The Antarctic Treaty

Measures adopted at
the Forty-fifth Consultative Meeting

Helsinki, 29 May – 8 June 2023

Presented to Parliament
by the Secretary of State for Foreign, Commonwealth and Development Affairs
by Command of His Majesty
March 2024

CP 1048

This publication is available at www.gov.uk/official-documents

Any enquiries regarding this publication should be sent to us at Treaty Section, Foreign, Commonwealth and Development Office, King Charles Street, London, SW1A 2AH

ISBN 978-1-5286-4761-8
E03096019 03/24

Printed on paper containing 40% recycled fibre content minimum

Printed in the UK by HH Global on behalf of the Controller of His Majesty's Stationery Office

MEASURES ADOPTED AT THE FORTY-FIFTH ANTARCTIC TREATY CONSULTATIVE MEETING

Helsinki, Finland 29 May – 8 June 2023

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

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

The approval procedures set out in Article 6 (1) of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty[2] apply to Measures 1 to 18 (2023).

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[1]As defined in Decision 1 (1995), published in Miscellaneous No. 28 (1996) Cm 3483
[2] Treaty Series No. 15 (2006) Cm 6855
The texts of the Antarctic Treaty together with the texts of the Recommendations of the first three Consultative Meetings (Canberra 1961, Buenos Aires 1962 and Brussels 1964) have been published in Treaty Series No. 97 (1961) Cmnd. 1535 and Miscellaneous No. 23 (1965) Cmnd. 2822. The text of the Environmental Protocol to the Antarctic Treaty has been published in Treaty Series No. 6 (1999) Cm 4256. The text of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty has been published in Treaty Series No. 15 (2006) Cm 6855.

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

Measures Adopted at the XLIV Consultative Meeting held at Helsinki, Finland 29 May – 8 June 2023

Measure 1 (2023)

Antarctic Specially Managed Area No 1 (Admiralty Bay, King George Island): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation X-5 (1979), which designated the Western shore of Admiralty Bay as Site of Special Scientific Interest ("SSSI") No 8, and Decision 1 (2002), which renamed and renumbered the Site as Antarctic Specially Protected Area ("ASPA") No 128;
- Recommendation XIII-16 (1985), which added Historic Site and Monument ("HSM") No 51 Puchalski Grave to the List of Historic Sites and Monuments ("the List");
- Measure 2 (2006) which designated Admiralty Bay, King George Island as ASMA 1, within which ASPA 128 and HSM 51 are located, and adopted a Management Plan for the Area;
- Measure 14 (2014), which adopted a revised Management Plan for ASMA 1;

Noting Measure 4 (2014), which adopted a revised Management Plan for ASPA 128;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASMA 1;

Desiring to replace the existing Management Plan for ASMA 1 with the revised Management Plan;

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

1. the revised Management Plan for Antarctic Specially Managed Area No 1 (Admiralty Bay, King George Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Managed Area No 1 annexed to Measure 14 (2014) be revoked.

Management Plan for Antarctic Specially Managed Area No.1

ADMIRALTY BAY, KING GEORGE ISLAND

Introduction

Admiralty Bay is located on King George Island, South Shetland Islands, about 125 kilometers from the northern tip of Antarctic Peninsula (Fig. 1). The primary reason for its designation as an Antarctic Specially Managed Area (ASMA) is to protect its outstanding environmental, historical, scientific, and aesthetic values. Admiralty Bay was first visited by sealers and whalers in the 19th and early 20th centuries, and relics from these periods still remain. The area is characterized by magnificent glaciated mountainous landscape, varied geological features, rich sea-bird and mammal breeding grounds, diverse marine communities, and terrestrial plant habitats. For nearly four decades coordinated scientific research has been conducted in Admiralty Bay by five different countries. The studies on penguins have been undertaken continuously since 1976, and is the longest ever done in Antarctica. Admiralty Bay also has one of the longest historical series of meteorological data collected for the Antarctic Peninsula, considered as one of the most sensitive areas of the planet to climate change.

The Area comprises environments laying within three domains defined in the Environmental Domains Analysis for Antarctica: Environment A – Antarctic Peninsula northern geologic; Environment E – Antarctic Peninsula, Alexander and other islands main ice fields and glaciers; and Environment G – Antarctic Peninsula offshore islands (Resolution 3 (2008)). Under the Antarctic Conservation Biogeographic Regions (ACBR) classification the Area lies within ACBR 1 – Northwest Antarctic Peninsula (Resolution 3 (2017)).

The Area, which includes all the marine and terrestrial areas within the glacial drainage basin of Admiralty Bay, is considered to be sufficiently large to provide adequate protection to the values described below.

Admiralty Bay has become a site of increasingly diverse human activities, which are continuously growing, becoming more complex and creating a situation of conflicting uses. During the last 30 years, more stations have settled, visitors increased in numbers per year, from a few hundreds to over 3000 and commercial krill fishing operations have been conducted in the Area in the season 2009/2010. Better planning and coordination of existing and future activities will help to avoid or to reduce the risk of mutual interference and minimize environmental impacts, thus providing more effective mechanisms for the conservation of the valuable features that characterize the Area.

Five Consultative Parties – Brazil, Ecuador, Peru, Poland and the United States – have active research programs in the area. Poland and Brazil operate two all-year round stations (Poland: Henryk Arctowski Station at Thomas Point; and Brazil: Comandante Ferraz Antarctic Station at Keller Peninsula). Peru and the United States operate two summer stations (Peru: Machu Picchu Station at Crepin Point; USA:

Copacabana Field Camp south of Llano Point). Ecuador has a refuge, República del Ecuador at Hennequin Point,. There are several small permanent and semi-permanent installations elsewhere.

The Area includes one ASPA (ASPA No. 128 Western Shore of Admiralty Bay – former SSSI No. 8) and one Historic Site and Monument (HSM No. 51: Puchalski Grave) at Arctowski Station. Seven graves at Keller Peninsula are under special protection.

In addition to numerous scientists, supporting personnel and research expeditions, Admiralty Bay is visited by an increasing number of tourists, the latter mainly as organized tourist ship expeditions and private yachts.

A Management Plan for designating Admiralty Bay and its surroundings (herein called the Area) as an Antarctic Specially Managed Area (ASMA), under Annex V of the Protocol to the Antarctic Treaty on Environmental Protection (herein called Protocol), was jointly proposed by Brazil and Poland, in coordination with Ecuador and Peru and voluntarily adopted by the ATCPs at ATCM XX (Utrecht, 1996). In 2006, a revised version of the Management Plan was presented and approved at the Committee for Environmental Protection, which designated the Area as ASMA No 1 (Measure 2, CEP IX – ATCM XXIX, 2006, Edinburgh). In 2014 the latest version of the Management Plan was presented and approved at the Committee for Environmental Protection (Measure 14, CEP XVII – ATCM XXXVII, 2014, Brasilia).

This revised management plan was prepared with reference to the "Guidelines for the preparation of ASMA management plans" (Resolution 1, CEP XX – ATCM XL, 2017, Beijing).

1. Description of values to be protected

- *Environmental values*

The area of Admiralty Bay is representative of the terrestrial, limnetic, coastal, near-shore, pelagic, and fjord bottom ecosystems of King George Island. Flora is mostly represented by more than 300 species of lichens, around 63 species of mosses and numerous algae, as well as two species of native vascular plants (Deschampsia antarctica and Colobanthus quitensis). Plant associations are accompanied by a large diversity of soil microorganisms. Twenty-four species of birds and six species of pinnipeds have been registered for the Area, but only fourteen species of birds and three species of pinnipeds actually breed within the Area. The marine ecosystem of the bay largely reflects the general environmental conditions prevailing in the South Shetland Islands. The Admiralty Bay shelf benthic community is characterized by high species richness and high assemblage diversity. Giant algae (specially Himantothallus sp.), with a very diverse associated fauna, are found near the coastal zone, between 15 and 30 m depth, in several sites of the bay. An unique site, Napier

Rock, situated at the entrance of the bay, supports especially rich and highly diverse benthic invertebrate fauna. Fish are represented by fifteen species of Nototheniidae.

- *Scientific values*

Admiralty Bay is of outstanding scientific interest, especially for research in biology and geoscience. King George Island was discovered in 1819 and since that time has been visited occasionally by whalers, sailors and scientists. More important geological investigation was performed by British scientists from Base G on Keller Peninsula, Admiralty Bay between 1948 – 1960. Several scientific expeditions were carried out also later, However, diverse and continuous scientific activities have been undertaken in the Area since the 1970s supported by the Polish Henryk Arctowski Station, by the Brazilian Comandante Ferraz Station and by the US Antarctic Program at ASPA No. 128 Western Shore of Admiralty Bay. Research activities at the Peruvian Machu Picchu Station (at Crepin Point) and at the Ecuadorian refuge (at Hennequin Point) have occurred intermittently during the Antarctic summer seasons.

The main subjects for field and laboratory research at the Polish and Brazilian stations have been marine and terrestrial biology, including physiology and adaptation of Antarctic fish and krill; taxonomy and ecology of the benthic fauna; vascular plants; mosses and lichens; terrestrial and marine ecology; migration, and dispersion of birds; microbiological studies. A long-term research project on the biology and dynamics of bird populations (mainly Pygoscelid penguins and Catharacta skuas) has been carried out by the US Antarctic Program since 1976. This study is relevant to the CCAMLR Ecosystem Monitoring Programme (CEMP). Since 1985 a research program monitoring non-native grass Poa annua around Arctowski Station and in ASPA No 128 has been conducted, followed by the program of eradication of P. annua from Point Thomas Oasis (IP 150, ATCM XLII - CEP XXII, 2019) Prague, Czech Republic, Galera et al. 2017). Since the mid-twentieth century, Antarctica has experienced many of the planet’s largest regional temperature trends. For example, over the second half of the twentieth century, West Antarctica and the Antarctic Peninsula warmed more than twice as fast as the global average, but over the first two decades of the twenty-first century, temperature trends there strikingly reversed. Such strong regional changes are often most pronounced in the polar regions due to positive ice-albedo feedbacks that amplify warming, while stratospheric ozone depletion and extreme decadal variability can even induce regional cooling (Clem et al. 2020).

In King George Island, a retreat of the valley-type tidewater glaciers front by 1 km has been observed since 1956. Retreat of glaciers in the middle and outer parts of Admiralty Bay has exposed new ice-free coastal areas suitable for breeding grounds of some species of seals and colonization by plants. The ice-free areas have enlarged threefold during the last decades, creating conditions for inhabitation and succession. Phytosociological research and vegetation mapping of the areas successively freed by retreating glaciers are carried out.

Due to warmer temperatures, winter sea-ice duration in the region is shortening, impacting spawning and nursery areas of krill (Euphausia superba). The decrease in krill population has been found to coincide with an increase in salps (Salpa thompsoni). These changes among key species may have profound implications for the food web of the Area (Plum et al. 2020).

Since 2006, the overall number of Adelie (Pygoscelis adeliae) and chinstrap penguins (Pygoscelis antarctica) has declined by approximately 37%. However, the population of gentoo penguins (Pygoscelis papua) has more than doubled since the establishment of the ASMA. The numbers of fur seals change in multi-annual cycles. The abundance of elephant seals has kept stable, whereas those of Weddell and crabeater seals has declined.

Other studies conducted in the Area include geology and paleontology, glaciology and palaeoclimatology of the King George Island ice cap; and glacio-marine sedimentation within Admiralty Bay. Paleogene and Neogene rocks of King George Island preserve evidence of globally important environmental and climatic transition from greenhouse to icehouse world, which culminated at the Eocene-Oligocene boundary. That best record of the first Cenozoic glaciation in the Southern Hemisphere is well documented in stratigraphical, lithological and paleontological investigations on King George Island, which were summarized in a geological map done by Birkenmajker in 2002. The Eocene base of these rock formations build up the bedrock of ASMA 1 area and is continued eastward in younger rocks to the end of the island, proving Oligocene and Miocene glaciations.

Additional scientific values to note from the landscape viewpoint including geological and geomorphological attributes, are the following:

- The island displays landforms in ice-free areas resulting from proglacial and aeolian erosion. Sea action led to formation of beach bands along shoreline, several of them raised up to 20 m a.s.l. due to glacial isostatic uplift during the Holocene.
- Presence of early-middle Eocene fossiliferous sites of great scientific importance, at Ulmann and Hennequin Points, Keller Peninsula, Ezcurra Inlet, along the coastal area, behind Arctowski Station, on Błaszczyk moraine and at Red Hill. Fossilized wood of Araucaria, Nothofagus and leaf impressions of higher plants and pteridophytes, are common and well-preserved.
- Presence of well-preserved paleosols of ages dating back to 20 MA, with evidence of temperate to subtropical paleoclimates in their formation, with great scientific importance. These features can be found in Punta Plaza, Copacabana and Hennequin Point.
- Permafrost is generally present on northern slopes at altitudes higher than 30 meters, being absent or sporadic below that level. The Admiralty Bay is considered a key area for monitoring permafrost in the Shetlands Archipelago, and for being representative of the well-protected inner bay zones under Maritime Antarctic climate.

A year-round seismic and Earth-magnetism observatory, was functioning at Arctowski Station from 1978 until 1994, and in 2013 a research program aimed at monitoring the structure of Earth’s electric field was begun at Arctowski Station. Studies on atmospheric chemistry, geomagnetism, the ionosphere and astrophysics have been conducted at Ferraz Station since 1984. A meteorological station was operational at Arctowski from 1977 until 2000 and a new one has been operational since 2012. At Ferraz Station a meteorological station had been operational from 1984 until 2012 to provide basic data and to support logistic operations. Research on upper atmosphere winds has been developed at Machu Picchu Station with the aid of a MST radar. Since 2006, a long-term research project on marine plankton, macrobenthos biodiversity and quality of the marine environment in Mackellar Inlet has been carried out. Also ozone layer decrease anomalies study has been developed.

Both Arctowski and Ferraz stations have hosted scientists from many countries (Argentina, Belgium, Chile, Colombia, Denmark, Germany, Russia, The Netherlands, New Zealand, North America, Uruguay, Spain, Italy, Czech Republic, Ukraine, Bulgaria, Peru, Turkey and others) There is a strong tradition of co-operation between Polish and Brazilian scientists in matters related to Admiralty Bay and the South Shetland Islands as a whole. Both countries cooperated during the International Polar Year (2007-2008) through the Census of Antarctic Marine Life and comprehensively gathered marine benthic data from the past 30 years.

A comprehensive study of the state of the environment in the ASMA-1 was conducted by Brazilian researchers from 2002 to 2006 comprising the analysis of a series of biotic and abiotic parameters. Brazil created a National Institute of Science and Technology in Antarctic Environmental Research (INCT-APA) in 2008, which ensured the continuity of a monitoring program and other environmental studies until 2011. After the EACF fire (2012), Brazil included soil and vegetation monitoring around Ferraz Station and, for the marine compartment, prioritized the shallow coastal area of Admiralty Bay, contributing to the monitoring of human activities in the Area and for the implementation of environmental management strategies for the ASMA.

- *Historic values*

The presence of sheltered deep harbors and accessible beaches ensured an early start to activities in Admiralty Bay. The bay offered protection for ships in the area during the sealing and whaling periods in the 19th and early 20th centuries, and some remains related to those periods still exist (e.g. old whaling boat on Keller Peninsula, collection of whaling harpoons at Arctowski Station). Whale bones cover the beaches and are part of the landscape, remaining as heritage of those periods.

The Area was visited by the second French Antarctic Expedition Pourquoi Pas, under Dr J B Charcot (1908-10), and by D Ferguson (1913-14), a geologist who took part in a British whaling expedition. Reports on minerals and rocks collected during these expeditions, published between 1910 and 1921, are among the first earth-science publications on Admiralty Bay and the South Shetland Islands. The famous British Discovery voyages of 1934 and 1937 collected more rocks, as well as plants and animals from the Area. Results published from 1948 to 1964 constituted a substantial contribution to knowledge of the geology of Admiralty Bay. Argentina established a refuge hut at Keller Peninsula in 1948 (since dismantled) and the work of Argentinean geologists in Admiralty Bay in 1953 focused on fossil plants from the Tertiary age.

The UK Base "G", on Keller Peninsula, was established in 1947 as a center for meteorological observations, and glaciological and geological research in the Area. In 1961 it was closed and later on dismantled (1995).

A small hut named Campo Bove was built in Ezcurra Inlet in 1975 by the Italian expedition led by Giacomo Bove. It was dismantled in March 1976.

- *Aesthetic values*

Admiralty Bay has basic physiographic and aesthetic values as one of the most typical examples of bay/fjord settings in the South Shetland Islands. The ice-free areas within Admiralty Bay were formed by recent and raised pebble-cobble beaches, recent and sub-recent moraines, eskers, mountainous peninsulas, rocky islets, spurs, arêtes and nunataks. The terrain is heavily shaped by glacial, nival and coastal marine processes. These, together with the geological features of the area, add to the great scenic beauty of the landscape.

- *Educational and touristic values*

Admiralty Bay is a place of special attraction to tourists because of its accessibility, biological diversity and presence of several scientific stations. Therefore, its sites of ecological interest and scientific installations in the Area are frequently visited by tourists and participants in non-governmental expeditions, who have thus an opportunity to become familiar with the Antarctic environment and international scientific operations.

Education and outreach of Antarctic science should be widely encouraged in countries that develop scientific research in the Area. Penguins and krill are easily observed and are considered as iconic species of the Antarctic. The capture of images and videos provide a high level of educational potential. Promoting and facilitating the incorporation of Antarctic science at all levels of formal education, and informing the public and the media about the importance of studies in Antarctica are part of the strategy for Antarctic conservation (see Summary of SCAR's Strategic Plan 2017-2022 - https://www.scar.org/scar-library/other-publications/strategic-plans/774-2017-strategic-plan). Furthermore, as a region that distinctly shows the effects of climate change, the Area is considered an outdoor laboratory
and represents a great opportunity to encourage interest and training of early career researchers

2. Activities to Be Managed

- *Scientific activities*

Intensive and relevant research is conducted at Admiralty Bay, specially at summer season, when many scientists are at field, collecting samples for their scientific research, which cover all areas of knowledge relevant to the Antarctic continent.

- *Station operations and science support activities*

- Year-round stations are maintained throughout the year, which provide logistical support for scientific research conducted in this area.
- Currently, the Henryk Arctowski Polish Antarctic Station is being renovated.

- *Transportation*

There are several ways to move around ASMA, used by station staff, scientists, and tourists:

- on foot
- by zodiac boat
- on snowmobiles

- *Recreational activities and Tourism*

Admiralty Bay is a place willingly and frequently visited by tourists. Both cruise ships and private yachts appear in the bay. Tourists visit all-year-round stations, move within the designated routes around the facilities under the supervision of both Henryk Arctowski and Comandante Ferraz Antarctic Station's staff. Due to construction work being carried out on the Arctowski Station infrastructure, visits by tourists have been suspended until all work is completed.

- *Harvesting/fishing*

No fishing/harvesting is carried out in the area.

- *Environmental management*

Environmental monitoring is constantly carried out on the western shore of Admiralty Bay by the staff of the Henryk Arctowski station. The following are monitored:

- flora and fauna
- tourist traffic
- meteorological parameters
- alien species
- pollution

Environmental monitoring is constantly carried out at Keller Peninsula by the staff of the Comandante Ferraz Antarctic Station.

All pollution, rubbish, and alien species are removed in order to preserve the natural values of the area.

3. Aims and Objectives

The aim of this Management Plan is to conserve and protect the unique and outstanding environment of Admiralty Bay by managing and coordinating human activities in the Area in such a way as to provide long-term protection to the values, avoid possible conflict of interest and promote cooperation.

The specific objectives of management in the Area are to:

- Safeguarding the long-term scientific research in the Area while maintaining stewardship of the environment;
- Protecting important physiographic features, and the outstanding biological, ecological, scientific, historical and aesthetic values of the Area;
- Managing potential or actual conflicts of interest between different activities, including science, logistics, commercial fishing and tourism;
- Assisting with the planning and coordination of human activities in the Area;
- Ensuring that any marine harvesting activities are coordinated with scientific research and other activities taking place within the Area and are based on the precautionary approach;
- Avoiding or minimizing the risk of mutual interference and cumulative impacts on the terrestrial and marine environments;
- Improving the level of mutual assistance and co-operation among Parties operating in the Area;
- Encouraging communication and cooperation between users of the Area through dissemination of information on the Area and the provisions that apply;
- Minimizing the possibility of non-native species introduction through human activities and management of any non-native species already established in the Area;
- Managing visitation to the Area and promoting an awareness, through education, of its ecological and scientific significance.

4. Management Activities

The following management activities should be undertaken to achieve the aims of this Management Plan:

- Parties that have active research programs within the Area shall establish an Admiralty Bay Management Group to:
  - review the functioning and implementation of the Management Plan;

- monitor the Area to investigate possible sources of environmental impact including cumulative impacts;
- provide forum for facilitating communication among those working or visiting the Area, and for resolving potential conflicts;
- promote dissemination of information on this Management Plan to those working or visiting the Area;
- promote and encourage coordination of activities among those working or visiting the Area with the aim of protecting important values of the Area;
- promote and encourage cooperation among National Antarctic Programs conducting
  environmental monitoring of the Area with the aim of developing a joint environmental study of the Area;
- maintain a record of activities taking place in the Area.

- Parties belonging to the Management Group should consult amongst themselves with a view to designate a person to coordinate the implementation of the Management Plan in the Area (ASMA Coordinator). Designation will be for a 5 year period on a rotational basis. Duties of the ASMA Coordinator are:

  - Coordinate information exchange by Parties about the activities undertaken in the ASMA and analyze them in order to identify possible overlaps and unconformities in relation to the objectives of this Management Plan;
  - Report to the Parties and, as appropriate, to the CCAMLR or ATCM Secretariat, any incident that may cause impact to environment or research activities in the Area.

- Parties belonging to the Management Group should convene on an annual basis or when necessary to discuss all matters concerning the management of the Area. Other Parties and organizations active in the Area may be invited to participate in the discussions.
- National Antarctic Programs operating within the Area, as well as all other visitors, should undertake activities in accordance with the General Code of Conduct contained in this Management Plan.
- Wherever feasible, markers delimiting boundaries of already existing protected areas and other zones of ecological or scientific interest identified in this Management Plan with warnings for visitors about their nature should be provided, and removed when no longer necessary.
- Tour operators and other organizations planning activities in the Area should coordinate them with National Antarctic Programs operating in the Area in advance to ensure that they do not pose risks to its important values.
- National Antarctic Programs that have active research programs in the Area should make arrangements with other Parties that have installations and/or structures now abandoned to consider their value for reuse. Conservation plans should be formulated if any of the installations are assessed to be of historical value. If not, plans should be formulated for their removal in accordance with the provisions of Annex III on Waste Disposal and Waste Management to the Protocol on Environmental Protection.

- Parties operating permanent/seasonal facilities in the Area are encouraged to consult and, as far as practicable, coordinate their contingency plans for oil spills and other possible accidents with the aim of developing a multi-operator plan encompassing the Area.
- National Antarctic Programs, tour operators and other organizations active in the Area should seek to minimize to the maximum extent the risk of introduction of non-native species. Any non-native species present within the Area should be systematically monitored, and policies on its containment or/and eradication should be developed as a priority.
- National Antarctic Programs operating in the Area should ensure that their personnel have been briefed on the requirements of the Management Plan and, in particular, on the Code of Conduct for Visitors (Appendix A) and Scientific and Environmental Guidelines (Appendix B) that apply within the Area.
- Tour operators visiting the Area should ensure that their staff, crew and passengers are briefed on, and are aware of the requirements of this Management Plan and the Code of Conduct for Visitors (Appendix A).
- Copies of this management plan and supporting documentation, such as maps and appendices, should be kept in appropriate stations and refuges in the Area, and be made available to all persons in the Area.
- Visits to the Area should be made as necessary (no less than once every five years) to evaluate the effectiveness of the Management Plan, and to ensure that its requirements are being met.

5. Period of Designation

Designated for an indefinite period.

6. Maps

Figure 1: Location of ASMA No. 1 in King George Island, Antarctic Peninsula.
Figure 2: Location of Scientific Zones.
Figure 3: Visitor Zone – Comandante Ferraz Station
Figure 4: Facilities Zones – Machu Picchu Station

7. Description of the Area

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

Admiralty Bay is a large fjord, in the southern coast of King George Island, the biggest island in the South Shetlands Archipelago, off the north-west coast of the Antarctic Peninsula, separated from it by the Bransfield Strait (Fig. 1). The bay is characterized by the extreme bottom heterogeneity. It is surrounded by different kinds of landscapes, such as coastlines with penguin rookeries and seal wallows, big glacier forelands, lichen heaths, swamps, grasslands or barren rocky lands. An area of approximately 360 km² comprising Admiralty Bay and the surrounding area is designated as an Antarctic Specially Managed Area to manage human activities for the protection of scientific, environmental, historical and aesthetic values.

ASMA No. 1: Admiralty Bay, King George Island (62º01'21"S – 62º14'09"S/ 58º 15'05"W– 58º41'02"W) comprises the terrestrial and marine areas immediately within the glacial drainage basin of this bay (Fig. 2). In addition, it includes ASPA No. 128 Western Shore of Admiralty Bay, part of which is outside the drainage basin area. One Historic Site and Monument, HSM No 51 Puchalski Grave, is located within the Area.

The Area is bounded by a line extending from its southern margin at the Telefon Point (62°14' 09.3" S, 58° 28'00.5" W) to The Tower (58°28'48"W, 62°12'55"S), and then toward Jardine Peak (58°29'54"W, 62°10'03"S) intersecting the ice divide of the Warszawa ice-field, thence following this divide to the west of Ezucurra Inlet, north-eastward to enclose Mackellar and Martel inlets, and then southward through Ternyck Needle (62°04'52.6" S, 58°15'24.1" W) to Cape Syrezol (62°11'38.4" S, 58°16'29.6"W) on the eastern shore of Admiralty Bay. The waters of Admiralty Bay and a small part of Bransfield Strait, north of a straight line between Cape Syrezol and Telefon Point, are also included in the ASMA. There are no fixed survey points available at the Area boundaries, but markers indicating the ASMA will be fixed at appropriate arrival points on land. In season 2020/2021 information boards appeared at the Henryk Arctowski Polish Antarctic Station and at the Demay refuge.

The revised total area of ASMA No. 1 is 360 km², of which 194 km² are ice covered, including 138 km² of Admiralty Bay Waters and an adjoining 7 km² of the Bransfield Strait (Admiralty Chart N° 6258, 1968, London; Polish Chart Admiralty Bay, King George Island, 1:50,000, Battke, S, Warszawa, 1990; ASPA No. 128: Western Shore of Admiralty Bay, King George Island, 1:12 500, ed. Department of Antarctic Biology, Polish Academy of Sciences, Pudełko R., 2002; Brazilian Chart No. 25121, Baía do Almirantado, 1:40,000, 1984, Rio de Janeiro; Braun et al. 2001a and b; Arigony-Neto, 2001). Approximately 90% of the land area within the proposed ASMA is ice-covered, the ice-free areas representing about 37 km².

- *Earth Science features*

The glacial drainage basin is formed mainly by the main ice cap of King George Island which flows from north, east and west towards the trough of Admiralty Bay. At the head of the bay, the ice cap spills into three inlets: Ezcurra, Mackellar and Martel inlets. Heavily crevassed outlet glaciers descend towards the sea becoming tidewater glaciers or floating glaciers.

Geomorphology of the area is dominated by glacial erosion and depositional landforms, fresh and old moraine ridges, flat basal moraines, eskers, flutings, striated rock pavement, rocky ice streams, valleys and deposits of sand, pebble to cobble covered forming recent beaches and raised marine terraces. Assemblages of poor tundra vegetation were already described in the coastal area influenced by birds, seals and sea spray fertilization, and in inland ecosystems suffering nutrients poverty. Adequate soil units (in diversified taxonomic modes) were proposed for that ecosystem. However, ecological mapping of the area was not performed till now. Particularly rich and diversified terrestrial ecosystems have been developed around penguin rookeries. Paternal profiles of ornithogenic soils of maritime Antarctic formed in the result of the phosphatization considered as a soil forming process were described along the coast in several sites. Igneous basaltic andesite rocks outcropping around Admiralty Bay intercalated with fossil plant bearing sedimentary, terrestrial and locally glacial deposits record, cryosphere formation and Cenozoic evolution of a volcanic island arc. Volcanic, pyroclastic and sedimentary rock sequences of Eocene provide evidence of environmental changes preceding Oligocene glaciation, first signs of coming cooling were found in tillite from Herve Cove (62°10'44.7" S, 58°32'00.6" W) interpreted as alpine Eocene glaciation.

- *Climate*

The climate of the Area is typical of maritime Antarctica. Based on more than 25 years of data obtained at the Polish Arctowski Station and at the Brazilian Comandante Ferraz Station, the local microclimate is characterized by an average annual temperature of around -l.8ºC (-2.1 ± 1.0°C, set from Deception Island data and measured at UK Base "G", Bellingshausen and Ferraz, from 1944 to 2010). Average annual temperature in Arctowski Station in years 1977-1998 was -1.6ºC while in 2013-2017 it was -1.7ºC (Marsz & Stryszyńska 2000, Plenzler et al. 2019). An average annual wind speed in the order of 6.5 m s^{-1} (6.0 ± 1.2 ms-1), measured at Base G, Bellingshausen and Ferraz Stations, from 1986 to 2010 and 5.7 m s^{-1} measured at Arctowski Station in years 2013-2017 (Plenzler et al. 2019). Annual average precipitation is 508.5 mm in years 1977-1998 and in 2017 it was 491.2 mm. Humidity is 78.1% and air pressure is 989.9 hPa (Plenzler et al. 2019). The waters of Admiralty Bay have an average annual temperature range of -1.8° to +4°C, being well mixed by tides and strongly influenced by currents from the west of Bransfield Strait. Currently, reconstruction of climate fluctuation in historical time is the subject of multi proxy investigation performed on the base of sediment cores extracted from Admiralty Bay.

- *Freshwater habitat*

In the area of ASMA No 1 there are no significant lakes, although there are numerous small ponds and streams, situated mostly on the southern and south-western coast of Admiralty Bay. The streams support some mosses as well as a diverse algae and cyanobacteria. Freshwater fauna, found in small ponds, moss banks and streams consists of Protozoa, Rotifera, Nematoda, Tardigrada, Collembolla (Cryptopygus antarticus and Friesea grisea) and only two species of Crustacea (Branchinecta gainii and Pseudoboeckella poppei).

Special attention has been lately paid to the laguna that has been forming at the front of the retreating Ecology Glacier (62°11'00.0" S, 58°28'00.0" W) during the last 30 years. The laguna permitted a large spectrum of environments: from freshwater glacier stream to marine waters. Several similar lagunas have been developed along the coast of Admiralty Bay during the late Holocene during intense retreat of glaciers. New lagoons are adjacent to the bay at the front of the retreating Windy, Wanda and Znosco glaciers.

- *Flora*

The Admiralty Bay area houses all three angiosperms that occur in Antarctica, two native: Deschampsia antarctica E. Desv. (Antarctic Hairgrass) and Colobanthus quitensis (Kunth) Bartl. (Antarctic pearlwort) and the invasive Poa annua L.

Poa annua has historically been introduced in many areas around the globe and it is not easy to distinguish any longer the introduced range from the native range, it has a cosmopolitan distribution throughout temperate regions of both hemispheres; is an early colonizer of bare ground, and common on lawn grass and one of the world's worst weeds. It was first reported in Antarctica more than 30 years ago, and for being an invasive species, eradication measures have already taken place and are currently undergoing.

Deschampsia antarctica is an Antarctic native (but not endemic) it also occurs in Tierra del Fuego and Patagonia. Colobanthus quitensis is also native (but not endemic) being common in the Andes region from Ecuador all the way south to Patagonia.

There are eight species of Marchantiophyta (Liverworts) divided in six families and seven genera, all have wide distribution in Antarctica, but are very difficult to find for the untrained eye, as they grow in small populations associated with the moss vegetation.

Other than that, vegetation is composed largely by Bryophyta (mosses), with a total of 63 species divided among 34 genera and 17 families present in ASMA 1. Considering the total number of species of mosses in Antarctica as 116, the Bay area houses about 53% of all Antarctic moss species, a highly significant number, especially considering the size of the Bay. Many groups of Antarctic mosses have not yet been properly revised taxonomically and phylogenetically. Actually few studies using molecular tools focusing on Antarctic moss diversity have suggested that much is still to be known about the local diversity. Moss species in the region are subject to harsh environmental conditions that can affect its morphology, so the use of molecular data in Antarctica is a very important but still underused tool.

In the adjoining ice-free areas of Admiralty Bay, the distribution of plant communities is closely related to geoforms, and to the presence of birds and soil. Wherever edaphic conditions are favorable, mosses form strands (which also contain lichen and fungi formations). The lichenized mycobiota is restricted to the rock fragments and rock outcrops, sometimes associated with bird colonies. The coastal areas are the most densely covered, with flora being represented mostly by moss carpet formations.

Near the Brazilian Ferraz Station two of these areas occur, both of which are almost 300 m long, however due to the reconstruction of the new Brazilian station, some moss carpets needed to be transplanted and such areas are currently under monitoring. Hennequin Point has large moss carpet areas as well. As elevations rise, showing rocky outcrops, crustose lichens and mosses which grow directly on rock predominate. The green algae Prasiola crispa occupies high nutrient concentrated areas, near bird breeding locations, and it has a large associated fauna.

Even though moss carpets ate the most conspicuous vegetation form, there are several small patches of mosses distributed everywhere on ice free areas across the bay, such small patches usually house the less common species whereas the big carpets are usually monoclonal formations of a single species (e.g. the widespread Sanionia uncinata).

Plant formations have a large number of species with their dispersal center found in the South Shetlands, apart from mixed formations, those centers are characterized by:

- Tufts of mosses, where large tufts are rarely found and species of the genus Polytrichum Hedw. are dominant;
- Carpets of mosses, mainly composed by Sanionia uncinata (Hedw.) Loeske, Warnstorfia sarmentosa (Wahlenb.) Hedenäs and W. laculosa (Müll. Hal.) Ochyra & Matteri; that are found.
- Aquatic mosses, with Bryum pseudotriquetrum (Hedw.) Schwaegr. And Warnstorfia sarmentosa (Wahlenb.) Hedenäs, which are found mostly in lakes, on the bay.

Mosses can randomly colonize on rocky outcrops, in areas that accompany drainage basins, lakes and along the coast. Regarding the distribution pattern of the moss species in the bay, it seems that no dispersal pattern exists, with species having a broad distribution everywhere in the Bay. In the ice-free areas, the distribution of plant communities is closely related to stable landforms and nesting birds and also depend mainly on light incidence. The rocky outcrops may host dense moss and algae communities, characteristic of the early stages of plant successions (Barbara et al. 2022).

- *Birds*

Within the Area, 14 species of birds breed. Three sympatrically breeding Pygoscelid penguins makeup 91% of the number and up to 95% of the biomass of the breeding bird communities. Other seabirds breeding in the Area are: Southern giant petrel (Macronectes giganteus); Antarctic shag (Phalacrocorax atriceps bransfieldensis); Brown skua and south polar skua (Stercorarius antarcticus, Stercorarius maccormicki) and Chilean skua Catharacta chilensis); Wilson's storm petrel (Oceanites oceanicus); Black-bellied storm petrel (Fregeta tropica); Cape petrel (Daption capense); Kelp gull (Larus dominicanus); Antarctic tern (Sterna vittata) and Pale-faced sheathbill (Chionis albus). The areas of ASPA No. 128 Western Shore of Admiralty Bay, Cape Vauréal, Chabrier Island, Shag Island and surroundings, are the most important bird breeding locations in Admiralty Bay. In Cape Vauréal are found 50% of the giant petrel population of the Area, and in Shag Island are found all nests of Antarctic shag, which share territory with chinstrap penguins (Pygoscelis antarcticus). Hennequin Point and Keller Peninsula are the most important breeding locations for Stercorarius maccormicki, where 90% of the breeding pairs are found. For S. lonnbergi, areas with high concentrations of penguins, like ASPA No 128, are the most important. There is a register of a hybrid breeding pair of C. chilensis and Stercorarius maccormicki at Hennequin Point.

Eudyptes chrysocome has been found every year since 2004 at Chabrier Rock, always followed by an Eudyptes chrysolophus specimen. Aptenodytes patagonicus had been registered at the Point Thomas colony several times and there have also been at least two sightings at Keller Peninsula.

Two Important Bird Areas (IBAs) were identified within ASMA No. 1, given the importance of maintaining ecosystems for the continued protection of bird species present at Point Hennequin and at ASPA No. 128.

- *Mammals*

Six species of pinnipeds occur in the Area. The most frequent mammal during winter is the crabeater seal (Lobodon carcinophagus). During summer, elephant seals (Mirounga leonina) and fur seals (Arctocephalus gazella) are the most frequent and abundant species. In periods when the ice covered areas decrease, it is possible to find lots of crabeater seals in the Area, especially at Ezcurra region. Fur seals, once relatively rare, have increased in number in recent years. Elephant seals and Weddell seals (Leptonychotes weddelli) breed in the area. Leopard seals (Hydrurga leptonyx) are found throughout the year in varying numbers. Ross seals (Ommatophoca rossi) rarely occur in the Area. Humpback whale (Megaptera novaeangliae) is the most frequent cetacean during summer, though killer (Orcinus orca), minke whales (Balaenoptera bonaerensis), and Sei whales (Balaenoptera borealis) have also occasionally been seen in the area.

- *Marine ecology*

Seasonal fluctuation in the condition of the marine ecosystem is driven by marine current, tidal currents, and seasonal biological changes. During last years attention was focused on unusually high early summer blooming (dominated by diatoms) followed by melting of winter fast ice covering Admiralty Bay all the winter (rare case because usually the bay is not perennially frozen during winter). Detailed environmental and phytoplankton investigation was performed in the frame of international ClicOPEN IPY and IMCOAST EU projects and results are synchronized for the whole region.

Usually, multicellular algae, predominantly Heterokontophyta, Chrophophyta and Rhodophyta, characterize the shallow water bottom community down to 50-60 m depth. With the exception of the limpet (Nacella concinna), epifauna is practically absent in the intertidal zone. The vagile benthos is abundant with a high variety and density of Amphipoda. Below 4-5 m, substrata are typically sandy and dominated by

Isopoda, particularly the genus Serolis. With the increasing depth, vagile species such as Sterechinus, Neobuccinum and Parborlasia dominate. In deeper waters, on a muddy and more stable substrata, sessile forms include sponges, anemones, the bivalve Laternula elliptica and tunicates, besides high-density concentrations of echinoderms such as Amphioplus acutus, Ophionotus victoriae and Odontaster validus. Invertebrate scavengers include Labidiaster annulatus, Gliptonotus antarcticus, Parborlasia corrugatus, Odontaster validus and Neobuccinum eatoni. In total, almost 1300 benthic species, including diatoms (157), foraminiferans (135), macroalgae (55), invertebrates (>400 species) and demersal fish (30) have been recognized in Admiralty Bay. The species found in the area are largely the same as those observed on similar substrata at other sites in the region, indicating homogeneity in the benthic fauna of the Antarctic Peninsula and related areas. Fishes are represented by fifteen Nototheniidae, mainly Notothenia rossii, N. neglecta, N. gibberifrons, N. coriiceps, Nototheniops nudifrons, Trematodus newnesi, T. borchgrewincki and Pleuragramma antarcticum, two Channichthydae species, Hapagiferidae and Zoarcidae.

- *Human activities and impact*

Since the establishment of the ASMA, human activities in the Area have been related to scientific research, science-related logistic activities and tourism. Scientific and logistic support are received from ships belonging to or chartered by National Parties.

Base G, the first permanent station on King George Island, was constructed by Great Britain in 1947 at Keller Peninsula. In 1948, a refuge hut was set up by Argentina in the same area. Base G was closed in 1961 and later dismantled in 1995, as was also the case with Argentinian hut. In the summer 1975-1976 Italian alpinist expedition built a small hut (Campo Bove) on the shores of the Ezcurra Inlet at Italia Valley. The camp was dismantled in March 1976.

During the summer of 2019-2020 the number of passengers visiting the area reached 17.046 persons. The majority of passengers did not leave the vessel to land ashore, only cruising either on the ship or in small boats. Tourists typically land at Arctowski or Ferraz Stations for a tour of facilities, go for a walk along the coast, and sometimes make short cruises in Zodiac boats.

One alien species of grass (Poa annua) was recorded in summer 1985-1986 at Arctowski Station. Since then, small populations were observed in several places around the station, and, in 2008/2009, on the deglaciated moraines of the Ecology Glacier (approximate location 62°10'7"S, 58°27'54"W). In 2009/2010 soil seed bank of P. annua was found near the Arctowski Station. High genetic variability suggests several separate immigration events from different sources including Europe and South America. In 2009 propagules and pollen of the non-native rush Juncus bufonius were found in one location on the north-west boundary of ASPA No 128. In 2007-2010 extensive research (part of the international “Aliens in Antarctica” project) was conducted on the Arctowski Station to assess pathways by which non-native species can reach the station.

The non-native T. maculipennis fly was first reported at the Polish Antarctic Arctowski Station with live larvae and adult individuals in the sewage system in October 2017 (Potocka & Krzemieńska, 2018). Since its first discovery, the systematic monitoring and control measures have been carried out to eradicate this species. In December 2022, imago individuals of the genus Trichocera were reported at two locations of ASMA no. 1: near Llano Point (62°10´15´´S, 58°26´30´´W) and the Rakusa Point area (62°09´30´´S, 58°27´30´´W) (IP 42, ATCM XLV - CEP XXV, 2023).

All fin-fishing is currently prohibited in the western Antarctic Peninsula region (CCAMLR Statistical Subarea 48.1) under CCAMLR Conservation Measure 32-02. Krill fishing occurred within Admiralty Bay during the 2009-2010 season, when the reported total krill catch was 11,500 tonnes (CCAMLR 2012b). In 2013 CCAMLR decided that any proposal to undertake commercial harvesting within an ASMA should be submitted to CCAMLR for its consideration and that the activities outlined in that proposal should only be taken with the prior approval of CCAMLR (Final Report CCAMLR-XXXII, paragraph 5.83)

7(ii) Access to the Area

Access to the Area is generally by ship or yacht, or less frequently by helicopter. Specific conditions of access are in Section 7(i).

7(iii) Structures within the Area

There are currently two permanent year-round research stations (Henryk Arctowski Station and Comandante Ferraz Station), three seasonal research stations/facilities (Machu Picchu Station, Copacabana Field Camp and Hannequin Point Refuge) and several minor structures (historical remains, emergency refugees, permanent field camps) in the Area.

(a) Main permanent structures and field camps in the Area

- *Henryk Arctowski Station (Poland): 62°09´34´´S – 58°28´15´´W*

  The station was established at Thomas Point in 1977 as a facility for scientific research and associated logistic operations of the Polish Antarctic Programme, and has been in year-round operation since then. It has dormitories for 16 residents in winter and up to 40 in summer; biological, meteorological and geophysical laboratories; storage facilities; a small hospital unit; double-walled fuel tanks with total capacity of more than 1,000 tons; hangars for boats and land vehicles etc. Due to ongoing redevelopment of the station infrastructure, a temporary heliport is in operation.
- *Comandante Ferraz Station (Brazil): 62º05'07" S – 58º23'32"W*

  The station was established in 1984 on the eastern coast of Keller Peninsula as the base for scientific research and associated logistic operations conducted by the Brazilian Antarctic Programme. It started year-round operations in 1986. In the summer of 2012, an accident destroyed 70% of

Ferraz Station. After 3 years of reconstruction, in January 2020 the new Ferraz Station was officially opened. Using renewable energy sources - wind, solar and cogeneration, in addition to diesel generators - the station can accommodate 64 people; it has 14 internal and 3 external laboratories; storage facilities; a range of amenities including medical and laundry facilities, a library and a gym. The station is equipped with a helicopter pad. Fuel is stored in 16 tanks with double steel walls, with total capacity for 480,000 liters of arctic diesel. The EACF today has a system for the reuse of water served with savings of up to 39%, through the reuse of water discarded by showers and faucets of the bathrooms and in the laundry, which, after treatment, are used to flush toilets and to wash vehicles. The final effluents are treated using the technique with UV radiation. The incineration of organic waste takes place at a temperature of 750ºC in which the gasses resulting from the incineration go through filtering processes, being released into the environment free of pollutants.

- *Machu Picchu Station (Peru): 62º05'30" S – 58º28'30" W*

  The station was built in 1988 at Crepin Point, Mackellar Inlet. At present, it is used for summer operations only. The station consists of eight metallic modules including 2 dormitories, 1 kitchen and canteen, 1 generator room, 1 scientific laboratory, 1 waste treatment building, 1 emergency and 1 maintenance room. The station is equipped with one portable helicopter pad.

- *Copacabana Field Camp (United States of America): 62º10'45" S – 58º26'49" W*

  The summer station, consisting of three wooden huts for 4-6 people, is located in the south of Llano Point. It has been used every summer since its construction in 1977 as a field base for the Seabird Research Program (USA), in close cooperation with Arctowski station.

- *República del Ecuador Refuge at Hennequin Point (Ecuador): 62º 07' 16" S – 58º 23' 42" W*

  The refuge was built in 1989, and has occasionally been used since then during summer seasons. It is a very important logistical support point for researchers with activities in that region.

(b) Emergency refuges in the Area (Fig. 2)

- three Brazilian emergency refuges (Refuge I - 62°05'15.8" S, 58°23'43.2" W, Refuge II - 62°04'23.4" S, 58°25'10.1" W, Ipanema Refuge - 62°05'09.8" S, 58°25'02.6" W), and Brazilian scientific module on Keller Peninsula (62°05'24.4" S, 58°24'11.3" W);
- Polish refuge at Demay Point functioning as summer field camp (62°13'2.9" S, 58°26'32.27" W);
- Polish refuge (an Apple type hut) at Italia Valley functioning as a summer field camp (62°10'32.3" S, 58°0'49.0" W).

(c) Historical remains in the Area

- HSM Nº 51 Puchalski Grave near Arctowski Station (62°13' S 58°28' W) (Fig. 2)
- the remains of Italian hut Campo Bove at Italia Valley, Ezcurra Inlet (62°10'32.3" S, 58°30'49.0" W);
- a whale skeleton assembled by the oceanographer Jacques Cousteau, on the Keller peninsula, near Ferraz Station (62°04'55.0" S, 58°23'32.0" W);
- wooden barrels from whaling period at Barrel Point (62°10'00.0" S, 58°35'00.0" W), Ezcurra Inlet;
- a collection of whaling harpoons assembled on the shores of Admiralty Bay, exhibited at Arctowski Station;
- A group of seven crosses and graves on Keller Peninsula, above Ferraz Station, three of which in honor of Brazilian military personnel that lost their lives in Antarctica: Navy 1st Sergeant Alberto Poppinger (1995); Lieutenant Carlos Alberto Figueiredo and Lieutenant Roberto Lopes dos Santos who died during the fire that destroyed the EACF in 2012. The remaining four crosses are in memory of British Falkland Islands Dependencies Survey (FIDS) members who lost their lives while serving at Base G: Eric Platt, (1948); Ronald Gordon Napier (1956); Alan Sharman (1959); and Dennis Ronald Bell (1959); and
- a wooden cross on top of Flagstaff Hill (62°04'52.8" S, 58°24'14.0" W) on Keller Peninsula.

7(iv) Restricted and managed zones within the Area

Three types of management zones (Facilities, Scientific, Visitor) are designated within the Area.

- *Facilities Zones*

Facilities Zones are established to ensure that permanent and semi-permanent facilities in the Area are concentrated in defined locations with the aim of minimizing human impact on the important values of the Area. The existing Facilities Zones in the Area are listed in 7(iii) Structures in the Area.

The designation of new Facilities Zones should be done sparingly and after careful consideration of scientific and/or logistical justification. New installations should, as far as practicable, be located inside existing Facilities Zones. Parties active in the Area are encouraged to practice the cooperative use of infrastructure.

- *Scientific Zones*

Scientific Zones are established to protect the important scientific and ecological values of the Area from human disturbance. They have considerable scientific/ecological interest as breeding sites and/or concentrations of birds and/or mammals, feeding sites for birds and marine mammals, sites of typical vegetation cover, and varied marine habitats. Some of these zones, such as Chabrier Rock - Vaureal Cape, on the eastern shore of Admiralty Bay are of great relevance, as the only breeding sites for the Antarctic blue-eyed shag, penguins and southern giant petrel outside ASPA 128 Western Shore of Admiralty Bay.

Activities in all these zones should be carried out with particular care to avoid or minimize disturbance of wildlife, trampling of vegetation and interference with on-going research.

Designated Scientific Zones in the Area (see Fig. 2).

Specific guidelines for the conduct within the Scientific Zones are presented in Appendix B (Scientific and Environmental Guidelines).

- *Visitor Zones*

Visitor Zones are established to manage the activities of tourists, non-governmental expeditions and National Antarctic Programs' scientists and staff when undertaking recreational visits to the Area.

Existing tour routes for visitors in the vicinity of Ferraz station are presented on Fig. 3. These routes give the opportunity to observe wildlife and the station installations, while minimizing disturbance to the station activities and the environment, and avoiding habitat degradation. In future, routes for tourists may be established at Machu Picchu Station (Fig. 4) and Ecuador field camp.

Visits to Ferraz Station are possible with prior agreement of the Station Leader.

Isolated laboratory modules, refuges and the area behind Ferraz Station: visits should be only by small groups accompanied by station personnel.

Due to the ongoing renovation of Station facilities, the Arctowski Station is closed to tourist traffic. This decision remains valid until further notice.

Specific guidelines for the conduct within the Visitor Zones are presented in Appendix A (Code of Conduct for Visitors).

7(v) Location of other protected areas within the Area

The following areas are currently designated within the ASMA No 1:

- *ASPA No. 128 (Western shore of Admiralty Bay): 62º09´46´´S – 62º14´10´´S – 58º25´15´´W – 58º29´58´´W:*

  This area is the site of long-term studies on bird biology performed by the US Antarctic Program, as well as intensive biological research of the Polish Academy of Sciences. It is entirely contained within ASMA No 1. Part of the Area western boundary (from Telefon Point to Warszawa Icefield – 62°12'S, 58°29'W) is shared with ASPA No 128.

- *Historic Site No. 51, at Arctowski Station: 62° 10'S – 58° 28'W:*

The grave of Wlodzimierz Puchalski, a photographer and a producer of documentary nature films, who died on 19 January 1979. Bronze cross is located on a hill to the south of Arctowski Station, near the last working place of the late photographer. The cross is in fact a monumental sculpture with an artistic impression of fauna seen by the eye of a photo camera. It has been done by the famous artist Bronislaw Chromy, close friend of Wlodzimierz Puchalski.

