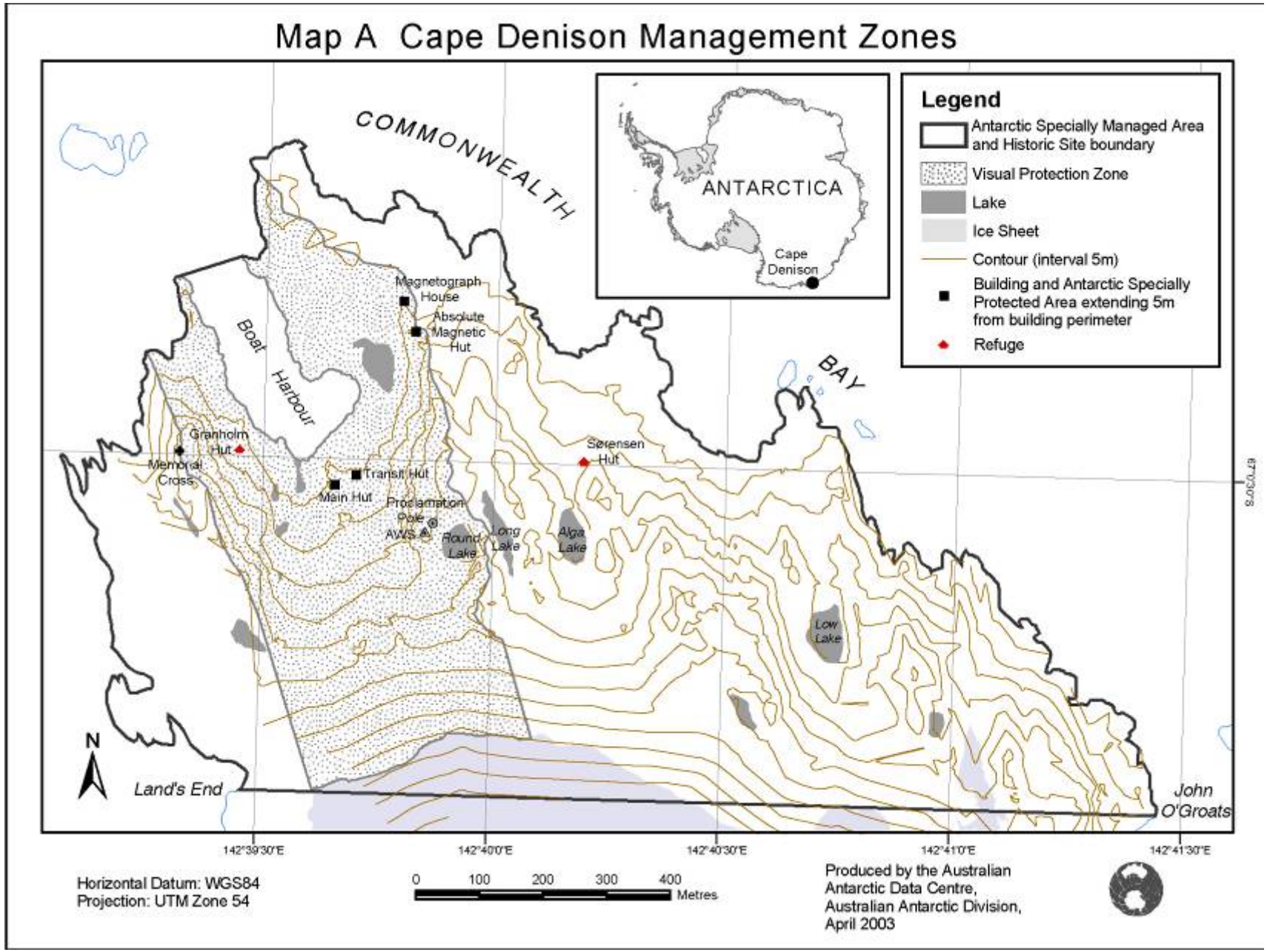
Buelliaceae