7(vi). Location of other protected areas in the vicinity of the Area

- ASPA No 125 Fildes Peninsula, King George Island (25 de Mayo) and ASPA No 150 Ardley Island, Maxwell Bay, King George Island (25 de Mayo) lie ~27 km west of the Area.
- ASPA No 132, Potter Peninsula, King George Island (25 de Mayo), lies ~15 km to the west.
- ASPA No 151, Lion's Rump, King George Island, lies ~20 km to the east of the Area (see Fig. 1).

8. Supporting Documentation

- Code of Conduct for Visitors (Appendix A)
- Scientific and Environmental Guidelines (Appendix B)
- Management plan for Antarctic Specially Protected Area No 128 (Appendix C)
- Overview of HSM No 51, Puchalski Grave (Appendix C)
- Manual of Regulations and Guidelines Relevant to Tourism and Non-Governmental Activities in the Antarctic Treaty Area (Appendix D)
- Scientific Committee on Antarctic Research's Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica (Appendix D)
- Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica. (Appendix D)
- Scientific Committee on Antarctic Research's Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Appendix D)
- Guidelines for the preparation of ASMA management plans (Appendix D)
- Non-Native Species Manual (Appendix D)
- General Guidelines and Site Guidelines Checklist for Visitors to the Antarctic (Appendix D)
- Practical Guidelines for Ballast Water Exchange in the Antarctic Treaty Area.
- Guidelines for the Operation of Aircrafts near Concentrations of Birds in Antarctica. (Appendix D)

9. General Code of Conduct

The General Code of Conduct is proposed as an instrument for the management of activities in the Area, and as a guide for ongoing and future research and logistic operations of the Parties, tour operators and other organizations active in the Area. A Code of Conduct for Visitors and Scientific and Environmental Guidelines are presented in Appendix A and B.

9(i) Access to and movement within or over the Area

- Access to the Area is generally by ship or yacht, or less frequently by helicopter. There are no landing sites for fixed-wing aircraft in the Area.
- There are no special restrictions on the transit of ships through the Area, but anchoring should avoid marine components of Scientific Zones, and areas of environmental monitoring. If anchoring near Ferraz Station is unavoidable, it should be done in front of the station at 62°05.111 S, 58°22.565 S (depth 50-60 m) or between Botany Point and Ullman Spur at 62°05.735 S, 58°20.968 W (approximate location);
- There are no restrictions on small boats landing on any beaches outside ASPA No 128. During boat landings care should be taken to avoid disturbing birds and seals. Extreme caution should be exercised when attempting to land in places where submerged rocks occur. Recommended landing sites for those visiting the stations located in Admiralty Bay are shown in Fig 2;
- Overflight operations by fixed-wing aircraft and helicopters should be carried out in accordance with the “Guidelines for the Operation of Aircraft near Concentrations of Birds" contained in Resolution 2 (2004), as a minimum requirement. Overflight of wildlife colonies should be avoided throughout the Area. Specific airflight restrictions apply to ASPA 128, and are contained in the Management Plan.
- Recommended helicopter landing sites are: Arctowski Station (62°09´32.198´´S, 58°28´12.5´´W), Ferraz Station (62°5.1283’S, 58°23.9233’W), Machu Picchu Station (62º05’30” S, 58º28’30” W). Landing at Copacabana Field Camp which is located inside ASPA No 128 is prohibited except in emergencies.
- Except in emergencies, or in the course of carrying out inspections under Article VII of the Antarctic Treaty, helicopters ferrying scientists and visitors to and from Arctowski, Ferraz and Machu Picchu Stations and the Ecuador field camp should notify the relevant station/camp leader well in advance of the estimated time of arrival. They should land only on helicopter pads/landing sites indicated at each of the stations. There are no refueling facilities at the stations;
- Movement on land within the Area should be preferably on foot, although land vehicles may be used for scientific or logistical purposes inside some Facilities Zones (Arctowski Station – from Thomas point to the Shag Point, Ferraz Station – from the main station compound to the refuges on Keller Peninsula, and to the isolated modular laboratories around the main compound, Machu Picchu Station – inside main station compound).
- Snowmobiles may be used for scientific and logistical purposes in the glaciated parts of the Area, and in winter throughout the whole Area.

- The use of land vehicles is regulated by Leaders of the Stations, and should be done in a manner minimizing disturbance to wildlife, soil and vegetated areas. As far as practicable existing tracks should be used.
- Movement inside Scientific Zones should be, as far as possible, restricted to those conducting scientific research and essential logistic support. All movement should be undertaken carefully to minimize disturbance to animals, soil and vegetated areas.
- Movement inside Visitor Zones by tourists and other visitors to Ferraz Station should, whenever possible, follow routes shown in Figure 3. These routes allow the observation of fauna and flora, while minimizing environmental impacts.
- Special guidelines regulating access and movement inside Scientific Zones are contained in Appendix B. Guidelines regulating access to and movement inside ASPA No 128 are contained in the ASPA Management Plan.

9(ii) Activities which may be conducted in the Area, which will not jeopardize the values of the area, and which are consistent with the Code of Conduct

- Scientific research, or the logistical support of scientific research which will not jeopardize the values of the Area;
- Tourist or private expedition visits consistent with the provisions of this Management Plan, Scientific and Environmental Guidelines and Code of Conduct for Visitors;
- Management activities, including maintenance or removal of facilities, clean-up of abandoned sites and monitoring the implementation of this Management Plan;
- Media, arts, education or other official national program visitors.
- Commercial harvesting of marine living resources, which should be conducted in coordination with research and other activities taking place, and could include development of a plan and guidelines that will help to ensure that harvesting activities did not pose a significant risk to the other important values of the Area.

All activities in the Area should be conducted in such a manner so as to minimize environmental impacts. Specific guidelines on the conduct of activities within the Area, including within Scientific Zones, can be found in the Appendices A and B, and in the Management Plan of ASPA No 128 Western Shore of Admiralty Bay.

9(iii) Installation, modification or removal of structures

Installation of new stations/refuges and modifications, or removal of already existing installations or other facilities in the Area, should be done only after consultation with the Parties that have active research programs in the Area, and in conformity with provisions of Article 8 and Annex 1 of the Environment Protocol and this Management Plan; in a manner that does not compromise the values of the Area. Existing installations and installation sites should be re-used as far as possible, and sharing of installations among National Antarctic Programs is encouraged.

As far as possible, permanent or semi-permanent structures should not be installed outside Facilities Zones, unless they are small in size and pose no significant threats to the important values of the Area.

Scientific equipment installed in the Area should be clearly identified by country, name of principal investigator, contact details, and date of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions, and pose minimal risk of contamination or damage to the values of the Area. All equipment and associated materials should be removed when no longer in use.

Before construction of new installations in the Area National Antarctic Programs should
exchange information through the ASMA Coordinator with the aim of sharing existing installations and minimizing the erection of new ones.

9(iv) Location of field camps

Field camps should be located as far as possible on non-vegetated sites, such as on barren ash plains, slopes or beaches, or on thick snow or ice cover when practicable, and should also avoid concentrations and breeding location of mammals and birds. Previously occupied campsites should be re-used where appropriate.

The location of field camps should be recorded, and the information exchanged through the Electronic Information Exchange System (EIES).

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

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued under the provisions of Article 3 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica should be used as a minimum standard.

Taking of marine organisms for scientific purposes should be limited to that restrictedly necessary to meet the purpose of the research. Invasive methods involving dredging, grabbing, trawling, etc. should be undertaken sparingly and with greatest care possible.

Seismic operations should be avoided, particularly with the use of explosives. Geological sampling of bottom sediments, particularly in shallow waters, should be carried out with extreme care so as to minimize adverse impact on the environment, or interference with other scientific research under way on benthic ecology.

The coordinates of sites where invasive methods were used should be recorded, and the information should be exchanged through the Electronic Information Exchange System (EIES).

Harvesting of marine living resources should be conducted in accordance with the provisions of this Management Plan and with due recognition of the important scientific and environmental values of the Area. All those planning to conduct marine commercial harvesting in the Area should first submit their proposal to CCAMLR. The activities outlined in the proposal should only be taken with the prior approval of CCAMLR.

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

All activities in the Area should be planned in a way minimizing risk of introduction of non-native species, including the transfer among different localities in Antarctica.

No living animals, plant material or microorganisms shall be deliberately introduced into the Area, except by permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty.

"Non-native Species Manual" (Resolution 4, 2016) should be used to minimize the risk of unintentional introductions.

National Antarctic Programs, tour operators and organizations active in the Area should educate all visitors (scientists, station personnel, ship crews, tour operators' staff, tourists etc.) about the risks of non-native species' accidental introduction, and the methods used to minimize the probability of such an introduction.

National Antarctic Programs, tour operators and organizations active in the Area should, as far as practicable, minimize the importation of untreated wood, sand, aggregate and gravel to the Area.

National Antarctic Programs, tour operators and organizations active in the Area should, as far as is practicable, monitor all cargo, food and equipment unloaded in the Area for the presence of non-native species and propagules. National Antarctic Programs should also undertake periodic inspections of their facilities in the Area.

Visitors to the Area shall take special precautions against non-native species introduction. To the maximum extent practicable, footwear, outer clothing, backpacks and other equipment, including scientific samplers or markers, used or brought into the Area shall be thoroughly cleaned before entering the Area. Special care should be taken by persons visiting locations where non-native grass Poa anuua is present.

Considering the high level of endemic marine benthos in Antarctica, National Antarctic Programs, tour operators and organizations active in the Area should, as far as is practicable, take precautions minimizing the possibility of the introduction of marine invertebrate larvae in ballast water. Practical Guidelines for Ballast Water (Resolution 3, 2006) should be used for guidance.

In view of the presence of numerous breeding bird colonies within the Area dressed poultry should be free of disease or infection before shipment to the Area, and if introduced to the Area for food, all parts and wastes of poultry shall be completely removed from the Area or incinerated or boiled long enough to kill potentially infective bacteria or viruses. Care should be taken to prevent food or food wastes being accessed by wildlife.

Potential non-native species spotted in the Area should be reported to the appropriate authorities, and the reports should be made available to the ASMA Coordinator and the ASMA Management Group.

ASMA Management Group and other Parties or organizations, as appropriate, should exchange information about the discovery and distribution of any non-native species in the Area, results of the monitoring programs, and methods applied to minimize the risk of their accidental introduction. Policies on containment or eradication of non-native species should be discussed and developed as soon as possible.

9(vii) The collection or removal of materials not imported into the Area

Materials should only be collected and removed from the Area for scientific, management or educational purposes, and should be limited to the minimum necessary for those needs.

Souvenirs, specifically rocks, minerals, fossils, eggs, flora and fauna, or any other material not brought into the area by the visitor, should not be collected in, or removed from the Area.

It may be permissible to remove from the site materials such as beach litter or abandoned relics and artifacts of no historic value from previous activities. Historical relics and artifacts should be removed only for a compelling scientific purpose. Dead or pathological fauna or flora should be removed only for scientific purposes, with specific permit, because they are used as food by mammals and birds.

9(viii) Disposal of waste

Disposal of waste generated by scientific research programs, tourism and all other governmental or nongovernmental activities in the ASMA should be carried out in compliance with the provisions of Annex III to the Protocol on Environmental Protection to the Antarctic Treaty.

All wastes, other than human and domestic liquid waste, should be removed from the Area. Human waste and domestic liquid waste may be removed from the Area or disposed of into the sea.

9(ix) Requirements for Reports

Reports of activities within the Area, which are not already covered under existing reporting requirements, should be, to the maximum extent practicable, made available to the ASMA Coordinator.

10. Advance exchange of information

Parties operating in the Area should, as far as practicable, exchange information on their activities through the ASMA Coordinator with the aim of enabling greater coordination between their research programs, enhanced cooperation and minimization of possible cumulative impacts.

Parties proposing to conduct, support, or authorize research or other activities in the Area are encouraged to inform the ASMA Coordinator, as far in advance as possible, of their planned activities. The Coordinator should make the information available to the Management Group and other interested Parties.

All NGO and tourist expeditions planning to conduct activities with the Area (both IAATO members and those not affiliated with IAATO) should, as far as practicable, provide the ASMA Coordinator in advance with details of planned visits.

All those planning to conduct marine harvesting within the Area should, as far as practicable, notify the ASMA Coordinator in advance of their location, duration and character. The commercial harvesting specified in the proposal shall only be undertaken after following review procedures designated by CCAMLR.

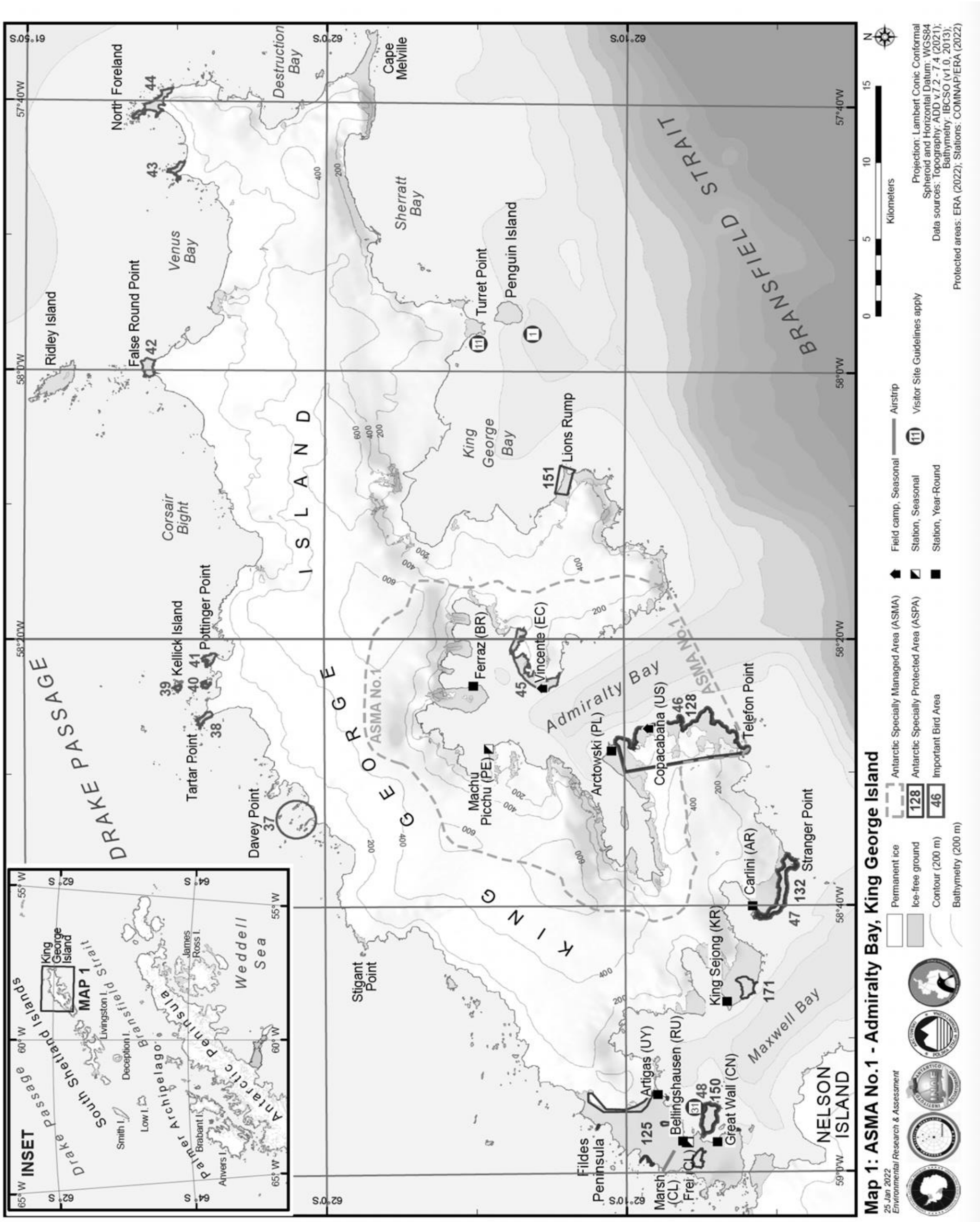


Figure 1: ASMA No 1 - Admiralty Bay, King George Island

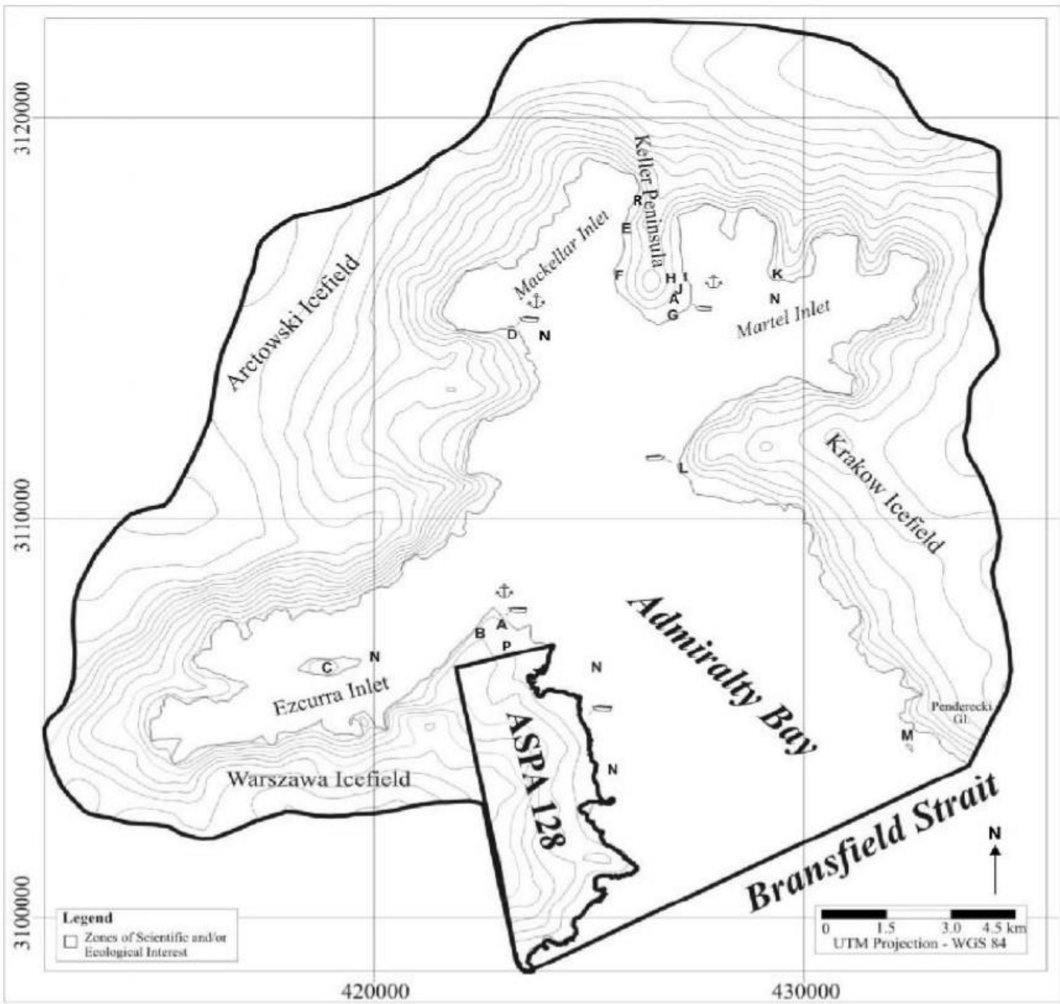


Figure 2: Scientific Zones

small boat landing site

anchorage

ASMA boundary

A- Freshwater lakes around Arctowski and Ferraz Station: example of freshwater environment;

B - Italia Valley (62°10'32.3" S, 58°30'49.0" W): concentration of seals;

C - Dufayel Island/Ezcurra inlet (62°09'59.4" S, 58°33'29.5" W): concentration of seals;

D - Machu Picchu Station (62º05’30” S, 58º28’30” W): breeding areas for Antarctic tern and skuas;

D - Crépin Point (62°05'28.6" S, 58°28'09.5" W): concentration of seals and breeding location of Sterna vittata;

E - Area north-west of Ferraz Station: concentration of seals;

F - Area west of Ferraz Station: concentration of seals;

G - Coastal area from Refuge No. 1 (Ferraz Station) to Plaza Point (southern tip of Keller Peninsula, 62°05'27.4" S, 58°24'18.9" W): concentration of seals and penguins, breeding location for Larus dominicanus ;

H - Ipanema, south-west coast of Keller Peninsula, approximate location (62º05'S, 58º26'W): breeding location for Larus dominicanus, presence of vegetation banks;

I - Coastal area up to 7 m in shore, north of Base "G" hill, above Ferraz Station: presence of vegetation banks;

J - Crosses Hill on northern flank of Ferraz Station, on Keller Peninsula (62º05'07" S, 58º23'32" W): concentrations of terns.

K - Ullman Spur (Martel Inlet) (62°04'39.4" S, 58°20'34.5" W): concentration of seals;

L - Hennequin Point (62°07'24.9" S, 58°23'52.3" W): concentration of seals and plant fossil localities; Main breeding area for Catharacta maccormicki and breeding Larus dominicanus and Sterna vittata; (Petry et al. 2016);

M - Cape Vaureal (62°10'49" S, 58°17'19.5" W) - Chabrier Rock (62°11'00" S, 58°19'00" W): breeding area for penguins, southern giant petrels and blue-eyed shags.;

N- Shallow marine waters down to 100 m in front of: ASPA No. 128, Martel, Mackellar and Ezcurra Inlets; Napier Rock (62°10'00.9" S, 58°26'22.7" W) and Monsimet Cove (62°10'49.2" S, 58°33'07.8" W): diverse benthic communities and scientific experiments and concentrations of different species of adult and juvenile fish;

P - area between Arctowski Station and ASPA Nº 128: presence of vegetation banks;

R - Costal area from Refuge N° 2 (south-west coast of Keller Peninsula, approximate location 62°04'20.0" S, 58°25'30.0" W) to south-east part of Domeyco Glacier (62°04'00.0" S, 58°25'00.0" W): the most important breeding location for Larus dominicanus at Keller Peninsula, concentration of Sterna vittata, presence of vegetation banks;

Keller Peninsula – Long-term Environmental Monitoring - Brazilian environmental monitoring of Admiralty Bay with emphasis on area of direct influence of the Comandante Ferraz Antarctic Station (EACF) through chemical and biological indicators, as well as monitoring the input of contaminants derived from fossil fuels, burning by-products, flame retardants, metals and sewage discharge to the region.

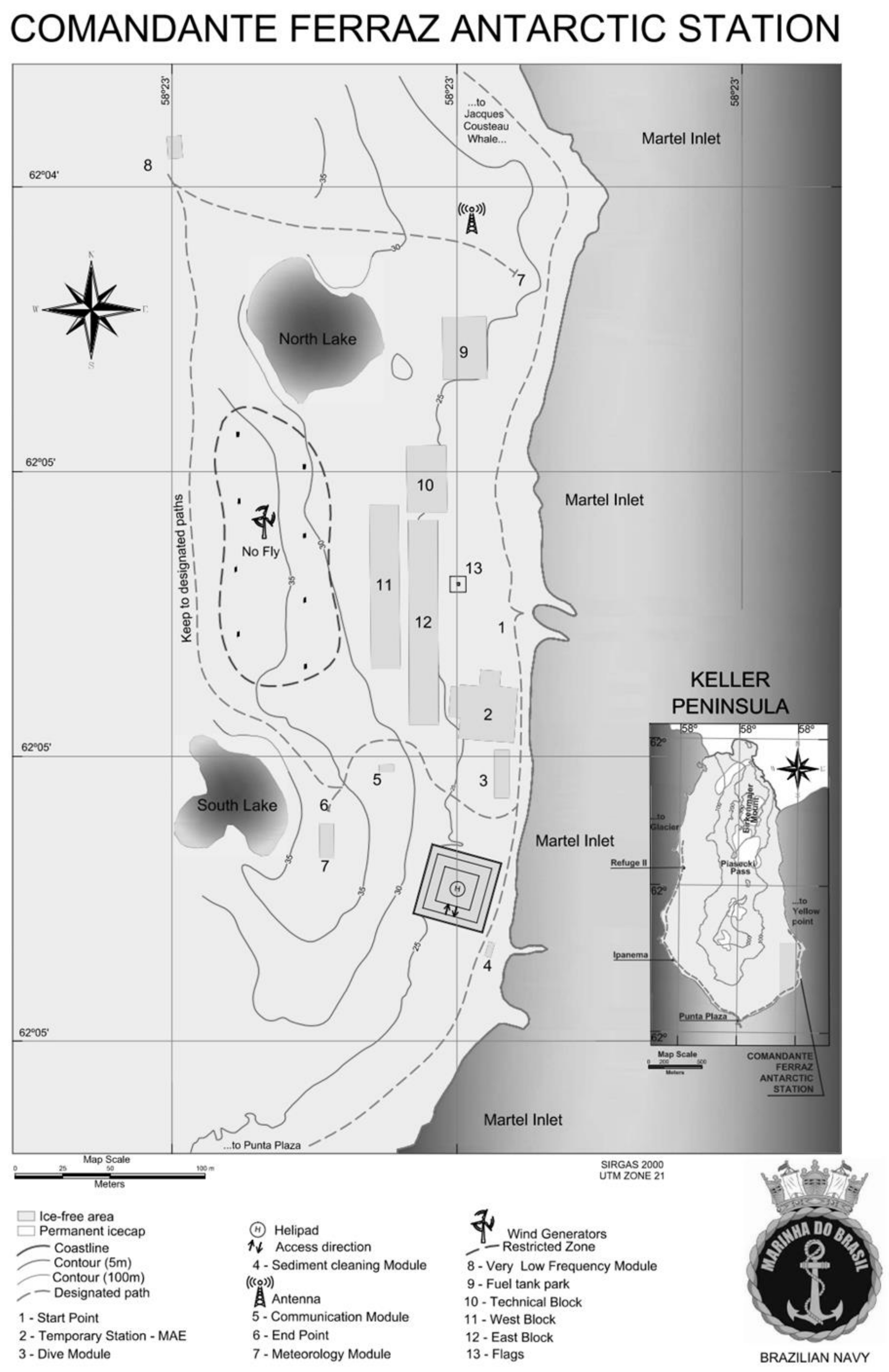
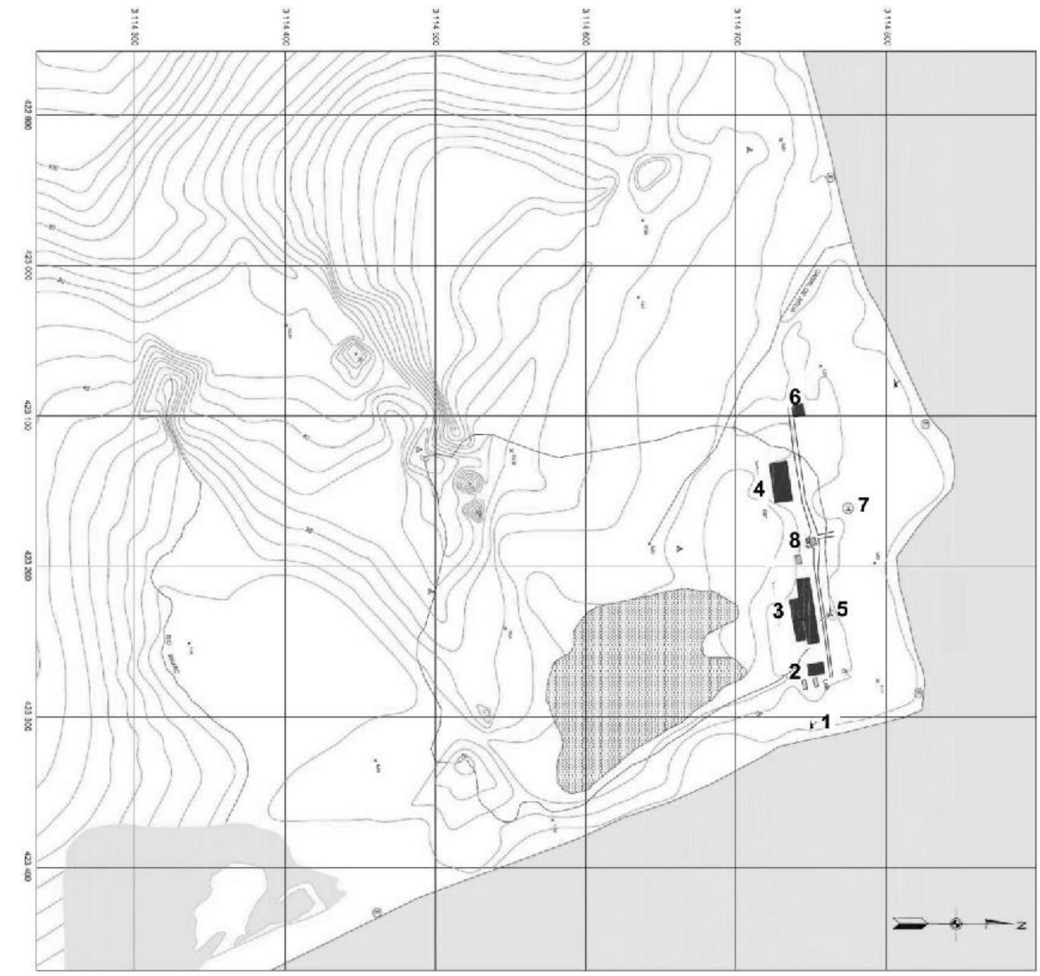


Figure 3: Visitor Zone - Comandante Ferraz Antarctic Station



1.Disembarkation point
2.Scientific Laboratory
3.Dining room/Kitchen
4.Generator room/ Maintenance room/Wate treatment building
5.Living quarters
6.Emergency refuge
7.Portable helicopter pad
8.Flag

Figure. 4: Facilities Zone - Machu Picchu Station

APPENDIX A

Code of Conduct for Visitors

This code of conduct has been produced for commercial tour operators (IAATO and non-IAATO affiliated), private expeditions and National Antarctic Programs scientists and staff when undertaking recreational visits to Admiralty Bay.

- All visitors should get acquainted with and follow the precepts of the Manual of Regulations and Guidelines Relevant to Tourism and Non-Governmental Activities in the Antarctic Treaty area. Decision 6 (2021).
- Tour operators should provide their visit schedules to the ASMA Coordinator in advance of their visits to the Area. ASMA Management Group should circulate this information among National Antarctic Programs active in the Area.
- Visits to Ferraz Station are possible with prior agreement of the appropriate Station Leader. Visits to isolated laboratory modules, refuges and the area behind Ferraz Station should be made only in small groups accompanied by station personnel with prior agreement of the Station Leader.
- Visits should be undertaken in line with Manual of Regulations and Guidelines Relevant to Tourism and Non-Governmental Activities in the Antarctic Treaty area. Decision 6 (2021). Visitors should be informed about the principles of this Code of Conduct, as well as the ASMA No. 1 Management Plan.
- Tour operators are encouraged to exchange itineraries with National Antarctic Programs using support vessels in the Area in order to avoid two ships unintentionally converging on a site simultaneously.
- Commercial cruise operators are encouraged to take care that no more than 100 passengers are ashore at a site at any time, accompanied by a minimum of one member of the expedition staff for every 20 passengers.
- Members of non-governmental and tourist expeditions, as well as National Antarctic Program staff during recreational visits to Ferraz station should use the routes shown in Fig. 3. These routes provide the opportunity to observe wildlife and the station installations, while minimizing disturbance to station activities and the environment, and avoiding habitat degradation.
- In order to avoid environmental impact, disturbance of wildlife and interference with on-going scientific research, landing at or entering Scientific Zones listed in Fig. 2 should not take place, except in emergencies.
- Due to the ongoing renovation of station facilities, Arctowski Station is closed to tourist traffic. This decision remains valid until further notice.
- All movement on land should be undertaken carefully to minimize
- disturbance to animals, soil and vegetated areas, or disturb scientific equipment. The visitor should:

  - Use marked walking paths instead of free walking on vegetation such as moss or lichen.

- maintain an appropriate distance from birds or seals which is safe and does not cause them disturbance. As a general rule, maintain a distance of 5 meters. Where practicable, keep at least 15 meters away from fur seals.
- wash boots and clean clothes, bags, tripods and walking sticks before landing, in order to prevent biological introductions.
- do not leave any litter.
- do not take biological or geological souvenirs or disturb artifacts.
- do not write or draw graffiti on any man-made structure or natural surface.
- do not touch or disturb scientific instruments or markers.
- do not touch or disturb field depots or other equipment stored by National Antarctic Programs.

APPENDIX B

Scientific and Environmental Guidelines

Admiralty Bay and its coastal areas have become an important site for scientific research, with many research teams of different specialties working there every year. These guidelines suggest a code of conduct formulated with the aim to protect the environmental, scientific, historical and aesthetic values of the area for the future generations.

- All scientific and logistical activities in the Area should be planned with the aim to minimize human impact on the values of the Area;
- Scientific research which can potentially disturb breeding birds or sea mammals should be conducted with a special care and only for compelling scientific reasons; where taking of or harmful interference with animals is involved, the SCAR Code of Conduct for Use of Animals for Scientific Purposes in Antarctica should be used as a minimum standard.
- The use of Remotely Piloted Aircraft Systems (RPAS) for scientific purposes should adopt the precautionary principle in order to help minimize impacts and to assist users in meeting their obligations under the Protocol. Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica should be used as a minimum standard.
- In order to protect the diversity of terrestrial environments, which include intrinsic and scientific values, acknowledging that these environments may be at risk from impacts associated with research activities, including through the introduction of non-native species, transfer of native species between locations, or the accidental release of contaminants, Scientific Committee on Antarctic Research's Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica and Non-Native Species Manual should be used as a minimum standard.
- Collecting any specimen (e.g. stones, fossils, historical objects etc.) except for approved scientific or educational purposes with appropriate permits should be prohibited;
- Sample size of biological or non-biological material should be, as far as possible, limited to the minimum;
- Long-term monitoring or experimental sites should be, as far as practicable, clearly identified, and the information should be exchanged through the ASMA Coordinator;
- Stringent measures to avoid the introduction or spread of non-native species should be taken;
- Human traffic should be undertaken carefully to minimize disturbance to animals, soil and vegetated areas.; as far as possible existing tracks should be used;
- Use of helicopters and land vehicles should be kept to an absolute minimum, and never – except in emergency – in places where near birds or sea mammals breed or congregate;

- Field camps should be located as far as possible on non-vegetated sites, and should also avoid concentrations and breeding locations of mammals and birds. Previously occupied campsites should be re-used where appropriate. The location of field camps should be recorded, and the information exchanged through the Electronic Information Exchange System (EIES);
- Scientific research in the Scientific Zones should be conducted with a special care, avoiding or minimizing environmental impact;
- Visits and activities conducted in the Scientific Zones should be recorded (especially type and quantity of all samples), and the information should be exchanged through the Electronic Information Exchange System (EIES);
- Access to Scientific Zones designated for the presence of breeding birds should be restricted between 1 October to 15 April to those conducting essential scientific research, monitoring or maintenance;
- Access to Scientific Zones designated for the presence of vegetation banks should be restricted during the summer season to those conducting essential scientific research, monitoring or maintenance;
- Access to Scientific Zone designated on Crosses Hill on northern flank of Ferraz Station because of concentration of terns should be restricted between 1 October to 31 December to those conducting scientific research, monitoring or essential station operations;
- Research in Scientific Zones designated in shallow marine waters should, as far as possible, avoid or minimize the use of invasive methods (dredging, grabbing, trawling etc.). The coordinates of sites where invasive methods were used should be recorded, and the information should be exchanged through the Electronic Information Exchange System (EIES).

APPENDIX C

Protected Areas within ASMA 01

- Antarctic Specially Protected Areas No 128, Western Shore of Admiralty Bay
  Currently valid management plan is available at https://documents.ats.aq/recatt/att648_e.pdf

- Antarctic Historic Sites and Monuments No. 51, Puchalski Grave
  Information about HSM No. 51 can be found at https://www.ats.aq/devph/en/apa-database/4

APPENDIX D

Relevant and Supporting Documents

Manual of Regulations and Guidelines Relevant to Tourism and Non-Governmental Activities in the Antarctic Treaty area. Decision 6 (2021) - ATCM XLIII - CEP XXIII, Paris (https://www.ats.aq/devAS/Meetings/Measure/738).
General Guidelines and Site Guidelines Checklist for Visitors to the Antarctic. Resolution 4 (2021) – ATCM XLIII - CEP XXIII, Paris (available at https://www.ats.aq/devAS/Meetings/Measure?lang=e&id=743).

Scientific Committee on Antarctic Research's Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica. Resolution 4 (2019) - ATCM XLII - CEP XXII, Prague (available at https://ats.aq/devAS/Meetings/Measure/704).

Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica. Resolution 4 (2018) – ATCM XLI – CEP XXI, Buenos Aires (available at https://ats.aq/devAS/Meetings/Measure/679).

Scientific Committee on Antarctic Research's Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica. Resolution 5 (2018) - ATCM XLI - CEP XXI, Buenos Aires (available at https://ats.aq/devAS/Meetings/Measure/680).

Guidelines for the preparation of ASMA management plans. Resolution 1 (2017) Annex B - ATCM XL - CEP XX, Beijing (available at https://www.ats.aq/devAS/Meetings/Measure/659).

Revised Antarctic Conservation Biogeographic Regions. Resolution 3 (2017) - ATCM XL - CEP XX, Beijing (available at https://www.ats.aq/devAS/Meetings/Measure?lang=e&id=661).
Non-Native Species Manual. Resolution 4 (2016) – ATCM XXXIX - CEP XIX Santiago (avaiable at https://ats.aq/devAS/Meetings/Measure/640).

Important Bird Areas in Antarctica (2015) appended to ATCM XXXVIII - IP 27 (available at Important_Bird_Areas_in_Antarctica_2015_v5.pdf (era.gs).

Environmental Domains Analysis for the Antarctic continent as a dynamic model for a systematic environmental geographic framework. Resolution 3 (2008) - ATCM XXXI - CEP XI, Kyiv (available at https://www.ats.aq/devAS/Meetings/Measure/412).

Practical Guidelines for Ballast Water Exchange in the Antarctic Treaty Area. Resolution 3 (2006) – ATCM XXIX – CEP IX, Edinburgh (available at http://www.ats.aq/documents/recatt%5Catt345 e.pdf).

Guidelines for the Operation of Aircrafts near Concentrations of Birds in Antarctica. Resolution 2 (2004) – ATCM XXVII - CEP VII, Cape Town (available at http://www.ats.aq/documents/recatt/Att224_e.pdf).

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Marsz A.A. and Stryszyńska A. (eds.) 2000. The main features of the climate region the Polish Antarctic Station H. Arctowski (West Antarctica, South Shetland Islands, King George Island). Wyższa Szkoła Morska, Gdynia: 1–264 (in Polish).

Plenzler, J., Budzik, T., Puczko, D., Bialik, R. 2019. Climatic conditions at Arctowski Station (King George Island, West Antarctica) in 2013–2017 against the background of observed regional changes. Polish Polar Research, 40 (1): 1-27. ISSN 0138-0338.

Potocka, M., Krzemińska, E. 2018. Trichocera maculipennis (Diptera) - an invasive species in Maritime Antarctica. Peer J, 6, e5408.

Report of a finding of Trichocera maculipennis in Antarctic Specially Protected Area 128. (2023) - ATCM XLV - CEP XXV, Helsinki.

Measure 2 (2023)

Antarctic Specially Protected Area No 108 (Green Island, Berthelot Islands, Antarctic Peninsula): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation IV-9 (1966), which designated Green Island, Berthelot Islands, Antarctic Peninsula as Specially Protected Area ("SPA") No 9;
- Recommendation XVI-6 (1991), which annexed a Management Plan for the Area;
- Decision 1 (2002), which renamed and renumbered SPA 9 as ASPA 108;
- Measures 1 (2002), 1 (2013) and 1 (2018), which adopted revised Management Plans for ASPA 108;

Recalling that Recommendation IV-9 (1966) was designated as no longer current by Decision 1 (2011) and that Recommendation XVI-6 (1991) did not become effective and was withdrawn by Decision 3 (2017);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 108;

Desiring to replace the existing Management Plan for ASPA 108 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 108 (Green Island, Berthelot Islands, Antarctic Peninsula), which is annexed to this Measure, be approved; and
2. the Management Plan for the Antarctic Specially Protected Area No 108 annexed to Measure 1 (2018) be revoked.

Management Plan for Antarctic Specially Protected Area No. 108

GREEN ISLAND, BERTHELOT ISLANDS, ANTARCTIC PENINSULA

Introduction

The primary reason for the designation of Green Island, Berthelot Islands, Antarctic Peninsula (65°19'S, 64°09'W; area 0.2 km²) as an Antarctic Specially Protected Area (ASPA) is to protect environmental values, and primarily the rich Chorisodontium-Polytrichum moss turf present within the Area.

Green Island, was originally designated as a Specially Protected Area (SPA) through Recommendation IV-9 (1966, SPA No. 9) after a proposal by the United Kingdom. It was designated on the grounds that the vegetation "is exceptionally rich, [and] is probably the most luxuriant anywhere on the west side of the Antarctic Peninsula". The Recommendation noted: "in some places the humus is 2 metres thick and that this area, being of outstanding scientific interest, should be protected because it is probably one of the most diverse Antarctic ecosystems". A Management Plan for the site was prepared by the United Kingdom and adopted through Recommendation XVI-6 (1991). The original reasons for designation were extended and elaborated, although following comparisons to other sites in the vicinity, Green Island was no longer considered to be particularly diverse. Nevertheless, the vegetation on the island was described as extensive on the north-facing slopes, with well-developed continuous banks of moss turf formed by Chorisodontium aciphyllum and Polytrichum strictum that, over much of their extent, overlie peat of more than one metre in depth. Antarctic hair grass (Deschampsia antarctica), one of only two native vascular plants that grow within the Antarctic Treaty area, was noted as frequent in small patches near an Antarctic shag (Leucocarbo bransfieldensis) colony. The colony of Antarctic shags, located on the steep, rocky north-western corner of the island, was noted as being possibly one of the largest along the Antarctic Peninsula.

The Area fits into the wider context of the Antarctic Protected Area system by protecting moss turf and peat that are rare in the west Antarctic Peninsula area and, unlike moss banks within more northerly ASPAs, are largely unimpacted by Antarctic fur seal damage (Arctocephalus gazella). Resolution 3 (2008) recommended that the Environmental Domains Analysis for the Antarctic Continent, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, ASPA No. 108 is contained within Environment Domain B (Antarctic Peninsula mid-northern latitudes geologic). Other protected areas containing Domain B include ASPA Nos. 115, 134, 140 and 153 and ASMA No. 4. ASPA No. 108 sits within Antarctic Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula (Resolution 3 (2017).

1. Description of values to be protected

Following a management visit to the ASPA in 2020, the values specified in the earlier designation were reaffirmed. These values are set out as follows:

- The primary value worthy of protection is the Polytrichum strictum moss banks, with associated Chorisodontium aciphyllum, which may be one of the most extensive examples of this vegetation feature in the west Antarctic Peninsula region, occupying an area of over 0.5 ha. Moreover, in recent years many comparable moss banks on more northerly islands have suffered damage as a result of an increase in Antarctic fur seals. The vegetation at Green Island has thus far escaped any significant damage.
- Chorisodontium aciphyllum is close to the southern-most limit of its range at the Berthelot Islands.
- The area contains a large number of breeding Antarctic shags (also known as imperial cormorants; Leucocarbo bransfieldensis), which may represent one of the largest breeding populations known within the Antarctic Peninsula.
- Green Island has been afforded protection throughout most of the period of scientific activity in the region, with entry permits having been issued for only the most compelling scientific reasons. The island has not been subjected to intensive visitation, research or sampling and is potentially valuable as a baseline site for future studies.

2. Aims and objectives

Management at Green Island aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microbes;
- minimise the possibility of the introduction of pathogens which may cause disease in fauna populations within the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardize the natural ecological system in that Area; and
- preserve the natural ecosystem of the Area as a reference area for future studies.

3. Management activities

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

- Copies of this Management Plan shall be made available to vessels and aircraft planning to visit the vicinity of the Area.

- Markers, signs or other structures (e.g., cairns) erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III to the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- The Management Plan shall be reviewed at least every five years and updated as required.
- A copy of this Management Plan shall be made available at Akademik Vernadsky Station (Ukraine; 65°15'S, 64°16'W).
- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I to the Protocol on Environmental Protection to the Antarctic Treaty.
- National Antarctic Programmes operating in the Area shall consult together with a view to ensuring the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1. Overview map, showing the location of Green Island on the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -55°, Standard parallel: -71°.

Map 2. Local area map showing the location of ASPA No. 108 Green Island, Berthelot Island, in relation to stations and other protected Areas in the vicinity. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -64°, Standard parallel: -71°.

Map 3. ASPA No. 108 Green Island, Berthelot Islands, Antarctic Peninsula, topographic map. Map derived from ground survey 24 February 2001 and digital orthophotography (source aerial photography taken 14 February 2001 by the British Antarctic Survey). Map specifications – Projection: UTM Zone 20S; Spheroid: WGS84; Datum: mean sea level (EGM96).

6. Description of the Area

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

- *General description*

Green Island (65°19'S, 64°09'W, approximately 0.2 km²; Map 1) is a small island situated 150 m north of the largest of the Berthelot Islands group, within Grandidier Channel, approximately 3 km off the Graham Coast of the Antarctic Peninsula (Map 2). Green Island is 520 m from north to south and 500 m from east to west, rising to a rounded peak at a height of 83 m. The island rises steeply on all sides, with high precipitous cliffs on the south and east side. The largest extent of low ground occurs above the northern coast, which comprises a gently sloping rock platform. There are several permanent snow patches with the largest occurring around the summit and to the south and east of the summit. There are no permanent freshwater bodies on the island.

- *Boundaries*

The designated Area comprises all of Green Island, with the boundary defined as the low tide level. Offshore islets and rocks are not included within the Area. Boundary markers have not been installed. The coast itself is a clearly defined and visually obvious boundary feature.

- *Climate*

No climate data are available for Green Island, but conditions are expected to be similar to those at Akademik Vernadsky Station (Ukraine) on Galindez Island, Argentine Islands, 8 km to the north. The mean summer temperature at Vernadsky is 0 °C while the extreme maximum summer temperature is 11.7 °C. In winter, the mean temperature is -10 °C and the extreme minimum temperature is -43.3 °C. The mean wind speed is 7.5 knots.

- *Geology and soils*

Green Island, together with the rest of the Berthelot Islands, is composed of gabbro of Lower Jurassic to Lower Tertiary age (British Antarctic Survey, 1981). Excluding the large peat deposits, soil is sparse and seldom exceeds 20 cm in depth, except occasionally in rock depressions and gullies. This is predominantly an ahumic coarse mineral soil derived from weathering of the parent rock. Ledges and gullies close to the Antarctic shag colony contain an organically richer soil derived in part from decayed moss and guano. Over much of the steep northern slopes the mosses Chorisodontium aciphyllum and Polytrichum strictum have developed a deep turf of living moss overlying at least 1 m of barely altered or decomposed moss peat (Smith, 1979, Fenton and Smith, 1982). The moss peat may be of use in determining climatic characteristics over the late Holocene (Royles et al., 2012). The permafrost layer is found 20-30 cm below ground level. Elsewhere on the island, notably the north-eastern side, there are small areas of scree. There are no well-developed periglacial features, although a few small stone circles are evident occasionally.

- *Vegetation*

The most significant feature of the vegetation is the extensive continuous stand of Polytrichum strictum on the northern slopes of the island (Map 3). Together with

Chorisodontium aciphyllum, a dense moss turf community (or moss bank) has formed that is approximately 140 m wide, extends from an elevation of approximately 25 m up to 70 m, and covers over 0.5 ha (Bonner and Smith, 1985). Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the total area of green vegetation within the ASPA to be 0.036 km² (c. 16.5% of the ASPA area). Growth is lush and the permanently frozen peat in places reaches two metres deep. The surface of the hard compact moss is stepped, which is thought to be a result of slumping of the active layer on the steep slope. Extensive erosion of the moss banks is evident in places, but this appears to be a consequence of the peat bank reaching a maximum sustainable depth on the steep slope and is not due to fur seal damage, as observed in banks in more northerly ASPAs (e.g., ASPA No. 113). Chorisodontium aciphyllum is abundant at the edges of the bank and around the periphery of small gullies in the bank, where there is some shelter and moisture available from drifted snow. Both C. aciphyllum and P. strictum are tall turf-forming mosses that are usually intimately intermixed in such communities further north in the maritime Antarctic; however, in the Grandidier Channel region the more xeric P. strictum often occurs alone. C. aciphyllum is close to its southernmost limit on Green Island (Smith, 1996). Amongst the C. aciphyllum, other mosses, such as Pohlia nutans and Sanionia georgicouncinata, are frequent, together with the liverworts Barbilophozia hatcheri, Cephaloziella varians and Lophozia excisa. The rare moss, Lophozia cfr. groenlandica (Nees) Macoun, has also been identified recently.

Epiphytic lichens are not abundant on the live Polytrichum and Chorisodontium, but Sphaerophorus globosus is frequent in the more exposed north-western area. Several species of Cladonia are widespread on the moss banks. The white encrusting epiphyte Ochrolechia frigida is present but not abundant here; black crustose species occur on moribund moss.

The edges of the moss banks and other large areas of the north, north-west and east-oriented rock terraces that extend towards the highest point of the island are covered with Sanionia georgicouncinata-dominated moss patches of different areas. Wetter habitats and melt runnels, especially widespread on terraces with small fresh pools, are inhabited by another community type comprised predominantly of Warnstorfia fontinaliopsis and Brachythecium austrosalebrosum.

A crustose lichen-domonated community is widespread on the island, being found on rocks from the coast to the summit. Acarospora macrocyclos, Buellia spp., Lecanora spp. and Rhizoplaca melanophthalma are widespread and Rhyzocarpon geographicum is abundant at all altitudes. An ornithophylic lichen Auestroplaca hookeri is common near penguin and shag nesting sites. There are also patches of Mastodia tessellata and Xanthoria spp. around the periphery of the penguin colony. Small areas of Austroplaca hookeri occur in the middle part of the islands north-facing slope, where south-polar skuas are active.

On rocks and boulders in areas away from the influence of birds, such as the north-facing rocks of the island, boulders and fellfields in the middle of the island’s northern slope and toward the highest point of the island, fruticose lichen and moss cushion communities are abundant, together with the lichens Umbilicaria antarctica, U. decussata, U. nylanderiana, U. umbilicarioides, Usnea antarctica, lichens of the Physcia genus, and various associated crustose lichens. The mosses Andreaea depressinervis, A. regularis and A. gainii are found on rocks as a component of these communities.

The steep western cliff of the island is covered by a moss carpet of Sanionia georgicouncinata and mosses Bartramia patens, Pohlia cruda, and Andreaea spp.

In the eastern corner of Green Island is located a community of nesting Larus dominicanus (65.322858°S, 64.144570°W), indicated by the presence of discarded limpet shells upon which the gulls have fed. Vegetation communities found in and around rock in this area include Deschampsia antarctica, Sanionia georgicouncinata, Pohlia nutans, Bartramia patens, Pohlia cruda and Syntrichia magellanica. Austroplaca hookeri, Mastodia tessellata and Usnea antarctica (together with Andreaea spp. mosses).

Plant records from the Area have been used in studies to examine moss and lichen species diversity on the Antarctic Peninsula at both a regional scale and a local scale (Casanovas et al., 2012). The only flowering plant thus far recorded on Green Island is Antarctic hair grass (Deschampsia antarctica), which, during a visit in 2020, was found to be frequent in small patches above the Antarctic shag colony and on rock ledges on the western side of the island beneath the cliff (65.323113°S, 64.153938°W) and near kelp gull nests (65.322858°S, 64.144570°W).

The green foliose alga Prasiola crispa is sparsely spread at the edges of the island's Antarctic shag and gentoo penguin colonies and is also found on the northern slopes of the island close to the hightest point. During the Antarctic summer, snow algae bloom on the snow cover of the island.

- *Breeding birds*

A sizeable colony of Antarctic shags (Leucocarbo bransfieldensis) is present on the steep, rocky northwestern flank of the island (65°19'21"S, 64°09'11"W; Map 3). This is one of the largest known Antarctic shag colonies along the Antarctic Peninsula (Bonner and Smith, 1985), although numbers may vary substantially from year to year (Casaux and Barrera-Oro, 2006). Approximately 50 pairs were estimated as present in 1971 (Kinnear, 1971), while 112 birds were recorded in 1973 (Schlatter and Moreno, 1976). During a visit in March 1981, 500-600 individuals (of which 300-400 were immature) were present. Harris (2001) recorded 71 chicks on 24 February 2001, while approximately 100 birds were noted on 15 February 2011 and 200-250 birds on 22 January 2013, of which c. 100 were adults. In April 2017, c. 100 adult birds were observed. In 2020, 100 nests with 185 chicks were recorded by researchers from the Ukrainian Antarctic Scientific Center.

Brown skuas (Stercorarius antarcticus) are only occasional visitors to the Berthelot Islands (Pilipenko, 2012). In contrast, south polar skuas (Stercorarius maccormicki) are numerous on the island, along with a few possible hybrids. In March 1981, over

80 birds were observed, but only ten breeding pairs were confirmed, most of which were rearing two chicks. In 2020, six nesting pairs were reported on the island. Gentoo penguins (Pygoscelis papua) started nesting on Green Island in around 2015. This is probably the southernmost known habitat of this species. The population has doubled in the last few years, to about 40 breeding pairs (as reported in during the 2019/20 season by Ukrainian researchers). Larus dominicanus (1-2 pairs) nest on the eastern corner of the island (65.322840°S, 64.144580°W). Further monitoring of gentoo penguin, Antarctic shag and other bird populations within the Area is encouraged.

During the summer, fur seals regularly hauling out onto rocks on the coast and only rarely climb on the more vegetated areas inland.

- *Invertebrates*

There is little information on the invertebrate fauna at Green Island, although 15 species were recorded in a study that suggested the invertebrate fauna on Green Island was comparatively diverse for the region (Usher and Edwards, 1986). The most abundant species were Cryptopygus antarcticus, Belgica antarctica and Nanorchestes gressitti. Larval B. antarctica were particularly abundant on Green Island compared to neighbouring Darboux Island. Other species recorded in the Area are Alaskozetes antarcticus, Ereynetes macquariensis, Eupodes minutus, Eupodes parvus grahamensis, Friesea grisea, Gamasellus racovitzai, Halozetes belgicae, N. berryi, Oppia loxolineata, Parisotoma octo-oculata, Rhagidia gerlachei and Stereotydeus villosus.

- *Human activities and impacts*

There have been few reported visits to Green Island. The first recorded landing on the island was by the Première Expédition Antarctiques Française in 1903-05. The Deuxième Expédition Antarctiques Française visited Green Island several times during the winter in 1909. The British Graham Land Expedition landed on the island on 18 March 1935. Vegetation studies were undertaken on Green Island by Smith in 1981 (Bonner and Smith, 1985) and Komárková in 1982-83 (Komárková, 1983). Numerous 30 cm lengths of 2.5 mm diameter iron wire, marking the corners of 50 m square quadrats of the Polytrichum strictum moss turf overlying the peat banks, were recorded (and left in situ) by an inspection team in January 1989 (Heap, 1994). It is not known precisely when these markers were installed. The number of markers, their distribution and the nature of any possible contamination these may have had on the moss is unknown. In January 2013, a metal rod, approximately 20 cm long and of unknown origin, was found located on the moss bank at 65°19'23"S, 64° 09'02"W.

In recent years a number of important vegetation sites in the Antarctic Peninsula region have been subjected to damage from trampling and nutrient enrichment by increasing numbers of Antarctic fur seals (Arctocephalus gazella). No Antarctic fur seals were observed on Green Island during a site visit made on 24 February 2001, although there was some evidence of recent trampling and nutrient enrichment on parts of the lower moss banks. However, damage appeared limited and most of the extensive moss banks remained intact. During a site visit in April 2017, no evidence of further seal damage was noted.

6(ii) Access to the Area

- Access to the Area shall be by boat, or over sea ice by vehicle or foot. No special restrictions apply to the routes used to move to and from the Area by boats or over sea ice.
- The recommended landing site for small boats is on the rocky northern coast, with the recommended landing site located in a small cove at 65°19'17.6"S, 64°08'46.0"W (Map 3). 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.
- Aircraft are prohibited from landing within the Area.
- Boat crew, or other people on boats, are prohibited from moving on foot beyond the immediate vicinity of the landing site unless specifically authorised by Permit.

6(iii) Location of structures within and adjacent to the Area

There are no structures present in the Area. The nearest scientific research station is Akademik Vernadsky (Ukraine) (65°15’S, 64°16’W), approximately 8 km north of the Area on Galindez Island.

6(iv) Location of other protected Areas in the vicinity

Other protected areas in the vicinity include:

- ASPA No. 113, Lichfield Island, Arthur Harbour, Anvers Island, Palmer Archipelago, 64°46'S, 64°06'W, 62 km to the north.
- ASPA No. 139, Biscoe Point, Anvers Island, Palmer Archipelago, 64°48'S, 63°46'W, 60 km to the north.
- ASPA No. 146, South Bay, Doumer Island, Palmer Archipelago, 64°51'S, 63°34'W, 60 km to the north west.
- ASPA No. 176, Rosenthal Islands, Anvers Island, Palmer Archipelago, 64°36'S 64°15'W, 80 km to the north.

ASPA Nos. 113, 139 and 176 lie within Antarctic Specially Managed Area 7 Southwest Anvers Island and Palmer Basin.

6(v) Special zones within the Area

There are no special zones within the Area.

7. Permit conditions

7(i) General 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 compelling scientific reasons which cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental or scientific values of the Area;
- the Permit shall be issued for a finite period; and
- the Permit, or an authorised copy, shall be carried when in the Area.

7(ii) Access to, and movement within or over, the Area

- Vehicles are prohibited within the Area and all movement within the Area should be on foot.
- The operation of aircraft over the Areas should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the operations of aircraft near concentrations of birds' contained in Resolution 2 (2004).
- Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for compelling scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority. Furthermore, operation of RPAS within or over the Area shall be in accordance with the 'Environmental guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica' (Resolution 4 (2018)) (available at: https://documents.ats.aq/recatt/att645_e.pdf).
- All movement should be undertaken carefully so as to minimise disturbance to the soil and vegetated surfaces and birds present, walking on snow or rocky terrain if practical.
- Pedestrian traffic should be kept to the minimum necessary to undertake permitted activities and every reasonable effort should be made to minimise trampling effects.

7(iii) Activities which may be conducted within the Area

Activities which may be conducted in the Area include:

- essential management activities, including monitoring;
- compelling scientific research that cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area; and
- sampling, which should be the minimum required for approved research programmes.

7(iv) Installation, modification or removal of structures

- Permanent structures or installations are prohibited.
- No structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit.
- All markers, structures or scientific equipment installed in the Area must be clearly identified by country, name of the principal investigator or agency, year of installation and date of expected removal.
- All such items should be free of organisms, propagules (e.g., seeds, eggs, spores) and non-sterile soil (see section 7(vi)) and be made of materials that can withstand the environmental condition and pose minimal risk of contamination of the Area.
- Removal of specific structures or 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(v) Location of field camps

When necessary for purposes specified in the Permit, temporary camping is allowed within the Area on the low platform on the northern coast (65°19’18’’S, 64°08’55’’W; Map 3). Camps should be located on snow surfaces that typically persist at this location or on gravel/rock when snow cover is absent. Camping on vegetated ground is prohibited.

7(vi) Restrictions on materials and organisms which may be brought into the Area

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. Further guidance can be found in the CEP non-native species manual (Resolution 4 (2016)) and the SCAR Environmental code of conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018)). In view of the presence of breeding bird colonies within the Area, no poultry products, including wastes from such products and products containing uncooked dried eggs, shall be released into the Area or into the adjacent sea.

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. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided. Fuel or other chemicals shall not be stored in the Area unless specifically authorised by Permit condition. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period. 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. The appropriate authority should be notified of anything released and not removed that was not included in the authorised Permit.

7(vii) Taking of, or harmful interference with, native flora or fauna

Taking of, or harmful interference with, native flora and fauna is prohibited, except in accordance with a permit issued in accordance with Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, this should, as a minimum standard, be in accordance with the SCAR code of conduct for the use of animals for scientific purposes in Antarctica (Resolution 4 (2019)). Any soil or vegetation sampling is to be kept to an absolute minimum required for scientific or management purposes, and carried out using techniques which minimise disturbance to surrounding soil, ice structures and biota.

7(viii) The collection or removal of materials 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, and which was not brought into the Area by the Permit holder or otherwise authorised may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ: if this is the case the appropriate national authority must be notified and approval obtained.

7(ix) Disposal of waste

All wastes, including all human wastes, shall be removed from the Area. Human wastes may be disposed of into the sea.

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis or to carry out protective measures.

- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Scientific activities shall be performed in accordance with the SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)). Geological research shall be undertaken in accordance with the SCAR Environmental Code of Conduct for Geosciences Field Research Activities in Antarctica (Resolution 1 (2021)).

7(xi) Requirements for reports

The principal Permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the Antarctic Specially Protected Area visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Appendix 2). The appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit. Wherever possible, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

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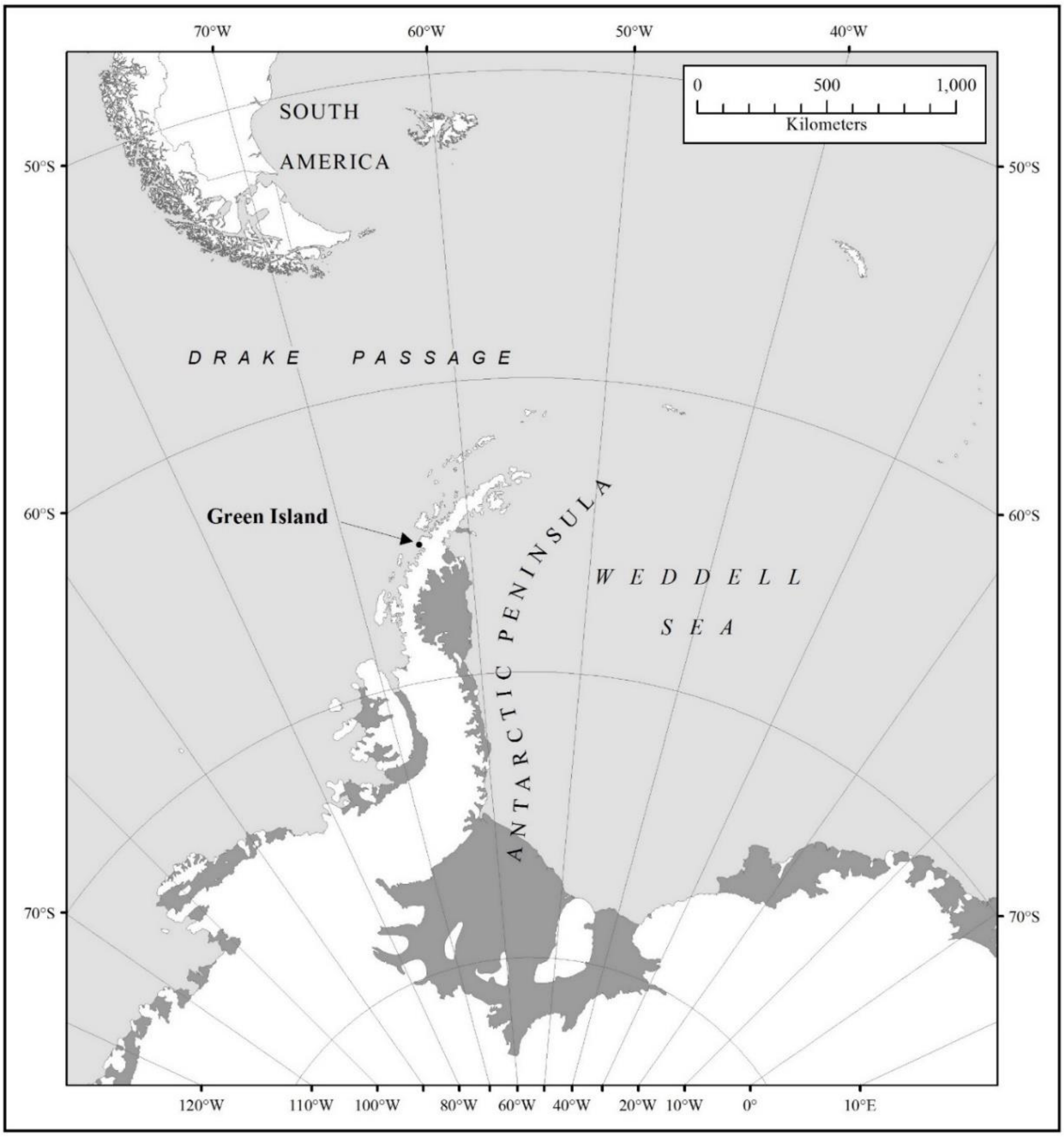
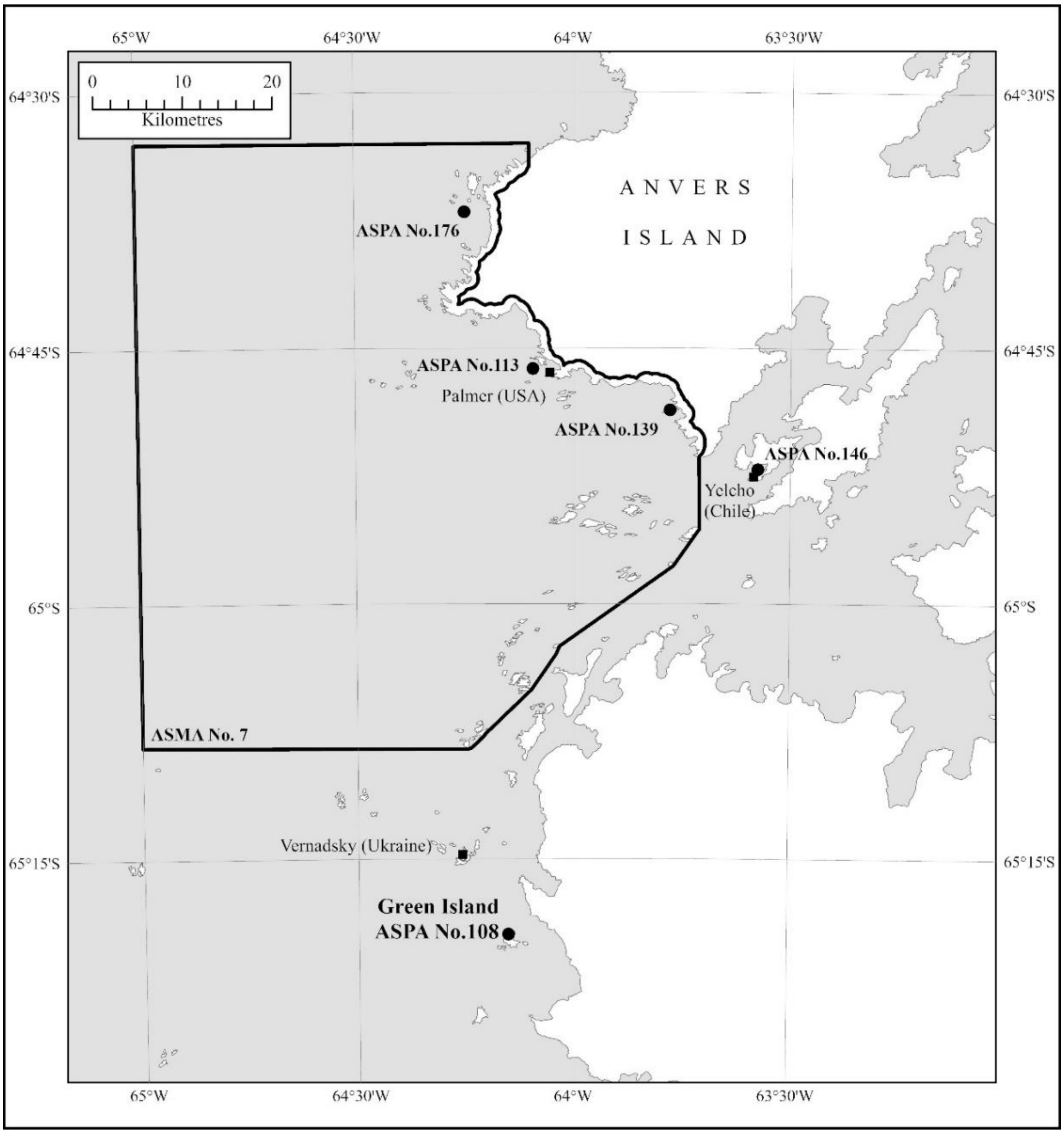
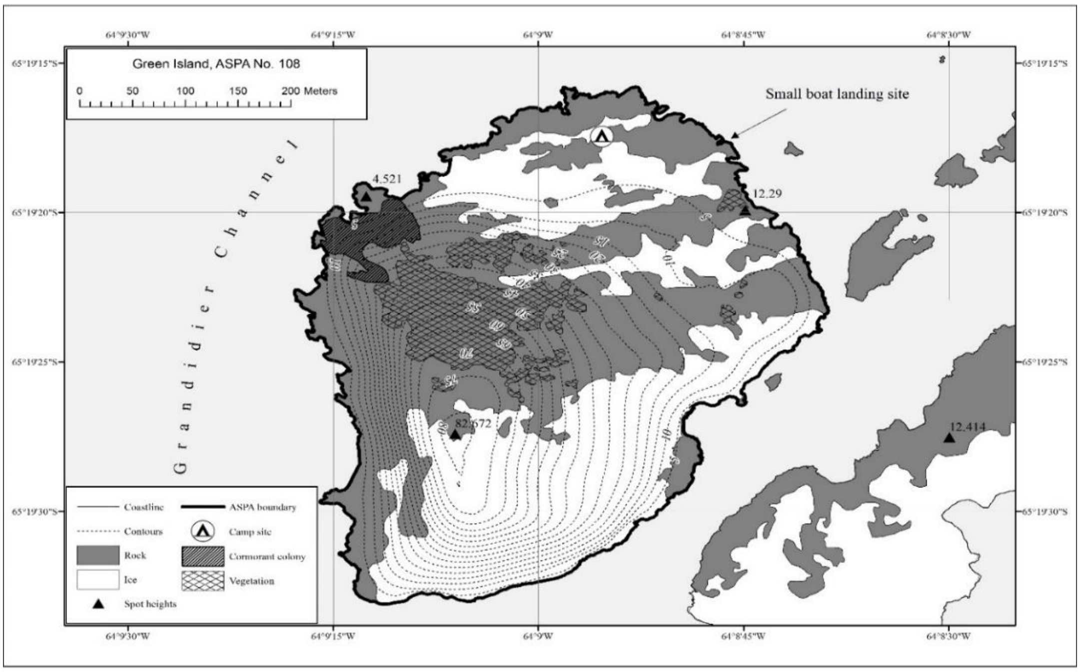
Map 1. Overview map, showing the location of Green Island on the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -55°, Standard parallel: -71°.



Map 2. Local area map showing the location of ASPA No. 108 Green Island, Berthelot Island, in relation to stations and other protected Areas in the vicinity. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -64°, Standard parallel: -71°.



Map 3. ASPA No. 108 Green Island, Berthelot Islands, Antarctic Peninsula, topographic map. Map derived from ground survey 24 February 2001 and digital orthophotography (source aerial photography taken 14 February 2001 by the British Antarctic Survey). Map specifications – Projection: UTM Zone 20S; Spheroid: WGS84; Datum: mean sea level (EGM96).



Measure 3 (2023)

Antarctic Specially Protected Area No 117 (Avian Island, Marguerite Bay, Antarctic Peninsula): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XV-6 (1989), which designated Avian Island, North-West Marguerite Bay as Site of Special Scientific Interest (“SSSI”) No 30 and annexed a Management Plan for the Site;
- Recommendation XVI-4 (1991), which redesignated SSSI 30 as Specially Protected Area (“SPA”) No 21 and annexed a revised Management Plan for the Area;
- Decision 1 (2002), which renamed and renumbered SPA 21 as ASPA 117;
- Measures 1 (2002), 2 (2013) and 2 (2018), which adopted revised Management Plans for ASPA 117;

Recalling that Recommendations XV-6 (1989) and XVI-4 (1991) did not become effective and were designated as no longer current by Decision 1 (2011);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 117;

Desiring to replace the existing Management Plan for ASPA 117 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 117 (Avian Island, Marguerite Bay, Antarctic Peninsula), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 117 annexed to Measure 2 (2018) be revoked.

Management Plan for Antarctic Specially Protected Area No. 117

AVIAN ISLAND, MARGUERITE BAY, ANTARCTIC PENINSULA

Introduction

The primary reason for the designation of Avian Island, Marguerite Bay, Antarctic Peninsula (67°46'S, 68°54'W; 0.49 km²) as an Antarctic Specially Protected Area (ASPA) is to protect environmental values and primarily the abundance and diversity of breeding seabirds on the island.

Avian Island is situated in northwestern Marguerite Bay, 400 m south of Adelaide Island on the western side of the central Antarctic Peninsula. It was originally designated as Site of Special Scientific Interest (SSSI) No. 30 under Recommendation XV-6 in 1989 after a proposal by the United Kingdom. Included was the island together with its littoral zone, but excluded was a small area near a refuge on the northwestern coast of the island. Values protected under the original designation were described as the abundance and diversity of breeding seabirds present on the island, that the southern giant petrel (Macronectes giganteus) colony is one of the most southerly known breeding populations of this species, and that the Antarctic shags (Leucocarbo bransfieldensis) are breeding close to the southern limit of their range. The Area was therefore considered of outstanding ornithological importance, meriting protection from unnecessary human disturbance.

Designation as an SSSI was terminated with redesignation of Avian Island as a Specially Protected Area (SPA) through Recommendation XVI-4 (1991, SPA No. 21) after a proposal by the United Kingdom. The boundaries were similar to the original SSSI, but included the entire island and the littoral zone without the exclusion zone near the refuge on the northwestern coast. After re-designation as ASPA 117 through Decision 1 (2002), the ASPA Management Plan was approved through Measure 1 (2002).

The Area fits into the wider context of the Antarctic Protected Area system by protecting the breeding site of seven seabird species, including southern giant petrels which are vulnerable to disturbance. No other ASPA in the region protects such a wide diversity of breeding bird species. Resolution 3 (2008) recommended that the Environmental Domains Analysis for the Antarctic Continent be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, Avian Island is described as Domain E (Antarctic Peninsula and Alexander Island main ice fields), which is also found in ASPAs 113, 114, 126, 128, 129, 133, 134, 139, 147, 149, 152 and ASMAs 1 and 4. However, given that Avian Island is predominantly ice-free this domain may not be fully representative of the environment encompassed within the Area. Although not specifically described as such in Morgan et al., Avian Island may be better represented by Domain B (Antarctic Peninsula mid-northern latitudes geologic). Other protected areas containing Domain B include ASPAs 108, 115, 129, 134, 140 and 153 and ASMA 4. The ASPA sits within Antarctic

Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula (Terauds et al., 2012; Terauds and Lee, 2016) (Resolution 3 (2017)). Through Resolution 5 (2015) Parties recognised the usefulness of the list of Antarctic Important Bird Areas (IBAs) in planning and conducting activities in Antarctica. Important Bird Area ANT095 Avian Island has the same boundary as ASPA 117 and qualifies on the basis of the Adélie penguins (Pygoscelis adeliae), Antarctic shags, and south polar skuas (Stercorarius maccormicki).

1. Description of values to be protected

The outstanding environmental value of the Area, which is the primary reason for designation as an ASPA, is based on the following:

- the Adélie penguin (Pygoscelis adeliae) colony is one of the largest in Palmer Land, containing around 77,515 breeding pairs;
- the Antarctic shag (Leucocarbo bransfieldensis) colony is one of the largest known breeding sites in the Antarctic and is close to the southern limit of this species' breeding range;
- the outstanding and unique attribute of being the only known site on the Antarctic Peninsula where seven seabird species are breeding in such close proximity to each other within the confined space of a single, small island, with unusually high population densities and virtually the whole island occupied by breeding birds throughout the summer;
- the southern giant petrel (Macronectes giganteus) colony is one of the two largest on the Antarctic Peninsula;
- the kelp gull (Larus dominicanus) colony is also large and is breeding near the southern extent of its range; and
- the moss Warnstorfia fontinaliopsis on Avian Island is near the southern limit of its known range.

2. Aims and objectives

The aims and objectives of this Management Plan are to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microbes;
- minimise the possibility of the introduction of pathogens which may cause disease in fauna populations within the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardize the natural ecological system in that Area; and
- preserve the natural ecosystem of the Area as a reference area for future studies.

3. Management activities

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

- A copy of this Management Plan shall be made available at Teniente Luis Carvajal Station (Chile; 67°46'S, 68°55'W), Rothera Research Station (UK; 67°34' S, 68°07'W) and General San Martín Station (Argentina; 68°08' S, 67°06'W).
- The Management Plan shall be reviewed at least every five years and updated as required.
- Visiting field parties shall be briefed fully by the national authority on the values that are to be protected within the Area and the precautions and mitigation measures detailed in this Management Plan.
- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I of the Protocol on Environmental Protection to the Antarctic Treaty.
- Copies of this Management Plan shall be made available to vessels and aircraft planning to visit the vicinity of the Area.
- All pilots operating in the region shall be informed of the location, boundaries and restrictions applying to entry and over-flight in the Area.
- Markers, signs or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III to the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- National Antarctic Programmes operating in the Area shall consult together with a view to ensuring the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1. Avian Island, ASPA No. 117, in relation to Marguerite Bay, showing the locations of the stations Teniente Luis Carvajal (Chile), Rothera (UK), General San Martín (Argentina) and the Turkish Scientific Research Camp (Türkiye). The location of other protected areas within Marguerite Bay (ASPA No. 107 at Emperor Island (Dion Islands), ASPA No. 115 at Lagotellerie Island, ASPA No. 129 at Rothera Point and ASPA No. 177 which covering parts of Leonie Islands and southeast Adelaide Island) are also shown. Inset: the location of Avian Island on the Antarctic Peninsula.

Map 2. Avian Island, ASPA No. 117, topographic map. Map specifications – projection: Lambert conformal conic; standard parallels: 1st 67° 30' 00"S; 2nd 68° 00' 00"S; central meridian: 68° 55' 00"W; latitude of origin: 68° 00' 00"S; spheroid: WGS84; datum: mean sea level; vertical contour interval 5 m; horizontal accuracy: ±5 m; vertical accuracy ±1.5 m.

Map 3. Avian Island, ASPA No. 117, breeding wildlife sketch map. Positions of nests and colonies are accurate to ±25 m. Information was derived from Poncet (1982). Map specifications – projection: Lambert conformal conic; standard parallels: 1st 67° 30' 00"S; 2nd 68° 00' 00"S; central meridian: 68° 55' 00"W; latitude of origin: 68° 00' 00"S; spheroid: WGS84; datum: mean sea level; vertical contour interval 5 m; horizontal accuracy: ±5 m; vertical accuracy ±1.5 m.

6. Description of the Area

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

- *General description*

Avian Island (67°46'S, 68°54'W, 0.49 km²), is situated in the northwest of Marguerite Bay, 400 m south of the southwestern extremity of Adelaide Island (Map 1). The island is 1.45 km long by 0.8 km at its widest and is of roughly triangular shape. It is rocky with a low relief of generally less than 10 m in the north, rising to about 30 m at the centre, and 40 m in the south where several rock and ice slopes of up to 30 m drop steeply to the sea. The coastline is irregular and rocky with numerous offshore islets, although there are several accessible beaches on the northern and eastern coasts. The island is usually ice-free in summer. It contains habitat particularly suitable for a variety of breeding birds: well-drained north-facing slopes suitable for Antarctic shags; broken rock and boulders with crevices suitable for small nesting birds such as Wilson’s storm petrels (Oceanites oceanicus); elevated rocky heights suitable for southern giant petrels (Macronectes giganteus); extensive expanses of snow-free ground for Adélie penguins (Pygoscelis adeliae). The presence of the latter attracts skuas (Stercorarius maccormicki and Stercorarius antarcticus) and kelp gulls (Larus dominicanus).

- *Boundaries*

The designated Area comprises the whole of Avian Island and the littoral zone, offshore islets and rocks, and a buffer zone of the surrounding marine environment (including sea ice when present) within 100 m of the shoreline of the main island (Map 2). Boundary markers have not been installed because the coast forms a visually obvious reference for the marine boundary.

- *Climate and sea ice*

No extended meteorological records are available for Avian Island, but records from 1962-74 for Adelaide Base (formerly UK; now Teniente Luis Carvajal, Chile), 1.2 km distant, show a mean daily maximum temperature of 3 ºC in February (extreme maximum 9 ºC) and a mean daily minimum of -8 ºC in August (extreme minimum -44ºC). The same general pattern was observed in year-round observations made on the island in 1978-79 (Poncet and Poncet, 1979). Precipitation on the island in this year was usually as snow, most of which fell between August and October, but with occasional snowfalls and some rain in the summer.

Marguerite Bay may freeze in winter, although the extent and character of sea ice shows considerable inter-seasonal variation. Despite the extent and frequent persistence of regional sea ice, a recurrent polynya has been observed near Avian Island, which can provide ice-free conditions locally from October onward. In addition, strong tidal currents around Avian Island help to keep surrounding waters ice-free for much of the year, which facilitates easy access to feeding grounds for several species. The island is not particularly windy, with an annual average of 10 knots in 1978-79. However, the strong katabatic winds that descend from Adelaide Island, perhaps for 1-3 days a few times every month, reduce snow accumulation on the island and push sea ice away from the coast, helping to form the polynya. The relatively snow-free conditions are important for bird colonisation.

- *Geology, geomorphology and soils*

The bedrock of Avian Island forms part of a down-faulted block at the southwestern end of Adelaide Island and is composed of interbedded lithic-rich and feldspar-rich volcaniclastic sandstones. Bedded tuffaceaous sandstones, pebbly sandstones rich in volcanic lithics, and a volcanic granule breccia also occur. The latter is probably a primary volcanic deposit, while the rest of the sequence is largely composed of reworked volcanic material. The sequence forms part of the Mount Liotard Formation of Adelaide Island and is probably late Cretaceous in age (Griffiths, 1992; Moyes et al., 1994; Riley et al., 2012). Apart from rock outcrop, the surface consists mainly of frost-shattered rock with permafrost. Ornithogenic soils are widespread, particularly in the north; organic peat soil is virtually absent, but where present is not well-developed and is associated with moss growth. Several raised beaches have been noted on Avian Island, but the geomorphology has not otherwise been described.

- *Streams and lakes*

Avian Island has several ephemeral freshwater ponds of up to 10,000 m2 and of about 40 cm in depth, the largest being on the eastern coast, at about 5 m altitude, and on the north-western coast near sea level. Numerous small pools and meltwater channels develop from seasonal snow melt, and small streams drain valleys in the vicinity of the ponds. Both the ponds and melt-pools freeze solid in winter. Freshwater bodies on the island are organically enriched by guano, a source of nutrients, and in summer a number of the ponds show a rich benthic flora and fauna of algae, Phyllopoda, Copepoda, Nematoda, Protozoa, Rotifera, and Tardigrada.

Large numbers of the crustacean Branchinecta sp. have been observed (Poncet and Poncet, 1979). The freshwater ecology of the island has not been studied in detail.

- *Breeding birds*

Seven species of birds breed on Avian Island, which is a high number compared to other sites on the Antarctic Peninsula. Several species have unusually high populations, being some of the largest for their species in the Antarctic Peninsula region (Map 3). Detailed year-round data for all species were collected in 1978-79 (Poncet and Poncet, 1979), while data are otherwise sporadic. Descriptions below are thus often based on a single season's observations, and it should be emphasised that these data are therefore not necessarily representative of longer term population trends. However, this is the best information that is presently available.

The Avian Island Adélie penguin (Pygoscelis adeliae) colony occupies the northern half and central eastern coast of the island (Map 3). The initial management plan referred to the Adélie penguin colony as "the largest on the Antarctic Peninsula [containing] a third of the total population breeding in the region". While this is not substantiated by recent data (e.g., one Antarctic Peninsula colony has over 120,000 pairs (Woehler 1993)), the Avian Island colony still represents one of the largest breeding populations in Palmer Land. Recent research suggests that Adélie penguin numbers are decreasing at almost all locations on the Antarctic Peninsula (Lynch et al., 2012). The most recent population count undertaken on 19 January 2020, which coincided with an unusually wet and snowy season, recorded 31,006 breeding pairs. The count was undertaken at a late point in the season, but still represents a substantial decrease in numbers relative to previous counts. For example, an earlier population estimate for Adélie penguins on Avian Island for the 2015/16 season recorded 65,888 breeding pairs (W. Fraser, pers. comm. 2018). Two sets of population data available for Adélie penguins on Avian Island collected in 2013 indicated populations of 77,515 breeding pairs (± 5%; January 2013) (W. Fraser, pers. comm. 2013; Sailley et al., 2013) and 47,146 pairs (Casanovas et al., 2015), although the reasons for the discrepancy between counts is unclear. These data compare with an estimate of Adélie penguin numbers, based on aerial photographs taken in December 1998, that revealed 87,850 birds (± 0.16 S.D.; Woehler, 1993) and an earlier count recorded on 11 November 1978, of 36,500 breeding pairs (Poncet and Poncet, 1979).

In 1978-79 Adélie penguins were recorded on the island from October until the end of April, with egg laying occurring through October and November, and the first chicks hatching around mid-December. Chick créches were observed around mid-January, with the first chicks becoming independent near the end of January. Most of the moulting adults and independent chicks had departed the island by the third week of February, although groups returned periodically throughout March and April.

A large colony of Antarctic shags (Leucocarbo bransfieldensis) has been recorded in three groups located on the south-western coastal extremity of the island (Map 3). However, during a visit on 26-27 January 2011, it was noted that the two more northerly colony sites were not occupied and the nesting mounds were in a poor state, suggesting that these sites may have been abandoned for some time. Stonehouse (1949) reported about 300 birds present in October 1948; a similar number of birds was recorded in mid-November 1968, most of which were breeding (Willey 1969). Poncet and Poncet (1979) observed 320 pairs in 1978, and approximately 670 pairs on 17 January 1989 (Poncet, 1990). A count on 23 February 2001 recorded 185 chicks, although it is probable some had departed by the time of the count; approximately 250 nest sites were counted. A count in mid- to late January 2013 recorded 302 breeding pairs (W. Fraser, pers. comm., 2013). A survey undertaken on 20 January 2020 counted 260 pairs; however, this was a late count and was likely to be an underestimating the total population (W. Fraser, pers. comm., 2023). In 1968 Antarctic shags were observed to be present on the island from 12 August, with egg laying occurring from November, and chicks hatching in December (Willey 1969). In 1978-79 they were observed from September until June, with egg laying occurring from November through to January, when the first chicks hatched, and chicks started to become independent in the third week of February (Poncet and Poncet, 1979).

Of the southern giant petrel (Macronectes giganteus) colonies known south of the South Shetland Islands, Avian Island is one of the two largest, and may comprise a substantial proportion of the breeding population in the southern Antarctic Peninsula region (estimated at 1190 pairs in 1999/2000; Patterson et al., 2008). In 1979 the southern giant petrels occupied principally the elevated rocky outcrops of the central and southern half of the island in four main groups (Map 3). Data on the numbers of birds present on the island are shown in Table 1.

Table 1: Southern giant petrel (*Macronectes giganteus)* numbers at Avian Island.

Year	Number of birds	Number of pairs	Number of chicks	Source
1948	~100	n/a	n/a	Stonehouse, 1949
1968	400	163	n/a	Willey, 1969
1979	n/a	197	n/a	Poncet and Poncet, 1979
1989	n/a	250	n/a	Poncet, 1990
2001	n/a	n/a	237	Harris, 2001
2013	n/a	470	n/a	W. Fraser, pers. comm., 2013
2020	n/a	459*	n/a	W. Fraser, pers. comm., 2023

n/a - not available.

* count undertaken late in the season (20 January) and likely to be an underestimating the total population

In 1978-79 the birds were present on Avian Island from mid-September through to as late as June. In this season, egg laying occurred from late October through to the end of November, with hatching occurring throughout January and chicks generally achieving independence by April. In the 1978-79 austral summer up to 100 non-breeders were observed on the island during the courtship period in October, with these numbers decreasing to a few non-breeders as the season progressed.

Approximately 200 adult kelp gulls (Larus dominicanus), of which over 60 pairs were breeding, were recorded on Avian Island in 1978-79. These birds were distributed widely, but principally in the elevated central and southern parts of the island (Poncet and Poncet 1979) (Map 3). In the 1978-79 austral summer the majority of breeders arrived in early October, followed by egg laying around mid-November and hatching a month later. Detailed data are not available because of concern that human disturbance by data collection would seriously impair the breeding performance of this species. However, no more than 12 chicks were observed on the island near the end of January 1979, which would suggest breeding performance in this season was low: the exact cause – whether human disturbance or natural factors – could not be determined. In 1967, 19 pairs and 80-120 birds were recorded (Barlow, 1968).

An estimate of at least several hundred pairs of breeding Wilson's storm petrels (Oceanites oceanicus) on the island was made in 1978-79 (Poncet and Poncet, 1979). Wilson’s storm petrels were observed on the island from the second week of November, with laying and incubation probably occurring through to mid-December. Departure of adults and independent chicks was largely complete by the end of March. Most of the rocky outcrops on the northern half of the island and all of the stable rocky slopes in the south are ideal habitat for this species.

In 1978-79 about 25-30 pairs of south polar skuas (Stercorarius maccormicki) were breeding on Avian Island. The skua nests were distributed widely over the island, although the majority were on the central and eastern part of the island, especially on slopes overlooking the Adélie penguin colony (Map 3). Large groups of non-breeders (around 150 birds; Poncet and Poncet 1979) were observed to congregate around the shallow lake on the eastern side of the island. Barlow (1968) reported approximately 200 non-breeding birds in 1968. Approximately 195 pairs of south polar skuas were breeding in the central and eastern parts of the island in 2004 (W. Fraser pers. comm. 2015), with 880 non-breeding individuals also counted on the island (W. Fraser pers. comm. 2015, in correction of data reported in Ritz et al. 2006). In the 1978-79 austral summer, the south polar skuas took up residence around the end of October, with egg laying in early December and hatching complete by the end of January. Independent chicks and adults generally departed by the end of March, with some late-breeders remaining until mid-April. A breeding success of one chick per nest was reported in the 1978-79 austral summer. Barlow (1968) reported 12 breeding pairs of brown skuas (Stercorarius antarcticus), although this number could include south polar skuas. One breeding pair of brown skuas was recorded on the southwest of the island in the 1978-79 austral summer. This is the southernmost record of this species breeding along the Antarctic Peninsula. Several non-breeding brown skuas were also recorded in the same season.

Several other bird species, known to breed elsewhere in Marguerite Bay, are frequent visitors to Avian Island, notably Antarctic terns (Sterna vittata), snow petrels (Pagodroma nivea), and southern fulmars (Fulmarus glacialoides). These species have not been observed nesting on Avian Island. Small numbers of Antarctic petrels (Thalassoica antarctica) have been seen on a few occasions. The cape petrel (Daption capense) was observed on Avian Island in October 1948 (Stonehouse, 1949). Solitary individuals of king (Aptenodytes patagonicus) and chinstrap (Pygoscelis antarctica) penguins were observed in 1975 and 1989, respectively. A new high-latitude record for the macaroni penguin (Eudyptes chrysolophus) at Avian Island was reported following observation of individuals in the Area in 2007 (Gorman et al, 2010).

- *Terrestrial biology*

Vegetation on Avian Island is generally sparse, and the flora has not been described in detail. Phanerogams are absent from the island and there is a limited range of cryptogams, although there is a rich lichen flora. To date, nine moss and 11 lichen species have been identified within the Area.

Mosses described are Andreaea depressinervis, Brachythecium austro-salebrosum, Bryum argenteum, B. pseudotriquetrum, Ceratodon purpureus, Pohlia cruda, P. nutans, Sanionia georgico-uncinata, S. uncinata, Syntrichia magellanica and Warnstorfia fontinaliopsis. The latter species is at the southern limit of its known range on Avian Island (Smith, 1996). Moss development is confined to those parts of the island that are unoccupied by breeding Adélie penguins or Antarctic shags and occurs in moist depressions or by melt pools. Patches of moss of up to 100 m2 surround the shore of a small pond on the hill in the south of the Area, at ca. 30 m elevation. The green foliose alga Prasiola crispa is widespread in wet areas of the island and a liverwort, Cephaloziella varians, has also been identified.

Lichens identified on Avian Island are Acarospora macrocyclos, Cladonia fimbriata, C. gracilis, Dermatocarpon antarcticum, Lecanora dancoensis, Lecidea brabantica, Physcia caesia, Rinodina egentissima, Siphulina orphnina, Thamnolecania brialmontii, and Usnea antarctica. The most extensive communities are on the rocky outcrops in the south of the island.

The microinvertebrate fauna, fungi and bacteria on Avian Island have yet to be investigated in detail. Thus far only one mesostigmatid mite (Gamasellus racovitzai) (BAS Invertebrate Database, 1999) has been described, although a Collembollan (springtail) and several species of Acari (mites) have been observed but not identified (Poncet, 1990). A number of nematode species (dominated by Plectus sp.) (Spaull, 1973) and one fungus (Thyronectria hyperantarctica) (BAS Invertebrate Database, 1999) have been recorded on the island.

- *Breeding mammals and marine environment*

Weddell seals (Leptonychotes weddellii) were common on and around Avian Island in 1978-79. During the winter more than a dozen remained, hauled out on coastal ice (Poncet, 1990). Several pups were born on the shores of the island in the last week of September 1978. An elephant seal (Mirounga leonina) was reported pupping on the northeastern coast of Avian Island on 10 October 1969 (Bramwell, 1969). Aerial photography taken on 15 December 1998 revealed 182 elephant seals hauled out in groups, mostly close to the ponds. Leopard seals (Hydrurga leptonyx) have been observed around the shoreline, and one was observed ashore in winter 1978. A number of non-breeding Antarctic fur seals (Arctocephalus gazella) were reported on the island in March 1997 (Gray and Fox, 1997), at the end of January

1999 (Fox, pers. comm., 1999) and January 2011. At least several hundred were present on 23 February 2001 (Harris, 2001), particularly on beaches and low-lying ground in the central and northern parts of the island. Crabeater seals (Lobodon carcinophagus) are regularly seen in Marguerite Bay but have not been reported on Avian Island. The marine environment surrounding Avian Island has not been investigated.

- *Human activities / impacts*

Human activity at Avian Island has been sporadic. The first record of a visit was made in October 1948, when members of the UK Stonington Island expedition discovered the large Adélie penguin colony on Avian Island (then referred to as one of the Henkes Islands). Subsequent visits have comprised a mixture of science, base personnel recreation, tourism and logistic activity (survey, etc.). Refuges were constructed on the island in 1957 and 1962 by Argentina and Chile, respectively (see section 6(iii)).

A geological field party of two camped for about 10 days on the southeast of the island in November 1968 (Elliott, 1969). In the same year, a UK Naval hydrographic survey team camped on the eastern coast of Avian Island over the summer. Permanent chains and rings for mooring lines to the survey vessel were installed in a small bay on the northwestern coast, and were still present in 1989 (Poncet, 1990).

In 1969, a field party camped on the island for a month conducting research on the common cold virus: accompanying dogs were inoculated with a virus and then returned to base (Bramwell, 1969). Dogs often accompanied personnel on the regular visits to Avian Island during the period of operation of the UK base on Adelaide Island, but impacts are unknown.

A two-person party spent a year on the island in 1978-79, based on the yacht Damien II, making detailed observations of the avifauna and other aspects of the biology and natural environment of the island (Poncet and Poncet, 1979; Poncet, 1982; Poncet, 1990). The yacht was moored in a small cove on the northwest coast. This yacht party regularly visited the island over the next decade before SPA designation.

Map survey work and aerial photography was conducted on and over the island in 1996-98 (Fox and Gray, 1997, Gray and Fox, 1997), and 1998-99 (Fox, pers. comm., 1999).

The impacts of these activities have not been described and are not known but are believed to have been relatively minor and limited to transient disturbance to breeding birds, campsites, footprints, occasional litter, human wastes, scientific sampling and markers. Despite the likely transient nature of most disturbance, it has been reported that human visits have caused loss of eggs and chicks, either through nest abandonment or by opportunistic predation. Several species, such as southern giant petrels and kelp gulls are particularly vulnerable to disturbance and have been observed to abandon nests at particular periods of the nesting cycle, perhaps at the sight of people as much as 100 m distant (Poncet, 1990). Approximately 140 people, including a tour vessel of 100, were reported to have visited Avian Island in the 1989-90 summer. Growing concern over the number and unregulated nature of visits prompted SPA designation.

The most lasting and visually obvious impacts are associated with the two refuges and two beacon structures described in section 6(iii), which are situated close to breeding birds. Both refuges were in poor repair in February 2001 and, during environmental management visits in January 2011 and January 2016, further deterioration was noted in both refuges. Birds and seals were observed among rubbish around the refuges in February 2001, January 2011 and January 2016. Since the previous revision of the ASPA Management Plan, the refuge erected on the eastern coast (67°46'26"S, 68°53'01"W) in 1957 has undergone substantial restoration and is now in a good state of repair and usable as a shelter. The larger refuge erected on the northwestern coast (67°46'08"S, 68°53'29"W) in 1962 remains in a poor state of repair. In January 2016, it was observed that attempts had been made to secure the refuge from further degradation (e.g., the windows and door have been boarded). However, in January 2023 it was noted that the refuge was no longer weather tight and was unlikely to be useable as a shelter. The refuge showed significant deterioration due to damp, with warping of timbers and extensive areas of mould and algae on the walls and ceiling material. A large portion of the ceiling had collapsed revealing the roof above. Debris, including timber, glass and metal, was be found in the immediate vicinity of the refuge.

The older of the two beacon structures is disused and its iron structure, while standing, is rusting and deteriorating. The new beacon, erected in February 1998, appeared to be in good repair in January 2011.

6(ii) Access to the Area

- boat landings should be made at the designated locations on the central north-western coast (67°46'08.1"S, 68°53'30.1"W) or on the central eastern coast of the island (67°46'25.5"S, 68°52'57.0"W) (Map 2). If sea or ice conditions render this impractical, small boat landing may be made elsewhere along the coast as conditions allow.
- Access by vehicle to the coast when sea ice is present should also use these access points, and vehicles shall be parked at the shore.
- Travel by small boat or vehicle within the marine part of the Area is not confined to specific routes but shall be by the shortest route consistent with the objectives and requirements of the permitted activities.
- Vehicle or boat crew, or other people on vehicles or boats, are prohibited from moving on foot beyond the immediate vicinity of the landing site unless specifically authorised by Permit.
- Aircraft should avoid landing within the Area throughout the year
- A Permit may be granted for helicopter use when this is considered necessary for essential purposes and where there is no practical alternative, such as for the installation, maintenance or removal of structures. In such instances the need for helicopter access, including alternatives, and the potential disturbance to breeding birds shall be adequately assessed before a Permit

may be granted. Such a Permit shall clearly define the conditions for helicopter access based on the findings of the assessment.

6(iii) Location of structures within and adjacent to the Area

Two small refuges and two beacon structures are present within the Area. A refuge erected by Chile in 1962 is located on the northwestern coast of the island at 67°46'08"S, 68°53'29"W. A refuge constructed by Argentina in 1957 is 650 m SE of this position, on the eastern coast at 67°46'26"S, 68°53'01"W.

An old iron frame structure, believed to have been erected by the UK during the operation of Adelaide Base and used as a navigational aid, is located at approximately 38 m near the highest point of the island (67°46'35.5" S, 68°53'25.2" W). The structure remains standing, although is rusting.

A new beacon was constructed by Chile in February 1998 on an adjacent site at a similar elevation (67°46'35.3" S, 68°53'26.0" W). This structure is a solid cylindrical painted iron tower of approximately 2 m diameter and 2.5 m in height, set in a concrete pad of approximately 2.5 x 2.5 m. A lit beacon, protective rails and solar panels are fixed to the top of the structure. No other structures are known to exist on the island.

Four survey control markers were installed on the island on 31 January 1999 (Map 2). The southernmost marker is located adjacent to the navigation beacon and consists of a survey nail in bedrock covered by a cairn. A similar marker is installed on the high point of the low ridge on the north-eastern coast of the island, also covered by a cairn. The remaining two markers are survey nails affixed to the roof of each of the refuges.

The nearest scientific research station is 1.2 km northwest at Teniente Luis Carvajal (Chile), on southern Adelaide Island (latitude 67°46'S, longitude 68°55'W). Since 1982 this has been operated as a summer-only facility, open from October until March. Over this period the station has generally accommodated up to 10 personnel. Formerly, this facility was established and operated continuously by the UK from 1961 until 1977.