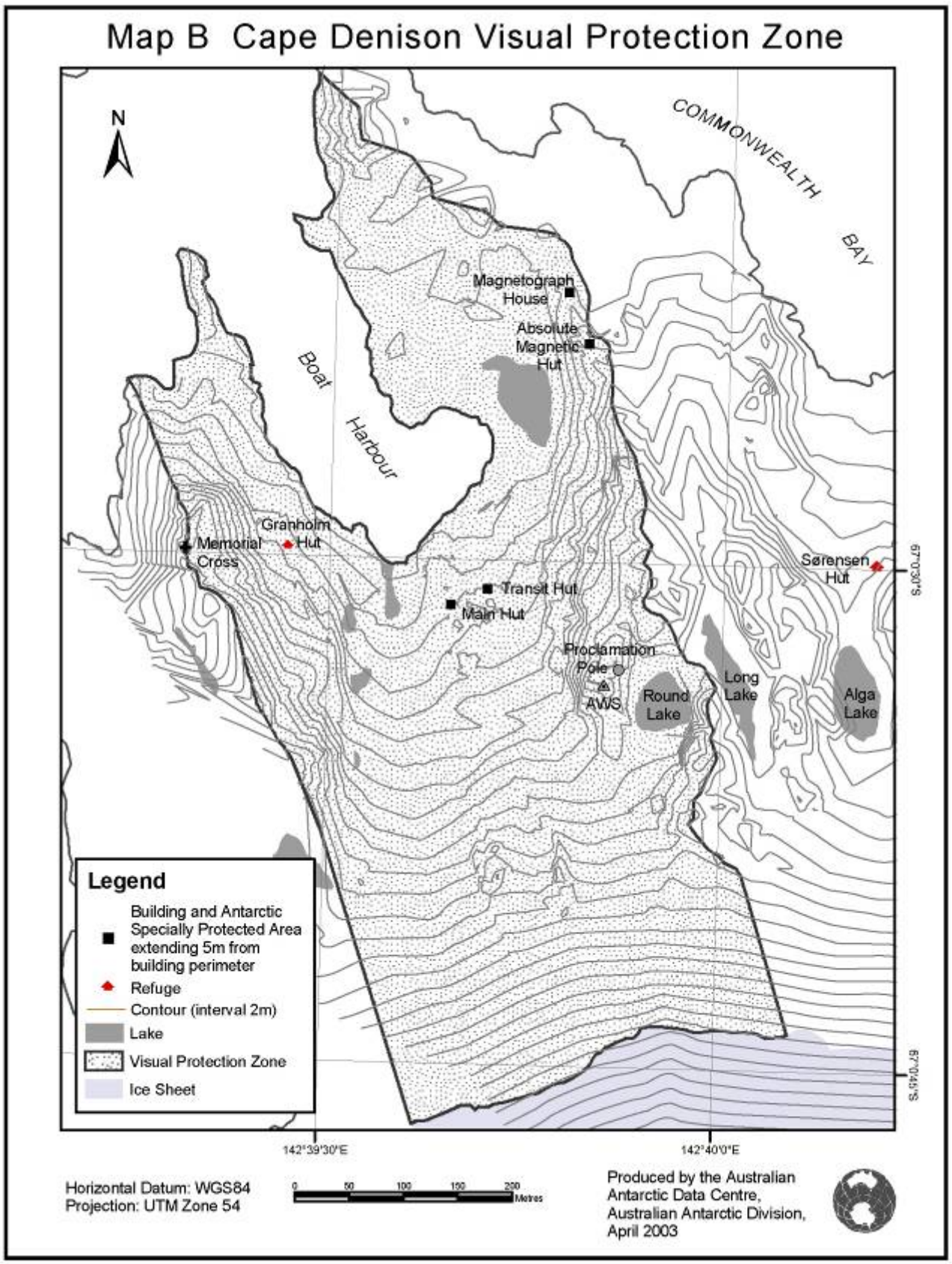
Buellia frigida Darb.