6(iv) Location of other protected Areas in the vicinity

Other protected areas in the vicinity include:

- ASPA 107, Emperor Island, Dion Islands, Marguerite Bay, Antarctic Peninsula, 67°52’S, 68°42’W, 12.5 km south-southeast;
- ASPA 129, Rothera Point, Adelaide Island, 67°34’S, 68°08’W, 40 km to the northeast; and
- ASPA 115, Lagotellerie Island, Marguerite Bay, Graham Land, 67°53'20"S, 67°25'30"W, 65 km east
- ASPA 177, Leonie Islands and south-east Adelaide Island, Antarctic Peninsula, 67°35′60″S, 68°13′48″W, 35 km northeast (Map 1)

6(v) Special zones within the Area

None.

7. Permit conditions

7(i) General 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 compelling scientific reasons which cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental or scientific values of the Area;
- the Permit shall be issued for a finite period; and
- the Permit, or an authorised copy, shall be carried when in the Area.

7(ii) Access to, and movement within or over, the Area

- Land vehicles (skidoos, quad bikes, etc.) are prohibited on land within the Area.
- All movement on land within the Area shall be on foot. Pedestrian traffic should be kept to the minimum necessary to undertake permitted activities and every reasonable effort should be made to minimise trampling effects.
- Movement within the Area on foot shall be by routes that minimise any disturbance to breeding birds, and to achieve this it may be necessary to take a longer route to the destination than would otherwise be the case.
- Walking routes have been designated with the intention of avoiding the most sensitive bird breeding sites and should be used when it is essential to traverse across the island (Map 2). Visitors should bear in mind that specific nest sites may vary from year to year, and some variations on the recommended route may be preferable. Routes are provided as a guide, and visitors are expected to exercise good judgement to minimise the effects of their presence. In other areas, and where practical and safe, it is usually preferable to adopt a route that follows the coastline of the Area. Three routes are designated (Map 2): Route 1 crosses the central part of the island, linking the Chilean and Argentine refuges. Route 2 facilitates access to the beacons on the south of

the island, and extends from the central eastern coast up the eastern slopes of the hill. However, during a management visit in 2011, this route was found to be colonized by birds. Consequently, Route 3 has also been designated, which runs directly east from the Argentine refuge to a narrow inlet on the western side of the island, and then proceeds southwest up a gully/slope to a flat area above the abandoned (as of January 2011) Antarctic shag colonies. From this point the route proceeds east to the beacons. Care should be taken to avoid trampling moss patches in the vicinity of a melt water pool c. 70 m north of the beacons.

- Access into areas where southern giant petrels are nesting (Map 3) shall only be undertaken for purposes specified in the Permit. When access to the beacon is necessary (e.g. for maintenance), visitors shall follow the most appropriate designated access route as closely as possible, trying to avoid nesting birds. Much of the area leading up to and surrounding the beacon is occupied by breeding petrels, so great care must be exercised.
- Movements should be slow, noise kept to a minimum, and the maximum distance practicable should be maintained from nesting birds.
- Visitors shall watch carefully for signs of agitation and preferably retreat from approach if significant disturbance is observed.
- The operation of aircraft over the Areas should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the operations of aircraft near concentrations of birds' contained in Resolution 2 (2004).
- Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for compelling scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority. Furthermore, operation of RPAS within or over the Area shall be in accordance with the 'Environmental guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica' (Resolution 4 (2018)) (available at: https://documents.ats.aq/recatt/att645_e.pdf).

7(iii) Activities which may be conducted in the Area

Activities which may be conducted in the Area include:

- essential management activities, including monitoring;
- compelling scientific research that cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area; and
- sampling, which should be the minimum required for approved research programmes.

Restrictions on times at which activities may be conducted apply within the Area, and are specified in the relevant sections of this Management Plan.

7(iv) Installation, modification or removal of structures

- Any new or additional permanent structures or installations are prohibited.
- Existing abandoned or dilapidated structures should be removed or

renovated.

- Installation, modification, maintenance or removal of structures shall be undertaken in a manner that minimises disturbance to breeding birds. Such activities shall be undertaken between 1 February and 30 September inclusive to avoid the main breeding season.
- No structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit.
- All markers, structures or scientific equipment installed in the Area must be clearly identified by country, name of the principal investigator or agency, year of installation and date of expected removal.
- All such items should be free of organisms, propagules (e.g., seeds, eggs, spores) and non-sterile soil (see section 7(vi)) and be made of materials that can withstand the environmental condition and pose minimal risk of contamination of the Area.
- Removal of specific structures or 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(v) Location of field camps

Camping should be avoided within the Area. However, when necessary for purposes specified in the Permit, temporary camping is allowed at two designated campsites: one on the central eastern coast of the island (67°46'25.8"S, 68°53'00.8"W), the other on the central north-western coast of the Area (67°46'08.2"S, 68°53'29.5"W) (Map 2).

7(vi) 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. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. Further guidance can be found in the CEP non-native species manual (Resolution 4 (2016)) and the SCAR Environmental code of conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018)). In view of the presence of breeding bird colonies within the Area, no poultry products, including wastes from such products and products containing uncooked dried eggs, shall be released into the Area, including the marine component of 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. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided. Fuel or other chemicals shall not be stored in the Area unless specifically authorised by Permit condition. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period. 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. The appropriate authority should be notified of anything released and not removed that was not included in the authorised Permit.

7(vii) Taking of, or harmful interference with, native flora or fauna

Taking of, or harmful interference with, native flora and fauna is prohibited, except in accordance with a permit issued in accordance with Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, this should, as a minimum standard, be in accordance with the SCAR code of conduct for the use of animals for scientific purposes in Antarctica (Resolution 4 (2019)). Any soil or vegetation sampling is to be kept to an absolute minimum required for scientific or management purposes, and carried out using techniques which minimise disturbance to surrounding soil and biota.

7(viii) The collection or removal of materials 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, and which was not brought into the Area by the Permit holder or otherwise authorised may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ: if this is the case the appropriate national authority must be notified and approval obtained. Permits shall not be granted if there is a reasonable concern that the sampling proposed would take, remove or damage such quantities of soil, native flora or fauna that their distribution or abundance on Avian Island would be significantly affected. Samples of flora or fauna found dead within the Area may be removed for analysis or audit without prior authorisation by Permit.

7(ix) Disposal of waste

All wastes, except human wastes, shall be removed from the Area. Preferably, all human wastes should be removed from the Area, but if this is not possible, they may be disposed of into the sea.

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis or to carry out protective measures.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Scientific activities shall be performed in accordance with the SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)). Geological research shall be undertaken in accordance with the SCAR Environmental Code of Conduct for Geosciences Field Research Activities in Antarctica (Resolution 1 (2021)).

7(xi) Requirements for reports

The principal Permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the Antarctic Specially Protected Area visit report form contained in the Guide to the preparation of Management Plans for Antarctic Specially Protected Areas (Appendix 2). The appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit. Wherever possible, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

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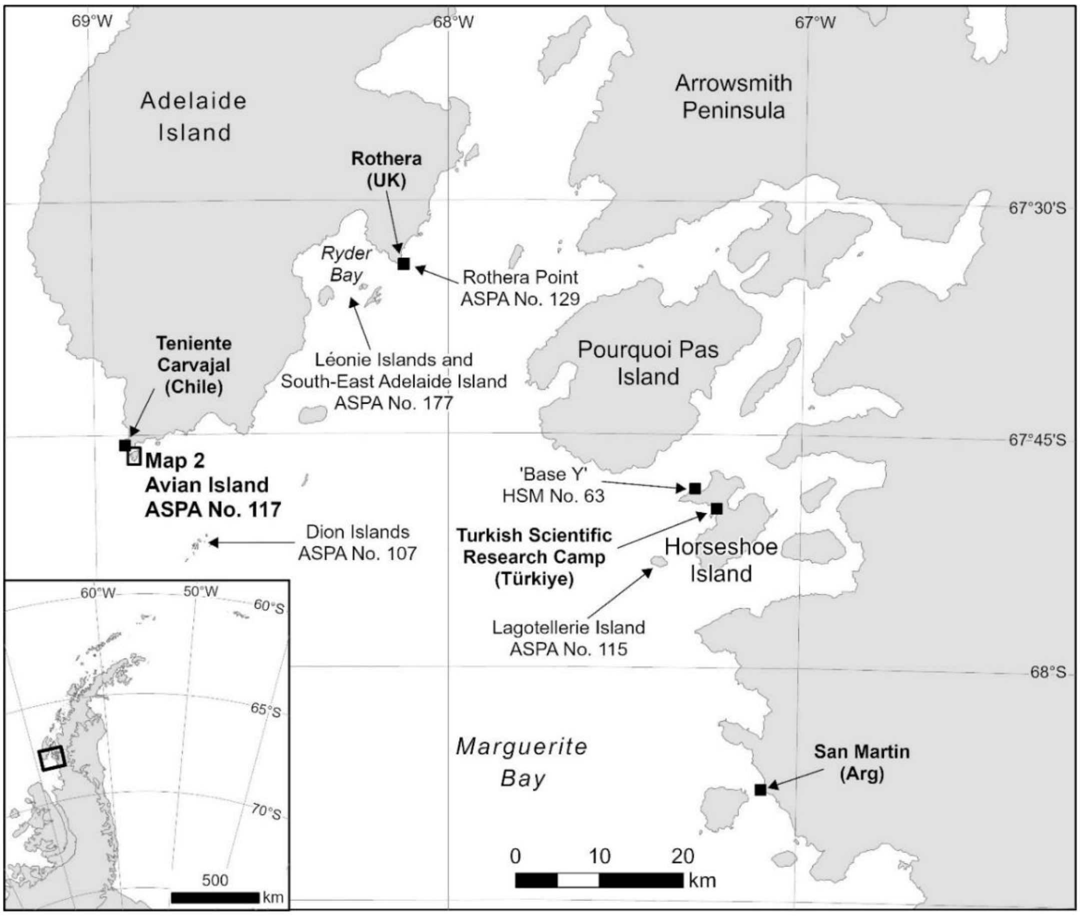
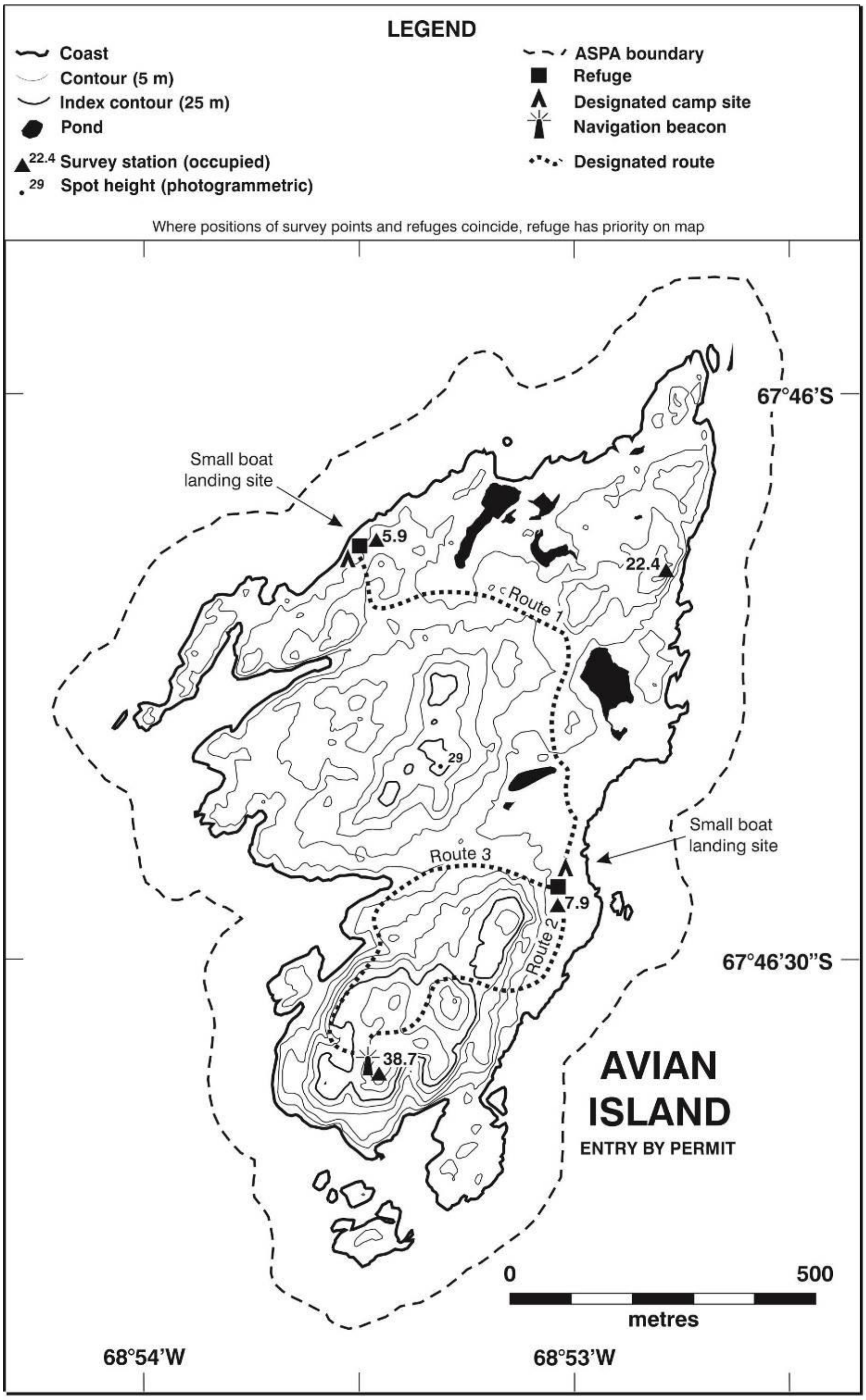
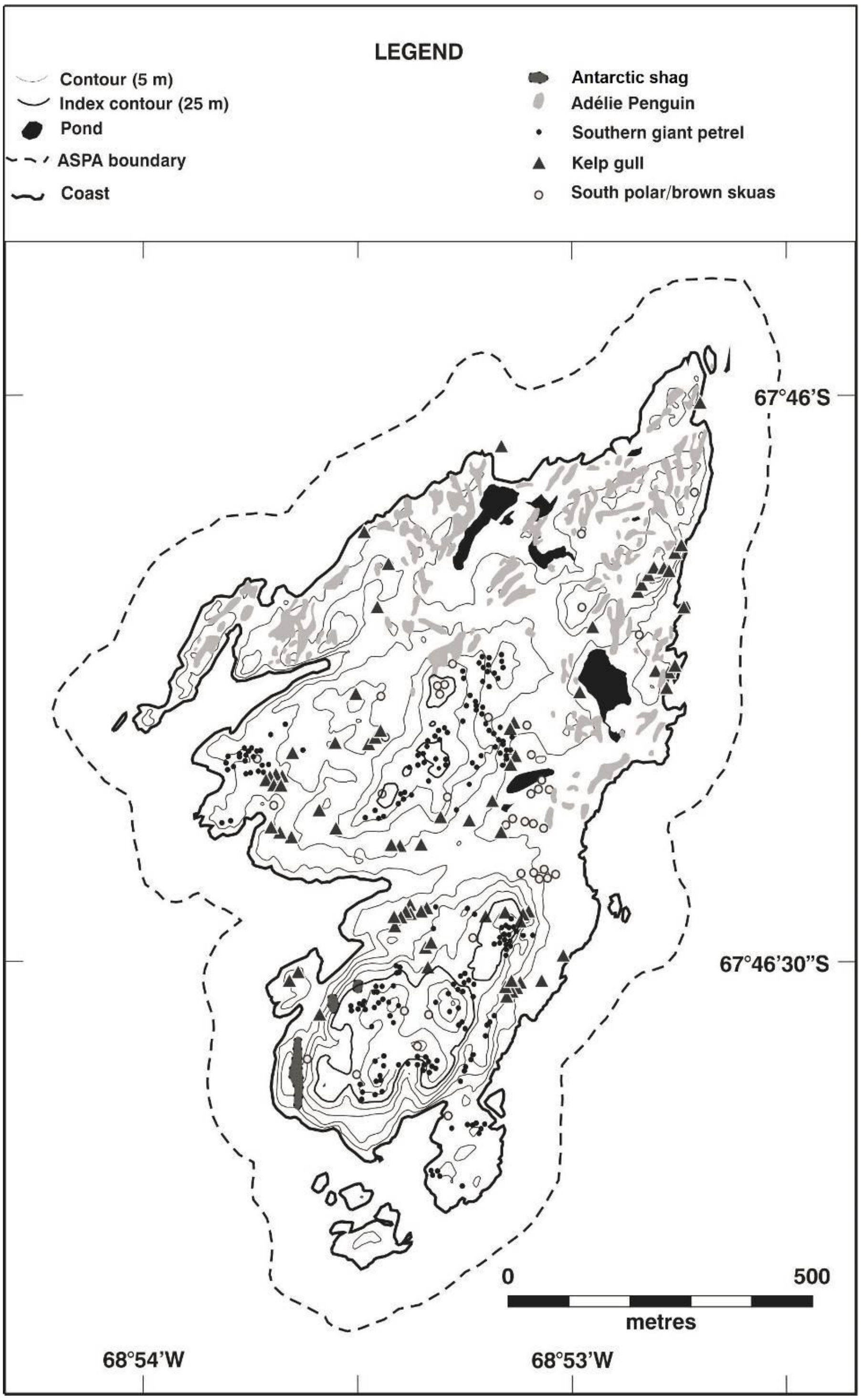
Map 1. Avian Island, ASPA No. 117, in relation to Marguerite Bay, showing the locations of the stations Teniente Luis Carvajal (Chile), Rothera (UK), General San Martín (Argentina) and the Turkish Scientific Research Camp (Türkiye). The location of other protected areas within Marguerite Bay (ASPA No. 107 at Emperor Island (Dion Islands), ASPA No. 115 at Lagotellerie Island, ASPA No. 129 at Rothera Point and ASPA No. 177 which covering parts of Leonie Islands and south-east Adelaide Island) are also shown. Inset: the location of Avian Island on the Antarctic Peninsula.



Map 2. Avian Island, ASPA No. 117, topographic map. Map specifications – projection: Lambert conformal conic; standard parallels: 1st 67° 30' 00"S; 2nd 68° 00' 00"S; central meridian: 68° 55' 00"W; latitude of origin: 68° 00' 00"S; spheroid: WGS84; datum: mean sea level; vertical contour interval 5 m; horizontal accuracy: ±5 m; vertical accuracy ±1.5 m.



Map 3. Avian Island, ASPA No. 117, breeding wildlife sketch map. Positions of nests and colonies are accurate to ±25 m. Information was derived from Poncet (1982). Map specifications – projection: Lambert conformal conic; standard parallels: 1st 67° 30' 00"S; 2nd 68° 00' 00"S; central meridian: 68° 55' 00"W; latitude of origin: 68° 00' 00"S; spheroid: WGS84; datum: mean sea level; vertical contour interval 5 m; horizontal accuracy: ±5 m; vertical accuracy ±1.5 m.



Measure 4 (2023)

Antarctic Specially Protected Area No 122 (Arrival Heights, Hut Point Peninsula, Ross Island): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation VIII-4 (1975), which designated Arrival Heights, Hut Point Peninsula, Ross Island as Site of Special Scientific Interest (“SSSI”) No 2 and annexed a Management Plan for the Site;
- Recommendations X-6 (1979), XII-5 (1983), XIII-7 (1985), XIV-4 (1987), Resolution 3 (1996) and Measure 2 (2000), which extended the expiry date of SSSI 2;
- Decision 1 (2002), which renamed and renumbered SSSI 2 as ASPA 122;
- Measures 2 (2004), 3 (2011), 3 (2016) and 8 (2022), which adopted revised Management Plans for ASPA 122;

Recalling that Measure 2 (2000) was withdrawn by Measure 5 (2009);

Recalling that Recommendations VIII-4 (1975), X-6 (1979), XII-5 (1983), XIII-7 (1985), XIV-4 (1987) and Resolution 3 (1996) were designated as no longer current by Decision 1 (2011);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 122;

Desiring to replace the existing Management Plan for ASPA 122 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 122 (Arrival Heights, Hut Point Peninsula, Ross Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 122 annexed to Measure 8 (2022) be revoked.

Management Plan for Antarctic Specially Protected Area No. 122

ARRIVAL HEIGHTS, HUT POINT PENINSULA, ROSS ISLAND

Introduction

The Arrival Heights Antarctic Specially Protected Area (ASPA) is situated near the south-western extremity of Hut Point Peninsula, Ross Island, at 77° 49' 41.2" S, 166° 40' 2.8" E, with an approximate area 0.73 km². The primary reason for designation of the Area is its value as an electromagnetically 'quiet' site for the study of the upper atmosphere and its close proximity to logistical support. The Area is used for a number of other scientific studies, including trace gas and ultraviolet (UV) radiation monitoring, auroral and geomagnetic studies and air quality surveys. As an example, the longevity and quality of the numerous atmospheric datasets makes the Area of high scientific value. Since its designation in 1975 numerous projects have been located in or near the Area with a potential to degrade the electromagnetically quiet conditions at Arrival Heights. The interference generated by these activities appears to have an acceptably low impact on scientific experiments, with one known exception, discussed below. The continued use of the Area is favored by its geographical characteristics, unobstructed low viewing horizon, clean air and its proximity to logistical support and high costs associated with relocation. The Area was proposed by the United States of America and adopted through Recommendation VIII-4 [1975, Site of Special Scientific Interest (SSSI) No. 2]; date of expiry was extended through Recommendations X-6 (1979), XII-5 (1983), XIII-7 (1985), and XIV-4 (1987), Resolution 3 (1996) and Measure 2 (2000). The Area was renamed and renumbered through Decision 1 (2002); a revised management plan was adopted through Measure 2 (2004), Measure 3 (2011) and Measure 3 (2016). The degradation of electromagnetically 'quiet' conditions within the Area was recognized by SCAR Recommendation XXIII-6 (1994).

The Area lies within 'Environment S – McMurdo – South Victoria Land geologic', as defined in the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)). Under the Antarctic Conservation Biogeographic Regions classification (Resolution 3 (2017)) the Area lies within ACBR9 – South Victoria Land.

1. Description of values to be protected

An area at Arrival Heights was originally designated in Recommendation VIII-4 (1975, SSSI No. 2), after a proposal by the United States of America on the grounds that it was "an electromagnetic and natural 'quiet site' offering ideal conditions for the installation of sensitive instruments for recording minute signals associated with upper atmosphere programs." For example, electromagnetic recordings have been carried out at Arrival Heights as part of long term scientific studies, yielding data of outstanding quality because of the unique characteristics of the geographic location with respect to the geomagnetic field combined with relatively low levels of electromagnetic interference. The electromagnetically quiet conditions and the longevity of data collection at Arrival Heights make the data obtained of particularly high scientific value.

In recent years, however, increases in science and support operations associated with Scott Base and McMurdo Station have raised the levels of locally generated electromagnetic noise at Arrival Heights and it has been recognized that the electromagnetically ‘quiet’ conditions have to some degree been degraded by these activities, as identified in SCAR Recommendation XXIII-6 (1994).

Scientific research within the Area appears to operate within an acceptably low level of electromagnetic interference (EMI) from other activities in the vicinity and the aims and objectives set out in the management plan for Arrival Heights therefore remain relevant. However, recent site visits and deployment of new instruments have shown that there is some elevated very-low frequency (VLF) noise in the 50 Hz – 12 kHz range from sources located outside of the Area (associated with the wind turbines that are installed ~1 km from the Area). Analysis of the noise source indicates that inserting power filters into the electrical lines between the wind turbines and the power grid would significantly reduce the level of interference, but this solution has not yet been implemented. The review also produced evidence of increased VLF noise in the 12 - 50 kHz frequency range, which was mitigated by modifying the configuration and grounding of the electrical power grid local to Arrival Heights, and by decommissioning demonstrably electrically noisy equipment, such as some specific types of uninterruptable power supplies (UPS).

Notwithstanding these observations, the original geographical characteristics of the site, such as its elevated position and thus broad viewing horizon, the volcanic crater morphology, and the close proximity to the full logistic support of nearby McMurdo Station (US) 1.5 km south and Scott Base (NZ) 2.7 km SE, continue to render the Area valuable for upper atmospheric studies and boundary layer air sampling studies. Moreover, there are scientific, financial and practical constraints associated with any proposed relocation of the Area and the associated facilities. Thus, the current preferred option for management is to minimize sources of EMI to the maximum extent practicable, and to monitor these levels routinely so that any significant threat to the values of the site can be identified and addressed as appropriate.

Since original designation the site has been used for several other scientific programs that benefit from the restrictions on access in place within the Area. In particular, the broad viewing horizon and relative isolation from activities (e.g. vehicle movements, engine exhausts) has been valuable for measurement of greenhouse gases, trace gases such as ozone, spectroscopic and air particulate investigations, UV radiation and total column ozone monitoring, pollution surveys, and auroral and geomagnetic studies. It is important that these values are protected by maintenance of the broad and unobstructed viewing horizon and that anthropogenic gas emissions (in particular long-term gaseous or aerosol emissions from sources such as internal combustion engines) are minimised and where practicable avoided.

In addition, the protected status of Arrival Heights has also had the effect of limiting the extent and magnitude of physical disturbance within the Area. As a result, soils and landscape features are much less disturbed than is the case in the surrounding areas of Hut Point where station developments have taken place. In particular, sand-wedge polygons are far more extensive than elsewhere in the Hut Point vicinity, covering an area of approximately 0.5 km^2. The relatively undisturbed nature of the environment at Arrival Heights makes the Area valuable for comparative studies of impacts associated with station developments, and valuable as a reference against which to consider changes. These additional values are also important reasons for special protection at Arrival Heights.

The Area continues to be of high scientific value for a variety of high quality and long-term atmospheric data sets that have been collected at this site. Despite the acknowledged potential for interference from local and surrounding sources, the long-term data series, the accessibility of the site for year-round observations, its geographical characteristics, and the high cost of relocation, warrant that the site receive ongoing and strengthened protection. The vulnerability of this research to disturbance through chemical and noise pollution, in particular electromagnetic interference and potential changes to the viewing horizon and/or shadowing of instrumentation, is such that the Area requires continued special protection.

2. Aims and objectives

Management at Arrival Heights aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human presence, disturbance and sampling within the Area;
- allow scientific research in the Area, in particular atmospheric research, while ensuring protection from incompatible uses and equipment installation that may jeopardize such research;
- minimize the possibility of generation of excessive electromagnetic noise interference within the Area through regulating the types, quantity and use of equipment that can be installed and operated in the Area;
- avoid degradation of the viewing horizon and shadowing effects by installations on instrumentation reliant on solar and sky viewing geometries;
- avoid / mitigate as far as practicable anthropogenic gaseous or aerosol emissions from sources such as internal combustion engines to the atmosphere within the Area;
- encourage the consideration of the values of the Area in the management of surrounding activities and land uses, in particular to monitor the levels, and encourage the minimization of sources of electromagnetic radiation that may potentially compromise the values of the Area;
- allow access for maintenance, upgrade and management of communications and scientific equipment located within the Area;
- 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; and

- allow visits for education or public awareness purposes associated with the scientific studies being conducted in the Area that cannot be fulfilled elsewhere.

3. Management activities

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

- Signs showing the location and boundaries of the Area with clear statements of entry restrictions shall be placed at appropriate locations at the boundaries of the Area to help avoid inadvertent entry. The signs should include instructions to make no radio transmissions and to turn vehicle headlights off within the Area, unless required in an emergency.
- Notices 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 the principal research hut facilities within the Area and at McMurdo Station and Scott Base.
- National programs shall take steps to ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- Markers, signs or other structures should not be installed within the Area except for essential scientific or management purposes. If installed, they shall be recorded, secured and maintained in good condition and removed when no longer required by the responsible National Antarctic program;
- 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.
- Electromagnetic noise surveys shall be undertaken within the Area bi-annually to detect equipment faults and to monitor levels of interference that may have potential to compromise the values of the Area unacceptably, for the purposes of identification and mitigation of their sources.
- Potentially disruptive activities that are planned to be conducted outside of but close to the Area, such as blasting or drilling, or the operation of transmitters or other equipment with the potential to cause significant electromagnetic interference within the Area, or activities that produce significant changes to the power grid (whether supplying or loading), should be notified in advance to the appropriate representative(s) of national authorities operating in the region, with a view to coordinating activities and / or undertaking mitigating actions in order to avoid or minimize disruption to scientific programs.
- National Antarctic Programs operating in the region shall appoint an Activity Coordinator who will be responsible for inter-program consultation regarding all activities within the Area. The Activity Coordinators shall keep a log of visits to the Area by their programs, recording number of personnel, time and duration of visit, activities, and means of travel into the Area, and

shall exchange this information to create a consolidated log of all visits to the Area annually.

- National Antarctic Programs operating in the region shall consult together with a view to ensuring the conditions in this management plan are implemented, and take appropriate measures to detect and enforce compliance where the conditions are not being followed.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: ASPA No. 122 Arrival Heights – Regional overview, showing Hut Point Peninsula, nearby stations (McMurdo Station, US; and Scott Base, NZ), installations (SuperDARN, satellite receptors and wind turbines) and routes (roads and recreational trails). Projection Lambert Conformal Conic: Standard parallels: 1st 77° 40' S; 2nd 78° 00' S; Central Meridian: 166° 45' E; Latitude of Origin: 77° 50' S; Spheroid WGS84; Datum McMurdo Sound Geodetic Control Network. Data sources: Topography: contours (10 m interval) derived from digital orthophoto and DEM from aerial imagery (Nov 1993); Permanent ice extent digitized from orthorectified Quickbird satellite image (15 Oct 2005) (Imagery © 2005 Digital Globe); Infrastructure: station layout CAD data USAP (Feb 09 / Mar 11), ERA (Nov 09) and USAP (Jan 11) field survey; Recreational trails PGC field survey (Jan 09 / Jan 11).

Inset 1: The location of Ross Island in the Ross Sea. *Inset 2:* The location of Map 1 on Ross Island and key topographic features.

Map 2: ASPA No. 122 Arrival Heights – topographic map, showing protected area boundaries, site facilities, nearby installations (SuperDARN, satellite receptors) and routes (access roads and recreational trails). Projection details and data sources are the same as for Map 1.

6. Description of the Area

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

Arrival Heights (77° 49' 41.2" S, 166° 40' 2.8" E; Area: 0.73 km^2) is a small range of low hills located near the southwestern extremity of Hut Point Peninsula, Ross Island. Hut Point Peninsula is composed of a series of volcanic craters extending from Mount Erebus, two of which, namely First Crater and Second Crater, respectively form part of the southern and northern boundaries of the Area. The Area is predominantly ice-free and elevations range from 150 m to a maximum of 280 m at Second Crater. Arrival Heights is located approximately 1.5 km north of McMurdo Station and 2.7 km northwest of Scott Base. The Area has a broad viewing horizon and is comparatively isolated from activities at McMurdo Station and Scott Base, with the majority of McMurdo Station being hidden from view.

- *Boundaries and coordinates*

The southeastern boundary corner of the Area is defined by Trig T510 No.2, the center of which is located at 77° 50' 08.4" S, 166° 40' 16.4" E at an elevation of 157.3 m. Trig T510 No.2 replaced and is 0.7 m from the former boundary survey marker (T510), which no longer exists. The replacement T510 No.2 marker is an iron rod (painted orange) installed into the ground approximately 7.3 m west of the access road to Arrival Heights, and is surrounded by a small circle of rocks. The boundary of the Area extends from Trig T510 No.2 in a straight line 656.0 m northwest over First Crater to a point located at 77° 49' 53.8" S, 166° 39' 03.9" E at 150 m elevation. The boundary thence follows the 150 m contour northward for 1186 m to a point (77° 49' 18.6" S, 166° 39' 56.1" E) due west of the northern rim of Second Crater. The boundary thence extends 398 m due east to Second Crater, and around the crater rim to a US Hydrographic Survey marker (a stamped brass disk) which is installed near ground level at 77° 49' 23.4" S, 166° 40' 59.0" E and 282 m elevation, forming the northeastern boundary of the Area. The boundary thence extends from the US Hydrographic Survey marker southward for 1423 m in a straight line directly to Trig T510 No.2.

- *Geology, geomorphology and soils*

Point Peninsula is 20 km long and is formed by a line of craters that extend south from the flanks of Mt. Erebus (Kyle 1981). The basaltic rocks of Hut Point Peninsula constitute part of the Erebus volcanic province and the dominant rock types are alkali basanite lavas and pyroclastics, with small amounts of phonolite and occasional outcrops of intermediate lavas (Kyle 1981). Aeromagnetic data and magnetic models indicate that the magnetic volcanic rocks underlying Hut Point Peninsula are likely to be <2 km in thickness (Behrendt et al. 1996) and dating studies suggest that the majority of basaltic rocks are younger than ~ 750 ka (Tauxe et al. 2004).

The soils at Arrival Heights consist mostly of volcanic scoria deposited from the eruptions of Mount Erebus, with particle size ranging from silt to boulders. The thickness of surface deposits ranges from a few centimetres to tens of metres, with permafrost underlying the active layer (Stefano, 1992). Surface material at Arrival Heights also includes magma flows from Mount Erebus, which have been weathered and reworked over time. Sand-wedge polygons cover an area of approximately 0.5 km² at Arrival Heights and, because physical disturbance has been limited by the protected status of the Area, are far more extensive than elsewhere in the southern Hut Point Peninsula vicinity (Klein et al. 2004).

- *Climate*

Arrival Heights is exposed to frequent strong winds and conditions are generally colder and windier than at nearby McMurdo Station and Scott Base (Mazzera et al. 2001). During the period February 1999 to April 2009, the maximum temperature recorded within the Area was 7.1ºC (30 Dec 2001) and the minimum was -49.8ºC (21 July 2004). During this period, December was the warmest month, with mean monthly air temperatures of -5.1ºC, and August was the coolest month, averaging – 28.8ºC (data sourced from National Institute of Water and Atmospheric Research (NIWA), New Zealand, http://www.niwa.co.nz, 21 May 2009).

The mean annual wind speed recorded at Arrival Heights between 1999 and 2009 was 6.96 ms-1, with June and September being the windiest months (data sourced from NIWA, http://www.niwa.co.nz, 21 May 2009). The highest recorded gust at Arrival Heights between 1999-2011 was 51 m/s (~184 km/h) on 16 May 2004. The prevailing wind direction at Arrival Heights is north-easterly, as southern air masses are deflected by the surrounding topography (Sinclair 1988). Hut Point Peninsula lies at the confluence of three dissimilar air masses, predisposing the area to rapid onset of severe weather (Monaghan et al. 2005).

- *Scientific research*

Numerous long-term scientific investigations are conducted at Arrival Heights, with the majority of research focusing on the earth's atmosphere and magnetosphere. Radio observations from the ultra low frequency band through the visible light spectrum support scientific research into lightning processes, lightning-ionosphere interactions, thunderstorm-generated atmospheric gravity waves, auroral events, geomagnetic storms, as well as other forms of space weather and heliospherical drivers of global climate change. Other instruments support research into meteorological phenomena and variations in UV radiation and trace gas levels, particularly ozone, ozone precursors, ozone destroying substances, biomass burning products and greenhouse gases. The Area has good access and logistical support from nearby McMurdo Station and Scott Base, which are important to facilitate research within the Area.

The extremely-low-frequency and very-low-frequency (ELF/VLF) data have been continuously collected at Arrival Heights since the austral summer of 1984/1985 (Fraser-Smith et al. 1991). The ELF/VLF noise data are unique in both length and continuity for the Antarctic and were recorded concurrently with ELF/VLF data at Stanford University and now at the University of Florida, allowing for comparison between polar and mid-latitude time series. The lack of electromagnetic interference and remote location of Arrival Heights allow researchers to measure background ELF/VLF noise spectra and weak ELF signals, such as Schumann resonances, which are associated changes in the magnetosphere and ionosphere (Füllekrug & Fraser-Smith 1996). ELF/VLF and Schumann resonance data collected within the Area have been studied in relation to space weather: fluctuations in sun spots, solar particle precipitation events, and planetary-scale meteorological phenomenon (Anyamba et al. 2000; Schlegel & Füllekrug 1999; Fraser-Smith & Turtle 1993). Observations of narrowband VLF transmitter signals at Arrival Heights have been used to track and analyze the ionospheric response to a solar eclipse in the Northern hemisphere (Moore & Burch 2018). Furthermore, ELF data have been used as a proxy measure of global cloud-to-ground lightning activity and thunderstorm activity (Füllekrug et al. 1999) and VLF data provide input to global networks which monitor lightning activity and conditions in the ionosphere (Clilverd et al. 2009; Rodger et al. 2009). Current ELF and VLF research investigates which types of lightning have the most impact on the magnetosphere and (separately) on the Schumann resonances. High quality electromagnetic data from Arrival Heights has enabled determination of an upper limit for the photon rest mass of ~10^{-52}kg (Füllekrug 2004) based on detection of minute global ionospheric reflection height measurements (Füllekrug et al. 2002), and it has also provided a critical link between lightning at mid- and tropical latitudes and surface temperature variations in moderate and tropical climates (Füllekrug & Fraser-Smith 1997). Recent research has developed novel measurement technologies with a sensitivity of μV/m over the broad frequency range from ~4 Hz to ~400 kHz (Füllekrug 2010), which has promising scientific potential requiring conditions of electromagnetic quiescence such as are present at Arrival Heights.

The Fe-Boltzmann and Na Lidars at Arrival Heights provide laser-based remote sensing of the upper atmosphere (and thereby space weather) by measuring the temperature and density of metallic particles between 30 and 200 km altitude. Observations at Arrival Heights demonstrate that Iron and Sodium layers respond with significantly different dynamics to external stimuli, specifically aurora (Chu et al. 2020). They determined that the auroral affected the iron/sodium mixing ratio, and thereby directly impacted the transport and dissipation of wave energy in the mesosphere. The lidar record is now greater than 10 years in length and will be used to study the atmospheric response over a complete solar cycle.

The southerly location of Arrival Heights results in several weeks of total darkness during the austral winter, allowing low intensity auroral events and dayside emissions to be observed (Wright et al. 1998). Data recorded at Arrival Heights have been used to track the motion of polar cap arcs, a form of polar aurora, and results have been related to solar wind and interplanetary magnetic field conditions. Auroral observations made at Arrival Heights by researchers for the University of Washington have also been used to calculate the velocity and temperature of high altitude winds by analyzing the Doppler shift of auroral light emissions. In addition to auroral research, optical data collected within the Area have been used to monitor the response of the thermosphere to geomagnetic storms (Hernandez & Roble 2003) and medium frequency radar has been used to measure middle atmospheric (70-100 km) wind velocities (McDonald et al. 2007).

A range of trace gas species are measured at Arrival Heights, including carbon dioxide, ozone, bromine, methane, nitrogen oxides, hydrogen chloride and carbon monoxide, with records commencing as early as 1982 (McKenzie et al. 1984; Zeng et al. 2012; Kolhepp et al. 2012). Measurements made at Arrival Heights in the 1980s provided key data to support the (now verified) depletion of ozone from man-made chlorofluorocarbon (CFC) compounds (Solomon et al. 1987).

Arrival Heights represents a key site in the Network of the Detection of Atmospheric Composition Change (NDACC), Global Climate Observing System (GCOS) Reference Upper-Air Network (GRUAN) and the WMO Global Atmosphere Watch (GAW) program, with data being used to monitor changes in the stratosphere and troposphere, including long-term evolution of the ozone layer, Southern Hemisphere greenhouse gas concentrations and changes in overall atmospheric composition (Allan et al. 2005; Lowe et al. 2005; Manning et al. 2005). The measurements made at Arrival Heights are vital for Southern Hemisphere and Antarctic satellite comparison (e.g. Vigouroux et al. 2007; Sha et al. 2021), atmospheric chemistry model validation (Risi et al. 2012), ozone hold monitoring (Klekociuk et al. 2021) and global-scale stratospheric circulation trend studies (Strahan et al. 2020). Arrival Heights has also been used as one of several Antarctic reference stations for intercomparisons of surface air measurements (Levin et al. 2012; Schaefer et al. 2016). UV radiation has been continuously monitored at Arrival Heights since 1989 (Booth et al. 1994). These measurements quantified the effect of the ozone hole on UV radiation at the surface (Bernhard et al. 2006, 2010; McKenzie et al. 2019) and elucidated the interdependent effects of surface albedo and clouds on UV levels (Nichol et al. 2003).

Tropospheric and stratospheric ozone concentrations as well as total ozone columns have been recorded at Arrival Heights since 1988 and are used to monitor both long-term and seasonal variations in ozone (Oltmans et al. 2008; Nichol et al. 1991; Nichol 2018), as well as in estimations of stratospheric ozone loss (Kuttippurath et al. 2010). In addition to longer-term trends, sudden and substantial ozone depletion events have been recorded during spring-time at Arrival Heights, which occur over a period of hours and thought to result from the release of bromine compounds from sea salt (Riedel et al. 2006; Hay et al. 2007). Tropospheric bromine levels have been continuously recorded since 1995 within the Area and have been studied in relation to ozone depletion, stratospheric warming and changes in the polar vortex, as well as being used in validation of satellite measurements (Schofield et al. 2006). Nitrogen oxide (NO^2) data collected at Arrival Heights have also been used to investigate variations in ozone levels and results show substantial variations in NO^2 at daily to interannual timescales, potentially resulting from changes in atmospheric circulation, temperature and chemical forcing (Struthers et al. 2004; Wood et al. 2004). In addition, ground-based Fourier transform spectroscopy has been used at Arrival Heights to monitor 16+ atmospheric trace gas species. Examples of science include: carbonyl sulfide levels, HCl fluxes from Mount Erebus and observing the effects of sudden stratospheric warmings on the ozone hole (Kremser et al. 2015; Keys et al. 1998; Smale et al. 2021).

- *Vegetation*

Lichens at Arrival Heights were surveyed in 1957 by C.W. Dodge and G.E. Baker, with species recorded including: Buellia alboradians, B. frigida, B. grisea, B. pernigra, Caloplaca citrine, Candelariella flava, Lecanora expectans, L. fuscobrunnea, Lecidella siplei, Parmelia griseola, P. leucoblephara and Physcia caesia. Moss species recorded at Arrival Heights include Sarconeurum glaciale and Syntrichia sarconeurum (BAS Plant Database, 2009), with S. glaciale documented within drainage channels and disused vehicle tracks (Skotnicki et al. 1999).

- *Human activities and impact*

The Arrival Heights facilities are used year-round by personnel from McMurdo Station (US) and Scott Base (NZ). In addition to two laboratory buildings, numerous antenna arrays, aerials, communications equipment, and scientific instruments are located throughout the Area, along with associated cabling.

The scientific instruments used for atmospheric research in the Area are sensitive to electromagnetic noise and interference, with potential local noise sources including VLF radio transmissions, powerlines, vehicle emission systems and also laboratory equipment. Noise sources generated outside of the Area that may also affect electromagnetic conditions at Arrival Heights include radio communications, entertainment broadcast systems, ship, aircraft, or satellite radio transmissions, or aircraft surveillance radars. Any significant source or sink connected to the power grid has the potential to affect observations at Arrival Heights. A site visit report from 2006 suggested that levels of interference at that time were acceptably low, despite activities operating out of McMurdo Station and Scott Base. On the other hand, the installation of wind turbines in 2009/10 introduced electrical noise to the power grid, which in turn affected measurements at Arrival Heights. In order to provide some degree of protection from local radio transmissions and station noise, some of the VLF antennas at Arrival Heights are located within Second Crater.

Unauthorised access to the Area, both by vehicle and on foot, is thought to have resulted in damage to cabling and scientific instruments, although the extent of damage and impact upon scientific results is unknown. A camera was installed at the USAP building in early 2010 to monitor traffic entering the Area via the road leading to the laboratories.

Recent installations within and close to the Area include an FE-Boltzmann LiDAR in the New Zealand Arrival Heights Research Laboratory in 2010, the Super Dual Auroral RADAR Network (SuperDARN) Antenna Array (2009-10) and two satellite earth station receptors (Map 2). The SuperDARN Antenna Array transmits at low frequencies (8 – 20 MHz), with the main transmission direction to the southwest of the Area, and its location was selected in part to minimize interference with experiments at Arrival Heights. Two satellite earth station receptors (Joint Polar Satellite System (JPSS) and MG2) are located nearby. One of the receptors has the ability to transmit (frequency range 2025 – 2120 Hz) and measures have been taken to ensure that any irradiation of the Area is minimal.

Three wind turbines were constructed approximately 1.5 km east of the Area and close to Crater Hill during austral summer 2009-10 (Map 1). EMI emissions from the turbines should comply with accepted standards for electrical machinery and utilities. As referenced above, EMI originating from the new wind turbines has been detected in very low frequency datasets at Arrival Heights, with potential sources of EMI including turbine transformers, generators and power lines. Interference in the VLF range has been sufficient to render Arrival Heights unsuitable for scientific studies measuring radio pulses from lightning (e.g. the AARDVARK experiment), and for this reason a second antenna was established at Scott Base where disturbance in the VLF range is much lower.

Air quality monitoring has been regularly carried out at Arrival Heights since 1992 and recent studies suggest that air quality has been reduced, most likely due to emissions originating from McMurdo or Scott Base (Mazzera et al. 2001), for example from construction and vehicle operations. Investigations found that air quality samples contained higher concentrations of pollution derived species (EC, SO^2, Pb, Zn) and PM_{10} (particles with aerodynamic diameters less than 10 μm) aerosols than other coastal and Antarctic sites.

6(ii) Access to the Area

Access to the Area may be made over land by vehicle or on foot. The access road to the Area enters at the south-east and extends to the research laboratories. Several vehicle trails are present within the Area and run from the Satellite Earth Station in First Crater to the foot of Second Crater. Pedestrian access may be made from the access road.

Access by air and overflight of the Area are prohibited, except when specifically authorized by permit, in which case the appropriate authority supporting research programs within the Area must be notified prior to entry.

6(iii) Location of structures within and adjacent to the Area

Both New Zealand and United States maintain research and living facilities within the Area. New Zealand opened a new research laboratory at Arrival Heights on 20 January 2007, replacing an old building which has been removed from the Area. The United States maintains one laboratory within the Area. A range of antenna arrays and aerials designed to meet scientific needs are located throughout the Area (Map 2), and a new VLF antenna was installed at Arrival Heights in December 2008. A Satellite Earth Station (SES) is located several meters inside the boundary of the Area on First Crater (Map 2).

The SuperDARN Antenna Array is located approximately 270 m SW of the Area, while two satellite earth station receptors are installed approximately 150 m SW of the Area (Map 2).

6(iv) Location of other protected areas in the vicinity

The nearest protected areas to Arrival Heights are on Ross Island: Discovery Hut, Hut Point (ASPA No.158), is the closest at 1.3 km southwest; Cape Evans (ASPA No. 155) is 22 km north; Backdoor Bay (ASPA No. 157) is 32 km north; Cape Royds (ASPA No. 121) is 35 km NNW; High Altitude Geothermal sites of the Ross Sea region (ASPA No. 175) near the summit of Mt. Erebus is 40 km north; Lewis Bay (ASPA No. 156) the site of the 1979 DC-10 passenger aircraft crash is 50 km NE; New College Valley (ASPA No. 116) is 65 km north at Cape Bird; and Cape Crozier (ASPA No. 124) is 70 km to the NE. NW White Island (ASPA No. 137) is 35 km to the south across the Ross Ice Shelf. Antarctic Specially Managed Area No. 2 McMurdo Dry Valleys is located approximately 50 km to the west of the Area.

6(v) Special zones within the Area

A Restricted Zone has been designated to provide spatially explicit restrictions on access, installations and emissions within a part of the Area. The Restricted Zone is intended for application to meet particular needs, for example at substantial and / or long-term facilities with special management requirements, rather than for general application to every experiment or installation within the Area (provisions elsewhere within the Management Plan cover these more general circumstances).

New Zealand installed a new Geomagnetic Observatory at Arrival Heights in 2021/22, which is located ~200 m NE of the main United States laboratory (Map 2). The objective of the Observatory is to capture data continuously on natural changes in the regional Earth's magnetic field as part of a global recording network. The Observatory comprises a Variometer hut and an Absolute hut, with power and data service cables extending to the existing New Zealand laboratory. Instruments collecting data at the Observatory are particularly sensitive. A Restricted Zone has been designated around the Observatory to help minimize potential interference.

Geomagnetic Observatory Restricted Zone: boundary extent and conditions for access and installations:

- The Restricted Zone is designated with a maximum radius of 140 m around the Observatory (Map 2).
- Installation of any new facilities, antennae, scientific instruments or any other structure is prohibited within the Restricted Zone unless authorized by permit after consultation with the operator responsible for the Observatory.
- An inner part of the Restricted Zone is designated with a radius of ~100 m around the Observatory where access should be only for compelling reasons that cannot be served elsewhere within the Area. A minor variation to this inner zone boundary is defined to align parallel with and 5 m to the east of the road to Second Crater to allow for access along the road (Map 2).
- Vehicles and machinery are generally prohibited within the inner part of the Restricted Zone, except as required for essential scientific or maintenance purposes specified by a permit. Access into the inner part of the Restricted Zone shall thus generally be on foot. However, in winter (01 Mar – 31 Oct) vehicles may approach the Observatory along the designated foot access route (Map 2) to within 50 m of the huts to facilitate safe access. Winter visitors should observe all restrictions on use of headlights and radios as specified in other sections of the Management Plan.
- Visitors traversing through the outer part of the zone by vehicle (e.g. en route to Second Crater or the northern part of the Area) shall record vehicle movement times in a log book held at the main NZ laboratory.
- Disturbance of rocks within a 10 m radius of each hut at the Observatory is prohibited, unless specifically authorized by permit.
- Pedestrian entry within a 10 m radius of the huts at the Observatory shall be recorded in the log book held at the main NZ laboratory.

7. Terms and conditions for entry permits

7(i) General 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 study of the atmosphere and magnetosphere, or for other scientific purposes that cannot be served elsewhere; or
- it is issued for operation, management and maintenance of science support facilities (including safe operations), on the condition that movement within the Area be restricted to that necessary to access those facilities; or
- it is issued for educational or public awareness activities that cannot be fulfilled elsewhere and which are associated with the scientific studies being conducted in the Area, on the condition that visitors are accompanied by permitted personnel responsible for the facilities visited; or
- it is issued for essential management purposes consistent with plan objectives such as inspection or review;
- the actions permitted will not jeopardize the scientific or educational 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 or authorities named in the permit;
- permits shall be valid for a stated period.