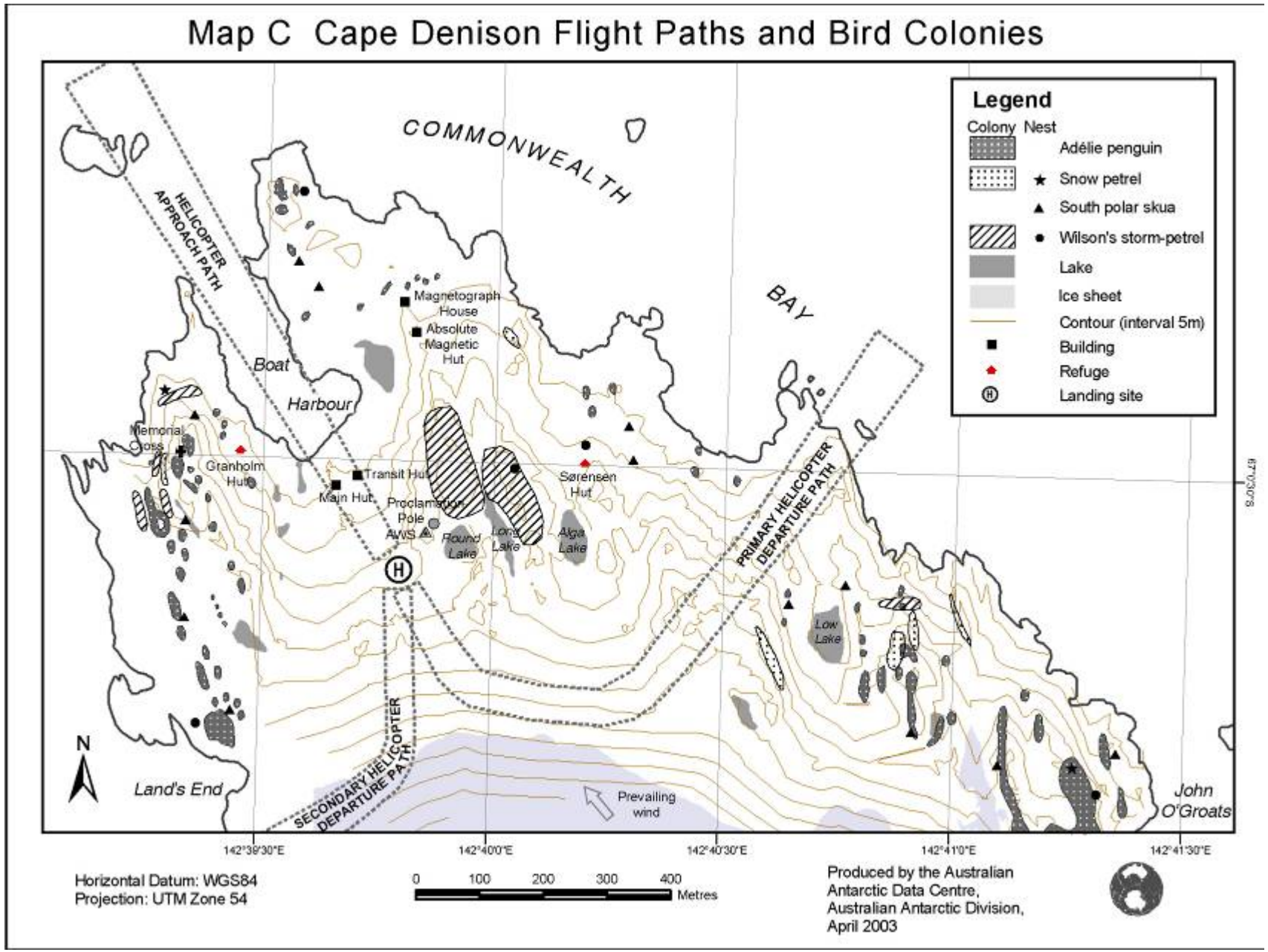
BRYOPHYTES

No bryophytes evident at Cape Denison.

There are numerous non-marine algae; however, no surveys have been undertaken.


Map A Cape Denison Management Zones
COMMONWEALTH
BAY
Boat Harbour
ANTARCTICA
Cape Denison
Legend
Antarctic Specially Managed Area and Historic Site boundary
Visual Protection Zone
Lake
Ice Sheet
Contour (interval 5m)
Building and Antarctic Specially Protected Area extending 5m from building perimeter
Refuge
Magnetograph House
Absolute Magnetic Hut
Granholm Hut
Memorial Cross
Transit Hut
Main Hut
Proclamation Pole
AWS
Round Lake
Long Lake
Alga Lake
Sørensen Hut
Low Lake
Land's End
John O'Groats
N
142°39'30"E
142°40'0"E
142°40'30"E
142°41'0"E
142°41'30"E
67°0'30"S
Horizontal Datum: WGS84
Projection: UTM Zone 54
0 100 200 300 400
Metres
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, April 2003


Map B Cape Denison Visual Protection Zone
N
COMMONWEALTH BAY
Boat Harbour
Magnetograph House
Absolute Magnetic Hut
Granholm Hut
Memorial Cross
Transit Hut
Main Hut
Proclamation Pole
AWS
Round Lake
Long Lake
Alga Lake
Sørensen Hut
67°03'0"S
67°04'0"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
COMMONWEALTH
BAY
HELICOPTER APPROACH PATH
Boat Harbour
Magnetograph House
Absolute Magnetic Hut
Memorial Cross
Granholm Hut
Transit Hut
Main Hut
Proclamation Pole
AWS
Round Lake
Long Lake
Alga Lake
Sørensen Hut
PRIMARY HELICOPTER DEPARTURE PATH
Low Lake
SECONDARY HELICOPTER DEPARTURE PATH
Land's End
John O'Groats
Prevailing wind
N
Legend
Colony Nest
Adélie penguin
Snow petrel
South polar skua
Wilson's storm-petrel
Lake
Ice sheet
Contour (interval 5m)
Building
Refuge
Landing site
142°39'30"E
142°40'0"E
142°40'30"E
142°41'0"E
142°41'30"E
67°0'30"S
Horizontal Datum: WGS84
Projection: UTM Zone 54
0 100 200 300 400
Metres
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, April 2003

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*), Pale-faced 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.

II. Measures

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 plagioclase-phyric 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).

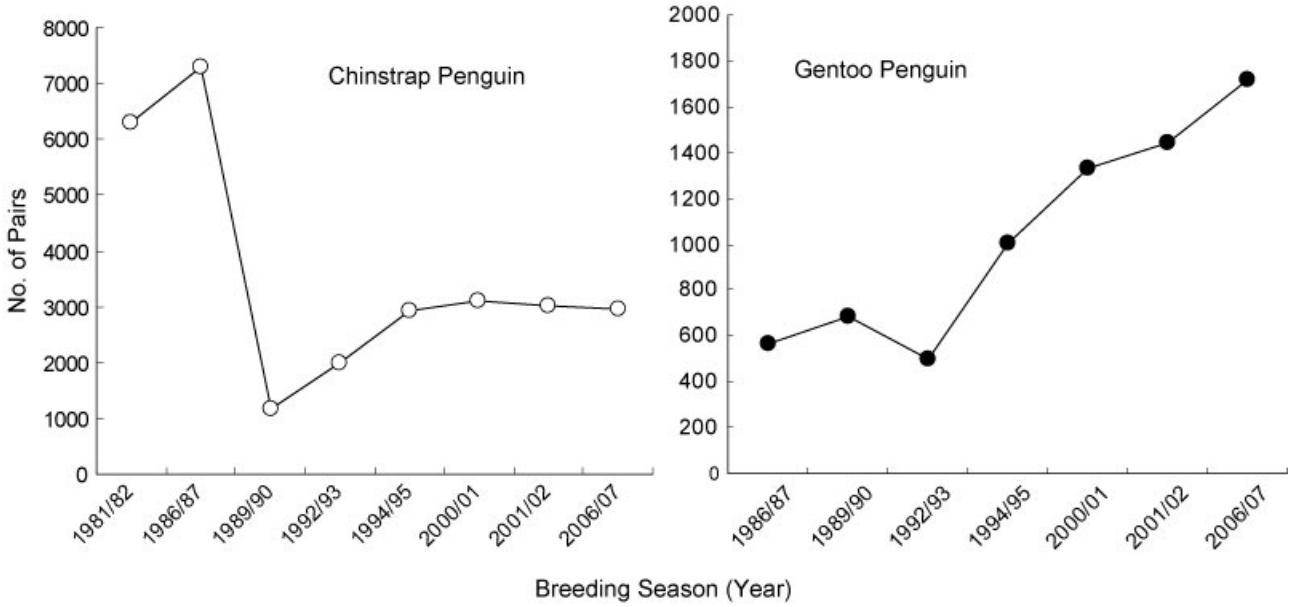


Figure 1. Breeding populations of Chinstrap Penguin and Gentoo Penguin at the Narębski Point (Jablonski, 1984; Trivelpiece *et al*., 1987; Yoon, 1990; MOST, 1993; MAF, 1997; Kim, 2002; MEV, 2007)

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). Pale-faced 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;

II. Measures

- 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.

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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.

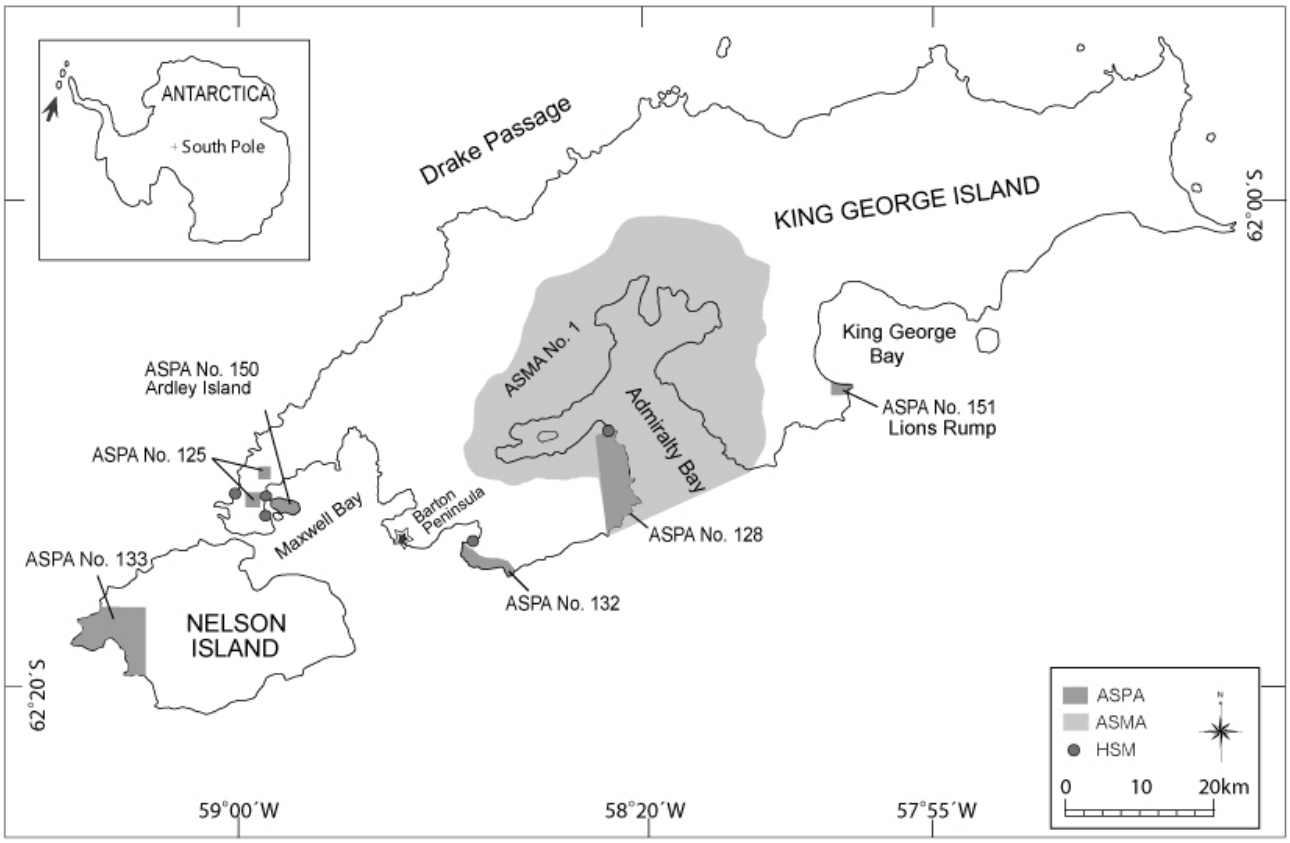
Mosses
Andreaea depressinervis Cardot
Andreaea gainii Cardot
Andreaea regularis Müll. Hal.
Bartramia patens Brid.
Bryum argenteum Hedw.
Bryum orbiculatifolium Cardot & Broth.
Bryum pseudotriquetrum (Hedw.) C.F. Gaertn. et al.
Ceratodon purpureus (Hedw.) Brid.
Chorisodontium aciphyllum (Hook. f. & Wils.)
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