7(ii) Access to, and movement within or over, the Area

Access to the Area is permitted by vehicle and on foot. Landing of aircraft and overflight within the Area, including by both piloted and Remotely Piloted Aircraft Systems (RPAS), is prohibited unless specifically authorized by permit. Prior written notification must be given to the appropriate authority or authorities supporting scientific research being conducted in the Area at the time of the proposed aircraft activity. The location and timing of the aircraft activity should be coordinated as appropriate in order to avoid or minimize disruption to scientific programs, including the preservation of unobstructed viewing horizons. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

Vehicle and pedestrian traffic should be kept to the minimum necessary to fulfil the objectives of permitted activities and every reasonable effort should be made to minimize potential impacts on scientific research: e.g. personnel entering the Area by vehicle should coordinate travel so vehicle use is kept to a minimum.

Vehicles shall keep to the established vehicle tracks as shown on Map 2, unless specifically authorized by permit otherwise. Pedestrians should also keep to established tracks wherever possible. Care should be taken to avoid cables and other instruments when moving around the Area, as they are susceptible to damage from both foot and vehicle traffic. During hours of darkness, vehicle headlights should be switched off when approaching the facilities, in order to prevent damage to light-sensitive instruments within the Area.

For conditions applying to access within the Restricted Zone see Section 6(v).

7(iii) Activities which may be conducted in the Area

- scientific research that will not jeopardize the scientific values of the Area or interfere with current research activities;
- essential management activities, including monitoring, inspection, and the installation of new facilities to support scientific research;
- Activities with educational aims (such as documentary reporting (visual, audio or written) or the production of educational resources or services) that cannot be served elsewhere. Activities for educational and / or outreach purposes do not include tourism;
- use of hand-held and vehicle radios by visitors entering the Area is allowed; however, their use should be minimized and shall be restricted to communications for scientific, management or safety purposes;
- surveys of electromagnetic noise to help ensure that scientific research is not significantly compromised.

7(iv) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit.
- All structures, scientific equipment or markers installed within the Area, outside of research hut facilities, must be authorized by permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination or of damage to the values of the Area
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes environmental disturbance and installations should not jeopardize the values of the Area, particularly the electromagnetically 'quiet' conditions and the current viewing horizon. The time period for removal of equipment shall be specified in the permit.
- No new Radio Frequency (RF) transmitting equipment other than low power transceivers for essential local communications may be installed within the Area. Electromagnetic radiation produced by equipment introduced to the Area shall not have significant adverse effects on any on-going investigations unless specifically authorized. Precautions shall be taken to ensure that

electrical equipment used within the Area is adequately shielded to keep electromagnetic noise to a minimum.

- Installation or modification of structures or equipment within the Area is subject to an assessment of the likely impacts of the proposed installations or modifications on the values of the Area, as required according to national procedures. Details of proposals and the accompanying assessment of impacts shall, in addition to any other procedures that may be required by appropriate authorities, be submitted by investigators to the activity coordinator for their national program, who will exchange documents received with other activity coordinators for the Area. Activity coordinators will assess the proposals in consultation with national program managers and relevant investigators for the potential impacts on the scientific or natural environmental values of the Area. Activity coordinators shall confer with each other and make recommendations (to proceed as proposed, to proceed with revisions, to trial for further assessment, or not to proceed) to their national program within 60 days of receiving a proposal. National programs shall be responsible for notifying investigators whether or not they may proceed with their proposals and under what conditions.
- The planning, installation or modification of nearby structures or equipment outside the Area that emit EMR, obstruct the viewing horizon or emit gases to the atmosphere should take into account their potential to affect the values of the Area.
- Removal of structures, equipment or markers 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.
- For conditions applying to installation, modification or removal of structures within the Restricted Zone see Section 6(v).

7(v) Location of field camps

Camping within the Area is prohibited. Overnight visits are permitted in buildings equipped for such purposes.

7(vi) Restrictions on materials and organisms which may be brought into the Area

- anthropogenic gaseous or aerosol emissions to the atmosphere from sources such as internal combustion engines within the Area shall be minimised or where practicable avoided. Long-term or permanent anthropogenic gaseous or aerosol emissions within the Area would jeopardize scientific experiments and are prohibited;
- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions should be taken to minimize the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);
- Herbicides and pesticides are prohibited from 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 shall not be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted. In general, all materials introduced shall be for a stated period only and shall be removed at or before the conclusion of that stated period;
- All materials 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(vii) Taking of, 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 Article 3 of Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where animal taking or harmful interference is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

7(viii) Collection or removal of materials 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. This includes biological samples and rock or soil specimens.
- 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 and approval obtained.
- The appropriate national authority should be notified of any items removed from the Area that were not introduced by the permit holder.

7(ix) Disposal of waste

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

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

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

- Electromagnetic bands of particular scientific interest and that warrant special protection from interference should be identified by parties active within the Area. As far as practically possible, the generation of electromagnetic noise should be limited to frequencies outside of these bands.
- The intentional generation of electromagnetic noise within the Area is prohibited, apart from within agreed frequency bands and power levels or in accordance with a permit.
- Research or management should be conducted in a manner that avoids interference with long-term research and monitoring activities or possible duplication of effort. Persons planning new projects within the Area are strongly encouraged to consult with established programs working within the Area, such as those of New Zealand or the United States, before initiating the work.

7(xi) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable after the visit has been completed in accordance with national procedures.
- Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Parties that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.
- Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures that might have exceptionally been undertaken, and / or of any materials released and not removed, that were not included in the authorized permit.

8. Supporting documentation

Allan, W., Lowe, D.C., Gomez, A.J., Struthers, H. & Brailsford, G.W. 2005. Interannual variation of 13C in tropospheric methane: Implications for a possible atomic chlorine sink in the marine boundary layer. Journal of Geophysical Research: Atmospheres 110 (D11): D11306.

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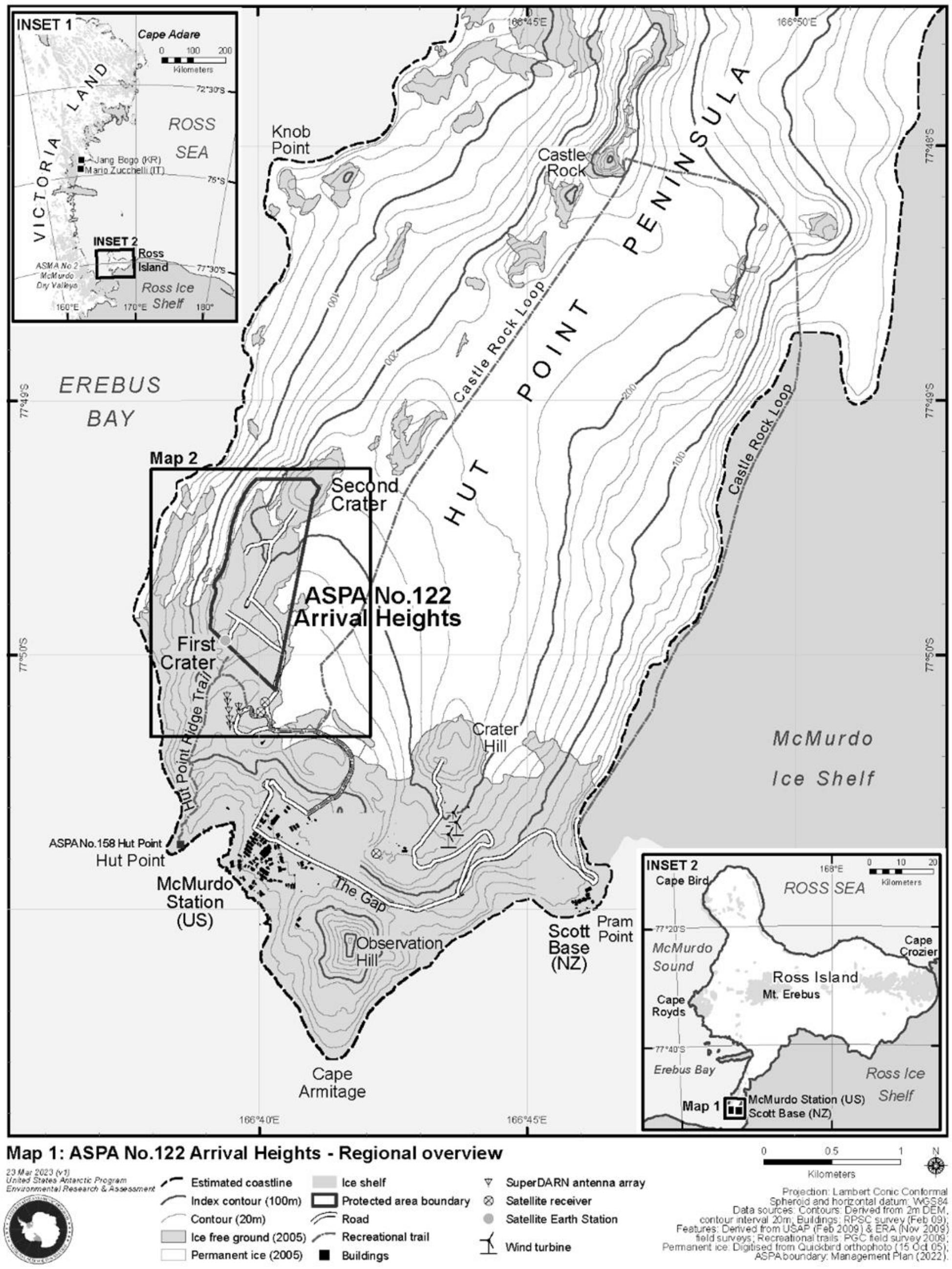
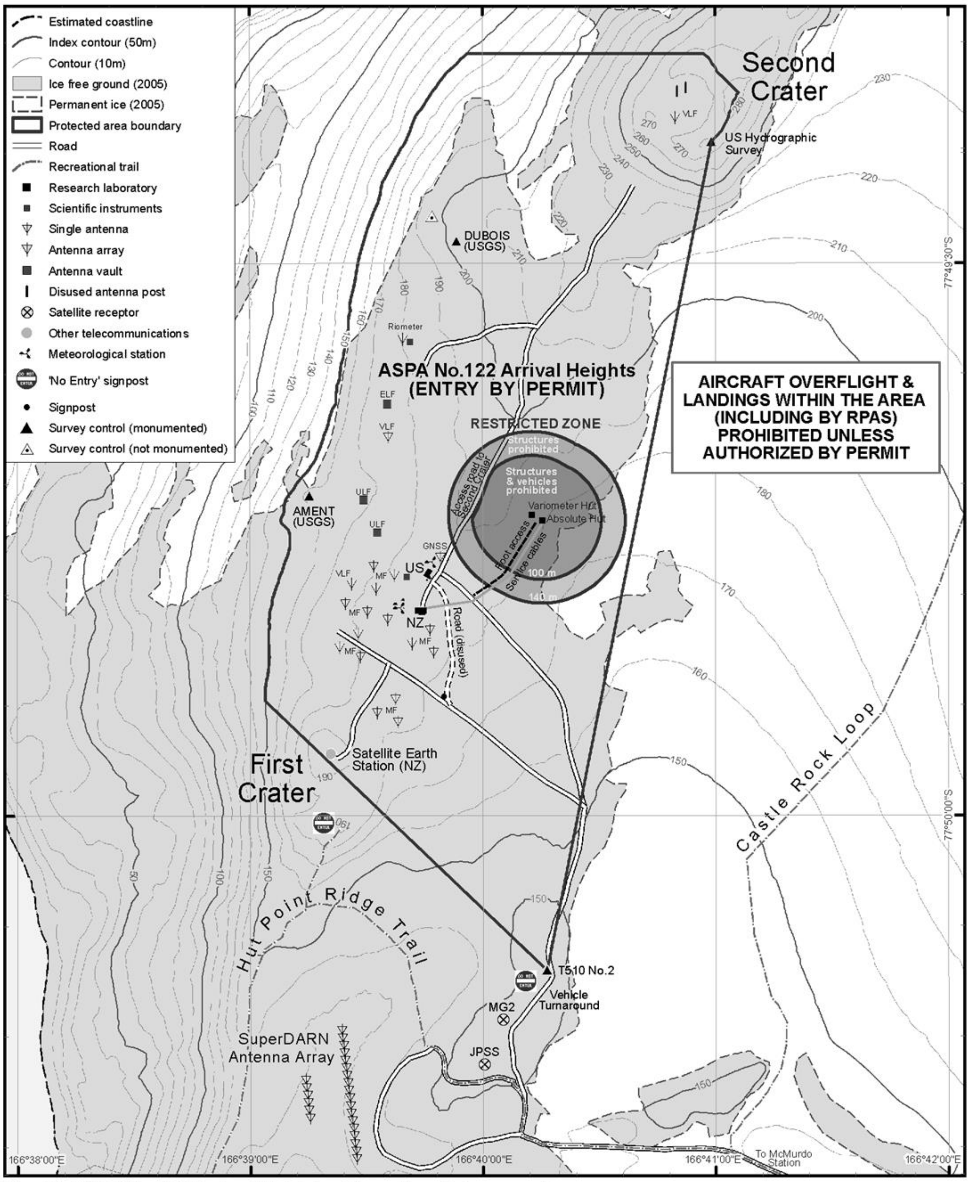


Map 1: ASPA No.122 Arrival Heights - Regional overview



Map 2: ASPA No.122 Arrival Heights - Boundary & topography

23 Mar 2023 (v1)
United States Antarctic Program
Environmental Research & Assessment

Caution:
Overground cables are present throughout Arrival Heights and are not shown on this map. Care should be taken to avoid disturbing these cables.

N
0 100 200
Meters

Projection: Lambert Conic Conformal
Data sources: Contours: Derived from 2m DEM, contour interval 10m; Features: Derived from USAP (Feb 2009) & ERA (Nov 2009) field surveys; Recreational trails: PGC field survey 2009; Permanent ice digitised from orthorectified Quickbird image (15 Oct 05) (Imagery © Digital Globe); ASPA boundary: Management Plan (2022); Antennae / instruments / infrastructure: verified 2022.

Measure 5 (2023)

Antarctic Specially Protected Area No 123 (Barwick and Balham Valleys, Southern Victoria Land): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation VIII-4 (1975), which designated Barwick Valley, Victoria Land as Site of Special Scientific Interest ("SSSI") No 3 and annexed a Management Plan for the Site;
- Recommendations X-6 (1979), XII-5 (1983), XIII-7 (1985), Resolution 7 (1995) and Measure 2 (2000), which extended the expiry date of SSSI 3;
- Decision 1 (2002), which renamed and renumbered SSSI 3 as ASPA 123;
- Measures 1 (2002), 6 (2008), 3 (2013) and 1 (2019), which adopted revised Management Plans for ASPA 123;

Recalling that Recommendations VIII-4 (1975), X-6 (1979), XII-5 (1983), XIII-7 (1985) and Resolution 7 (1995) were designated as no longer current by Decision 1 (2011);

Recalling that Measure 2 (2000) did not become effective and was withdrawn by Measure 5 (2009);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 123;

Desiring to replace the existing Management Plan for ASPA 123 with the revised Management Plan;

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

1. the revised Management Plan for Antarctic Specially Protected Area No 123 (Barwick and Balham Valleys, South Victoria Land), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 123 annexed to Measure 1 (2019) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 123

BARWICK AND BALHAM VALLEYS, SOUTHERN VICTORIA LAND

Introduction

The Barwick and Balham Valleys are located within Antarctic Specially Managed Area (ASMA) No. 2 McMurdo Dry Valleys, Victoria Land, Ross Sea. The Area is centered at 77° 21' S, 160° 57' E and is approximately 423 km² in area. The Barwick and Balham Valleys are rarely visited and are an important reference area for comparing changes in other Dry Valley ecosystems which are regularly visited for scientific purposes. The Area contains examples of a wide variety of the environments found in the polar desert ecosystem. Some of the best examples of the physical surface features associated with this unique and extreme environment are found on the valley floors, where there are also fine examples of microbial life, lichens, as well as soil and lake microflora.

Barwick and Balham Valleys were originally designated as Site of Special Scientific Interest (SSSI) No. 3 through Recommendation VIII-4 (1975) after a proposal by the United States of America. A number of Recommendations extended the Management Plan expiry dates (Recommendation X-6 (1979), Recommendation XII-5 (1983), Recommendation XIII-7 (1985), and Resolution 7 (1995)). Measure 2 (2000) advanced the expiry date of the management plan from 31 December 2000 until 31 December 2005. Decision 1 (2002) renamed and renumbered SSSI No. 3 as Antarctic Specially Protected Area No. 123. Measure 1 (2002) designated the Area for an indefinite period, enlarged the original Area to include more of the Balham Valley catchment and rationalized it to exclude the Victoria Upper Glacier catchment. Measure 6 (2008) amended the Management Plan to include additional provisions to reduce the risk of microbial and vegetation introductions from soils at other Antarctic sites or from regions outside Antarctica. Measure 3 (2013) updated literature, improved the map of the Area, and made minor adjustments to provisions on aircraft access. The boundary was adjusted to follow the Barwick / Balham catchments more precisely. Soil geochemistry analyses on samples collected in 2015 revealed low-level contamination present at a former soil pit near Lake Vashka. However, the low absolute levels overall and the very limited spatial extent of contamination observed suggested that the pristine nature of the Area was maintained and its value as a reference site remained valid. These observations and other minor updates were incorporated into the Management Plan adopted through Measure 1 (2019).

The Area is classified as Environment S – McMurdo - South Victoria Land geologic based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) and is classified as Region 9 – South Victoria Land under the Antarctic Conservation Biogeographic Regions (ACBR) classification (Resolution 3 (2017)).

1. Description of values to be protected

An area of 325 km² at Barwick Valley, including part of adjacent Balham Valley, was originally designated in Recommendation VIII-4 (1975, SSSI No. 3) after a proposal by the United States of America on the grounds that it was “one of the least disturbed and contaminated of the Dry Valleys of Victoria Land” and was important as a reference base against which to measure changes in comparable ecosystems of the other Dry Valleys where scientific investigations were being regularly conducted. The site remains distant from field stations and has not been subjected to intensive visitation or research. The Barwick Valley was first visited in 1958 and several subsequent expeditions were conducted in the 1960s through to 1975, after which time visits have been few because of the designation of the SSSI. Although some human impacts from these early expeditions were visible within the region in 1993-94, Barwick and Balham Valleys are believed to remain one of the least impacted areas in the McMurdo Dry Valleys region of Antarctica. Soil samples collected in 2015 showed evidence of low levels of metals and hydrocarbon contamination at one previously disturbed site near Lake Vashka. However, given the low magnitude and very limited spatial extent of contamination observed, as well as very low absolute levels of contaminants observed in samples taken nearby, the largely pristine nature of the Area is being maintained and its value as a reference site is considered to remain valid.

The boundaries of the original Area were re-designed in Measure 1 (2002) so they followed the Barwick and Balham catchments more truthfully, resulting in a total area of 418 km² (correction from 480 km², an error in Measure 1 (2002)), which were again adopted without change in Measure 6 (2008). The catchment boundaries were refined further in 2013 based on improved mapping, resulting in an increase in total area from 418 km² to 423 km². The boundary remains unchanged in the current Management Plan.

The McMurdo Dry Valleys have a unique and extreme polar desert ecosystem. The Area contains examples of a wide variety of the environments found in this ecosystem, including desert pavements, sand dunes, patterned ground, glacial and moraine features, streams, freshwater and saline lakes, valleys and high-altitude ice-free ground. Some of the best examples of ventifact pavements and weathering-pitted dolerites are found on the valley floors, along with examples of chasmolithic lichens, layered communities of endolithic lichens, fungi, algae and associated bacteria, and populations of soil and lake microflora. Special protection of the Area provides the opportunity to conserve a relatively pristine example of this ecosystem as a baseline for future reference. Protection on a catchment basis serves to provide greater representation of the ecosystem features, and also facilitates management of the Area as a geographically distinct and integrated ecological system. The high ecological values, as well as the scientific, aesthetic and wilderness values derived from the isolation and relatively low level of human impact are important reasons for special protection at Barwick and Balham Valleys.

2. Aims and objectives

Management at Barwick and Balham Valleys aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human presence, disturbance and sampling in the Area;
- preserve the natural ecosystem as an area largely undisturbed by direct human activities;
- preserve the almost pristine ecosystem as a biological reference area;
- allow scientific research on the natural ecosystem and physical environment within the Area provided it is for compelling reasons which cannot be served elsewhere;
- prevent or minimize the possibility of introduction of non-native species (e.g. plants, animals and microbes) to the Area; and
- 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:

- Notices 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, at permanent scientific stations located within the Ross Sea region;
- All pilots operating in the region shall be informed of the location, boundaries and restrictions applying to entry, overflight and landings within the Area;
- National programs shall ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- 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;
- Any abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area;
- The Area shall be visited as necessary to assess whether it 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 the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: ASPA No. 123 Barwick and Balham Valleys – topography and boundary. Map specifications: Projection: Lambert conformal conic; Standard parallels: 1st 77° 15' S; 2nd 77° 25' S; Central Meridian: 161° 10' E; Latitude of Origin: 78° 00' S; Spheroid and datum: WGS84; Contour interval 100 m.

Inset 1: Ross Sea region, showing the location of the McMurdo Dry Valleys and Inset 2.
Inset 2: McMurdo Dry Valleys and Ross Island, showing location of McMurdo Station (US) and Scott Base (NZ), and Antarctic Specially Managed Area (ASMA) No. 2 McMurdo Dry Valleys.

6. Description of the Area

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

- *General description*

Barwick Valley (77° 21' S, 161° 57' E) is situated about 65 km inland from the Ross Sea coast of southern Victoria Land (Map 1 and Insets). The Area includes Barwick and Balham Valleys and their respective catchments and is bordered on the south, west and north by the McKelvey Valley, the Willett Range and the divide between the Victoria and Barwick Valleys, respectively.

- *Boundaries and coordinates*

The boundary of the Area extends from its eastern extremity in the lower Barwick Valley (around the confluence of the Barwick, Victoria and McKelvey Valleys) several kilometers south towards the ridge leading SW to the summit of Mount Insel (1345 m, 77° 23.50' S, 161° 30.74' E,), from where the boundary follows the high points of the ridge of the Insel Range over Halzen Mesa for 5.5 km before descending to a low pass between the McKelvey and Balham Valleys at the location of Bullseye Lake (722 m, 77° 24.78' S, 161° 14.41' E). The boundary crosses the lake before ascending the ridge to a further high point on Canfield Mesa on the Insel Range (approximately 1250 m), and continues over Green Mesa to follow Rude Spur to Mount Cassidy (1917 m) and onwards to the upper reaches of the Balham Valley. As the terrain becomes gentler in the upper Balham and approximately 6.5 km southeast of the summit of Shapeless Mountain (2736 m), the boundary extends northward at an elevation of between 1800 – 1900 m towards the Huka Kapo Glacier and Apocalypse Peaks. The boundary extends NW from the Huka Kapo Glacier for approximately 9 km towards a prominent ridge leading to the summit of Mount Bastion (2477 m, 77° 19.18' S, 160°29.39' E). This ridge is followed in a northerly direction to the top of McSaveney Spur, thence follows the upper ridgeline of the cirque containing Webb Icefall to the summit of Vishniac Peak (2280 m, 77° 14.71' S, 160° 31.82'E). The boundary thence follows the main ridge northeast for 5 km to the summit of Skew Peak (2537 m, 77° 13.16' S, 160° 42.07'E), located at the head of the Barwick Valley. The boundary then descends along the east ridge of Skew Peak above Webb Cirque, before following the catchment boundary in a more southerly direction to Parker Mesa. From Parker Mesa the boundary descends further to follow the upper ridge of The Fortress and the Cruzon Range, which is the dividing ridge between the catchments of the Victoria Upper Glacier and the Barwick Valley. The boundary extends east along this ridge for ~12 km via Loewenstein Peak (1539 m) and Shulman Peak (1400 m) to Sponsors Peak (1454 m, 77° 18.2' S, 161°24.4' E). The boundary descends the SE ridge of Sponsors Peak and Nickell Peak (approximately 1400 m, 77° 19.21' S, 161° 28.25' E) to the lower Barwick to the eastern extremity of the Area, which is about 4 km northwest of Lake Vida, Victoria Valley.

- *Physiography, glaciology, streams and lakes*

An extensive névé south of Skew Peak feeds the Webb Glacier in the upper Barwick Valley. Very little ice from the Polar Plateau flows over the scarp into the Barwick Valley, as flow vectors and debris cover patterns on the Webb Glacier indicate that this part of the glacier is almost stationary. The Barwick and Balham Valleys merge in the southeast of the Area, 9 km from where the Barwick joins the Victoria Valley. A series of lakes occupy the Barwick Valley, the largest being Webb Lake (approximate elevation 658 m) at the snout of Webb Glacier. Lake Vashka (approximate elevation 476 m), partially filling an unusually deep circular depression (Chinn 1993), is the second largest and 5.7 km down-valley from Webb Lake. Hourglass Lake (approximate elevation 617 m), the next largest, is approximately half way between Webb Lake and Lake Vashka. An intermittent stream connecting this series of lakes terminates at Lake Vashka, which has a level well below its overflow threshold. Early observations of the smooth surfaces of Lakes Webb and Vashka suggested that they are ‘ice-block’ lakes that contain no significant liquid water (Chinn 1993). However, liquid water up to several meters in depth was observed at the perimeter of Lake Vashka in December 1993. Recent studies on the physical features of any of the Barwick Valley lakes have not been made. Lake Balham, a small lake in a depression (671 m elevation) below Apocalypse Peaks, is the only lake in Balham Valley (generally around 800 m in elevation).

Multiple glaciations, mainly between 13 Ma and 3.5 Ma ago, have resulted in a thick ground moraine on both valley floors (Péwé 1960). These deposits are mantled by solifluction sheets at the head of Balham Valley. In addition, the valleys bear a small number of fresh and saline lakes on the drift surfaces. In many cases the lakes have evaporated to leave extensive salt deposits. The walls of Barwick and Balham Valleys display remnants of glacial benches at about 800 m and 1,200-1,500 m altitude (Bull et al. 1962). The soils near Lake Vashka consist of moraine debris derived largely from dolerite and sandstone, but granites, gneiss and schist make up as much as 35% of boulders locally (Claridge 1965). Weathering is often indicated by deep red staining due to oxidation of iron compounds, usually eroded by wind-driven sand on the boulders’ windward side (Claridge & Campbell 1984). The valley floors are extensively covered with patterned ground of sand-wedge polygons, typical of permafrost areas in the Dry Valleys (Campbell & Claridge 1987). The majority is old (high centered), with young (hollow centered) polygons found in recent stream channels, and both typically measure 20 m across. Soil samples were collected from five sites in the Area (~1kg each, four from the Barwick Valley and one from Balham Valley) in January 2019 as part of studies for preparation of a Digital Soil Map for ice-free areas in the McMurdo Dry Valleys (Morgan 2019).

- *Terrestrial and animal ecology*

No invertebrates have been found in the dry soils of the Barwick Valley and there is little obvious vegetation (Freckman & Virginia 1998). Algal crusts and mats fringe the lakes and streams but the flora reported is essentially microbial: chasmolithic lichens are present in jagged screes of the Apocalypse Range and dense layered communities of endolithic lichens, fungi, algae and associated bacteria are occasionally found in boulders of Beacon Sandstone (Edwards et al. 1998, 2005). Black lichen growth is reported to be well developed in areas of sandstone on the valley floor of Balham Valley (Russell et al. 1998). Significant heterotrophic bacterial populations have been reported in sandy samples from Barwick Valley. The population contained lactose-fermenters, nitrate-reducers, nitrogen-fixers, yeasts and algae but no detectable filamentous fungi or Protozoa (Cowan et al. 2002).

While the Barwick and Balham Valleys are one of the most remote areas of the Dry Valleys, south polar skuas (Catharacta maccormicki) are known to visit the Area, with about 40 carcasses found at Lake Vashka in 1959-60. The mummified carcasses of two seals have been found near the snout of Webb Glacier, and seven more, mainly crabeaters (Lobodon carcinophagus) were found near the Balham / Barwick Valley junction (Dort 1981).

- *Human activities / impacts*

Inspection of the Barwick and Balham Valleys in December 1993 from Bullseye Lake to Lake Vashka revealed evidence of prior human activity, particularly around Lake Vashka where field camps had been in use for scientific research in the 1960s. Impacts observed in the Lake Vashka vicinity included stone circles for tents at old camp sites, soil pits and a trench, remains of a wooden crate, a wooden box containing rocks and a paper poster, and a broken food cache partially submerged in the lake (Harris 1994). A poster recording names of visitors enclosed in a map roll at Lake Vashka was removed from the Area in 1993 because it was deteriorating (Harris 1994). Bamboo poles are situated near the snout of Webb Glacier and at Vashka Crag. Dynamite charges have been used in the vicinity of Lake Vashka and at least one other unknown location in the Barwick Valley. Remediation of the site was carried out in 1995/96 by a New Zealand team.

The spatial distribution of soils in the Barwick and Balham valleys was investigated in field work undertaken 6-13 January 2012 (McLeod & Bockheim 2012). Small, shallow excavations were made to determine soil properties, which were carefully remediated and their positions recorded by GPS (Antarctica NZ 2012). The team camped at a previously established site near Lake Vashka (77° 20.931' S, 161° 09.284' E) (Map 1). Walking routes and sampling sites were kept to the minimum to accomplish objectives and sensitive areas were avoided. Precautions were taken to minimize the risk of introduction of non-native species by cleaning equipment, and all wastes were removed. The team made observations of former soil excavations at three locations (77° 20.951' S, 161° 08.822' E; 77° 20.989' S, 161° 09.078' E; and 77° 20.989' S, 161° 09.085' E). No structures were observed within the Area and the team noted that the sites visited appeared to remain pristine.

To gain a quantitative understanding of baseline environmental conditions as well as possible impacts, Klein et al. (2019) collected soil samples along the western margin of Lake Vashka in November 2015 from four sites of past human activities reported previously (Harris 1994, McLeod & Bockheim 2012, Antarctica New Zealand 2012). The site on the shore of Lake Vashka where a broken and partially submerged food cache was found in 1993 was fully submerged several meters below the lake surface in 2015, and samples were not collected from this site directly but from the adjacent area above the present lake shoreline. All samples were analysed for polycyclic aromatic hydrocarbons (PAHs) and a suite of 17 metals / metalloids to determine whether there were geochemical indications of human activities. An additional site was identified with evidence of ~12 shallow soil excavations scattered over an area approximately 20 m in diameter at 77° 21.18' S, 161° 10.422' E, although this was not sampled.

Overall, the geochemical analyses revealed little evidence of contamination that could reasonably be associated with human activities in the Area. The majority of samples (18 of 24) showed no indication of contamination, with total PAHs lower than 6.5 ng/g and trace metals also showing levels consistent with expected baseline conditions. While no control site was sampled in 2015 to provide true baseline measurements, the overall consistent low level of contamination evident across all elements and the spatially distributed samples suggests that these 18 samples are likely to be a reasonable proxy for background baseline levels in the vicinity of Lake Vashka.

The results from four samples taken at one of the former soil excavation sites exhibited relatively elevated concentrations of both PAHs and a number of metals that are associated with human activities (Klein et al. 2019). The elements Ba, Cd, Fe, Hg, Mg, Pb, and Zn showed more than double the average concentrations observed at nearby sample sites, with mercury in particular being almost nine times the average. Total PAH at this former soil pit was also up to ~14 times the average levels across other sites. The results support the hypothesis that the spatial extent of any contamination present is very limited. While levels from this more contaminated soil pit site were much higher compared to the adjacent sampling sites, in the wider context of Antarctica the detected absolute concentrations overall are considered low and indicate limited human impact (Klein et al. 2019). Given the low measured concentrations and very limited spatial extent of contamination observed, as well as the very low baseline levels of contaminants observed in samples more generally, the largely pristine nature of this part of the Barwick Valley is confirmed and the value of the site as a reference area is considered to remain valid.

6(ii) Access to the area

The Area may be accessed by traversing over land or ice, or by air. Particular access routes have not been designated for entering the Area. Access restrictions apply within the Area, the specific conditions for which are set out in Section 7(ii) below.

6(iii) Location of structures within and adjacent to the Area

There are no structures within or near the Area.

6(iv) Location of other protected areas in the vicinity

Valley and Balham Valley lie within Antarctic Specially Managed Area (ASMA) No.2 McMurdo Dry Valleys. The nearest protected areas to Barwick and Balham Valleys are Linnaeus Terrace (ASPA No.138) 35 km south in the Wright Valley, and Canada Glacier (ASPA No.131) and Lower Taylor Glacier and Blood Falls (ASPA No. 172), both of which are approximately 45 km southeast in the Taylor Valley (Inset 2, Map 1).

6(v) Special zones within the Area

None.

7. Terms and conditions for entry permits

7(i) General 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 compelling scientific reasons that cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental, ecological, scientific, aesthetic and wilderness values of the Area, including the almost pristine nature of the Area and its value as a largely undisturbed reference site;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried when in the Area.

7(ii) Access to, and movement within or over, the Area

Access to and movement within the Area shall be on foot or by aircraft. Vehicles are prohibited within the Area.

- *Access on foot*

- Pedestrians are encouraged to access the Area at a practicable point closest to the site(s) they are visiting to minimize the amount of the Area that is traversed;
- Pedestrian routes should avoid lakes, ponds, stream beds, areas of damp ground and areas of soft sediments or dunes;
- Pedestrian traffic should be kept to the minimum necessary consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

\- *Access and overflight by piloted aircraft and Remotely Piloted Aircraft Systems (RPAS)*

- Overflight below 2000 ft (610 m) and landings within the Area by piloted aircraft, including by helicopters, are prohibited except in accordance with a permit issued by an appropriate national authority;
- Helicopter landings should avoid frozen lakes and stream beds. By preference, and where safe and practical, landings should be made on snow surfaces to minimize dust and soil disturbance;
- Overflight below 2000 ft (610 m) and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are prohibited except in accordance with a permit issued by an appropriate national authority. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

7(iii) Activities that may be conducted within the Area

- Compelling scientific research that cannot be undertaken elsewhere and will not jeopardize the values of the Area, or its pristine nature and value as a reference site;
- Essential management activities, including monitoring and inspection.

7(iv) Installation, modification or removal of structures / equipment

- Structures shall not be erected within the Area except as specified in a permit;
- Permanent structures are prohibited;
- All structures, scientific equipment or markers installed in the Area shall be authorized by permit and clearly identified by country, name of the principal investigator, year of installation and date of expected removal. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area;
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to the values of the Area;
- Removal of specific structures / 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(v) Location of field camps

Camping should generally be avoided within the Area, and two campsites outside of, but close to, the east and south boundaries are identified for access into the Area. One of these is at the confluence of the lower Barwick and Victoria Valleys (77° 21.75' S, 161° 41.25' E), while the other is close to Bullseye Lake in the McKelvey Valley (77° 25.67' S, 161° 13.13' E) (see Map 1). If deemed to be essential, camping should be at previously impacted sites, preferably on snow or ice-covered ground if available. One such previously established camp site is located on slopes ~150 m above the SW shore of Lake Vashka (77° 20.931' S, 161° 09.284' E) (Map 1), which is marked by a circle of stones, and this site should be used to meet research needs as appropriate. Researchers should consult with the appropriate national authority to obtain up-to-date information on any other sites where camping may be preferred.

7(vi) Restrictions on materials and organisms that may be brought into the Area

In addition to the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, restrictions on materials and organisms which may be brought into the area are:

- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);
- Visitors shall ensure that scientific equipment, particularly for sampling, and markers brought into the Area are clean. To the maximum extent practicable, clothing, footwear and other equipment used or brought into the area (including backpacks, carry-bags, walking poles, tripods, andcamping equipment etc.) shall be thoroughly cleaned before entering the Area. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2019), and in the Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018));
- To reduce the risk of microbial contamination, the exposed surfaces of footwear, sampling equipment and markers should, to the greatest extent practical, be sterilized before use within the Area. Sterilization should be by an acceptable method, such as by washing in 70% ethanol solution in water or in a commercially available solution such as 'Virkon';
- Herbicides and pesticides are prohibited from the Area;
- The use of explosives is prohibited within the Area;
- Fuel, food, chemicals, and other materials shall not be stored in the Area, unless specifically authorized by permit and shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment;
- All materials introduced shall be for a stated period only and shall be removed by the end of that stated period; and

- 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(vii) 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 issued under Article 3 of Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where animal taking or harmful interference with animals is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

7(viii) 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 soil, 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 the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ: if this is the case the appropriate authority should be notified and approval obtained.

7(ix) Disposal of waste

All wastes, including water used for any human purpose and including all human wastes, shall be removed from the Area.

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

Permits may be granted to enter the Area to:

- carry out monitoring and Area inspection activities, which may involve the collection of a small number of samples or data for analysis or review;
- install or maintain signposts, markers, structures or scientific equipment;
- carry out protective measures.

7(xi) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority after the visit has been completed in accordance with national procedures and permit conditions.

- Such reports should include, as appropriate, the information identified in the visit report form contained in Appendix 2 of the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.
- Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures that might have exceptionally been undertaken, or anything removed, or anything released and not removed, that were not included in the authorized permit.

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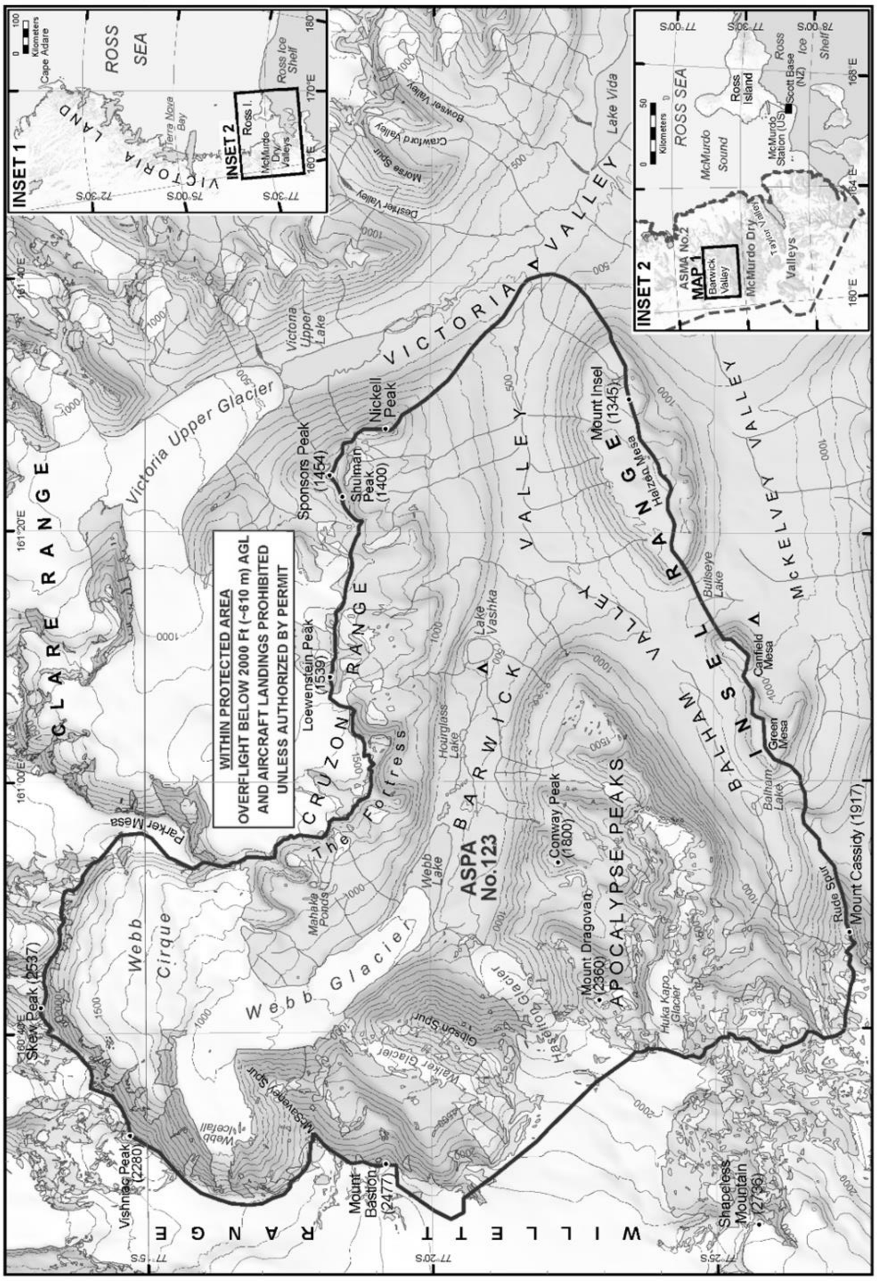

Map 1: ASPA No.123 Barwick and Balham Valleys — Topography and boundary

Measure 6 (2023)

Antarctic Specially Protected Area No 132 (Potter Peninsula, King George Island (Isla 25 de Mayo), South Shetland Islands): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XIII-8 (1985), which designated Potter Peninsula, King George Island (Isla 25 de Mayo), South Shetland Islands as Site of Special Scientific Interest ("SSSI") No 13 and annexed a Management Plan for the Site;
- Measure 3 (1997), which annexed a revised Management Plan for SSSI 13;
- Decision 1 (2002), which renamed and renumbered SSSI 13 as ASPA 132;
- Measures 2 (2005), 4 (2013) and 3 (2018), which adopted revised Management Plans for ASPA 132;

Recalling that Measure 3 (1997) has not become effective and was withdrawn by Measure 6 (2011);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 132;

Desiring to replace the existing Management Plan for ASPA 132 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 132 (Potter Peninsula, King George Island (Isla 25 de Mayo), South Shetland Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 132 annexed to Measure 3 (2018) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No 132

POTTER PENINSULA

Introduction

This area was originally designated as Site of Special Scientific Interest No. 1 (Recommendation XIII-8, ATCM XIII, Brussels, 1985) at the proposal of Argentina, due to its diverse and extensive vegetation and fauna, which constitutes a representative sample of the ecosystem of the Antarctica.

In 1997, the Management Plan was adapted to the requirements of Annex V to the Environment Protocol from the Antarctic Treaty, and approved by Measure 3 (1997). Then in 2005 the revision of the Management Plan was approved in accordance with Measure 2 (2005) and it was the second revision since Annex V became effective. Finally in 2018 the last revision of the Plan was approved through Measure 3 (2018).

The original objectives for the designation of this area remain significant. Potter Peninsula is designated as an Antarctic Specially Protected Area to protect its outstanding environmental values and to facilitate ongoing or planned scientific research. Anthropic disturbances could jeopardise long-term studies carried out in the area, especially during the breeding season, or modify basal levels in biotic and/or abiotic matrices of critical chemical pollutants (eg, trace elements and/or persistent organic composites).

The primary reason for designation as an ASPA is that Potter Peninsula constitutes a representative sample of species assemblages in the Antarctic ecosystem. The coastal areas are home to important bird colonies, breeding grounds for marine mammals and various plant species. Currently these coasts are among the most susceptible to climate change and its indirect effects such as glacial melting (Hernando et al., 2015), which has been shown to affect biodiversity (Sahade et al., 2015). For this reason, it has great scientific value, since various studies can be carried out in the area on the impacts of climate change on biotic and abiotic factors, as well as its consequences on the food chain (eg, Carlini et al., 2009, Carlini et al., 2010, Casaux et al., 2006, Daneri and Carlini 1999, Rombolá et al., 2010, Torres et al., 2012, Quillfeldt et al., 2017, Juáres et al., 2018). It is essential to maintain these scientific activities, such as the monitoring programme that has been carried out since 1982, among them the CCAMLR Ecosystem Monitoring Programme (CEMP, started in 1995), as it produces invaluable scientific data for this purpose. Likewise, knowledge about plankton (Bers et al., 2013; Schloss et al., 2014) and krill dynamics (Di Fonzo et al., 2014, 2017a, 2017b, Fuentes et al., 2016), the basis of the diet of higher organisms in the food web, are of special importance.

Currently, there is a need to increase the volume of studies related to the numbers and reproduction of seabirds and mammals, since they have the potential to be used as ecological indicators of processes on a global scale and of the environmental quality of ecosystems (Costa et al., 2019; Croxall et al., 1998). In this regard, the geographical location of ASPA 132 is crucial for this type of studies and other comparative studies between its fauna and that of other Antarctic areas. Climatic and oceanographic variabilities have been shown to have effects on seabird populations, generally with profound consequences, such as reduced breeding success and alterations in the mating cycles of some species (Chambers et al., 2011; Krüger et al., 2018; Warwick-Evans et al., 2021). The Antarctic Peninsula region is one of the places on the planet where the greatest effects of global climate change have been observed, notably the direct impact on the formation and duration of sea ice and the consequent effects on the entire food chain (Morley et al., 2020; Turner et al., 2009). Recent studies indicate that the drivers of change in ocean ecosystems are causing, in the western region of the Antarctic Peninsula, temperature increases, loss of sea ice and increased potential for invasion by other species, among other impacts (Morley et al., 2020). Some authors point out that the region of Harmony Point has undergone some of the greatest changes. Stability in the positive phase of the SAM (Southern Annular Mode) has had an impact on winds, water movement and the expanse of sea ice (Stammerjohn et al., 2008; Thompson and Solomon, 2002), and has repercussions for Antarctic flora and fauna.

There are several characteristics that make this area particularly susceptible to human interference, such as the configuration of the area, that is, a relatively narrow coastal area, enclosed between the sea and a cliff, where there is no area of movement that does not interfere with breeding colonies. The high concentration of activities, the scientific stations and the easy accessibility to the area by sea and by land, even with small boats, represent a potential threat to biological values and research activities.

According to recent studies, the state of the environment in the South Shetland Islands shows that Bransfield Strait, in the South Atlantic Ocean near the Potter Peninsula, has been severely altered, first by the almost complete extraction of the abundant colony of fur seals (Arctocephalus spp.) that feed on fish and krill, followed by baleen whales. More recently, fur seals have largely recovered and whales are beginning to do so (Ainley et al., 2010), but climate change is increasingly affecting ecological processes through physical changes in temperature, water circulation, and sea ice expanse, among others. As a result of prey reductions, not only due to climate change and the recovery of populations of competing species, but also due to other currently unknown factors, penguin populations are declining (Ducklow et al., 2007, Ainley and Blight 2009, Ainley et al., 2010, Trivelpiece et al., 2011, Juáres et al., 2015). With this regard, ASPA 132 has currently acquired special relevance, given that the study of the Pygoscelid penguin colonies present in the area offers answers to the environmental changes observed in the Antarctic Peninsula, especially the lower frequency of cold years associated with the reduction of sea ice expanses and its effects on krill abundance (García et al., 2015). It also contributes to detecting and recording significant changes in the marine ecosystem and seeks to distinguish between the changes caused by the commercial collection of the species and both the physical and biological changes caused by environmental variability.

The Potter Peninsula also offers exceptional opportunities for other scientific studies of terrestrial and marine biological communities.

The research and monitoring programmes currently underway in ASPA 132 include:

- Spatial and temporal dynamics of the prokaryotic and viral communities of Potter Cove.
- Effect of climate change and the presence of xenobiotics on Antarctic organisms.
- Effects of climate change on marine algae and Antarctic benthic fauna.
- Persistent organic pollutants (POPs), trace elements (TE) and microplastics in biotic and abiotic matrices of the Antarctic environment
- Energy intake, type of prey and possible responses of pinnipeds to climatic anomalies and sea ice expanse on the Antarctic Peninsula and the Scotia Arc.
- Response of Antarctic bird populations to the interannual variability of their prey in areas with evident effects of global warming.
- Phylogeography of Deschampsia antarctica, based on molecular, morphological and karyological studies
- Distribution and nutritional status of brown skuas and South polar skuas.
- CCAMLR Ecosystem Monitoring Programme-CEMP site since 1995

1. Description of values to be protected

The coastal areas are home to important colonies of birds, breeding colonies of marine mammals and profuse vegetation (large expanses of mosses and lichens, patches of Antarctic grass and air cloves (Deschampsia antarctica and Colobanthus quitensis) in coastal areas). Scientific research programmes have been developed on the breeding ecology of species of marine mammals and birds since 1982, such as elephant seals (Mirounga leonina), the Adelie penguin (Pygoscelis adeliae) and gentoo penguins (Pygoscelis papua), including the CCAMLR Ecosystem Monitoring Programme, among others. Breeding colonies are located in a particular coastal location. The area consists mainly of raised beaches, largely covered with medium-sized stones, basalt structures, and lateral and terminal moraines. The coast is very irregular and has a series of small bays formed between the rocky promontories where there are usually different species of Antarctic pinnipeds that come to these shores to reproduce or shed their fur. The above reasons give the area an exceptional scientific and aesthetic value.

Although Antarctica is considered one of the few uncontaminated areas on our planet, due to the fact that it is relatively isolated and distant from large industrial and urban centres, there are studies that demonstrate the existence of halos of contamination close to scientific stations, a fact also reported for the nearby Carlini station (Curtosi et al., 2010, Vodopivez et al., 2015), which require extreme precautions in ASPA 132.

According to Morgan et al. (2007), ASPA 132 represents the Environmental Domain of the “Antarctic Peninsula offshore islands”. Also, according to Terauds et al. (2012), the area represents the “Northwest Antarctic Peninsula” region of the “Antarctic Conservation Biogeographic Regions”. According to “Important Bird Areas in Antarctica 2015” (Harris et al., 2015), Potter Peninsula is area 047.

For more detailed features, please refer to section 6.

2. Aims and Objectives

- Preserve the natural ecosystem and prevent unnecessary human disturbance.
- Conserve the flora of the area as reference organisms, free of human impact.
- Prevent or minimise the introduction into the Area of non-native plants, animals and microbes.
- Minimise the possibility of introduction of pathogens that can cause disease in wildlife populations within the area.
- Prevent the introduction, production or dissemination of chemical pollutants that may affect the area.
- Protect the biodiversity of the Area, avoiding major changes in the structure and composition of the fauna and flora communities.
- Allow the development of scientific research that cannot be carried out elsewhere, and the continuity of ongoing long-term biological studies in the area, as well as the development of any other scientific research, providing it does not compromise the values on account of which the Area is protected.
- Allow the development of studies and monitoring tasks to estimate the direct and indirect effects of the activity of nearby scientific bases.
- Allow visits for management purposes in support of the aims of this Management Plan.

3. Management Activities

- The personnel assigned to Carlini Base (formerly, Jubany Base, the Argentina base close to the ASPA) and in particular, the personnel authorised to enter the ASPA, will be specifically instructed on the terms and conditions of the Management Plan;
- Copies of this Management Plan must be available at the Carlini Base.
- Distances from fauna must be respected, except when the scientific projects require otherwise and providing the significant permits have been issued.
- Collection of samples will be limited to the minimum required for the development of approved scientific research plans.
- All signs and structures erected within the ASPA for scientific or management purposes should be securely attached and maintained in good condition.
- In accordance with the requirements of Annex III to the Environmental Protocol from the Antarctic Treaty, abandoned equipment or materials will be disposed of to the greatest extent possible, provided that this does not have adverse impact on the environment and the values of the Area.
- Given the presence of important colonies of seabirds adjacent to the areas travelled by scientists and support staff, trails leading to research sites may

be marked to limit circulation to such trails, preferably those previously travelled or marked.