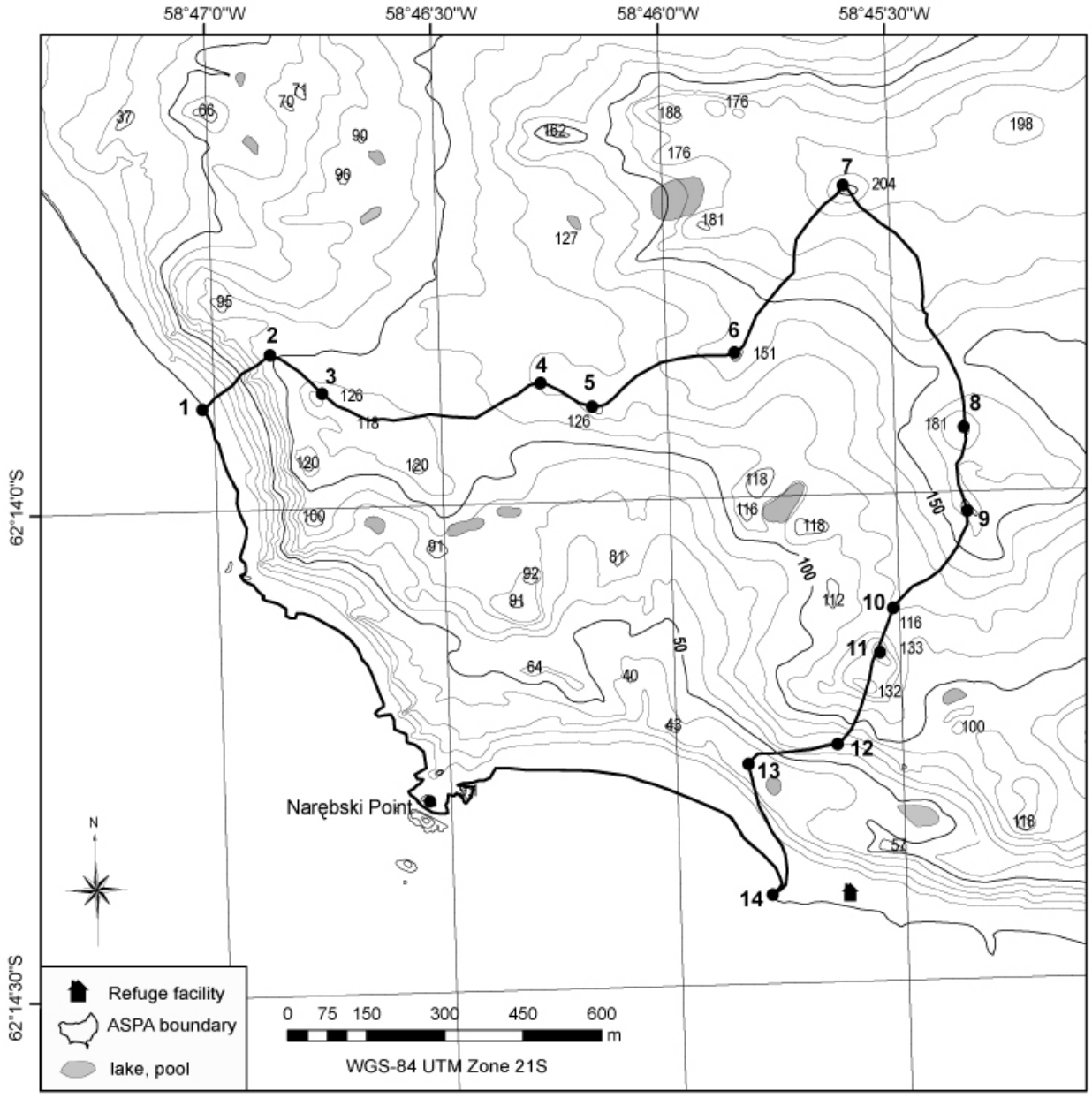
Algae
Prasiola crispa (Ligtf.) Menegh.

Flowering plant
Deschampsia antarctica Desv.

ANNEX II. Maps

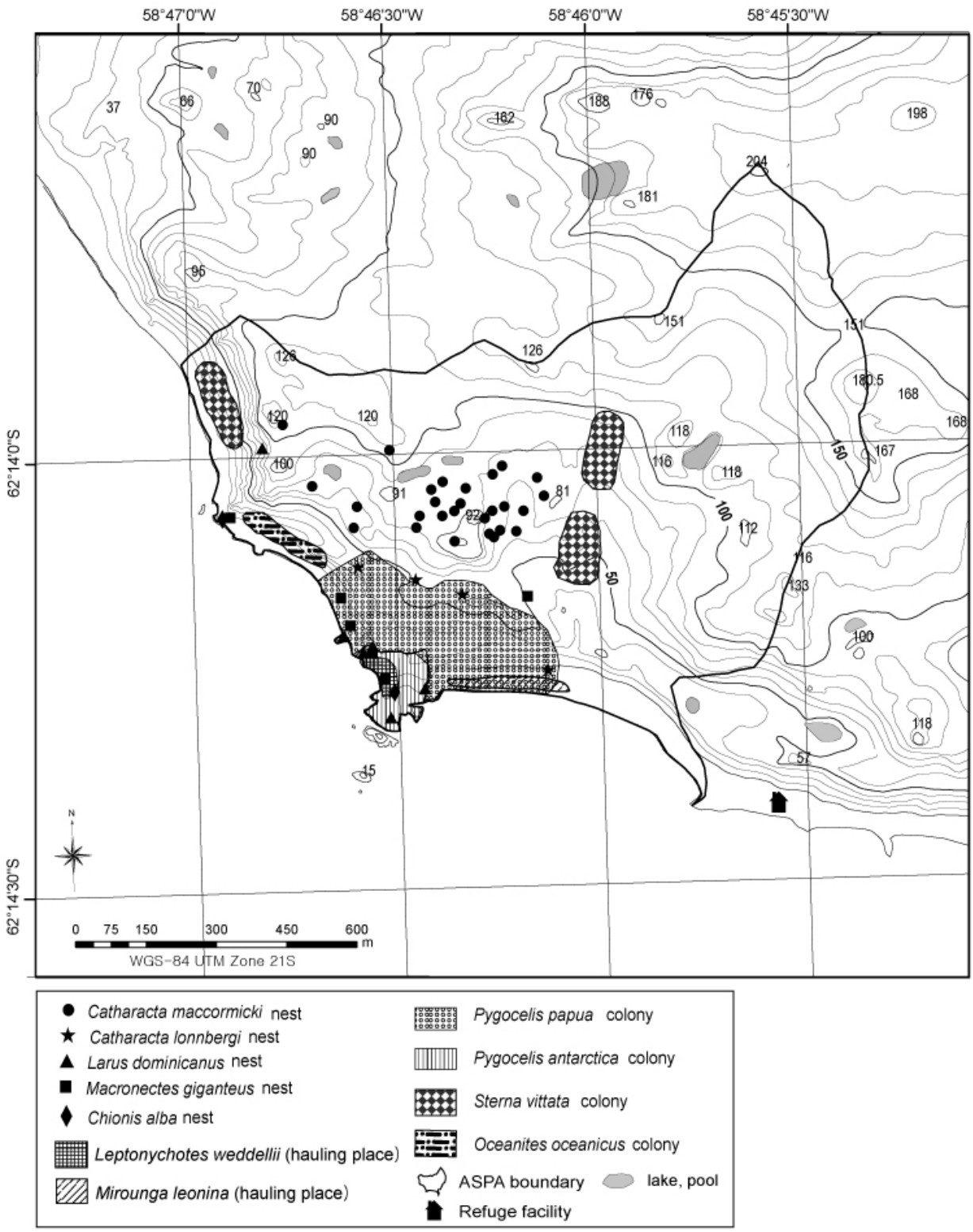


Map 1. Location of Narębski Point (✦) in relation to King George Island and the existing protected areas (ASMA, ASPAs, HSMs)