- Movement will be restricted to sectors without vegetation, avoiding proximity to fauna except when the scientific projects so require and if the corresponding harmful interference permits have been obtained.
- The Management Plan will be reviewed at least once every five years and updated if necessary.
- All pilots operating in the region must be informed of the location, limits and restrictions applicable to entering and overflying the area.
- Preventive measures will be implemented to avoid the introduction of non-native species
- In accordance with Resolution 5 (2019), all researchers visiting the ASPA will be reminded of the prohibition on using personal care products that contain plastic microbeads.
- The necessary visits will be made (at least once every five years) to determine whether the Area continues to serve the purposes for which it was designated and to ensure that management and maintenance measures are adequate.
- National Antarctic programmes operating in the region must consult with each other to ensure the implementation of the above provisions.

4. Period of Designation

Appointed for an indefinite period.

5. Maps

Map 1, included at the end of this Management Plan, shows the location of ASPA 132 (in diagonal lines) in relation to Potter Peninsula, King George (25 de Mayo) Island.

6. Description of the Area

6(i) Geographical co-ordinates, boundaries and natural features

This area is located on the east coast of the National Guard Bay, southwest of King George (25 de Mayo) Island, between the southern end of Mirounga Point (Northwest of the Potter Peninsula) and the rock exposure known as “Rock 7”, on the north-east border of Stranger Point (Cabo Funes). The area extends along the coastal strip towards low tide water levels and to the edge of the cliff, which reaches heights of 15 to 50 metres. The front of the cliff edge is included within the ASPA.

This coastal strip has a variable width, extending up to 500 metres from the coast at low tide water levels. The area consists mainly of raised beaches, largely covered with medium-sized pebbles, basaltic structures, and lateral and terminal moraines.

The coast is very irregular and has a series of small bays formed between the rocky headlands.

This topography constitutes a natural border for the settlement of breeding colonies of marine mammals and penguins, which justify the extension of the ASPA.

6(ii) Natural features

The area encompasses important scientific values due to the presence of breeding colonies of elephant seals (Mirounga leonina), non-breeding groups of Antarctic fur seals (Arctocephalus gazella) and occasionally Weddell seals (Leptonychotes weddelli), crabeater seals (Lobodon carcinophagus) and sea leopards (Hydrurga leptonyx). During the breeding season, there are around 400 female southern elephant seals with their respective pups and approximately 60 adult males of that species (Carlini et al., 2006, Negrete, 2011), while during the moulting period, between 200 and up to 800 individuals of southern Elephant seal wash up on the shores of ASPA 132. Non-breeding groups of Antarctic fur seals usually number around 300 individuals, although this number can vary considerably from one year to the next, sometimes exceeding 1 000 individuals (Durante et al., 2017).

Important colonies of gentoo penguins (P. papua) and Adélie penguins (P.adeliae) are also present, with 3800 and 3000 pairs, respectively. The population of petrels (mostly Oceanites oceanicus and, to a much lesser extent, Fregetta tropica) reaches about 200 pairs. Also breeding in the area are kelp gulls (Larus dominicanus), American sheathbills (Chionis alba), Antarctic Terns (Sterna vittata), southern giant petrels (Macronectes giganteus) and skuas (Catharacta sp.). Given that some of the nesting sites around the Potter Peninsula change their position over time, population data are considered estimates.

Gentoo and Adélie penguins are distributed around Stranger Point (Cabo Funes), between the Elephant refuge and Rock 7. The concentrations of mammals are distributed along the coast, between Rock 1 and Rock 7, and giant petrel nests are usually distributed around Three Brothers Hill mainly (outside the ASPA) and between Rock 7 and Rock 4 (see Map 1). In the Area there is an abundant development of plant communities dominated by lichens and mosses, on the rocky slopes and on the flat surfaces of the paleobeaches, respectively.

- *Weather*

Due to its location in the South Shetland Islands, we can say that the area has the cold oceanic climate characteristic of maritime Antarctica, with frequent summer rains and a moderate thermal amplitude, and a cold and humid morphoclimatic system of a cryoval nature. These climate parameters facilitate the occurrence of periglacial processes and the presence of an active layer that is usually saturated in summer. It has the same type of climate as Antarctica in general, although a little less rigorous. During the summer the temperature is between -2°C and 3°C, and during the winter the average temperatures are around -10°C and -20°C. In 2007 -26°C were measured. The wind is mostly moderate from the NE with measurements of up to 125 km/h, which is why the thermal sensation can reach -50°C. The precipitations are in the form of snow, although during the summer season there is some drizzle.

Regarding the expected climate change for the area, although there are no specific data, according to Turner et al., (2009) since the 1950s, the air temperature over the Western Antarctic Peninsula has increased at a rate of 0.56°C per decade. Such increase in temperature have caused a rapid retreat of the glaciers and the consequent exposure of the soil. Surface temperature trends show significant warming in the Antarctic Peninsula and, to a lesser extent, in West Antarctica since the early 1950s, with little change in the rest of the continent. The greatest warming trends occur in the western and northern parts of the Antarctic Peninsula, an area that includes the Harmony Point area. Some data indicate a warming of +0.20°C per decade, and also indicate that the warming of the western peninsula has been greater during the winter, with winter temperatures that increased by +1.03°C per decade from 1950 to 2006.

- *Natural features Flora*

The spatial pattern of the vegetation is the combination of related variables: the type of substrate, the exposure, the stability of the slopes and the drainage (water availability). Potter Peninsula covers an area of several square kilometres, free of permanent snow and ice cover. A relatively stable substrate is found around Three Brothers Hill. Moraines close to the glacier are sparsely covered with plants, while plant cover and species richness increase with distance from the moraines. A plateau located to the south-west of Three Brothers Hill is covered by exceptionally rich vegetation. It consists of two layers of plants that can achieve 100% coverage. Several of the moss and lichen species found on the Potter Peninsula are confined to that area. There are the two species of native Antarctic vascular plants Colobanthus quitensis and Deschampsia antarctica (Dopchiz et al., 2017a, 2017b) near the coast or in places with high nutrient supply.

Pleurocarpic mosses dominate, such as Sanionia uncinata and Calliergon sarmentosum, while rocks are commonly covered by encrusting lichens Lecidea sciatrapha. Higher up the slope, where the soil is more drained and the time with snow cover is shorter, mat-forming mosses like Andreaea regularis and Andreaea gainii, often along with Himantormia lugubris. Associations of bryophilous lichens such as Psoroma hypnorum and also some acrocarpic mosses. When the snow cover exceeds 10 cm, which occurs rarely even in winter, a double-mantle foliage of lichens and moss is formed.

The upper mantle is discontinuous and consists of fruticose lichens such as Usnea aurantiaco-atra, U. antarctica and Pseudephebe pubescens. The lower mantle is made up of a set of various species of mosses and liverworts. Tapestry of U. aurantiaco-atra and Himantormia lugubris is often intertwined (Bubach et al., 2016, Rivera et al., 2018). In the openings there are dicranoid mosses such as Chorisodontium aciphyllum and fruticose lichens that form mattresses like Sphaerophorus globosus. The most abundant bryophilous lichen is the Ochrolechia frigida. (Wiencke et al., 1998).

- *Natural features Fauna*

One of the important aspects of this ASPA is the presence of different bird colonies. For this reason, the area is classified as an Important Bird Area (IBA047) based on the presence of the Antarctic skua colony (Catharacta maccormicki), although before the recent declines in local Adélie penguin numbers (Pygoscelis adeliae), it also qualified on the basis of the high concentration of seabirds present.

According to Harris et al. (2015) Potter Peninsula is home to a diverse range of avifauna, with 14 554 Adélie penguin breeding pairs recorded in 1988/89 (Aguirre 1995), the majority at Stranger Point (Cabo Funes) (ASPA 132). Aguirre (1995) also recorded two 325 gentoo penguin pairs (Pygoscelis papua) and 265 chinstrap penguin pairs (P. antarctica) breeding in the summer of 1988-89. The Management Plan for ASPA 132 (2013) reported only 3 000 Adélie penguin pairs, although an increase in gentoo penguins to ~3 800 pairs.

South polar skuas breed at the site, with 63 breeding pairs in 2002 (Ritz et al., 2006). In 1998, 46 pairs of southern giant petrels (Macronectes giganteus) were registered as breeding on Potter Peninsula (Hahn et al., 1998), while 87 pairs were registered in 2007. In addition, approximately 200 breeding pairs of storm petrels are estimated in the area (mainly Oceanites oceanicus) (ASPA Management Plan No. 132, 2013). Other confirmed breeders are Cape petrel (Daption capense), black-bellied storm petrel (Fregetta tropica), the blue-eyed cormorant (Phalacrocorax [atriceps] bransfieldensis), the American sheathbill (Chionis albus), the brown skua (Catharacta antarctica), the hybrid skua (Catharacta sp.), Kelp gull (Larus dominicanus) and Antarctic tern (sterna vittata) (Hahn et al., 1998).

In the case of the gentoo penguin (Pygoscelis papua) Juarez et al. (2019) mention that the total number of breeding pairs of gentoo penguins present at Stranger Point (Cabo Funes) increased by 74.6% between 2000/2001 (3083 pairs) and 2018/2019 (5383 pairs) at an annual rate of +3.1%. Overall, the breeding population increased by 40.2% (+4.2% per year) between 2000/2001 and 2008/2009, decreased by 26.1% in the 2009/2010 season and increased by 68.6% (+5.8% per year) between 2009/2009/2010 and 2018/2019. The number of breeding pairs counted in the 2000/2001 and 2009/2010 seasons represented the lowest values recorded (ie, 3083 and 3192 nests, respectively).

Regarding marine mammals, a large number of southern elephant seals (Mirounga leonina) come out annually to breed on Potter Peninsula. 272 female southern elephant seals were recorded in the 2006 season. Antarctic fur seals (Arctocephalus gazella) and occasionally Weddell seals (Leptonychotes weddellii), crabeater seals (Lobodon carcinophagus) and leopard seals (Hydrurga leptonyx) are also present on the beaches of this site.

An important fact is related to the population of Mirounga leonina within ASPA 132. It must be taken into account that, according to Negrete et al. (2022), most of the breeding colonies belonging to the South Georgia population are stable; however, the current population status of some other subpopulations of this stock is unknown or needs to be updated. This is the case of one of the southernmost subpopulations located in the Antarctic Specially Protected Area (ASPA) No. 132 “Potter Peninsula”, King George (25 de mayo) Island. The first estimate of the population trend for this colony was in the 1980s when it was observed that the intrinsic population growth rate was positive between 1980 and 1988 (Vergani 1985; Vergani et al., 1987; Vergani and Stanganelli 1990). Then, between 1989 and 1994, the maximum number of females on land varied slightly from 559 to 423 individuals (Vergani et al., 2004). From that date to the present, preliminary reports showed a decrease in the number of reproductive females in this colony between 1995 and 2011 (Mennucci et al., 2012).

The current data reported by Negrete et al. (2022) establish that the number of adult females that bred on Potter Peninsula between 1995 and 2018 ranged from 204 to 555 individuals. In the study period, the number of adult females decreased by 11.9% at an annual rate of -0.6%. Although this decline was not significant, a breaking point was observed in the 2008 season. From 1995 to the breaking point identified in the population trend (2008), a linear regression of the log-normal transformed number of females vs time showed a significant decline of 46.5% at an annual rate of -4.6% (ie, from 469 to 251 individuals).

In contrast, for the period after the breakpoint (2008-2018), the number of females increased by 64.5% at an annual rate of 5% (ie, from 251 to 413 individuals), although this increase was not statistically significant. Despite the general trend between 1995 and 2018, the number of breeding females fluctuated, showing decreases and increases between years. Then the population increase registered since 2008 is encouraging and significant for the conservation efforts and management strategies that are being carried out in ASPA 132; for this reason the importance of this protected area is highlighted.

6(iii) Access to the Area

Except for authorised exceptions, access to the area will be on foot, from the northern end, near the Carlini base helipad (62°14’17”S; 58º40’42”W), or from behind the northern slope of Three Brothers Hill (see Map 1). Access to the area by sea to the beaches should be avoided when there is fauna present, especially between October and December, since it is concomitant with the periods of greatest activity of egg laying in birds and with lactation in elephant seals.

Supplementary information is found in section 7(ii).

6(iv) Location of structures within and adjacent to the area

- *Structures within the area*

Shelters: The Argentine Elephant refuge is located about 150 m from the coast, 1000 metres north-east of Stranger Point (Cabo Funes). From March to October it is used by research groups that carry out activities in the ASPA. The shelter accommodates a maximum of 6 people (see section 7(ix) on Waste Disposal).

Signs: Warning signs about entering the protected area are located at: Mirounga Point (near the runway), at the northern base of Three Brothers Hill and in the beach area near Rock I. The signs show information about the existence of the ASPA and about the obligation to carry an access permit.

- *Structures adjacent to the area*

Carlini is a permanent Argentine station located at 62°14’ Lat. S and 58º39’W Longitude, in Potter Cove, Potter Peninsula, on the SW part of King George (25 de Mayo) Island. It has several facilities, such as the Argentine-German laboratory Dallmann which is a business initiative between the Alfred Wegener Institute (AWI) and the Argentine Antarctic Institute (IAA).

The Albatros is an Argentine shelter located at 62°15’09”S Lat. and 58°39’23”W Long. /-62.2525, -58.65639 at Potter Cove, Potter Peninsula.
Other nearby stations are Rey Sejong, belonging to South Korea (62º13’394”S/58°47’190”W) and Arctowsky belonging to Poland, (62°9’586”S/58º28’399”W)

6(v) Location of other Protected Areas within a very short distance

- ASPA 125, Fildes Peninsula, King George (25 de Mayo) Island, South Shetland Islands, approximately 20 km to the east.
- ASPA No. 128, west coast of Admiralty Bay, King George (25 de Mayo) Island, South Shetland Islands are located about 10 km to the north-east.
- ASPA 171 Narębski Point (southeast coast of Barton Peninsula, King George (25 de Mayo) Island)
- ASPA 133, Harmony Point Nelson Island, is located about 30 kilometres to the west-southwest.

6(vi) Special areas within the Area

No special areas have been designated within the Area.

7. Terms and Conditions for entry permits

7(i) General authorisation conditions

Entry to the Area is prohibited except under a Permit issued by the appropriate national authority.

Conditions for the issuance of an Access Permit to the Area:

- The activity serves a scientific, ASPA management or outreach purpose consistent with the objectives of the Management Plan, and that cannot be carried out elsewhere; or for any management activity (inspection, maintenance or review) in support of the objectives of this Management Plan.
- The permit is carried by the personnel authorised to enter the Area.
- The actions allowed do not harm the natural ecological system of the Area.
- A report subsequent to the visit is sent to the appropriate national authority mentioned in the permit, once the activity is finished, within the terms established by the granting national authorities.
- The appropriate authority should be notified of any activities/measures undertaken that were not included in the permit.

Tourism is not allowed, nor any other recreational activity.

7(ii) Access to and movement within the Area

Whenever possible, movements within the area will be on foot, along existing tracks known to personnel familiar with the area and regular visitors to the area. This is the beach area and the upper limit of the Area, to the north-east of Three Brothers Hill.

Vehicles of any kind are prohibited within the area, with the exception of those essential for the maintenance of the shelter, which will only be operated by logistics personnel and in accordance with an access permit. In this case, access to the ASPA will be through a slight slope next to the Albatros refuge and vehicles must be driven avoiding areas with vegetation, as well as concentrations of birds and mammals (see Map 1).

Aircraft operations over the Area will be performed, as a minimum standard, as established in 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 metres (2 000 feet). A horizontal separation of 460 m (1/4 nautical mile) from the coast should be maintained whenever possible. Aircraft landing operations in the area are prohibited, except in cases of emergency or air safety.

The use of RPAs will not be allowed within the limits of the ASPA, unless previously analysed case by case during the environmental impact assessment process. They may only be used when stated in the entry permit and under the conditions established therein. During the analysis and authorisation process, all Antarctic Treaty directives in force will be taken into account.

7(iii) Activities which may be conducted within the Area

- Scientific research activities that cannot be carried out in other places and that do not endanger the Area's ecosystem;
- Essential management activities, including visits to assess the effectiveness of the management plan and management activities;
- Activities with educational or dissemination purposes, which contribute to publicise scientific activities, under the National Antarctic Programmes.

- The maintenance of the Elephant refuge, except between October and December. During this period, shelter maintenance should be avoided or, where appropriate, reduced to the extent possible and tasks should always be performed in compliance with a Permit. This period is considered especially sensitive, since it is concomitant with the moments of greatest activity of egg laying and lactation of elephant seals.

7(iv) Installation, modification or removal of structures/equipment

No structure will be erected within the Area, nor will scientific equipment be installed, except for compelling scientific or management reasons and subject to the appropriate permit.

Any scientific equipment installed in the Area, as well as any research marking, must be approved by permit and clearly labelled, indicating the country, name of the principal investigator, and year of installation. All these materials must be of such a nature that they pose a minimum risk of contamination of the Area, risk of interference with the fauna or damage to vegetation.

Structures and facilities must be removed when they are no longer needed or on the expiry date of the permit, whichever occurs first. Research markings must not remain after the Permit has expired. If a specific project cannot be completed within the term specified in the Permit, this circumstance must be informed in the report after the visit and an extension of the validity of the Permit will be requested, authorising any material to remain in the Area. Tents for the sole purpose of storing scientific instruments or equipment or for use as an observation post will be permitted.

7(v) Location of field camps

To avoid significant disturbances to the fauna, and taking into account that there are alternative places to lodge, camping is not allowed in ASPA 132. Projects authorised to work in the ASPA may request accommodation at the Carlini Base, subject to availability. When necessary for scientific reasons, the Elephant refuge (located within the area) or the Albatros refuge (outside the area, although very close) can be used. The use of the Elephant refuge for scientific purposes, by personnel other than the personnel of the Argentine Antarctic Programme, will be agreed in advance with said Programme.

The location of camps in the vicinity of the ASPA is the responsibility of the corresponding National Antarctic Programme, but for security reasons, it is recommended to inform the head of the Carlini Base.

7(vi) Restrictions on materials and organisms that may be brought into the Area

- No live animal or plant material may be deliberately introduced into the ASPA. All reasonable precautions must be taken against the unintentional introduction of foreign species into the area. It should be noted that foreign species are most often and most effectively introduced by humans. Clothing (pockets, boots, Velcro fasteners on clothing) and personal equipment (bags, backpacks, camera bags, tripods), as well as scientific instruments and work tools can carry insect larvae, seeds, propagules, etc. For more information, see the Non-native Species Manual. Revision 2019-CPA2011.

- Raw poultry products shall not be introduced into the Area;
- Herbicides or pesticides shall not be introduced into the Area; any other chemical product which is to be introduced with the corresponding Permit, must be removed from the Area when the activity for which the Permit was granted is completed. The purpose and type of chemicals should be documented in as much detail as possible to obtain information from other scientists.
- Fuel, food or any other material must not be stored in the Area, unless it is necessary for essential purposes related to the activity for which the Permit has been issued, provided that they are stored inside the Elephant refuge or near it, for disposal at the end of the activity. Any fuel used in the Elephant refuge will be managed in accordance with the Contingency plan established by the Argentine Antarctic Programme for the Carlini Station.

7(vii) Collection of or harmful interference with native flora and fauna

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

Distances from fauna must be respected, except when the scientific projects require otherwise and providing the significant permits have been issued.

The recommended distance from penguins is 10 m during breeding and moulting periods and 5 m for young. It is recommended to maintain a distance of 100 m from the nests of southern giant petrels, while a minimum distance of 10 m should be maintained for Antarctic fur seals, Weddell seals, leopard seals and crabeater seals. It is important to take into account that the purpose of these distances is indicative and they may vary and be greater if the response to human proximity clearly stresses the animal.

Where an activity involves taking of or harmful interference, it should be carried out in accordance with the SCAR Code of Conduct for Use of Animals for Scientific Purposes in Antarctica, as a minimum standard, in its latest available version.

Information on the taking of and harmful interference with flora and fauna will be duly exchanged through the Antarctic Treaty Information Exchange System and its record must be incorporated, at least, in the Antarctic Master Directory (AMD) or, in Argentina, in the National Antarctic Data Centre.

Scientists taking samples of any type will mention them in the EIES (Electronic Information Exchange System) and/or contact the appropriate National Antarctic Programmes in order to minimise the risk of possible duplication.

7(viii) The collection or transfer of anything that has not been brought to the Area by the permit holder

Material may be collected or removed from the Area only pursuant to a Permit. The collection of dead specimens for scientific purposes will be analysed on a case-by-case basis in order not to exceed levels that may lead to the deterioration of the nutritional base of local scavengers. This will depend on the species to be collected and, if necessary, specialist advice should be required before the granting of the Permit.

Any material in the Area may be collected or removed only with an appropriate permit that allows doing so. In the conditions of the permit, the applicant must provide detailed information on the methodology and logistics to be used for the removal and the way it will be transported. In particular, they must ensure that no material remains loose on the ground and may be transported to other sites by the wind.

The collection of dead specimens for scientific purposes must not exceed a level such that it deteriorates the nutritional base of local scavenger species. The latter depends on the species to be collected and, if necessary, expert advice will be requested prior to granting of the permit.

7(ix) Waste disposal

All non-physiological waste will be removed from the Area. Waste water and liquid domestic waste may be discharged into the sea in accordance with the provisions of Article 5 of Annex III to the Madrid Protocol.

Waste from research activities carried out in the Area can be temporarily stored next to the Elephant refuge pending removal, under conditions that ensure that they do not disperse or be accessible to the fauna. This waste will be moved as frequently as possible to the Carlini Base or collected by the Antarctic Programme that generates it, to be disposed of in accordance with Annex III to the Madrid Protocol.

7(x) Measures that may be necessary to continue to meet the objectives of the Management Plan

Permits for access to the Area may be granted in order to carry out biological monitoring and inspection of the sites, including the collection of plant material and animal samples for scientific purposes, the building or maintenance of signs, and other management measures.

7(xi) Reporting requirements

The Parties granting entry permits to ASPA 132 must ensure that the principal holder of each permit issued submits a report describing the activities carried out to the relevant authority. These reports must be submitted as soon as possible, within the deadlines established by the corresponding competent authorities. The reports should include the information indicated in the Visit Report Form, as provided in the stipulations of Resolution 2 (2011).

The Parties granting entry permits to ASPA 132 must keep a record of said activities, and submit summary descriptions of the activities carried out by the persons under their jurisdiction in the annual exchange of information. Wherever possible, the local authority should also forward a copy of the visit report to the proponent Parties, to assist in the administration of the Area and the revision of the Management Plan.

The Parties shall, whenever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both for review of the Management Plan and in organising the scientific use of the Area.

The information from the reports will be used for the purposes of revisions to the Management Plan and in the organisation of the scientific use of the Area.

ASPA permit records and post-visit reports will be exchanged with the other Consultative Parties, under the Information Exchange System, as specified in Article 10.1 of Annex V.

These reports should be stored and made available for inspection by all interested Parties, SCAR, CCAMLR and COMNAP, as well as to provide information on human activities in the area necessary to ensure proper management.

8. Support documentation

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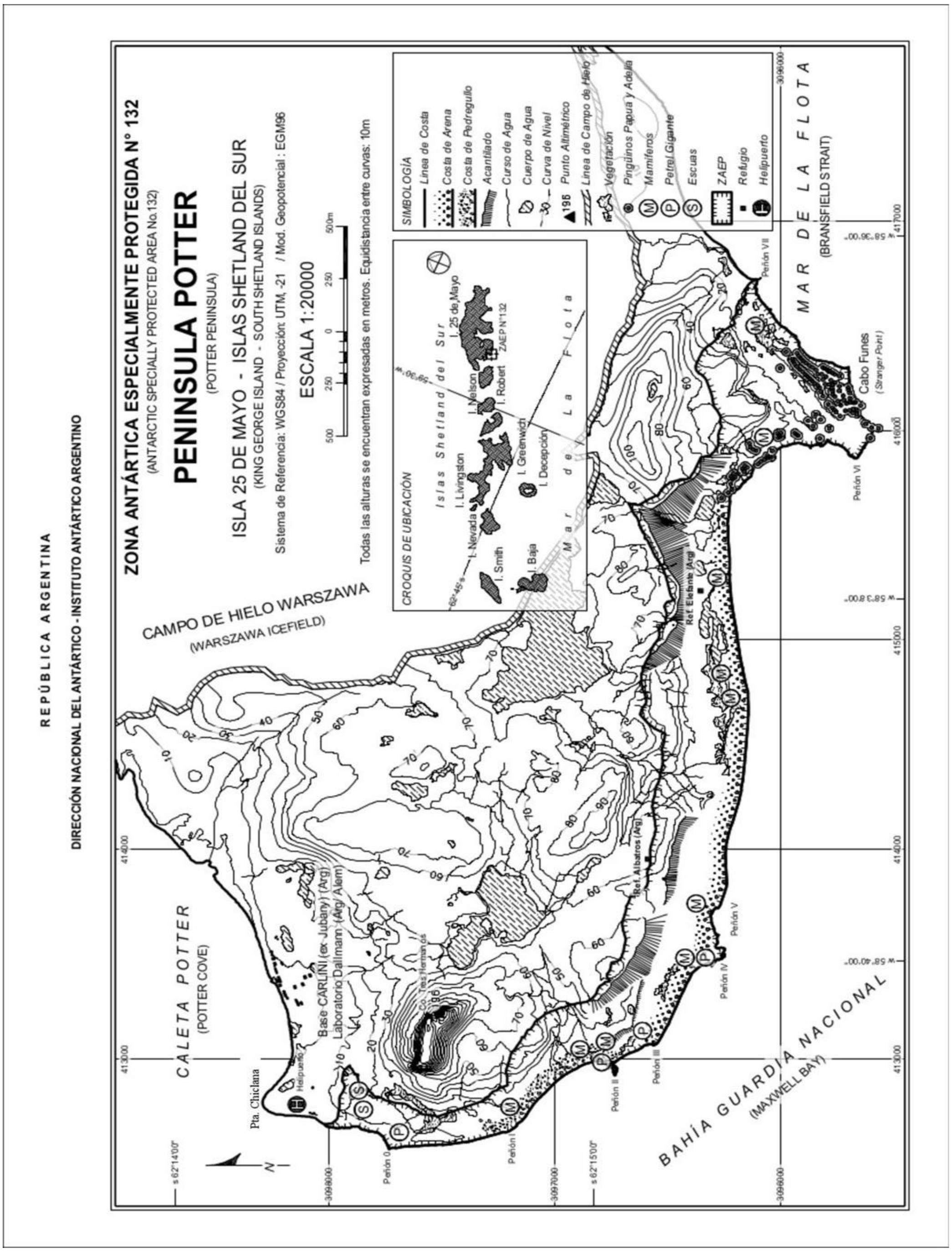
Map 1: Antarctic Specially Protected Area No. 132, Potter Peninsula.



Measure 7 (2023)

Antarctic Specially Protected Area No 137 (Northwest White Island, McMurdo Sound): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XIII-8 (1985), which designated Northwest White Island, McMurdo Sound as Site of Special Scientific Interest (“SSSI”) No 18 and annexed a Management Plan for the Site;
- Recommendation XVI-7 (1991) and Measure 3 (2001), which extended the expiry date of SSSI 18;
- Decision 1 (2002), which renamed and renumbered SSSI 18 as ASPA 137;
- Measures 1 (2002), 9 (2008) and 7 (2013), which adopted revised Management Plans for ASPA 137;

Recalling that Measure 3 (2001) did not become effective and was withdrawn by Measure 4 (2011);

Recalling that Recommendation XVI-7 (1991) did not become effective and was designated as no longer current by Decision 1 (2011);

Recalling that the Committee for Environmental Protection (“CEP”) XXI (2018) reviewed and continued without changes the Management Plan for ASPA 137, which is annexed to Measure 7 (2013);

Noting that the CEP has endorsed a revised Management Plan for ASPA 137;

Desiring to replace the existing Management Plan for ASPA 137 with the revised Management Plan;

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

1. the revised Management Plan for Antarctic Specially Protected Area No 137 (Northwest White Island, McMurdo Sound), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 137 annexed to Measure 7 (2013) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 137

NORTHWEST WHITE ISLAND, MCMURDO SOUND

Introduction

White Island is located approximately 25 km SE of McMurdo Station (United States) and Scott Base (New Zealand), Hut Point, Ross Island. The Area comprises a strip of five kilometers wide extending around the north-western and northern coastline of White Island, centered at 78° 02.5' S, 167° 18.3' E and is approximately 141.6 km² in area. The primary reason for designation of the Area is to protect the most southerly known pinniped population; a small, completely enclosed, naturally-occurring colony of Weddell seals (Leptonychotes weddellii) that is of high scientific importance. The seal colony was established around the mid-1940s to mid-1950s by a few individuals from Erebus Bay before an advancing McMurdo Ice Shelf cut off the newly-founded colony from access to open water in McMurdo Sound. Cracks exist in the ice shelf where it abuts the coastline of White Island, which allow the seals access to forage in the water underneath. The seal population has remained small, around 30 individuals. Seals at White Island are sensitive to disturbance arising from multiple visits over short time intervals. Scientific work is usually conducted during the breeding season. On-going research aims to understand the impact of isolation on the genetics of the White Island seal colony. The colony offers unique opportunities for scientific insights into the effects of in-breeding on small isolated populations, as well as valuable control information for larger scale studies of population dynamics and environmental variability of Weddell seals. It is essential that this natural ‘experiment’ is not disrupted, accidentally or intentionally, by human activities.

The Area was originally designated as Site of Special Scientific Interest (SSSI) No. 18, following a proposal by the United States of America, which was adopted through Recommendation XIII-8 (1985). Recommendation XVI-7 (1991) extended the expiry date of SSSI 18 until 31 December 2001. Measure 3 (2001) extended the expiry date further until 31 December 2005. Measure 1 (2002) revised the original boundaries of the ASPA based on new data on the spatial distribution of the seals on the ice shelves. Decision 1 (2002) renamed and renumbered SSSI 18 as Antarctic Specially Protected Area No. 137. Measure 9 (2008) updated the Management Plan to include recent census data on the seal colony, which led to a further revision of the boundary to include part of the Ross Ice Shelf in the north-east where seals were observed. Additional guidance on aircraft overflight and access was also included. Measure 7 (2013) updated the Management Plan with an improved map of White Island, and minor adjustments to provisions on aircraft access. The 2018 ATCM reaffirmed the Management Plan continued to remain in force.

The Area lies within Environment P – Ross and Ronne-Filchner ice shelves, based on the Environmental Domains Analysis for Antarctica and lies outside of the areas covered under the Antarctic Conservation Biogeographic Regions classification.

1. Description of values to be protected

An area of 150 km² of coastal shelf ice on the northwestern coast of White Island was originally designated following a proposal by the United States on the grounds that this locality contains an unusual breeding population of Weddell seals (Leptonychotes weddellii) which is the most southerly known, and which has been physically isolated from other populations by advance of the McMurdo Ice Shelf and Ross Ice Shelf (Map 1). The original boundaries were adjusted in 2002 (Measure 1) and again in 2008 (Measure 9) in light of new data recording the spatial distribution of the seals on the ice shelves. In the south, the boundary of the Area was shifted north and east to exclude the region north of White Strait where no observations of the seals have been recorded. In the north, the Area was extended to encompass an additional part of the Ross Ice Shelf in order to ensure inclusion of more of the region within which the seals may be found. The Area is now approximately 141.6 km².

The Weddell seal colony is small and appears to be quite isolated from other populations because of its distance from the open ocean of McMurdo Sound, and as such it is highly vulnerable to any human impacts that might occur in the vicinity. There is no evidence that the colony was present in the early 1900s, as there is no mention of seals by naturalists who visited White Island many times during Scott's 1902, 1903 and 1910 expeditions. An ice breakout occurred in the region between 1947 and 1956, and the first two seals were observed near the northeastern end of the island in 1958 (R. Garrott, pers. comm. 2007). Year-round studies have detected only limited evidence of immigration or emigration of seals from the population, which appears to have grown to around 25 to 30 animals from a population of around 11 in the 1960s. Although several seals have moved between White Island and the Erebus Bay population to the north, it appears that the very low rate of exchange is limited by the challenge of moving the 20 km distance either above or below the ice.

The seals gain access to the sea below the ice shelf through pressure cracks, which are formed by tidal motion and movement of the McMurdo and Ross ice shelves. The series of cracks and ridging area is convoluted and dynamic, and while most seals are found along the coastal tide crack, it is likely they utilize the ridge crack leads extending off the coast and may move through there throughout the year.

The Weddell seals at White Island are on average greater in size and weight than their McMurdo Sound counterparts and have been shown to make more shallow dives. NW White Island is one of very few sites where Weddell seals are known to feed under shelf ice. The population has exceptional scientific value because of its period of physical isolation from interaction with other seals, thought to be around 60-70 years, and investigations of the extent to which the group may be considered a genetically distinct population are currently underway. Genetic techniques have been used to construct a complete pedigree for the NW White Island population. The results of these studies support the conclusion that the year in which the colony was founded is likely to have been around 60 years ago, which agrees with historical sightings. The colony offers unique opportunities for scientific insights into the effects of in-breeding on small isolated populations, as well as valuable control information for larger scale studies of population dynamics and environmental variability of Weddell seals. It is essential that this natural ‘experiment’ is not disrupted, accidentally or intentionally, by human activities.

NW White Island is relatively accessible by shelf ice from the nearby United States and New Zealand research stations at Hut Point, Ross Island. In addition, a flagged access route between these stations and Black Island traverses within approximately 2 km of the Area (Map 1).

The Area requires long-term special protection because of the exceptional importance of the Weddell seal colony, outstanding scientific values and opportunities for research, and the potential vulnerability of the Area to disturbance from scientific and logistic activities in the region.

2. Aims and objectives

Management at NW White Island aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human presence, disturbance and sampling in the Area;
- allow scientific research on the ecosystem within the Area, in particular on the Weddell seals, while ensuring protection from excessive disturbance, oversampling or other possible scientific impacts;
- allow other scientific research provided it is for compelling reasons that cannot be served elsewhere and that will not jeopardize the natural ecological system within the Area;
- prevent or minimize the possibility of introduction of non-native species (e.g. alien plants, animals and microbes) to the Area;
- minimize the possibility of the introduction of pathogens that may cause disease in faunal populations within the Area; and
- 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:

- 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 appropriate places, in particular at McMurdo Station, Scott Base and at the Black Island facilities;
- All pilots operating in the region, all personnel travelling overland to Black Island on the marked route across McMurdo Ice Shelf, and any other personnel travelling overland within 2 km of the boundary of the Area, shall

be informed of the location, boundaries and restrictions applying to entry, overflight and landings within the Area;

- National programs shall ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and aeronautical charts;
- 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;
- Any abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area;
- The Area shall be visited as necessary (preferably no less than once every five years) to assess whether it 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 the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No.137 NW White Island topography.

Map specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 78° 00' S; 2nd 78° 12' S; Central Meridian: 167° 05' E; Latitude of Origin: 77° 30' S; Spheroid and datum: WGS84.

Inset 1: Ross Sea region.

Inset 2: Ross Island region, key features and nearby stations.

Map notes: Map 1 coastlines and ice shelf positions are derived from the Antarctic Digital Database (Version 5.0, SCAR, 2007). This framework is positionally inaccurate in the Ross Island / White Island region. Accurate ground control available for Hut Point Peninsula was used to adjust the geographical position of the framework by approximately +240 m (x direction) and +100 m (y direction). This shift improved the accuracy of Map 1, but the result is only an approximation. Topographic contours on White Island were derived by Environmental Research & Assessment (2013) from a 4 m LiDAR DEM (estimated accuracy of ~10 m horizontally and ~1 m vertically) produced by OSU/NASA/USGS (Schenk et al. 2004). Survey marker positions are from LINZ (2000) and Denys & Pearson (2000). Observations of seal positions provided by R. Garrott (pers. comm. 2008) were made using handheld GPS and are considered accurate to approximately 200 m of their true positions. Observations of seal positions provided by M. La Rue (pers. comm. 2012) are considered accurate to approximately 50 m of their true positions.

6. Description of the Area

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

- *General description*

White Island, part of the McMurdo volcanic complex, is situated approximately 20 km SE of the edge of the McMurdo Ice Shelf and 25 km SE of Hut Point, the location of McMurdo Station (United States) and Scott Base (New Zealand) on Ross Island (Inset 2, Map 1). The roughly triangular island is approximately 30 km long and 15 km wide at its maximum, and rises to a maximum elevation of 762 m in several locations (Map 1). The northern and western shores of White Island descend steeply, with water depths of 600 m occurring within 5 km of the island. The island is predominantly ice-covered with most of the rock outcrops being in the north. It is surrounded by the permanent shelf ice of the McMurdo Ice Shelf and Ross Ice Shelf, which is between 10 m and 100 m in thickness in this area. Black Island is situated 2.5 km west of White Island, separated by the shelf ice of White Strait. The GPS entry and exit points for the access route to Black Island from McMurdo through White Strait are 78° 12.0' S, 166° 50.0'E, and 78° 14.283' S, 166° 45.5' E respectively.

The westward movement of the McMurdo Ice Shelf is greatest at the northern end of White Island and movement of ice away from the NW coast ensures open water in cracks in the shelf at this locality is present year-round. The Weddell seal population uses the cracks for access to seawater and feeding grounds under the shelf ice, and inhabits and breeds in the region within approximately 5 km of their positions. The cracks occur parallel to and within a few hundred meters of the coast of White Island, and intermittently extend along the coast from the northern extremity of the island up to 15 km to the south.

- *Boundaries and coordinates*

The Area includes 141.6 km² of the shelf ice and open-water cracks of both the Ross Ice Shelf and McMurdo Ice Shelf up to 5 km offshore northeast, north and west from the White Island coast. The northeastern boundary extends from the northeastern coast of Cape Spencer-Smith (78° 0.717' S, 167° 32.7' E) 5 km due east to 78° 0.717' S, 167° 46.617' E. The boundary then extends northwest and follows a line parallel to and 5 km from the coast, around Cape Spencer Smith and then heading southwest to 78° 05.0' S, 167° 00' E. The boundary then extends due south for 7.8 km to 78° 09.2' S, 167° 0.0' E, and thence 1.5 km east to the southern-most significant outcrop of rock on the western coast of White Island (78° 09.2' S, 167° 05.0' E,).

The boundary then extends northwards, following the coastline around Cape Spencer Smith to the northeastern limit of the Area. The White Island coast is distinguished by a change in surface slope where the transition between the floating ice-shelf and land occurs: the transition is in some places gradual and indistinct, and the exact position of the coast is not precisely known. For this reason the coastal (generally east) boundary of the Area is considered to follow the line of the coast as evidenced by a surface elevation rise towards the land of two meters above the average elevation of the adjacent McMurdo Ice Shelf.

- *Weddell seal colony*

It was estimated there were 25-30 resident seals in 1981 (Castellini et al. 1984). A similar estimate of between 25 to 30 animals was made in 1991 (Gelatt et al. 2010). In 1991, an estimated 26 seals were greater than one year of age, 25 of which were of breeding age (>4) (Gelatt et al. 2010). Since 1991, 29 different females have produced 144 pups (1-13 pups per female; avg = 5) at White Island (J. Rotella pers. comm. 2023). In 2013 through 2022, 24 different females were sighted at White Island, and 11 of these individuals have produced pups (J. Rotella pers. comm. 2023). Between two and four live pups were recorded from 1963 to 1968 (Heine 1960; Caughley 1959), in 1981, and in 1991. Annual censuses since 1991 recorded between four and ten pups from 1991 to 2000, between one and five pups from 2001 to 2007, and between three and six pups from 2008 through 2022 (J. Rotella pers. comm. 2023). Pup mortality is high, possibly due to inbreeding, and pup production is low in comparison to the population in Erebus Bay (R.Garrott pers. comm 2008).

The seals are physically isolated by the barrier of the shelf ice, and it is difficult for seals to swim the 20 km distance under the ice to reach the seasonally open waters of McMurdo Sound: Weddell seals have been estimated to be capable of swimming a distance of around 4.6 km (2.5 nautical miles) on a single breath. The isolation of the colony is substantiated by tag observation data on Weddell seals in McMurdo Sound, where in more than 100,000 tag observations over a 20-year period no tagged seals from White Island have been observed in McMurdo Sound (Stirling 1967, 1971; Ward, Testa & Scotton 1999). These data suggest that the White Island seals do not generally traverse the 20 km distance to the open ocean over the surface of the shelf ice. However, there is at least one record of a yearling from the White Island colony found to have made the journey across to the Williams airfield close to McMurdo station (G. Kooyman pers. comm. 2007), and one female born in Erebus Bay near Turtle Rock was seen with a pup at White Island in 2022 (J. Rotella pers. comm. 2022). A recent genetic study found that seals at White Island showed consistent signs of reduced diversity compared to those in the Erebus Bay colonies (Miller et al. 2022).

Adult female seals begin to appear on the shelf ice in early November, one month later than other pupping areas in the southern Ross Sea. They pup at the NW extremity of the island during which time sub-adults and non-breeding adults can be found up to 15 km to the SW near open cracks on the west side of the island (Gelatt et al. 2010). Few adult male seals are observed on the sea-ice during this time (0 – 3 per year), as most remain in the water to establish and defend territories (J. Rotella pers. comm. 2023). The females remain on the ice until pups are weaned at about 6-8 weeks of age. After December, adults and sub-adults mix in the pupping area and along the cracks formed at the northwestern corner of the island.

The harsh surface conditions probably confine the seals to the water during the winter months. Winter surface temperatures reach as low as -60°C and it is thought that the seals expend considerable time maintaining open air holes in the cracks. This is considered to be a key factor limiting the population size (Yochem et al. 2009), with pups and sub-adults possibly excluded from use of the limited breathing holes by more dominant and aggressive adults. Some pups may be unable to maintain their own breathing holes and may become trapped on the ice surface if dominant seals do not allow them entry into the water (Castellini et al. 1992; Harcourt et al. 1998).

Studies have suggested that the Weddell seals at White Island have a diet similar to their counterparts at McMurdo Sound (Castellini et al. 1992). Studies of fish otoliths recovered from Weddell seal fecal samples have revealed a diet comprised primarily of the nototheniid fish Pleuragramma antarcticum, also with fish from the genus Trematomus (Burns et al. 1998). Invertebrates are thought to comprise the remainder of the diet, along with a cephalopod belonging to the family Mastogoteuthidae (Burns et al. 1998). Consumption of the latter was found to be considerably greater amongst White Island seals than those at McMurdo Sound (Castellini et al. 1992).

Other aspects of the physiology and behavior of seals at White Island appear to differ from nearby populations at McMurdo Sound and at Terra Nova Bay: the seals at White Island appear to be significantly fatter (Stirling 1972; Castellini et al. 1984), with recorded weights of up to 686 kg (1500 lb.) at White Island compared to no more than 500 kg at McMurdo Sound or Terra Nova Bay (Proffitt et al. 2008). On average adult female seals are considerably longer than those in McMurdo Sound, and young seals at White Island have been observed to exhibit faster growth rates than their McMurdo counterparts. Average diving depths at White Island are shallower than at McMurdo Sound (Castellini et al. 1992).

Observations of seal positions provided by M. La Rue (PGC, pers. comm. 2012) were made by visual inspection of six high resolution satellite images (Quickbird, WorldView 1 & 2, and GeoEye: imagery © 2010, 2011 Digital Globe) acquired in November of 2010 and 2011. Weddell seals tend to exhibit more stable haul-out behavior at this time of year. The satellite images were acquired between 0900-1100 hours local time, which corresponds with the period of lowest seal haul-out activity. Images were searched over a broad area extending up to approximately 10 km beyond the ASPA boundary. A combined total of nine seals were observed in three of the six images studied (Map 1).

No seals were observed outside of the ASPA boundaries. No seals were detected in imagery acquired in early November, with all detections made in mid- and late-November imagery. It was not possible to determine whether an individual was counted more than once, or to distinguish adults from pups, in the analysis. The observations confirm, however, the continued presence of the colony.

6(ii) Access to the area

Pedestrian and vehicular access to the Area is from the Hut Point – Black Island marked route that passes approximately two kilometers from the boundary at its nearest point. Access to the Area from the marked route is across the ice shelf. Aircraft access to the Area is prohibited unless in accordance with a permit, and all aircraft operating within or over the Area must follow the restrictions on overflight and landing set out in detail in Section 7(ii).

6(iii) Location of structures within and adjacent to the Area

There are no structures within the Area. Several small survey markers (LINZ 2000; Denys & Pearson 2000) are installed on White Island in close proximity to the Area (Map 1). Transantarctic Mountains Deformation Network (TAMDEF) WTE0 is installed at 78° 11.385' S, 167° 29.755' E at an elevation of 453.5 m. The marker comprises a threaded stainless steel rod embedded into a boulder and is identified by a yellow plastic disc. A Land Information New Zealand (LINZ) Antarctic Datum Unification Network Survey Mark named ‘HEIN’, comprising a brass pin grouted into rock, is located on Mount Heine at 78° 04.561' S, 167° 27.042' E at an elevation of 737.7 m.

6(iv) Location of other protected areas in the vicinity

The nearest protected areas to NW White Island are on Ross Island: Arrival Heights (ASPA No.122) adjacent to McMurdo Station and Discovery Hut (ASPA No.158) on the Hut Point Peninsula are the closest at 20 km to the northwest; Cape Evans (ASPA No.155) and Cape Royds (ASPA No.121) are 47 km and 55 km northwest respectively; and Tramway Ridge (ASPA No.130) near the summit of Mt. Erebus is 60 km to the north.

6(v) Special zones within the Area

None.

7. Terms and conditions for entry permits

7(i) General 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 study of the Weddell seal ecosystem, or for compelling scientific reasons which cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental, ecological and scientific values of the Area;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried when in the Area.

7(ii) Access to, and movement within, or over the Area

Access to and movement within the Area shall be on foot, by vehicle, or by aircraft.

- *Access on foot or by vehicle*

No special access routes are designated for access to the Area on foot or by vehicle over the shelf ice. Vehicles are permitted on the ice shelf but are strongly discouraged from approaching closer than 50 m from seals, and closer approaches should be on foot. Vehicle and pedestrian traffic should be kept to the minimum necessary consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize disturbance.

- *Aircraft access and overflight*

- Aircraft landings within the Area are prohibited unless authorized by permit for purposes allowed for by the Management Plan;
- Aircraft overflight below 2000 feet (~610 m) is prohibited, unless authorized by permit for purposes allowed for by the Management Plan;
- Aircraft approach and departure shall avoid overflight of the White Island coastline and tide-cracks within the Area, where the seals are most commonly found, unless authorized by permit for purposes allowed for by the Management Plan;
- Aircraft landings within ½ nautical mile (~930 m) of Weddell seals are prohibited. Pilots should make a reconnaissance of suitable landing sites from above 2000 feet (~610 m) before descending to land. When seals are not visible, aircraft landings shall be made at least ½ nautical mile (~930 m) from the coastline of White Island and the tide-crack;
- Overflight below 2000 ft (610 m) and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are prohibited except in accordance with a permit issued by an appropriate national authority. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

7(iii) Activities that may be conducted within the Area

- Scientific research that will not jeopardize the values of the Area;
- Essential management activities, including monitoring and inspection.

7(iv) Installation, modification or removal of structures / equipment

- Structures shall not be erected within the Area except as specified in a permit;
- Permanent structures or installations are prohibited, with the exception of permanent signs;
- All structures, scientific equipment or markers installed in the Area shall be authorized by permit and clearly identified by country, name of the principal investigator, year of installation and date of expected removal. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental

conditions and pose minimal risk of contamination of the Area;

- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to the values of the Area;
- Removal of specific structures / 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(v) Location of field camps

Permanent field camps are prohibited within the Area. Temporary camp sites are permitted within the Area. There are no specific restrictions to a precise locality for temporary camp sites within the Area, although sites selected shall be more than 200 m from the ice-shelf cracks inhabited by the seals, unless authorized by permit when deemed necessary to the accomplishment of specific research goals.

7(vi) Restrictions on materials and organisms that may be brought into the Area

In addition to the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, restrictions on materials and organisms which may be brought into the area are:

- Deliberate introduction of animals (including Weddell seals from outside of this colony), plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);
- Of particular concern are microbial and viral introductions from other seal populations. Visitors shall ensure that scientific and sampling equipment, measuring devices and 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, walking poles, tripods, and camping equipment) shall be thoroughly cleaned before entering the Area. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2019), and in the Environmental Code of Conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018));
- Herbicides or pesticides are prohibited from the Area;
- Use of explosives is prohibited within the Area;
- Fuel, food, chemicals, and other materials shall not be stored in the Area, unless specifically authorized by permit and shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment;
- All materials introduced shall be for a stated period only and shall be removed by the end of that stated period; and
- If a 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(vii) 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 issued under Article 3 of Annex II of the Protocol on Environmental Protection to the Antarctic Treaty.

Any proposed taking of, or harmful interference with, Weddell seals within the Area that are for purposes that could be achieved just as effectively on Weddell seals from populations outside of the Area should not be permitted.

Where animal taking or harmful interference is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica and, where applicable, follow stricter animal care or research standards or guidelines in accordance with national procedures.

7(viii) 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 soil, 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 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 and approval obtained.

7(ix) Disposal of waste

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

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

Permits may be granted to enter the Area to:

- carry out monitoring and Area inspection activities, which may involve the collection of a small number of samples or data for analysis or review;
- install or maintain signposts, markers, structures or scientific equipment;
- carry out protective measures.

7(xi) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority after the visit has been completed in accordance with national procedures and permit conditions;
- Such reports should include, as appropriate, the information identified in the visit report form contained in Appendix 2 of the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing 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, for the purpose of 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 that might have exceptionally been undertaken, or anything removed, or of anything released and not removed, that were not included in the authorized permit.

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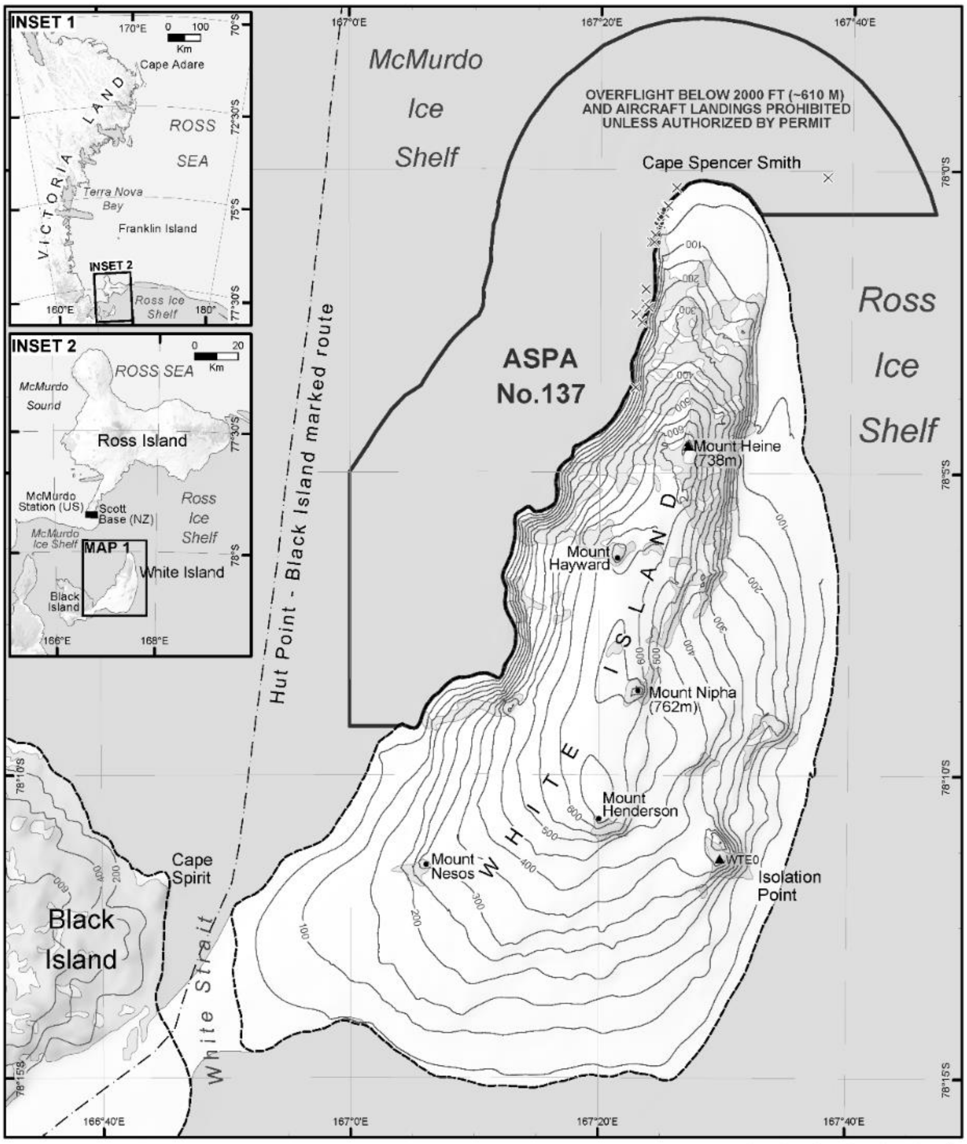

Map 1: ASPA No.137 NW White Island topography

16 Mar 2023 v1
United States Antarctic Program
Environmental Research & Assessment

- Peak
- Contour (50m)
- Ice free ground
- Permanent ice
- Ice shelf / Ice tongue
- Estimated coastline
- Antarctic Specially Protected Area (ASPA) boundary
- Survey mark (monumented)
- Weddell seal observations Nov & Dec 2010,Nov 2011 (LaRue)
- Weddell seal observations 1991 - 2007 (Garrott)
- Marked route

0 1 2 3 4 5
Kilometers

Projection: Lambert Conformal Conic
Spheroid and Datum: WGS84
Data sources: Topography - ADD v5.0 (horizontally adjusted (100m N and 240m E) using Hut Point GPS data), except White Island contours derived by ERA from 4m LiDAR DEM (OSU/NASA/USGS); Hut Point - Black Island route RPSC kinematic GPS (2008); Survey marks: LINZ (Dec 2000); Seal obs. pers comms - R Garrott, 2008; M LaRue, 2012.

Measure 8 (2023)

Antarctic Specially Protected Area No 138 (Linnaeus Terrace, Asgard Range, Victoria Land): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XIII-8 (1985), which designated Linnaeus Terrace, Asgard Range, Victoria Land as Site of Special Scientific Interest ("SSSI") No 19 and annexed a Management Plan for the Site;
- Resolution 7 (1995), which extended the expiry date of SSSI;
- Measure 1 (1996), which annexed a revised Management Plan for SSSI 19;
- Decision 1 (2002), which renamed and renumbered SSSI 19 as Antarctic Specially Protected Area No 138;
- Measures 10 (2008) and 8 (2013), which adopted revised Management Plans for ASPA 138;

Recalling that Resolution 7 (1995) was designated as no longer current by Decision 1 (2011);

Recalling that Measure 1 (1996) has not become effective and was withdrawn by Measure 10 (2008);

Recalling that the Committee for Environmental Protection ("CEP") XXI (2018) reviewed and continued without changes the Management Plan for ASPA 138, which is annexed to Measure 8 (2013);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 138;

Desiring to replace the existing Management Plan for ASPA 138 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 138 (Linnaeus Terrace, Asgard Range, Victoria Land), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 138 annexed to Measure 8 (2013) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No.138

LINNAEUS TERRACE, ASGARD RANGE, VICTORIA LAND

Introduction

Linnaeus Terrace is an elevated bench of weathered Beacon Sandstone located at the western end of the Asgard Range, 1.5km north of Oliver Peak, at 77° 35.8' S 161° 05.0' E. The terrace is ~ 1.5 km in length by ~1 km in width at an elevation of about 1600m. Linnaeus Terrace is one of the richest known localities for the cryptoendolithic communities that colonize the Beacon Sandstone. The sandstones also exhibit rare physical and biological weathering structures, as well as trace fossils. The excellent examples of cryptoendolithic communities are of outstanding scientific value, are the subject of some of the most detailed Antarctic cryptoendolithic descriptions, and Linnaeus Terrace is a type locality for several endemic algal and fungal species. The site is vulnerable to disturbance by trampling and sampling, and is sensitive to the importation of non-native plant, animal or microbial species and requires long-term special protection.

Linnaeus Terrace was originally designated as Site of Special Scientific Interest (SSSI) No. 19 through Recommendation XIII-8 (1985) after a proposal by the United States of America. The SSSI expiry date was extended by Resolution 7 (1995), and the Management Plan was adopted in Annex V format through Measure 1 (1996). The site was renamed and renumbered as ASPA No 138 by Decision 1 (2002). The Management Plan was updated through Measure 10 (2008) to include additional provisions to reduce the risk of non-native species introductions into the Area, and through Measure 8 (2013) which included revisions in compliance with Resolution 2 (2011). The ATCM reaffirmed the Management Plan continued to remain in force in 2018.

The Area is situated in Environment S – McMurdo – South Victoria Land Geologic based on the Environmental Domains Analysis for Antarctica and in Region 9 – South Victoria Land based on the Antarctic Conservation Biogeographic Regions. Linnaeus Terrace lies within Antarctic Specially Managed Area (ASMA) No.2, McMurdo Dry Valleys.

1. Description of values to be protected

Linnaeus Terrace was originally designated in Recommendation XIII-8 (1985, SSSI No. 19) after a proposal by the United States of America on the grounds that the Area is one of the richest known localities for the cryptoendolithic communities that colonize the Beacon Sandstone. Exposed surfaces of the Beacon Sandstone are the habitat of cryptoendolithic microorganisms, which may colonize a zone of up to 10 millimeters deep below the surface of the rocks. The sandstones exhibit a range of biological and physical weathering forms, as well as trace fossils, and many of the formations are fragile and vulnerable to disturbance and destruction by trampling and sampling.

Cryptoendolithic communities are known to develop over time periods in the order of tens of thousands of years, and damaged rock surfaces would be slow to recolonize. The excellent examples of these communities found at the site are the subject of the original detailed Antarctic cryptoendolithic descriptions. The first endolithic fungal endemic species Cryomyces antarcticus and Friedmanniomyces endolithicus were described at Linnaeus Terrace. As such, Linnaeus Terrace is considered a type locality with outstanding scientific values related to this ecosystem. These values, as well as the vulnerability of the site to disturbance and destruction, require that it receives long-term special protection.

The Management Plan was updated in 2013 to include new provisions agreed within the Guide to the Preparation of ASPA Management Plans (2011), revisions to Antarctic Specially Managed Area No. 2 McMurdo Dry Valleys, observations made during a field inspection of the Area made in January 2012, and the latest measures related to managing the risk of non-native species introductions agreed by the Antarctic Treaty Parties. Few visits have been made to the Area since those updates were made.

2. Aims and objectives

Management at Linnaeus Terrace aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human presence, disturbance and sampling in the Area;
- allow scientific research on the ecosystem, in particular on the cryptoendolithic communities, while ensuring protection from excessive disturbance, oversampling, damage to fragile rock formations, or other possible scientific impacts;
- allow other scientific research provided it is for compelling reasons that cannot be served elsewhere and that will not jeopardize the natural ecological system within the Area;
- prevent or minimize the possibility of introduction of non-native species (e.g. alien plants, animals and microbes) to the Area; and
- 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:

- 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, at permanent scientific stations located within 150 km of the Area;

- All pilots operating in the region shall be informed of the location, boundaries and restrictions applying to entry and landings within the Area;
- National programs shall ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- Durable wind direction indicators should be erected close to the designated helicopter landing site whenever it is anticipated there will be a number of landings at the Area in a given season. These should be replaced as needed and removed when no longer required;
- 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 designated helicopter landing site;
- 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;
- The Area shall be visited as necessary (preferably no less than once every five years) to assess whether it 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 to ensure the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No. 138 Linnaeus Terrace, Wright Valley – Regional overview.
Projection: Lambert conformal conic; Standard parallels: 1st 77° 30' S; 2nd 77° 40' S; Central Meridian: 161° 53' E; Latitude of Origin: 78° 00' S; Spheroid and datum: WGS84; Contour interval 250 m.
Data sources: USGS 1:50,000 Series (1970); ASMA No.2 McMurdo Dry Valleys management plan.

Map 2: ASPA No. 138 Linnaeus Terrace – topography and boundary.
Projection: Lambert conformal conic; Standard parallels: 1st 77° 35' S; 2nd 77° 36' S; Central Meridian: 161° 05' E; Latitude of Origin: 78° 00' S; Spheroid and datum: WGS84; Contour interval 5 m.
Data sources: Topography & boundary Gateway Antarctica, from an orthophotograph with an estimated positional accuracy of 0.5m, instruments, cairns, former facilities sites: ERA field survey (Jan 2012).

Figure 1: Photograph illustrating some of the fragile rock formations and trace fossils found on Linnaeus Terrace.

6. Description of the Area

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

Linnaeus Terrace (77° 35.8' S, 161° 05.0' E) is a bench of weathered Beacon Sandstone approximately 1.5 km in length and 1 km in width at an elevation of about 1600 m (Map 1). It is located at the western end of the Asgard Range, 1.5 km north of Oliver Peak (77° 36.7' S, 161° 02.5' E, 2410 m). The Area overlooks the South Fork of the Wright Valley, is approximately 4.5 km from Don Juan Pond and ~10 km from the terminus of the Wright Upper Glacier (Map 1).

The lower (northern) boundary of the Area is characterized by the presence of a predominantly sandstone outcrop of approximately 3 m in height which extends for much of the length of the terrace (Map 2). The lower boundary of the Area is defined as the upper edge of this outcrop, and as straight lines adjoining the visible edges where the outcrop is covered by surface talus. The upper (southwestern) boundary of the Area is characterized by a line of sandstone outcrop of about 2-5 m in height, occurring between the elevations of 1660 - 1700 m about 70 m above the general elevation of the terrace. The upper boundary of the Area is defined as the uppermost edge of this outcrop, and shall be considered a straight line between the visible edges where the outcrop is covered by surface talus. The western end of the Area is defined as where the terrace narrows and merges with a dolerite talus slope on the flank of the NW ridge of Oliver Peak. The boundary at the west dips steeply from where the upper outcrop disappears, following the border of the dolerite talus with the terrace sandstone down to the westernmost corner. The east boundary is defined as the 1615 m contour, which follows closely the edge of an outcrop which extends much of the width of the terrace (Map 2). At the southernmost corner of the Area the terrace merges with the slopes into the valley to the east: from this point the boundary extends upward to the 1700 m contour, from where it follows the line of outcrop defining the southwestern boundary.

Winter air temperature at Linnaeus Terrace ranges between -20°C and -45°C, while in January the daily mean is approximately -5°C (Friedmann et al. 1993). However, there is extreme daily variation in air temperature at the rock surface, due to alternating wind speeds and solar irradiation patterns. Therefore, cryptoendolithic microorganisms inhabit the more stable temperature zone which begins about 1-2 mm under the rock surface (McKay & Friedmann 1985). Cryptoendolithic microorganisms typically colonize porous Beacon sandstones with a 0.2 - 0.5 mm grain size, with an apparent preference for rocks stained tan or brown by Fe^{3+} - containing oxyhydroxides. A silicified crust of about 1 mm thickness on many of the rocks probably facilitates colonization by stabilizing the surface and reducing wind erosion (Campbell & Claridge 1987). Five cryptoendolithic microbial communities have been described by Friedmann et al. (1988), two of which can be found on Linnaeus Terrace: the Lichen Dominated and Red-Gloeocapsa Communities (Friedmann et al. 1988). Linnaeus Terrace is the type locality of the endemic green algal genus Hemichloris and of the endemic Xanthophycean algal species

Heterococcus endolithicus. The Area is unusual in that so many different living and fossil endolithic communities are present within a small area. The main physical and biological features of these communities and their habitat are described by Friedmann (1993) and Siebert et al. (1996). More recently, non-invasive techniques, such as in-situ micro-spectrometry, have been used to detect the organic chemical footprint of the microbial communities from scans of the rock surface (Hand et al. 2005).

Isolated and harsh environmental conditions in the McMurdo Dry Valleys have remained relatively stable over several million years, which has promoted a strong genetic divergence, leading to an ecosystem of distinct and unusual microbial diversity which still remains largely undescribed. The first endolithic fungal endemic species Cryomyces antarcticus and Friedmanniomyces endolithicus were described at Linnaeus Terrace (Selbmann et al. 2005).

Recent research using the shotgun metagenomic method on sandstone samples collected throughout Victoria Land, including Linnaeus Terrace, identified 269 new bacterial genomes, most of which could not be taxonomically classified, even at high taxonomic levels (Albanese et al. 2021). This research reinforces the importance of protecting the Area to preserve this unusual and rare biodiversity, and the need to avoid damage to the fragile habitats from being altered or even lost before more extensive discoveries are made.

Fragile weathered rock formations, such as trace fossils in eroded sandstone and brittle overhanging low rock ledges (ranging from approximately 10 cm up to 1 m in height), are present throughout the Area (Figure 1).

A small area (Map 2) has been contaminated by release of the 14C radioactive isotope. While the contamination poses no significant human or environmental threat, any samples gathered within this area are considered unsuitable for scientific work using 14C techniques.

6(ii) Access to the area

The Area may be accessed by helicopter or on foot. Access by air is usually from either the Wright or the Taylor valleys. Access over land is difficult but possible on foot from the South Fork of the Wright Valley, although is generally impractical from other directions. Particular access routes have not been designated for entering the Area, although elevated terrain south of the Area means that helicopter access will usually be made from the other directions, particularly from the north over the Wright Valley. Access restrictions apply within the Area, the specific conditions for which are set out in Section 7(ii) below.

6(iii) Location of structures within and adjacent to the Area

A joint US / NZ inspection visit made 17 January 2012 identified evidence of past activities within the Area (Harris 2013). At least four markers (wooden stakes) exist at former experimental sites within the Area (Map 2). These markers could be useful so future researchers can identify and revisit these sites. While weathered, these markers do not appear to represent a significant threat to the values of the Area, and should be left in situ and their continued presence kept under review.

A rock cairn has been constructed close to where several small instruments have been installed into rocks (Map 2). A large, torn and faded cloth is stored within the cairn, weighed down by rocks. Future researchers may find the cairn useful to relocate these experimental sites, and it should be left in situ. The cloth appears to serve no useful purpose, and should be removed on a future visit.

Three sites with several small instruments embedded into rocks were identified within the Area in January 2012 (Map 2). The instruments at Marker #2 consist of a line of 'screws' embedded in the rock. At the other sites, one rock contains three instruments of about 10 mm across, which are fully and securely embedded into drill holes in the rock. Another rock contains two similar instruments, one of which protrudes above the rock surface by about 10 mm. The instruments are assumed to be old temperature or moisture probes, or similar. The instruments do not represent a significant threat to the values of the Area, and should be left in situ and their continued presence kept under review.

Two former helicopter landing sites and campsites in the north-eastern and eastern part of the Area are evident by remnant stone circles (Map 2). These stone circles should be left in situ in order to identify sites within the Area that have previously been disturbed.

6(iv) Location of other protected areas in the vicinity

Linnaeus Terrace lies within Antarctic Specially Managed Area (ASMA) No.2, McMurdo Dry Valleys. The nearest protected areas to Linnaeus Terrace are Barwick and Balham Valleys (ASPA No.123), ~20 km to the north, Lower Taylor Valley and Blood Falls (ASPA No.172), ~9 km to the south, and Canada Glacier (ASPA No.131), ~47 km to the southeast (Map 1). The nearest Restricted Zone designated under ASMA No.2 is Don Juan Pond, ~4.5 km northeast in the South Fork of the Wright Valley.

6(v) Special zones within the Area

None.

7. Terms and conditions for entry permits

7(i) General 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 study of the cryptoendolithic ecosystem, or for compelling scientific reasons that cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental, ecological, and scientific values of the Area;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried when in the Area.

7(ii) Access to, and movement within or over, the Area

Access to and movement within the Area shall be on foot or by aircraft. Vehicles are prohibited within the Area. No special restrictions apply to the routes used to move to and from the Area.

- *Access on foot*

- Movement within the Area should generally be on foot;
- Pedestrians should avoid damage to fragile rock formations: care should be exercised to avoid walking on trace fossils (Figure 1) and brittle overhanging low rock ledges which are easily broken;
- Pedestrian traffic should be kept to the minimum necessary consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

- *Access by aircraft*

- Aircraft landings within the Area are prohibited unless authorized by permit for purposes allowed for by the Management Plan;
- Helicopters shall land only at the designated site at the west end of the terrace (77° 35.833' S, 161° 04.483' E, elevation 1610 m: Map 2), except when specifically authorized by Permit otherwise for a compelling scientific or management purpose.
- When transporting permitted visitors, pilots, air crew, or passengers en route elsewhere on helicopters are prohibited from moving on foot beyond the immediate vicinity of the designated landing and camping sites unless specifically authorized by a Permit.
- Overflight below 2000 ft (610 m) and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are prohibited except in accordance with a permit issued by an appropriate national authority. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

7(iii) Activities that may be conducted in the Area

- Scientific research that will not jeopardize the values of the Area;

- Essential management activities, including monitoring and inspection.

7(iv) Installation, modification or removal of structures / equipment

- Structures shall not be erected within the Area except as specified in a permit;
- Permanent structures are prohibited;
- All structures, scientific equipment or markers installed in the Area shall be authorized by permit and clearly identified by country, name of the principal investigator, year of installation and date of expected removal. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area;
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to the values of the Area;
- Existing scientific equipment or markers shall not be removed except in accordance with a permit;
- The small instruments observed within the Area (Map 2) in January 2012 are assumed to be no longer in use, although they do not appear to pose any significant threat to the values of the Area. They could be useful to future researchers as markers of former experimental sites. As such, these instruments should be left in situ until the next management plan review, at which time further consideration should be given to whether or not they should be removed;
- Removal of specific structures / 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(v) Location of field camps

Permanent field camps are prohibited within the Area. Temporary field camps are permitted within the Area only at the designated site in the immediate vicinity of the helicopter landing site (77° 35.833' S, 161° 04.483' E, elevation 1610 m, Map 2).

7(vi) Restrictions on materials and organisms that may be brought into the Area

In addition to the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, restrictions on materials and organisms which may be brought into the area are:

- deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);
- Visitors shall ensure that scientific equipment, particularly for sampling, and 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, walking poles, tripods and camping equipment) shall be thoroughly cleaned before entering the Area. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2019), and in the Environmental Code of Conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018));

- Herbicides and pesticides are prohibited from the Area;
- Use of explosives is prohibited within the Area;
- Fuel, food, chemicals, and other materials shall not be stored in the Area, unless specifically authorized by permit and shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment;
- All materials introduced shall be for a stated period only and shall be removed by the end; and
- 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(vii) Taking of, or harmful interference with, native flora and fauna

Taking or harmful interference with native flora or fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where animal taking or harmful interference is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

7(viii) 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 soil, 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 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 and approval obtained. At least four markers (wooden stakes) exist at former experimental sites within the Area (Map 2). These markers do not appear to represent a significant threat to the values of the Area and could be useful for future research projects. Therefore, they should be left in situ and their continued presence kept under review

7(ix) Disposal of waste

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

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

Permits may be granted to enter the Area to:

- carry out monitoring and Area inspection activities, which may involve the collection of a small number of samples or data for analysis or review;
- install or maintain signposts, markers, structures or scientific equipment;
- carry out protective measures.

7(x) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority after the visit has been completed in accordance with national procedures and permit conditions;
- Such reports should include, as appropriate, the information identified in the visit report form contained in Appendix 2 of the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing 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, for the purpose of 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 that might have exceptionally been undertaken, or anything removed, or anything released and not removed, that were not included in the authorized permit.

8. Supporting documentation

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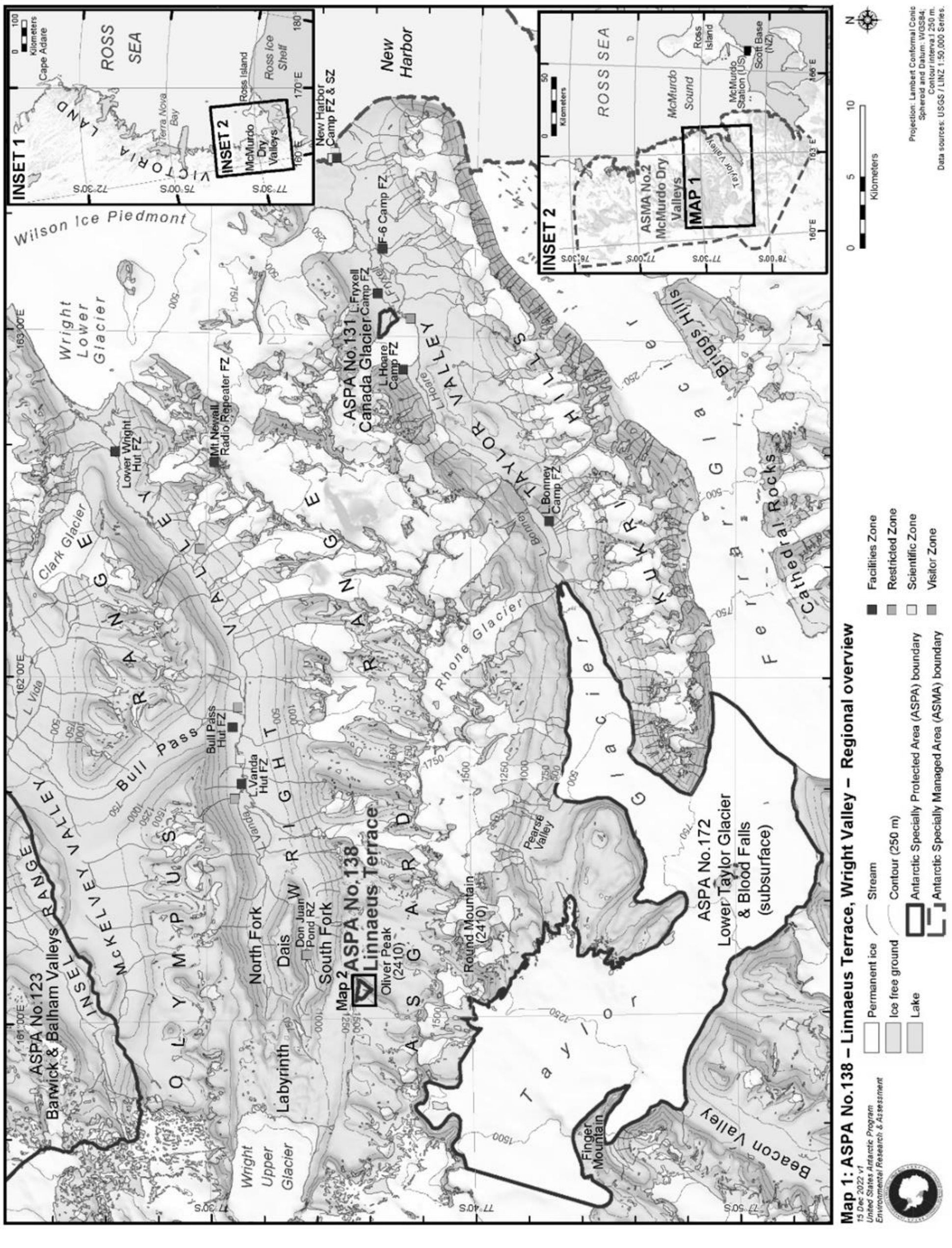
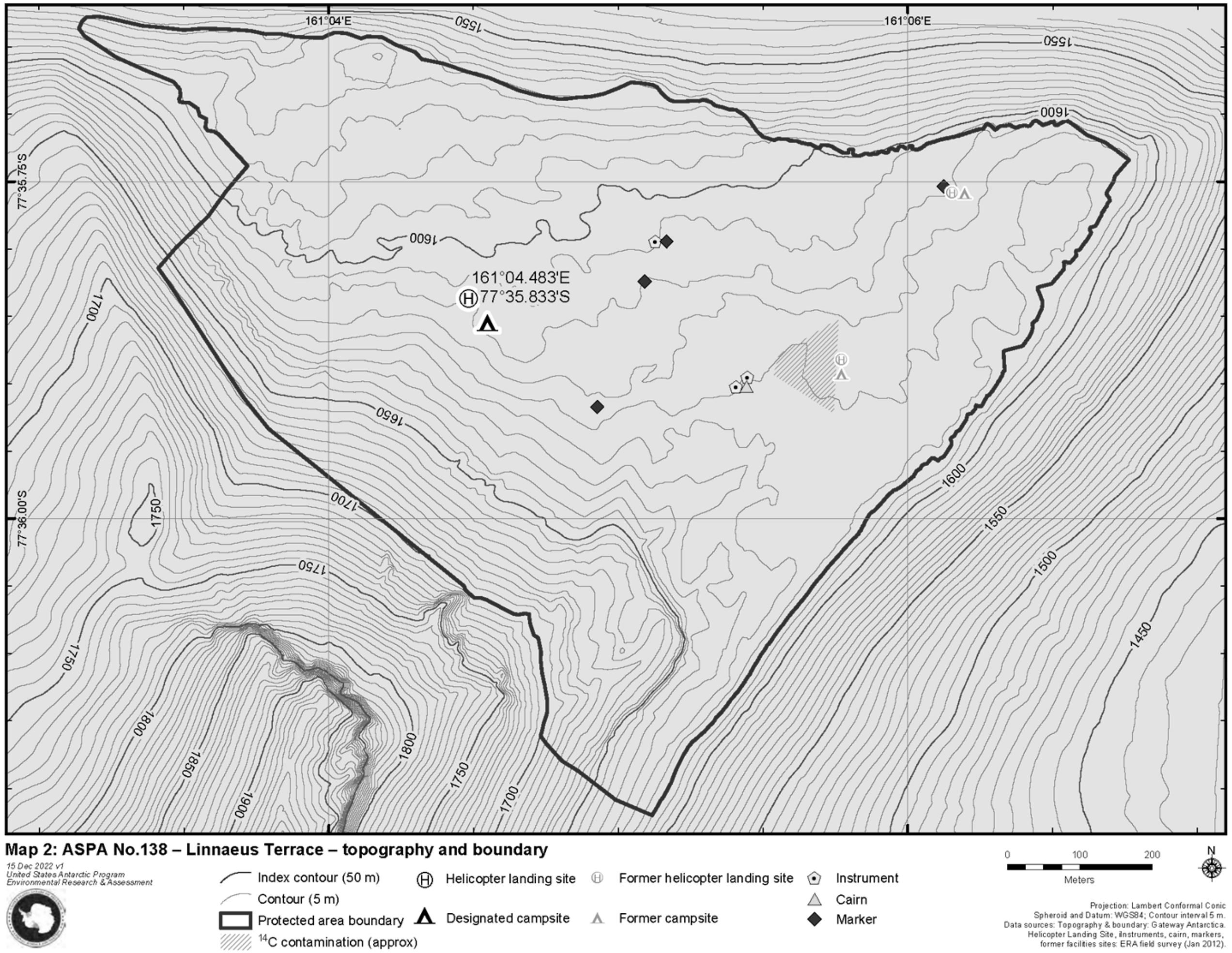
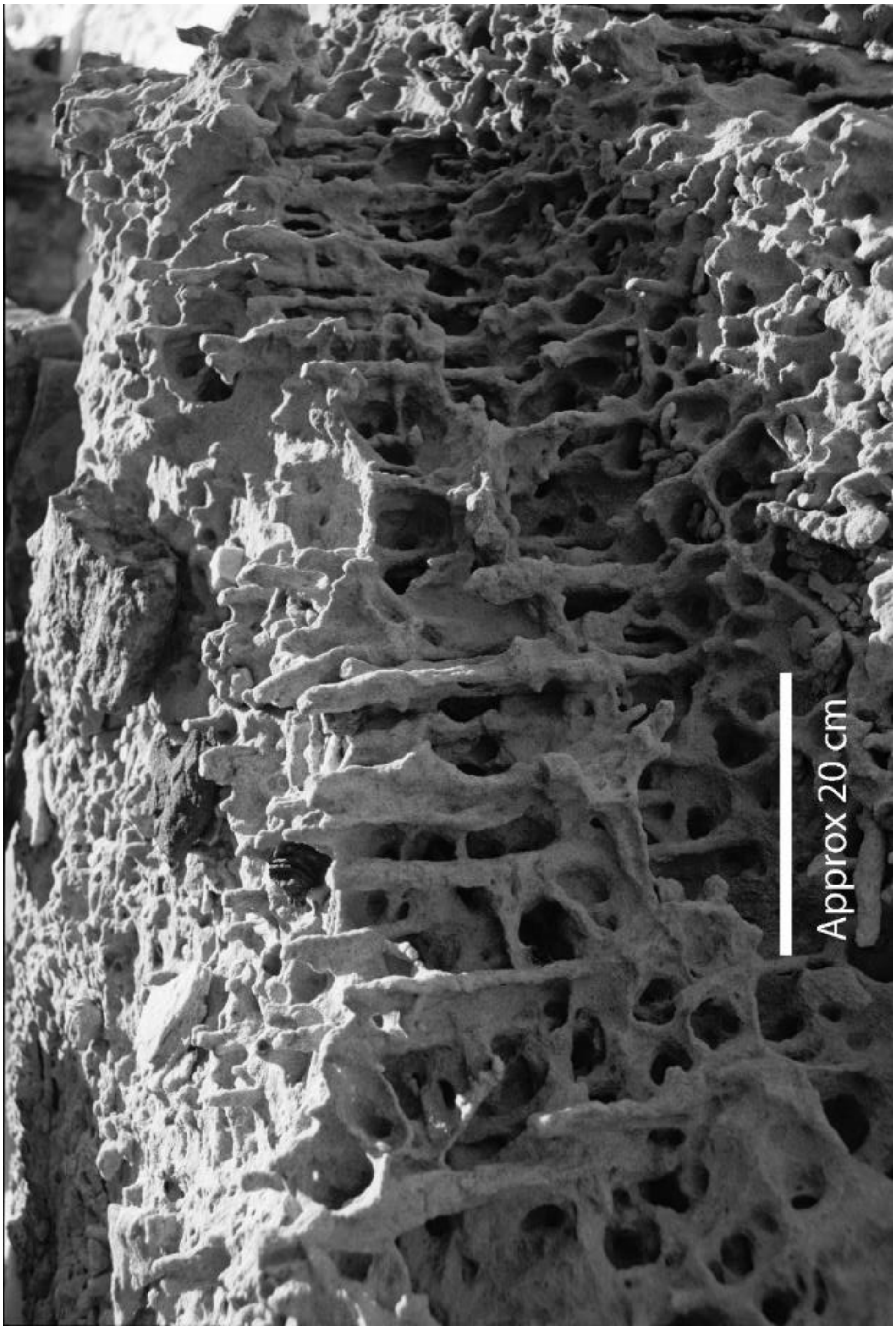

Map 1: ASPA No.138 – Linnaeus Terrace, Wright Valley – Regional overview
15 Dec 2022 v1
United States Antarctic Program
Environmental Research & Assessment
ASPA No.138
Linnaeus Terrace
ASPA No.123
Barwick & Balham Valleys
ASPA No.131
Canada Glacier
ASPA No.172
Lower Taylor Glacier
& Blood Falls
(subsurface)
OLYMPUS RANGE
ASGARD RANGE
WRIGHT VALLEY
TAYLOR VALLEY
McKELVEY VALLEY
INSEL RANGE
KUKRI HILLS
Ferrar Glacier
Taylor Glacier
Rhone Glacier
Wright Upper Glacier
Wright Lower Glacier
Wilson Ice Piedmont
Clark Glacier
Bull Pass
North Fork
South Fork
Dais
Labyrinth
Don Juan Pond RZ
Oliver Peak (2410)
Round Mountain (2410)
Pearse Valley
Finger Mountain
Beacon Valley
Cathedral Rocks
Briggs Hills
New Harbor
New Harbor Camp FZ & SZ
L.Vanda Hut FZ
Bull Pass Hut FZ
Lower Wright Hut FZ
Mt.Newall Radio Repeater FZ
L.Fryxell Camp FZ
F-6 Camp FZ
L.Hoare Camp FZ
L.Bonney Camp FZ
Map 2
INSET 1
VICTORIA LAND
ROSS SEA
Cape Adare
Terra Nova Bay
Ross Island
Ross Ice Shelf
INSET 2
McMurdo Dry Valleys
ASMA No.2 McMurdo Dry Valleys
MAP 1
McMurdo Sound
McMurdo Station (US)
Scott Base (NZ)
Permanent ice
Ice free ground
Lake
Stream
Contour (250 m)
Antarctic Specially Protected Area (ASPA) boundary
Antarctic Specially Managed Area (ASMA) boundary
Facilities Zone
Restricted Zone
Scientific Zone
Visitor Zone
Kilometers
Projection: Lambert Conformal Conic
Spheroid and Datum: WGS84;
Contour interval: 250 m.
Data sources: USGS / LINZ 1:50,000 Series.



Map 2: ASPA No.138 – Linnaeus Terrace – topography and boundary

Figure 1: Photograph of the fragile rocks that are common throughout the Area (photo Colin Harris, ERA).



Measure 9 (2023)

Antarctic Specially Protected Area No 144 (Chile Bay (Discovery Bay), Greenwich Islands, South Shetland Islands): Revoked Management Plan

The Representatives,

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

Recalling

- Recommendation XIV-5 (1987), which designated Chile Bay (Discovery Bay), Greenwich Islands, South Shetland Islands as Site of Special Scientific Interest ("SSSI") No 26, and annexed a Management Plan for the Site;
- Resolution 3 (1996) and Measure 2 (2000), which extended the date of expiry of SSSI 26;
- Decision 4 (1998), which listed SSSI 26 as a SSSI with marine areas of interest to the Commission for the Conservation of Antarctic Marine Living Resources;
- Decision 1 (2002), which renamed and renumbered SSSI 26 as ASPA 144;
- Measure 4 (2005), which extended the date of expiry of the Management Plan for ASPA 144;

Recalling that Recommendation XIV-5 (1987) was designated as no longer current by Measure 13 (2014);

Recalling that Resolution 3 (1996) was designated as no longer current by Decision 1 (2011) and that Measure 2 (2000) did not become effective and was withdrawn by Measure 5 (2009);

Recalling that Decision 4 (1998) was designated as no longer current by Decision 9 (2005);

Noting that the Committee for Environmental Protection has reviewed the appropriateness of additional protection afforded by ASPA status for Chile Bay (Discovery Bay);

Desiring to update the status of ASPA 144;

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

1. the Management Plan for Antarctic Specially Protected Area No 144 annexed to Recommendation XIV-5 (1987) be revoked; and
2. Antarctic Specially Protected Area No 144 shall not be used as a future designation.

Measure 10 (2023)

Antarctic Specially Protected Area No 145 (Port Foster, Deception Island, South Shetland Islands): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XIV-5 (1987) which designated Port Foster, Deception Island as Site of Special Scientific Interest ("SSSI") No 27 and annexed a Management Plan for the Site;
- Resolution 3 (1996) and Measure 2 (2000), which extended the date of expiry of the Management Plan for SSSI 27;
- Decision 1 (2002) which renamed and renumbered SSSI 27 as ASPA 145;
- Measure 3 (2005), which incorporated ASPA 145 into Antarctic Specially Managed Area No 4 (Deception Island) and adopted a revised Management Plan for ASPA 145;

Recalling that Recommendation XIV-5 (1987) was designated as no longer current by Measure 13 (2014);

Recalling that Resolution 3 (1996) was designated as no longer current by Decision 1 (2011);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 145;

Desiring to replace the existing Management Plan for ASPA 145 with the revised Management Plan;

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

1. the revised Management Plan for Antarctic Specially Protected Area No 145 (Port Foster, Deception Island, South Shetland Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 145 annexed to Measure 3 (2005) be revoked.

Management Plan for Antarctic Specially Protected Area No. 145

PORT FOSTER, DECEPTION ISLAND, SOUTH SHETLAND ISLANDS

Introduction

Following the submission of a proposal by Chile in 1987, two Port Foster sites were originally designated as SSSI No. 27 under Recommendation XIV-5. These were intended to protect the benthic values associated with two types of seabed, at depths of between 50 and 150 m (sub-site A), and between 100 and 150 m (sub-site B). The site was re-designated as ASPA No. 145 in Decision 1 (2002). Following two extensions of the original Management Plan, a revised Management Plan was adopted and the Area was incorporated into ASMA No. 4 (Deception Island) in Measure 3 (2005).

The Area was designated in order to protect the exceptional ecological interest of the area, mainly its benthic ecosystem, in order to reduce as much as possible, the risk of any accidental interference that could endanger scientific research and the species present. The designation of the Area aimed at protecting the existing marine biological values, mainly for the development of scientific activities, and preventing unnecessary human disturbance, from shipping activities or introduction of non-native species via scientific stations, tourism or scientific ships.

The Area is of exceptional ecological interest because of its actively volcanic character. However, no geothermal activity has been recorded within the Area.

Furthermore, scientific data obtained by researchers from the Spanish Antarctic Program between 2008 and 2017 indicate that the southern part of Port Foster (Fildes Point, in the Whalers Bay sector) contains the areas with the greatest number of benthic species of the island, and is considered a biodiversity hotspot with unique characteristics, corresponding to the new sub-site C of the Area, which considers the seabed between 0 and 50 m deep, as the only known hard substrate in Port Foster.

Scientific research programs are carried out at the three sub-sites of Port Foster, in general, but these are also areas adjacent to sites that receive visits or the influence of ships that enter or leave Deception Island. At present, no monitoring activity in the sub-sites is conducted, but regular ecological research is in place. There is the need to increase the knowledge on the recolonization by in- and epi-faunal organisms in bottoms affected by natural impacts (as volcanic activity or ice scouring), mainly in the present scenario of climate change on the Antarctic Peninsula region, but also is needed to improve the knowledge of the biodiversity inventory in the region.

Tourism is also an established activity near the area and is a potential threat to the values under protection.

Port Foster is a natural laboratory that makes it possible to compare the re-establishment of benthic communities in a deep and shallow marine environment, influenced by its unique volcanic activity in the South Shetland Islands region and in the Southern Ocean; therefore, this ASPA gives an opportunity to continue studies in a unique environment, influenced by volcanic and seismic activity and ensures that current and further research programmes will not be adversely affected by accidental human interference.

Resolution 3 (2008) recommended that the Environmental Domains Analysis for the Antarctic Continent, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol. Using this model, although the ASPA No.145 considers a marine area for protection, Deception Island is contained within Environment Domain G, Antarctic Peninsula offshore islands. According to Resolution 6 (2012), Antarctic Conservation Biogeographic Regions, Port Foster is also contained as part of ACBR 3, North-west Antarctic Peninsula.

1. Description of Values to be Protected

Deception Island is an active composite volcano with a basal diameter of 30 km and rising 1,400 m from the seafloor to a maximum height of 540 m above sea level, located in the south western sector of the South Shetland Islands. Its central part is occupied by a sea-flooded volcanic collapse caldera, called Port Foster, which have dimensions of about 6×10km, and a maximum water depth of 190 m and is connected to Bransfield Strait by a collapsed wall in the southeast sector of the volcanic cone. In several localities, this flooded caldera has geothermal activity, but not in the protected Area.

The 1967 volcanic eruption affected the benthic fauna due to the volcanic ash it produced and the high concentration of toxic compounds that were dissolved in the marine environment. The re-colonization of the oceanic bottom in Port Foster was also affected by new eruptions. After them, Echinodermata, Polychaeta, Crustacea, and Mollusca are the more representative groups in the benthic communities of the bay.

The protected values, within the framework of the original designation, correspond to the diversity of benthic fauna in the soft seabed substrates, located at depths of around 50 up to 150 m, in the caldera zone, and the benthic fauna located in hard bottoms from 0 to 50 m depth at the entrance of the bay.

The A and B sub-sites where proposed as representative zones in the caldera area to study the mechanism and lines of re-colonization of the benthic communities more affected by the volcanic eruption, after community studies where carried out to observe changes in the biota for a period of ten years in a Chilean biological monitoring program, assessing the recovery of mobile infaunal and epifaunal organisms in the more naturally impacted zone, to compare its structure with those in other soft bottom sites in Port Foster, mainly those more visited as Fumarole Bay and Whalers Bay, and with other Antarctic sites also affected by natural processes causing rapid, large scale changes to the environment.

By the other hand, sub-site C is a representative zone of hard bottoms with some influence from Bransfield Strait waters. These hard-bottoms are populated by macroalgae and sessile Suspension Feeder Communities (SFC), forming an extremely rich benthic community. These communities are composed by large sponges, ascidians, bryozoans, and macroalgae, which provide three-dimensionality to the ecosystem, and shelter to a myriad of small invertebrates such as amphipods, isopods, polychaetes, mollusks, echinoderms, etc. The species inhabiting the sub-site C are potentially vulnerable to the resuspension of sediments caused by nearby vessel operation.

Scientific studies have been carried out in the area in order to determine the composition of the benthic communities of the place. After the eruptions that occurred in 1967, 1969 and 1970 this included in situ monitoring of the different repopulation stages of the soft sub-coastal sea beds until mid 80's. In the 90's, several scientific programmes? developed marine research in the Area, improving the knowledge of Port Foster and Deception Island about the abundance, vertical migration, biomass and structure of the macrozooplankton and the micronekton. In 2000 monitoring activities were developed by the US Antarctic Program to study the oceanographic conditions influencing the marine life in Port Foster. Today several marine biology studies are conducted, mainly related with distribution, biodiversity, ecology and evolution of the Port Foster species. According to current records, the Area does not correspond to a type locality or only known habitat of any species. However, despite Deception Island being an intensively sampled area in the Southern Ocean, new species are still being recorded, emphasizing the currently incomplete characterization of the biodiversity inventory in the island.

2. Aims and Objectives

The management of Port Foster aims to:

- Avoid degradation or substantial risk to the values of the area by preventing unnecessary human disturbances;
- allow scientific research on the marine environment while ensuring protection from over-sampling;
- prevent or minimise the introduction to the Area of non-native species, and pathogens which may affect native populations within the Area;
- and to allow visits from the National Antarctic Programs for management purposes in support of the aims of this management plan.

3. Management Activities

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

- A map showing the three sub-sites in the Area will be located in highly visible places at Decepción (Argentina) and Gabriel de Castilla (Spain) stations, and copies of this management plan will also be made available.
- Copies of this management plan will be provided by National Antarctic Programs, and in Ushuaia, Punta Arenas and Puerto Williams ports to vessels planning to visit the Area or sailing in the vicinity of it, and they must carry it on board.
- Any signs or structures that must be installed in the Area for scientific or management purposes, as floaters, lines, or buoys, must be kept in good condition, well secured and conspicuously identified.
- Any equipment and materials installed in the Area must be removed as soon as their use is no longer required.
- 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 the management measures are adequate.

4. Period of Designation

Designation is for an indefinite period.

5. Maps and Figures

Map 1: Location of Deception Island in relation to the Antarctic Peninsula and the South Shetland Islands (Extracted from Deception Island Antarctic Specially Managed Area No. 4 Management Plan).

Map 2: Map of Deception Island showing the location of the three sub-sites of ASPA No. 145 in Port Foster (A, B and C), and ASPA No. 140 sub-sites. Cartographic base provided by Centro Geográfico del Ejército de Tierra and Instituto Hidrográfico de la Marina (Spain), with help of MAGIC-BAS (UK).

Map 3: Bathymetric map of Port Foster in Deception Island, showing the general location of the three sub-sites of ASPA No. 145 (demarked in yellow). Image provided by the Instituto Hidrográfico de la Marina, Spain. Bathymetry data compiled from hydrographic surveys carried out in the years 2012 and 2016.

Figure 1: Species richness in the shallow areas of Port Foster, by group. The NEP and WHB stations describe the species richness of sub-site C of ASPA No. 145 (Extracted from Angulo-Preckler et al., 2018).

Figure 2: Representative photography's of the communities presented in the Area. Examples of suspension feeder community: a) massive sponge Mycale (Oxymycale) acerata and the soft-coral Alcyonium haddoni, and b) the sponges Dendrilla antarctica, Hemigellius pillosus, and the tunicate Cnemidocarpa verrucosa. Examples mobile deposit feeder community; c) Ophionotus victoriae, Sterechinus neumayeri, and Odontaster validus, and d) very high densities of Ophionotus victoriae (Extracted from Angulo-Preckler et al., 2018).

6. Description of the Area

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

- *General description*

Deception Island is an active volcano located in the southwestern sector of the South Shetland Islands. The island's volcanic activity is attributed to its location at the confluence of two tectonically active features: The southwestern portion of the Bransfield Basin and the extension of the southern intersection of the Hero Fracture Zone. Its caldera, located in the centre of the island, is flooded and connected with Bransfield Strait through a collapsed wall in the south-eastern sector of the volcanic cone called Neptunes Bellows. The caldera has been called Port Foster, which receives a large amount of fresh water during the thaw period (southern spring-summer). This flooded caldera presents geothermal activity in several places, with temperatures in its bottom waters close to 2–3 °C, mainly in the northern and central sectors. The seabed at Port Foster drops steeply from the coast into the caldera, and remains relatively flat at a depth of 150 m. The Neptunes Bellows are approximately 500 m wide at their narrowest point, with minimum depths of 10 m, which minimizes the number of icebergs that can enter Port Foster from the outside, limiting this disturbance factor that affects Antarctic benthic communities in other areas. This narrow exit also increases the retention time of the water in the caldera which can be as high as one year.

The Area is determined by three sub-sites, habitats A, B and C, which present different and contrasting granulometric substrates compositions. The bottom of Habitat A consists of closely spaced volcanic sediments of medium to coarse texture, including slag and lapilli; Habitat B consists of more separated volcanic ash of medium to fine texture; while Habitat C corresponds to hard, rocky substrates located in shallow waters. Soft bottom habitats (in the deepest area) have low dissolved oxygen concentrations.

- *Boundaries*

The Area is wholly marine, compromising the benthic environment in three sub-sites. There are two deeper benthic habitat zones located at the seabed, mainly between 50 and 150 m depth (sub-sites A and B), and a third benthic coastal zone, located in waters from 0 to 50 m (sub-site C). The water column and the water surface above the sub-sites are not part of the Area.

Sub-Sites A and B

The boundaries of the sub-site A are defined in the north as the line of latitude at 62°55’40”S, and in the south at 62°56’23”S; the east boundary is defined as the line of longitude at 60°37'00”W, and in the west at 60°38'00”W.

The boundaries of sub-site B of the Area, the north boundary is defined as the line of latitude at 62°57’13”S, and in the south at 62°57'54"S; the east boundary is defined as the line of longitude at 60°36'20"W, while the west boundary is at the line 60°37'20"W.

The vertical boundary of sub-sites A and B lies at the seabed, below 50 m depth from the surface.

These sub-sites are mainly inhabited by infauna and mobile epifauna organisms, as ophiuroids, worms, crustaceans, sea stars, sea urchins and mollusks, consider a surface of approximately 2.2 km² of the bottom, in total, size considered enough to assess the recovery of infaunal and epifaunal organisms in this naturally impacted zone, to be compared with other sites within Port Foster and other Antarctic soft bottoms sites.

Sub-Site C

Sub-site C, corresponds to a benthic habitat located at a depth of 0 to 50 m, which west boundary is defined by the line generated by connecting the north point of coordinates latitude 62°59’22.92”S; longitude 60°33’59.0”W, and the south point in latitude 62°59’06”S; longitude 60°33’20.16”W. This line is perpendicularly connected to the east with the coastal line, at the lowest tide. The site covers the 50 m isobaths to the coast, and includes most known hard-bottoms in Port Foster. The vertical boundary of sub-site C lies at the sea bottom.

- *Geological and volcanic characteristics*

Deception Island constitutes a back-arc stratovolcano with a basal diameter of approximately 30 km. The 15 km diameter island is horse-shoe shaped and displays a flooded caldera (Port Foster) which wall is breached by a 500 m wide passage (Neptunes Bellows). The geodynamics setting of the island is characterized by interactions among small tectonic units, the Drake microplate, the South Shetland Trench and the Bransfield Rift.

The volcanic evolution of the island is marked by a caldera collapse, which took place between 8,300 and ∼3,980 years BC. The pre-caldera evolutionary stage was characterized by the formation of multiple coalesced shoaling seamounts and a subaerial volcanic shield. The post-caldera phase, which includes the recent historical eruptions (1829–1970), comprises at least 70 scattered eruptive vents inside the caldera, except one located along the structural borders of the caldera itself. Magma that erupted after the caldera collapse outlines a well-defined evolutionary trend, showing the widest compositional range on the island from basalts to rhyolites. Overall, major and trace element compositions of post-caldera magmas define a tholeiitic trend.

The caldera of Deception Island volcano has been described as a classic example of collapse caldera that formed about a ring fractures following one or more voluminous eruptions of andesitic magma. All historical eruptions have been relatively small in volume (<0.1 km³) of material, with variable degrees of explosivity according to the water amount and its source (sea, ice melting, aquifer) interacting with the magma, and occurring at locations near the coast of Port Foster, all around the caldera. Evidences for present-day volcanic activity of the island include fumaroles and hydrothermal activity, resurgence of the floor of Port Foster, and seismicity.