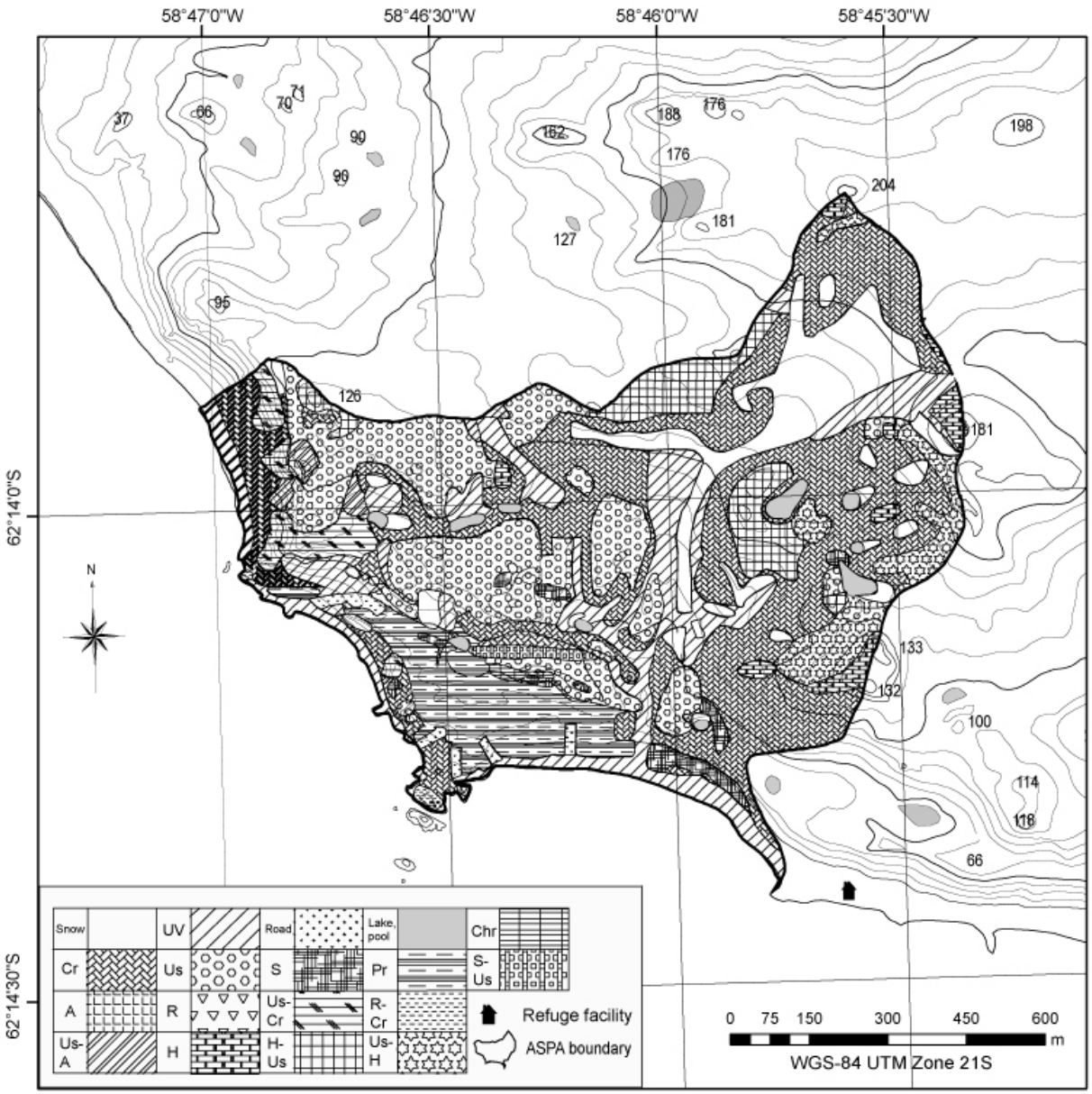


	Latitude	Longitude		Latitude	Longitude
1	62°13′53.69″S	58°47′01.31″W	9	62°14′00.86″S	58°45′20.85″W
2	62°13′50.48″S	58°46′52.37″W	10	62°14′06.96″S	58°45′30.62″W
3	62°13′52.85″S	58°46′45.84″W	11	62°14′09.73″S	58°45′33.08″W
4	62°13′52.53″S	58°46′16.62″W	12	62°14′15.30″S	58°45′38.87″W
5	62°13′54.18″S	58°46′09.53″W	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



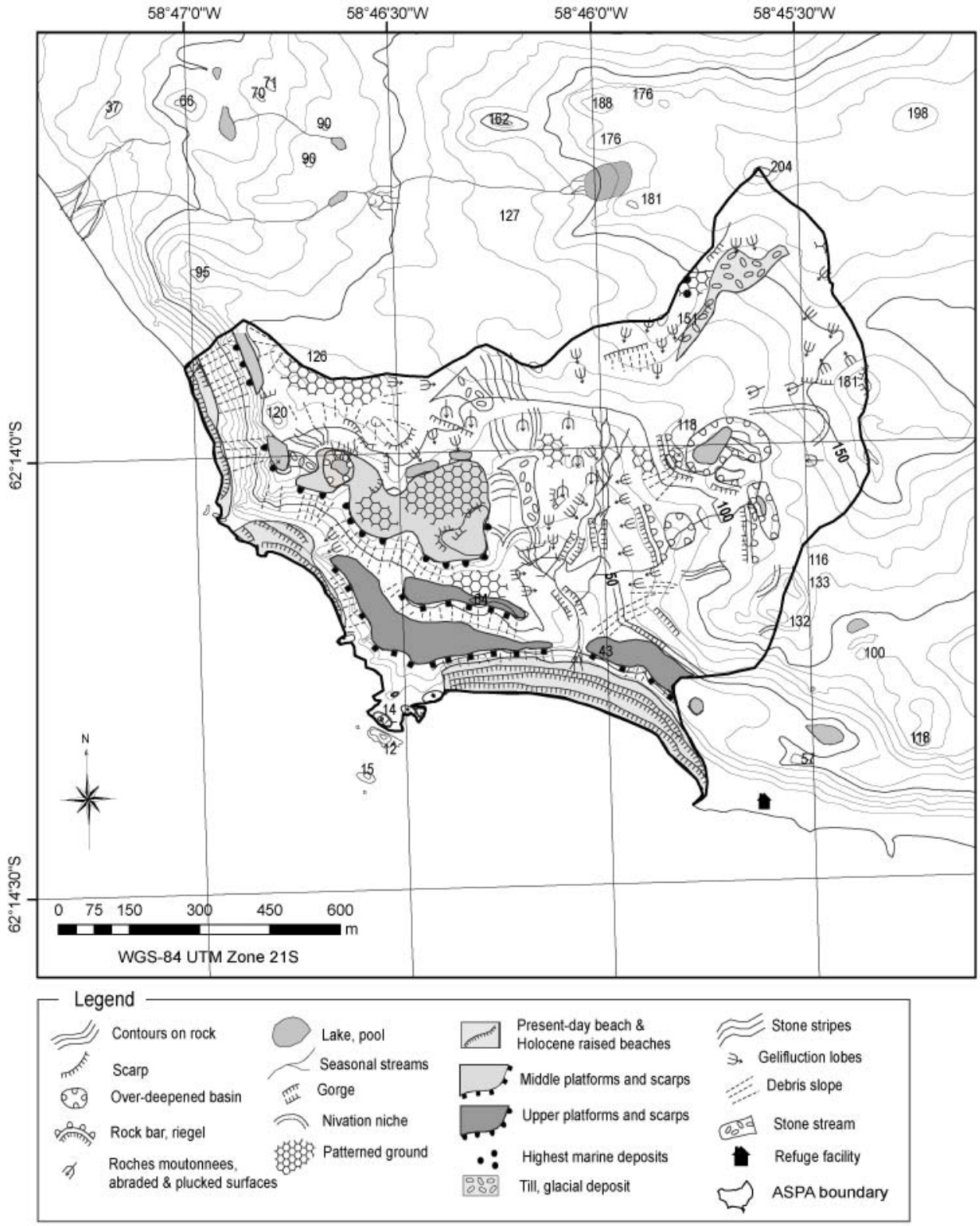
Community abbreviations

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*

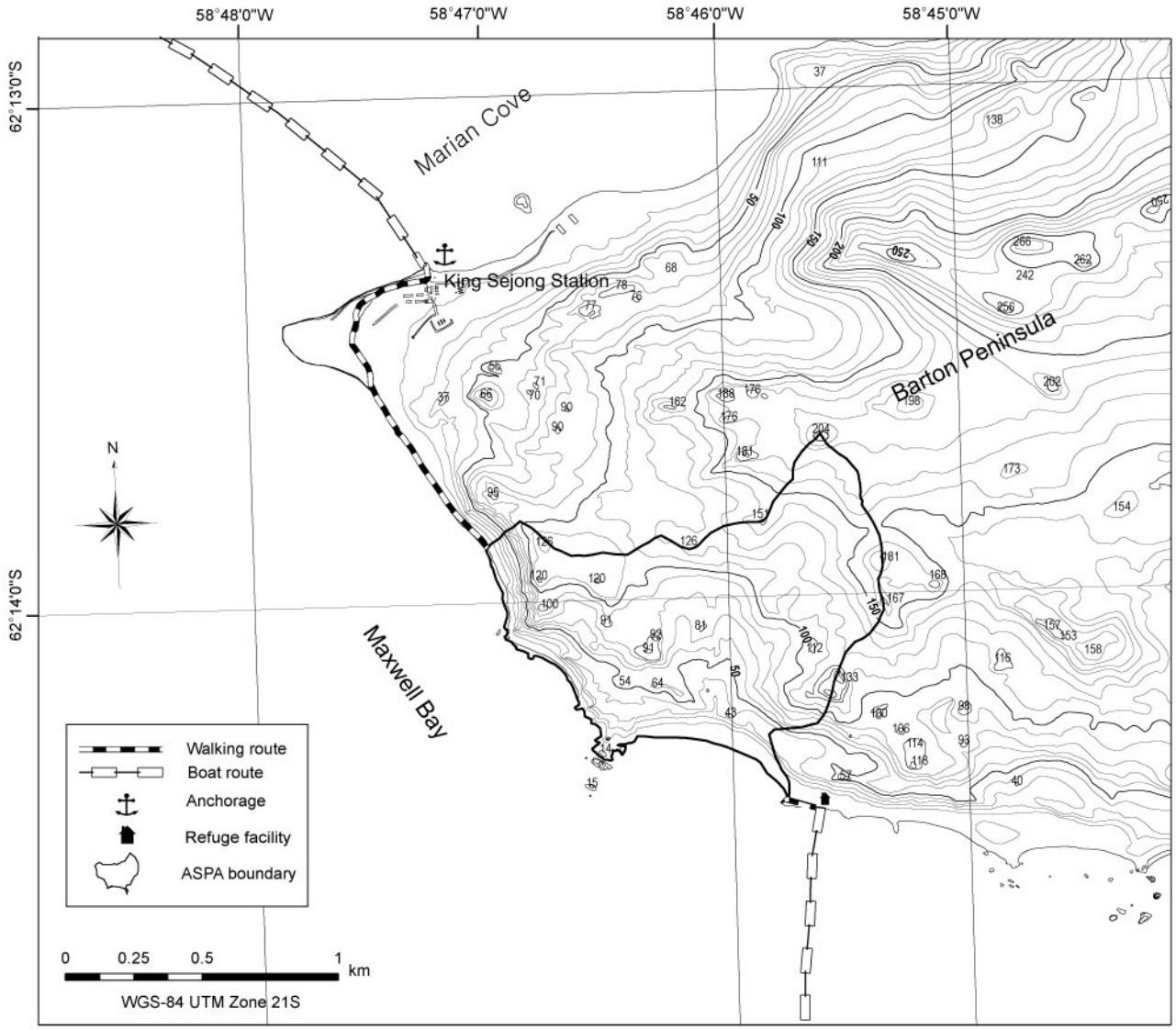
Total coverage of each community (%)

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