- *Hydrography*

The temperatures recorded in the substrate at Port Foster are similar to those measured in the outer area of the island, in Bransfield Strait, with values between -1.4 ºC and 2.0 ºC. However, these values increase in areas of the bay near fumaroles, where the temperature can rise to 7.5 ºC. Therefore, the temperature of the water near benthic habitat A can fluctuate greatly, depending on circulation and the underwater hot springs located in the vicinity.

The salinity values in Port Foster are presented in the range of 33.9‰–34.2‰, although somewhat lower values are recorded in some areas associated with glacial melt.

Current studies indicate pH values recorded for Port Foster of between 7.8 and 8.1. This value is probably due to components derived from the volcanic activity of the island.

- *Benthic species*

The composition of the benthic assemblages has varied greatly since the volcanic eruption of December 1967, when the ashes covered almost all the bay, producing a high mortality of the marine species. The eruptions also produced the alteration of the physical-chemical characteristics of the bay, modifications on the oceanic floor and the high temperature in the surrounding areas. Following eruptions in 1969, 1970 and 1976 also produced the mortality of the marine species inhabiting Port Foster. After those events, the Area was colonized mainly by Polychaeta, Crustacea, Echinodermata and Mollusca, the more representative groups in the benthic communities of the bay. The groups of benthic species are related to the type of sediment: soft beds are dominated by organisms of the infauna and mobile epifauna (sub-sites A and B), while sessile species dominate in hard sediments (sub-site C).

The predominant groups in the soft bed habitat (sub-site B) are polychaetes, bivalves, nemerteans, cumaceae and amphipods. On hard beds the predominant groups are (sub-site A) echinoderms, amphipods and tunicates, while on the hard substrates of sub-site C they are macroalgae, sponges, soft corals, tunicates, and bryozoans.

The most representative assemblages of polychaetes area are represented by Maldane sarsi antarctica, Tharyx cincinnatus and Haploscoloplos kerguelensis; crustaceans as Eudorella gracilior, Glyptonotus antarcticus and Phoxocephalidae sp.; nemerteans as Lineus sp. and Paraborlasia corrugatus; the isopod Serolis kemp; bivalves as Yoldia eightsii and Limopsis hirtella; the echinoderms Abatus agassizii and Sterechinus neumayeri; the asteroids Lysasterias perrieri and Odontaster validus; holothurian Ypsilothuria sp., and ophiuroids, as Astrotoma agassizi, Ophionotus victoriae and Ophiactis asperula, being the most abundant group in these sub-sites.

In sub-site C, which has the highest biodiversity in the area, the biocenosis is characterized by an important macroalgal community, with more than 30 species identified, and a rich community of macrofauna, with an important presence of sponges, of which more than 24 species have been identified, highlighting Dendrilla antarctica, Mycale (Oxymycale) acerata, Sphaerotylus antarcticus and Isodictya kerguelenensis. In this sub-site there are also bryozoans, such as Beania erecta and Camptoplites giganteus, and the mollusks Laternula elliptica and Limatula hodgson, the chiton Nuttallochiton mirandus, polychaetes and amphipods, among many other species, forming what is known as an “Antarctic Marine Animal Forest". New metabarcoding techniques studies are showing a high value of biodiversity, with more than 32 different phyla and a very high species richness.

- *Other animals*

Seals have also been identified in the Area, especially Weddell seals, Leptonychotes weddellii, which frequent Port Foster for breeding, feeding and resting. Antarctic fur seals, Arctocephalus gazella, are regular visitors during summer, when they can be seen resting on the beaches. Some cetaceans, such as killer whales, Orcinus orca, and minke whales, Balaenoptera acutorostrata, can also be sighted in the bay. Fur seals and cetaceans also possibly feed in the Area.

6(ii) Access to the Area

- Access into the Area is generally by ship or smaller boats.
- Vessels may transit above the sub-sites A and B of the Area, although anchoring should be avoided, except in compelling circumstances. Only small boats can access to sub-site C.
- In winter, if sea-ice is strong enough to allow the displacement on it, the sub-site C, in particular, could be accessed from land by foot.
- There are no specific restrictions on routes of access to, although the transit should be kept to the minimum necessary, consistent with the objectives of any permitted activity.

6(iii) Location of structures within and adjacent to the Area

There are no structures known to be within the Area.

The structures located in the vicinity of Port Foster correspond to Decepción (Argentina) and Gabriel de Castilla (Spain) scientific stations. In addition, the remains of Pedro Aguirre Cerda (Chile) and Base B (United Kingdom) stations, along with those of the Hektor whaling station are located in the vicinity of the Area. All these structures are described in detail in the management plan for ASMA No. 4, Deception Island.

6(iv) Location of other protected areas in the vicinity

The Area is located within the ASMA No. 4, Deception Island.

ASPA No. 140 is the nearest protected area, which is also located on Deception Island, compromising eleven small sub-sites. In addition, HSM No. 76 is located in the vicinity of Pendulum Cove, with the remains of the Pedro Aguirre Cerda Station. In Whalers Bay, HSM No. 71 comprises the remains of the Hektor whaling station, other artefacts that predate the whaling station, and the remains of Base B (United Kingdom). All of these areas are part of ASMA No. 4.

In the vicinity of Deception Island, there are also the following protected areas:

- ASPA No. 126, Byers Peninsula, on Livingston Island, about 40 km to the northwest.
- ASPA No. 149, Cape Shirreff and San Telmo Islets, Livingston Island, almost 30 km away to the north.
- ASPA No. 152, West of Bransfield Strait, about 70 km to the southwest.

6(v) Special Zones within the Area

There are no special zones in the Area.

7. Terms and Conditions for Entry Permits

7(i) General permit conditions

Entry to 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 the following:

- permits will be issued only for compelling scientific research in the marine environment of the Area that cannot be carried out elsewhere, or for other scientific studies that do not compromise the values for which the Area is protected, or for the development of activities for essential management purposes that are compatible with the objectives of the plan, such as inspections, maintenance or examination activities;
- the actions permitted will not jeopardise the ecological or scientific values of the Area;
- any management activities must observe the aims and objectives of this management plan;
- the permit, or a copy of it, must be carried whilst performing such activities within the Area;
- a report of the visit must be submitted to the authorities indicated in the permit and to the Chair of the Deception Island Management Group;
- permits shall be valid for a stated period; and
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised permit.

7(ii) Access to and Movement within or over the Area

The Area can only be accessed by sea. 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.

Ships may transit above sub-sites A and B.

In sub-site C, access should be restricted to small boats, where small boat refers to rigid boats, semi-rigid inflatable boats, rubber boats or any similar small landing craft used for shore interactions. Larger vessels navigation is forbidden.

It is not permitted to anchor in the Area, or to use any other anchoring system (anchored buoys, moorings etc.), except as specified in a permit or in case of emergency.

Visitors to Pendulum Cove and to Whalers Bay must organize their activities to comply with these restrictions.

7(iii) Activities which may be conducted within the Area

- Scientific research that will not jeopardise the ecosystem of the Area.
- Essential operations of vessels that do not endanger the values of the Area, to facilitate scientific or other activities, including tourism.
- Essential management activities, including monitoring.
- Underwater activities Diving, only for scientific purposes.
- The use of RPAs (remotely piloted aircraft, UAV or drones), to overflight the Area, or the use of submarine ROVs (remote operation vehicles) will not be allowed unless a permit issued by a Competent Authority. During the analysis and authorisation process, all Antarctic Treaty directives in force will be taken into account.

7(iv) Installation, modification or removal of structures

- No structures are to be erected within the Area, except as specified in a permit. 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 marine flora and fauna.
- Mooring is not permitted within the Area, except as specified in a permit or in cases of emergency.
- All structures and installations must be removed from the Area when they are no longer required, or on the expiry of the permit, whichever is the earlier.

7(v) Location of field camps

Not applicable in most cases. In winter the sea- ice could be strong enough to allow an on-ice field camp, but this is rare. In this case the field camp should not allow the discharge of waste of any type either on the ice or into the water beneath.

7(vi) Restrictions on materials and organisms that may be brought into the Area

No living animals shall be deliberately introduced into the Area, and all necessary precautions shall be taken to prevent accidental introductions.

To ensure that the wildlife and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microorganisms or invertebrates from other Antarctic sites or from regions outside Antarctica. All sampling equipment and markers brought into the area should be cleaned or sterilized as far as possible before being used in the marine environment. Further guidance can be found in the CEP Non-Native Species Manual and COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species.

Any chemicals, including radio-nucleotides or stable isotopes, which may be introduced for scientific or management purposes specified in a permit, shall be managed properly while are in use to avoid any accidental released, and shall be removed from the Area at the latest upon conclusion of the activity for which the permit was granted.

All materials introduced to the Area shall remain for a stated period only, and must be removed at or before the conclusion of the stated period. These materials must be stored and handled so as to minimise the risk of their introduction into the environment.

If release occurs that 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 on site.

7(vii) Taking of, or harmful interference with, native flora and fauna

Taking of or harmful interference with native flora or fauna is prohibited, except by a permit issued by an appropriate national authority specifically for that objective, in accordance with Article 3 of Annex II to the Protocol on Environmental Protection to the Antarctic Treaty.

Where taking or harmful interference with animals is involved, SCAR Code of Conduct for Use of Animals for Scientific Purposes in Antarctica shall be used as a minimum standard.

In sub-sites A and B, dredging and grab sampling are allowed, according to the scientific studies authorized to be developed in it. Sub-site C should be studied by scuba-diving or ROVs only.

7(viii) Collection or removal of materials not brought into the Area by the permit holder

Material may only be collected or removed from the Area as authorized in a permit and must be limited to the minimum necessary to meet scientific or management needs. Permits shall not be granted if there is reasonable concern that the sampling proposed might take, remove or damage such quantities of sediment, 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, and which was not brought into the Area by the permit holder or otherwise authorized, may be removed unless the impact of such removal may be greater than the leaving the material on site. In such a case, the appropriate authority should be notified.

Artefacts found at the seabed within the Area and judged to be of high historic value, which cannot be kept on site, may be removed in accordance with a permit for storage in a controlled environment until such time as they can safely be returned to the Historic Site nearby the Area, unless there is a high risk that return would be likely to damage or destroy the integrity of the artefact(s). National authorities should ensure that any removal of artefacts and assessment is carried out by personnel with appropriate heritage conservation expertise.

A report describing the nature of the material found at or removed from the Area, should be submitted to the Deception Island Antarctic Specially Managed Area (ASMA) Management Group, informing the final destination of it.

7(ix) Disposal of Waste

Dumping waste of any kind into the marine environment is prohibited. All waste generated, liquid and solid, including human waste, shall be removed from the Area.

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

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 examination, or to take protective measures.

Where feasible, all sites where long-term monitoring activities are taking place, which are vulnerable to unintentional disturbance, should be appropriately marked on the site and on maps of the Area.

To develop the activities on the Area, ships must comply with? the Practical Guidelines for Ballast Water Exchange in the Antarctic Treaty Area.

7(xi) Reporting requirements

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed.

Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.

Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising 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 authorised permit.

The records of permits and post-visit reports related to the Area will be exchanged with the other Consultative Parties, as part of the Information Exchange System, as established in Art. 10.1 of Annex V.

8. Supporting Scientific Documents

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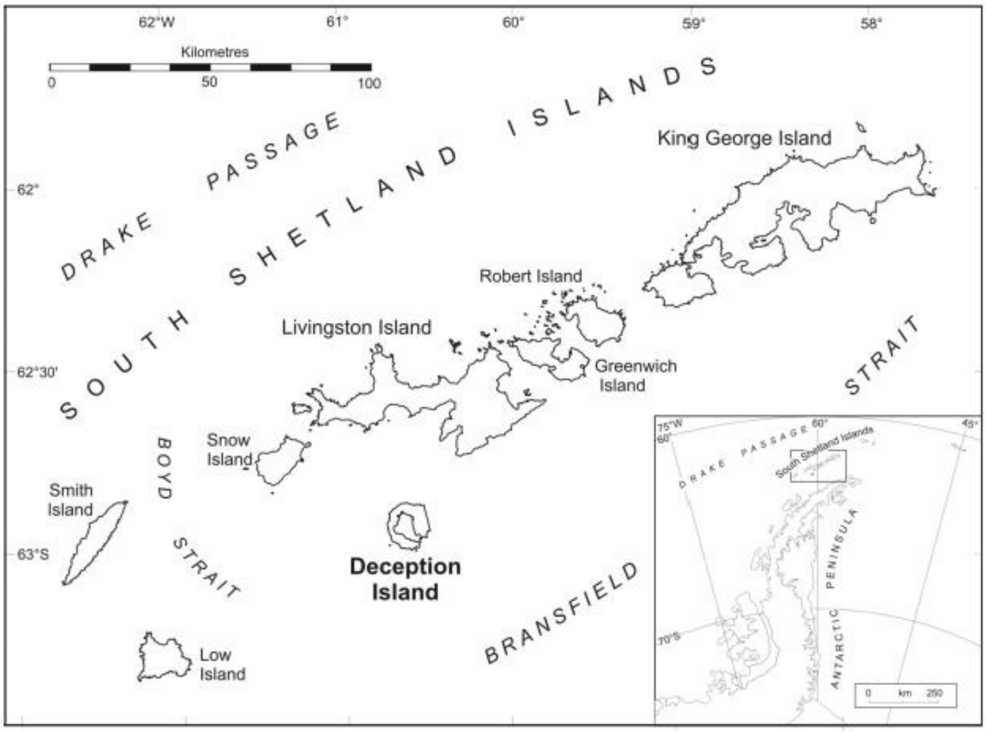
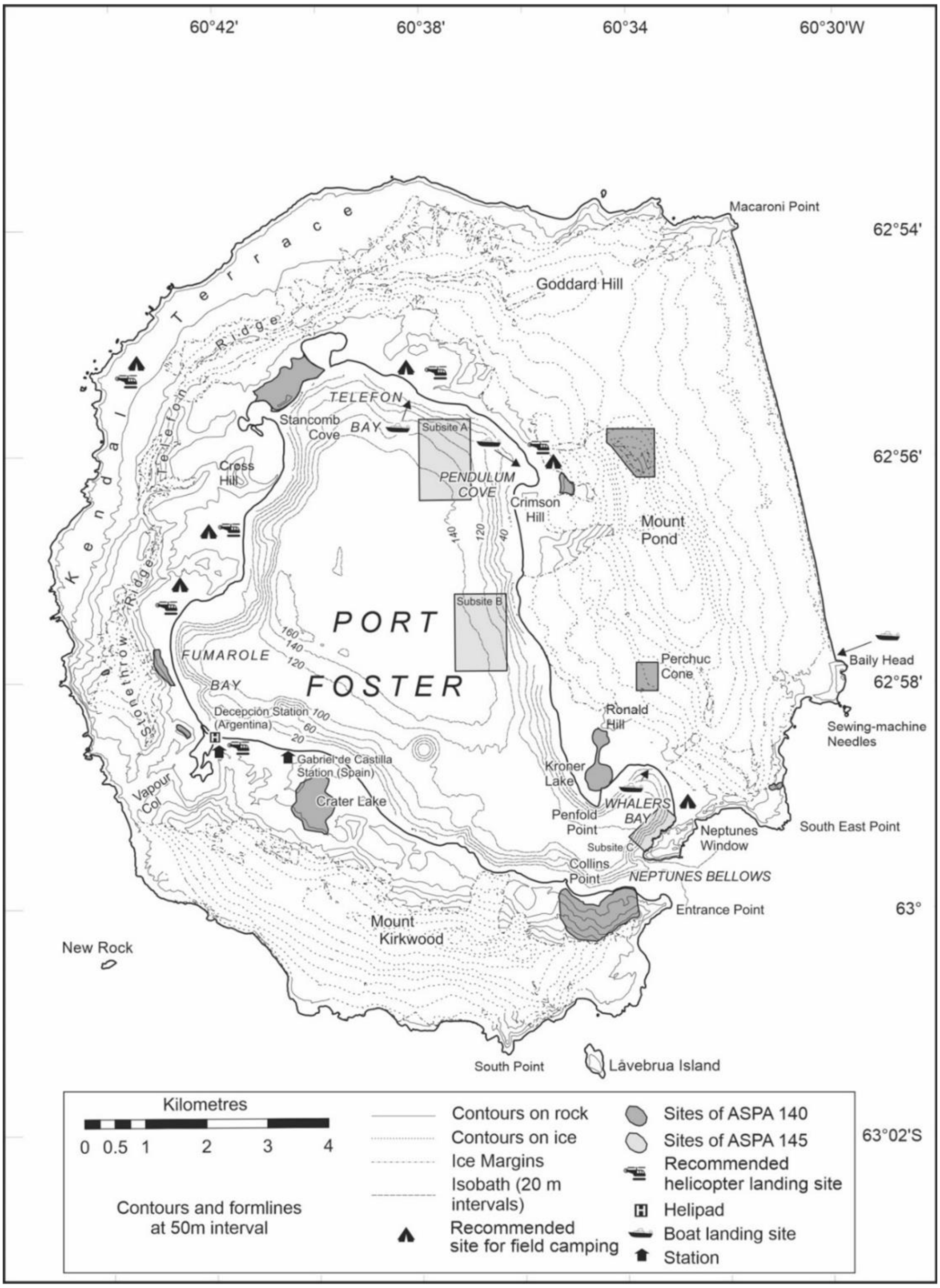
Map 1. Location of Deception Island in relation to the Antarctic Peninsula and the South Shetland Islands (Extracted from Deception Island Antarctic Specially Managed Area No. 4 Management Plan).



Map 2. Map of Deception Island showing the location of the three sub-sites of ASPA No. 145 in Port Foster (A, B and C), and ASPA No. 140 sub-sites. Cartographic base provided by Centro Geográfico del Ejército de Tierra and Instituto Hidrográfico de la Marina (Spain), with help of MAGIC-BAS (UK).



Map 3. Bathymetric map of Port Foster in Deception Island, showing the general location of the three sub-sites of ASPA No. 145 (demarked in yellow). Image provided by the Instituto Hidrográfico de la Marina, Spain. Bathymetry data compiled from hydrographic surveys carried out in the years 2012-and 2016.

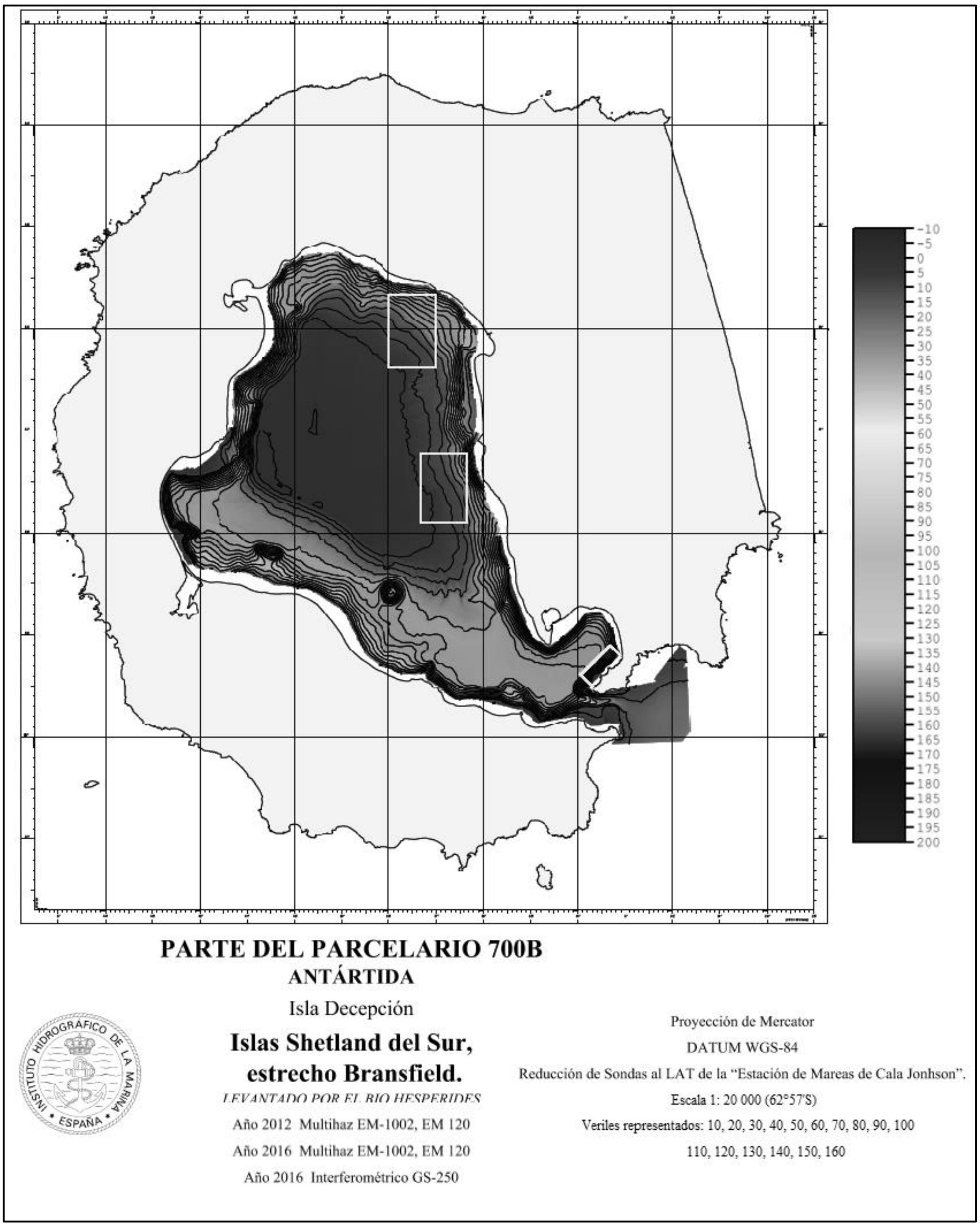


Figure 1: Species richness in the shallow areas of Port Foster, by group. The NEP and WHB stations describe the species richness of sub-site C of ASPA No. 145 (Extracted from Angulo-Preckler et al., 2018).

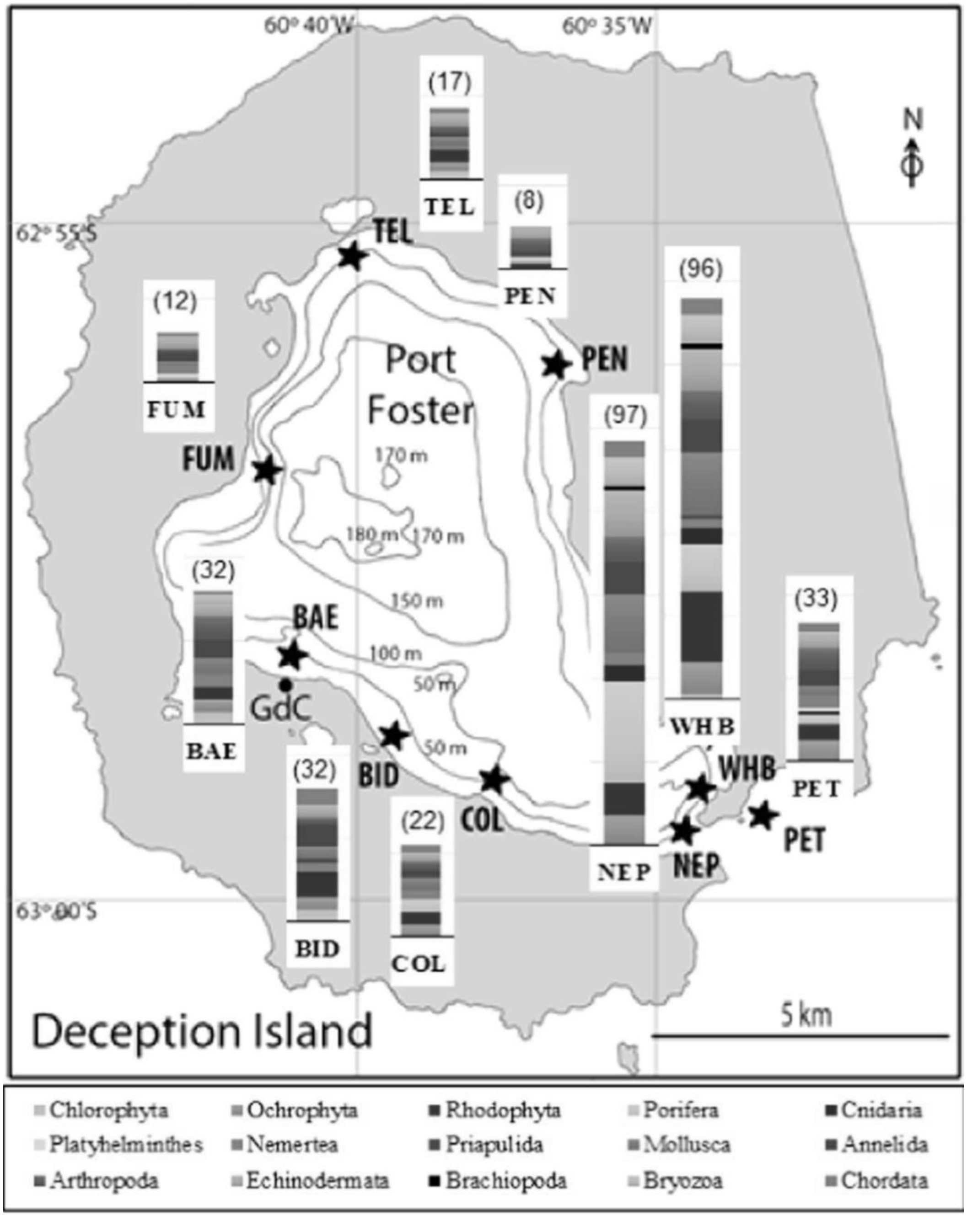
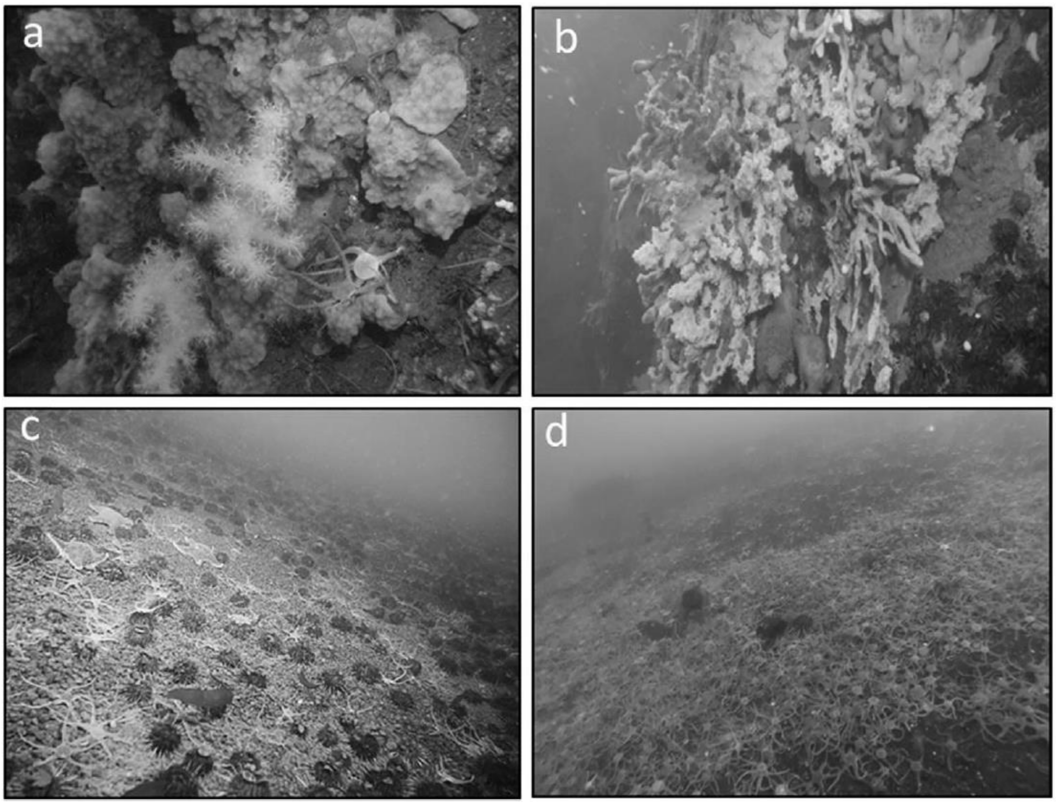


Figure 2. Representative photography's of the communities presented in the Area. Examples of suspension feeder community: a) massive sponge Mycale (Oxymycale) acerata and the soft-coral Alcyonium haddoni, and b) the sponges Dendrilla antarctica, Hemigellius pillosus, and the tunicate Cnemidocarpa verrucosa. Examples of mobile deposit feeder community; c) the echinoderms Ophionotus victoriae, Sterechinus neumayeri, and Odontaster validus, and d) very high densities of Ophionotus victoriae

(Extracted from Angulo-Preckler et al., 2018).



Measure 11 (2023)

Antarctic Specially Protected Area No 147 (Ablation Valley and Ganymede Heights, Alexander Island): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XV-6 (1989), which designated Ablation Valley and Ganymede Heights, Alexander Island as Site of Special Scientific Interest ("SSSI") No 29 and annexed a Management Plan for the Site;
- Resolution 3 (1996), which extended the expiry date for SSSI 29;
- Measure 2 (2000), which extended the expiry date for the Management Plan for SSSI 29;
- Decision 1 (2002), which renamed and renumbered SSSI 29 as ASPA 147;
- Measures 1 (2002), 10 (2013) and 4 (2018), which adopted revised Management Plans for ASPA 147;

Recalling that Recommendation XV-6 (1989) and Resolution 3 (1996) were designated as no longer current by Decision 1 (2011);

Recalling that Measure 2 (2000) did not become effective and was withdrawn by Measure 5 (2009);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 147;

Desiring to replace the existing Management Plan for ASPA 147 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 147 (Ablation Valley and Ganymede Heights, Alexander Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 147 annexed to Measure 4 (2018) be revoked.

Management Plan for Antarctic Specially Protected Area No. 147

ABLATION VALLEY AND GANYMEDE HEIGHTS, ALEXANDER ISLAND

Introduction

The primary reason for the designation of Ablation Valley and Ganymede Heights, Alexander Island (70°48'S, 68°30'W, approximately 180 km²) as an Antarctic Specially Protected Area (ASPA) is to protect scientific values, relating particularly to the geology, geomorphology, glaciology, limnology and ecology of this extensive ablation area.

Ablation Valley and Ganymede Heights, Alexander Island, was designated originally in 1989 as Site of Special Scientific Interest (SSSI) No. 29 Ablation Point – Ganymede Heights, Alexander Island, through Recommendation XV-6, after a proposal by the United Kingdom. Included was a largely ice-free region between latitudes 70°45'S and 70°55'S and from longitude 68°40'W to the George VI Sound coastline. The Area comprised several valley systems separated by ridges and plateau of about 650-760 m high. The original management plan (Recommendation XV-6) described the Area as "one of the largest ablation areas in West Antarctica…[with]…a complex geology, the main rock types being conglomerates, arkosic sandstones and shales with subordinate pebbly mudstones and sedimentary breccias. The base of the succession is formed of a spectacular mélange, including large blocks of lava and agglomerate. This outcrops on the valley floors and at the base of several cliffs. [The Area] possesses a wide range of geomorphological features including raised beaches, moraine systems and patterned ground. There are several permanently frozen freshwater lakes and many ice-free ponds supporting a diverse flora (including aquatic bryophytes) and fauna. The vegetation is generally sparse, with the unique moss and liverwort-dominated community type being restricted to 'oases', where water issues from otherwise dry barren hillsides. The terrestrial and freshwater ecosystems are vulnerable to human impact and therefore merit protection from uncontrolled human presence". In summary, the principal values of the Area were considered to be the geological, geomorphological, glaciological, limnological, and ecological features, and the associated outstanding scientific interest of one of the largest ice-free ablation area in West Antarctica. The Area was renumbered as ASPA No. 147 through Decision 1 (2002) and a revised Management Plan was adopted through Measure 1 (2002).

ASPA No. 147 Ablation Valley and Ganymede Heights, Alexander Island, fits into the wider context of the Antarctic Protected Area system by protecting one of the largest ablation areas in West Antarctica. Equivalent environmental and scientific values are not protected in other ASPAs within the Antarctic Peninsula area. Resolution 3 (2008) recommended that the Environmental Domains Analysis for the Antarctic Continent, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V to the Protocol (see also Morgan et al., 2007). Using this model, small parts of ASPA 147 are contained within

Environment Domain E Antarctic Peninsula and Alexander Island main ice fields); however, although not stated specifically in Morgan et al., the Area may also include Domain C (Antarctic Peninsula southern geologic). Other protected areas containing Domain E include ASPA Nos. 113, 114, 117, 126, 128, 129, 133, 134, 139, 149, 152, 170 and ASMA Nos. 1 and 4. Other protected areas containing Domain C include ASPA 170 (although not stated specifically in Morgan et al., 2007). The ASPA sits within Antarctic Conservation Biogeographic Region (ACBR) 4 Central South Antarctic Peninsula and is one of only two ASPAs in ACBR 4, the other being ASPA No. 170 (Terauds et al., 2012; Terauds and Lee, 2016) (Resolution 3 (2017)).

1. Description of values to be protected

The values noted in the original designation are reaffirmed in the present Management Plan. Further values evident from scientific descriptions of Ablation Valley and Ganymede Heights are also considered important as reasons for special protection of the Area. These values are:

- The presence of exposures of the Fossil Bluff Formation, which is of prime geological importance because it is the only known area of unbroken exposure of rocks spanning the Jurassic – Cretaceous boundary in the Antarctic, which makes this a critical locality for understanding the change in flora and fauna at this temporal boundary.
- The presence of an exceptional and unique contiguous geomorphological record of glacier and ice-shelf fluctuations extending over several thousand years, together with an outstanding assemblage of other geomorphological features derived from glacial, periglacial, lacustrine, aeolian, alluvial and slope processes.
- Two perennially frozen freshwater lakes (Ablation and Moutonnée lakes) which have the unusual property of contact with the saline waters of George VI Sound.
- The presence of marine biota, including the fish Trematomus bernacchii, in Ablation Lake, where several seals have also been observed, despite the fact that it is almost 100 km from open sea.
- The Area has the greatest bryophyte diversity of any site at this latitude in Antarctica (at least 21 species); it also has a diverse lichen (>35 taxa), algal and cyanobacterial biota. Many of the bryophytes and lichens are at the southern limit of their know distributions. There are several species which are very rare in the Antarctic.
- Several mosses occur in lakes and ponds to depths of 9 m. Although these are all terrestrial species, they tolerate inundation for several months each year when their habitat floods. One species, Campylium polygamum, has adapted to an aquatic existence, and some permanently submerged colonies reach large dimensions, with shoots in excess of 30 cm length. These are the best examples of aquatic vegetation in the Antarctic Peninsula region.
- Several bryophyte species within the Area are fertile (producing sporophytes), and some of these are not known or are very rare in this condition elsewhere in the Antarctic (e.g., the liverwort Cephaloziella

varians, and mosses Bryoerythrophyllum recurvirostrum, Distichium capillaceum, Schistidium spp.).

- The Area has one of the most extensive stands of vegetation on Alexander Island. Many of these occur on seepage areas where the bryophyte and lichen communities cover up to 100 m² or more. In the sheltered seepage areas, assemblages of terricolous species develop communities not known elsewhere in Antarctica, while exposed rock ridges and stable boulder fields support a community of locally abundant lichens, usually dominated by Usnea sphacelata.
- The Area is comparatively rich in the number and abundance of microarthropod species for its locality this far south, with representation of the springtail Friesia topo which is thought to be endemic to Alexander Island. Ablation Valley is also the only site on Alexander Island where the predatory mite Rhagidia gerlachei has been described, making the food web more complex than other sites at this latitude.

2. Aims and objectives

The aims and objectives of this Management Plan are to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microbes;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardize the natural ecological system in that Area; and
- preserve the natural ecosystem of the Area as a reference area for future studies.

3. Management activities

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

- Markers, signs or other structures (e.g., cairns) erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- Copies of this Management Plan shall be made available to aircraft planning to visit the vicinity of the Area.
- The Management Plan shall be reviewed at least every five years and updated as required.
- A copy of this Management Plan shall be made available at Rothera Research Station (UK; 67°34'S, 68°07'W) and General San Martín Station (Argentina; 68°08'S, 67°06'W).

- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I to the Protocol on Environmental Protection to the Antarctic Treaty.
- National Antarctic Programmes operating in the Area shall consult together with a view to ensuring the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1. Location of Ablation Valley and Ganymede Heights on the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central Meridian -55°, Standard Parallel: -71°.

Map 2. ASPA No. 147, Ablation Valley and Ganymede Heights, location map. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -71°, Standard Parallel: -71°.

Map 3. ASPA No. 147, Ablation Valley and Ganymede Heights, topographic sketch map. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -68.4°, Standard Parallel: -71.0°.

6. Description of the Area

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

- *General description*

Ablation Valley and Ganymede Heights (between latitudes 70°45’S and 70°55’S and longitudes 68°21’W and 68°40’W, approximately 180 km²) is situated on the east side of Alexander Island, the largest island off the western coast of Palmer Land, Antarctic Peninsula (Maps 1 and 2). The Area has a central west–east extent of about 10 km and a north–south extent of about 18 km, flanked to the west by the upper part of Jupiter Glacier, to the east by the permanent ice shelf in George VI Sound, to the north by Grotto Glacier and to the south by the lower reaches of Jupiter Glacier. Ablation Valley and Ganymede Heights contain the largest contiguous ice-free area in the Antarctic Peninsula sector of Antarctica, with the smaller permanent ice fields and valley glaciers within the massif representing only about 17% of the Area. The topography of the region is mountainous, comprising steep-sided valleys separated by gently undulating plateau-like ridge crests lying generally between 650-750 m, rising to a maximum altitude of 1070 m (Clapperton and Sugden, 1983). The region has been heavily glaciated, although the relatively flat-lying attitude of the sedimentary rocks and rapid weathering have contributed to a generally rounded form of topography, coupled with sheer cliff ‘steps’ of thickly-bedded sandstones and conglomerates (Taylor et al., 1979).

The Area includes four principal ice-free valleys (Ablation, Moutonnée, Flatiron and Striation), the first three of which contain large ice-covered freshwater lakes (Heywood, 1977, Convey and Smith, 1997). The largest of these is the proglacial Ablation Lake (approximately 7 km²), which has been impounded by shelf ice penetrating up-valley under pressure from the westward movement of the 100-500 m thick George VI Ice Shelf, the surface of which lies 30 m above sea level (Heywood, 1977; Clapperton and Sugden, 1982). Biologically, the terrestrial ecosystem is intermediate between the relatively mild maritime Antarctic farther north and the colder, drier continental Antarctic to the south. As a “dry valley” area it is extremely rich in biota and serves as a valuable contrast to the more extreme and biologically impoverished ablation areas on the Antarctic continent (Smith, 1988).

- *Boundaries*

The designated Area comprises the entire Ablation Valley – Ganymede Heights massif, bounded in the west by the principal ridge dividing Jupiter Glacier from the main Ablation – Moutonnée – Flatiron valleys (Map 3). In the east, the boundary is defined by the western margin of George VI Ice Shelf. The northern boundary of the Area is defined as the principal ridge dividing Grotto Glacier from Erratic Valley and other tributary valleys feeding into Ablation Valley, immediately to the south. In the northwest of the Area, the boundary extends across the mostly glaciated col separating upper Jupiter Glacier from Ablation Valley. The southern boundary of the Area, from east of the principal ridge on the west side of Flatiron Valley to where Jupiter Glacier joins George VI Ice Shelf, is defined as the northern lateral margin of Jupiter Glacier. As the margin between Ablation Lake and George VI Ice Shelf is in places indistinct, the eastern boundary of the Area at Ablation Valley is defined as a straight line extending due south from the eastern extremity of Ablation Point to where the ice shelf abuts land, and from where the eastern boundary follows the land/ice shelf margin. The physiography is similar further south at Moutonnée Lake, and the eastern boundary in this locality is defined as a straight line extending from the eastern extremity of the point on the northern side of (and partially enclosing) Moutonnée Lake to the locality of a prominent meltwater pool where the ice shelf abuts land, and from where the boundary follows the land/ice shelf margin south to where Jupiter Glacier and George VI Ice Shelf adjoin. The Area thus includes the entirety of Ablation and Moutonnée lakes and those parts of the ice shelf behind which they are impounded. The boundary co-ordinates are given in Annex 1.

- *Climate*

No extended meteorological records are available for the Ablation Valley – Ganymede Heights area, but the climate has been described as dominated by the dual influences of easterly-moving cyclonic depressions of the Southern Ocean, against the more continental, north to northwesterly, flow of cold anticyclonic air from the West Antarctic Ice Sheet (Clapperton and Sugden, 1983). The former brings relatively mild weather, strong northerly winds and a heavy cloud cover to the region, whereas the latter induces clear, cold and stable conditions with temperatures below 0° C, and relatively light winds from the south. Based on data recorded nearby (25 km) in the early 1970s, the mean summer temperature was estimated as just below freezing point, with mean annual temperature estimated at about -9 °C (Heywood, 1977); precipitation was estimated at <200 mm of water equivalent per year, with little snow falling in summer. A thin snow cover is common after winter, but the region is generally snow-free by the end of the summer, apart from isolated snow patches that may persist in places.

- *Geology*

The geology of Ablation Valley – Ganymede Heights is complex but is dominated by well-stratified sedimentary rocks. The most prominent structural feature of the massif is a large asymmetrical anticline with a northwest–southeast orientation, extending from Grotto Glacier to Jupiter Glacier (Bell, 1975, Crame and Howlett, 1988). Thrust faults in the central part of the massif suggest vertical displacements of strata of up to 800 m (Crame and Howlett, 1988). The main lithologies are conglomerates, arkosic sandstones and fossiliferous shales, with subordinate pebbly mudstones and sedimentary breccias (Elliot, 1974; Taylor et al., 1979; Thomson 1979). A range of fossils have been found in the strata, which are of Upper Jurassic–Lower Cretaceous age, including bivalves, brachiopods, belemnites, ammonites, shark teeth and plants (Taylor et al., 1979; Thomson, 1979; Crame and Howlett, 1988; Howlett, 1989). Several interstratified lavas have been observed in the lowest exposures at Ablation Point (Bell, 1975). The base of the succession is formed of a spectacular mélange, including large blocks of lava and agglomerate which crop out on the valley floors and at the base of several cliffs (see Bell, 1975; Taylor et al., 1979). The presence of exposures of the Fossil Bluff Formation is of prime geological importance because it is the only known area of unbroken exposure of rocks spanning the Jurassic – Cretaceous boundary in the Antarctic, which makes this a critical locality for understanding the change in floras and faunas at this temporal boundary.

- *Geomorphology and soils*

The entire area was at one time over-run by glacier ice from the interior of Alexander Island. Thus, landforms of both glacial erosion and deposition are widespread throughout the Area, providing evidence of a former general eastward flow of ice into George VI Sound (Clapperton and Sugden 1983). Misfit glaciers, striated bedrock and erratics indicate considerable deglaciation since the Pleistocene glacial maximum (Taylor et al., 1979; Roberts et al., 2009). Numerous terminal moraines fronting present remnant glaciers, several unexpectedly talus-free sites, and polished and striated roches moutonnées indicate that glacial retreat may have been rapid (Taylor et al., 1979). There is evidence that George VI Ice Shelf was absent between c. 9600 and 7730 calendar years BP, which suggests that the Ablation Valley – Ganymede Heights massif is likely to have been largely free of permanent ice around that time, although there have been a number of subsequent glacier fluctuations in the region (Clapperton and Sugden, 1982; Bentley et al., 2005; Smith et al., 2007a,b; Roberts et al., 2008; Bentley et al., 2009). The absence of the ice shelf suggests that early Holocene ocean-atmosphere variability in the Antarctic Peninsula was greater than that measured in recent decades (Bentley et al., 2005). Roberts et al. (2009) examined deltas adjacent to Ablation and Moutonnée Lakes that were formed higher than the present-day lake level and concluded that sea level had fallen by c. 14.4 m since the mid-Holocene in this part of Alexander Island.

The landforms within the Area have been modified by periglacial, gravitational and fluvial processes. Bedrock on the upper plateau surfaces (where it has been largely scraped free of till overburden) has been shattered by frost action into platy or blocky fragments (Clapperton and Sugden, 1983). On valley slopes gelifluction lobes and stone stripes and circles are common, while on valley floors stone circles and polygonal patterned ground are frequently found in glacial till and in fluvioglacial sediments subjected to frost action. Valley walls are also dominated by landforms derived from frost action, rock/ice-fall activity, and seasonal meltwater flows, which have led to ubiquitous talus slopes and, commonly, boulder fans below incised gullies. Mass wasting of fissile sedimentary rocks has also led to the development of steep (about 50°) horizontally rectilinear bedrock slopes thinly veneered with debris. Occasional aeolian landforms have been observed, with dunes of up to 1 m in height and 8 m in length as, for example, in Erratic Valley (Clapperton and Sugden, 1983). Thin layers of peat of up to 10-15 cm in depth are occasionally associated with vegetated areas, and these are the most substantial developments of soil within the Area.

- *Freshwater ecology*

Ablation Valley – Ganymede Heights is an exceptional limnological site that contains a number of lakes, ponds and streams and a generally rich benthic flora. From late December until February running water develops from three main sources: precipitation, glaciers and from melting on George VI Ice Shelf, with run-off generally converging toward the coast (Clapperton and Sugden, 1983). Most of the streams, which are up to several kilometres in length, drain glaciers or permanent snowfields. The principal streams drain into Ablation Lake and Moutonnée Lake, both dammed by the ice shelf. Surveys in the early 1970s recorded these lakes as frozen to 2.0–4.5 m depth year-round, with maximum water depths of around 117 m and 50 m respectively (Heywood, 1977). A stable upper layer of fresh water, down to approximately 60 m and 30 m respectively, overlies increasingly saline waters influenced by interconnection with the ocean beneath the ice shelf and which subjects the lakes to tidal influence (Heywood, 1977). Surface meltwater pools, which in summer form particularly in hollows between lake-ice pressure ridges, flood to higher levels daily and encroach up alluvial fans in the lower valleys (Clapperton and Sugden, 1983).

Some recent observations suggested a decrease in the permanent ice cover of the lakes, for example with about 25% of Moutonnée Lake being free of ice cover in the 1994–95 and 1997–98 summers (Convey and Smith 1997, Convey pers. comm., 1999). However, all three of the main lakes in the Area showed almost complete ice cover in early February 2001 (Harris 2001). Numerous ephemeral, commonly elongated, pools and ponds form laterally along the land/ice shelf margin, varying in length from 10 to 1500 m and up to 200 m wide, with depths ranging from 1 to 6 m (Heywood, 1977; Clapperton and Sugden, 1983). These pools/ponds often rise in level over the melt period, yet on occasion may drain suddenly via sub-ice fissures opening into the ice shelf, leaving former lake shorelines evident in surrounding moraines. The pools/ponds vary widely in their turbidity depending on the presence of suspended glacial sediment. The pools are typically ice-free in summer, while the larger ponds often retain a partial ice cover, and all but the deeper ponds probably freeze solid in winter (Heywood, 1977). Numerous ponds of up to 1 ha and 15 m in depth are present within the valleys, some with moss growth covering extensive areas down to 9 m in depth (Light and Heywood, 1975). The dominant species described were Campylium polygamum and Dicranella, stems of which reached 30 cm in length. Bryum pseudotriquetrum (and possibly a second Bryum species), Distichium capillaceum, and an unidentified species of Dicranella all grew on the benthic substratum at or below 1 m in depth (Smith, 1988). Moss cover was 40-80% in the 0.5-5.0 m depth zone (Light and Heywood, 1975). Much of the remaining area was covered by dense cyanobacterial felts (11 taxa) up to 10 cm thick, dominated by species of Calothrix, Nostoc and Phormidium together with 36 taxa of associated microalgae (Smith, 1988). The extensive growths of moss suggest that these ponds are probably relatively permanent, although their levels may fluctuate from year to year. The water temperature reaches up to c. 7 °C in the deeper ponds and c. 15 °C in the shallower pools in summer, offering a relatively favourable and stable environment for bryophytes. The shallower pools, in which several mosses have been found, may normally be occupied by terrestrial vegetation and flooded for short periods during summer (Smith, 1988). Algae are abundant in slow-moving streams and ephemeral melt runnels, although they do not colonise the unstable beds of fast-flowing streams. For example, large wet areas of level ground in Moutonnée Valley have a particularly rich flora, in places forming over 90% cover, with five species of desmid (which are rare in Antarctica) and the filamentous green Zygnema being abundant, and Nostoc spp. and Phormidium spp. colonising drier, less stable and silted areas (Heywood, 1977).

Protozoa, Rotifera, Tardigrada and Nematoda form a benthic fauna in the pools, ponds and streams (Heywood, 1977). Densities are generally highest in the slow-moving streams. The copepod Boeckella poppei was abundant in lakes, ponds and pools, but absent from streams. The marine fish Trematomus bernacchii was captured in traps laid in Ablation Lake at a depth of 70 m, within the saline water layer (Heywood and Light, 1975, Heywood, 1977). A seal (species unidentified, but probably crabeater (Lobodon carcinophagus) or Weddell (Leptonychotes weddellii)) was reported at the edge of Ablation Lake in mid-December 1996 (Rossaak, 1997), and isolated sightings of solitary seals have also been reported in earlier seasons (Clapperton and Sugden, 1982).

- *Vegetation*

Much of the Ablation Valley – Ganymede Heights area is arid, and overall vegetation abundance is low with a discontinuous distribution. However, complex plant communities exist in seepage areas and along stream margins, which are of particular interest because:

- they occur in an otherwise almost barren landscape;
- the mixed bryophyte and lichen communities are the best-developed and most diverse of any south of 70°S (Smith, 1988; Convey and Smith, 1997);
- some bryophyte taxa are profusely fertile and fruiting at their southern limit – an unusual phenomenon in most Antarctic bryophytes, especially so far south (Smith and Convey, 2002);
- the region represents the southernmost known locality for many taxa; and
- although some of these communities also occur at other sites on southeastern Alexander Island, the Area contains the best and most extensive examples known at this latitude.

The diversity of mosses is particularly high for this latitude, with at least 21 species recorded within the Area, which represents 73% of those known to occur on Alexander Island (Smith, 1997). The lichen flora is also diverse with more than 35 taxa known. Of the macrolichen flora, 12 of the 15 species known to occur on Alexander Island are represented within the Area (Smith, 1997). Ablation, Moutonnée and Striation valleys, and the SE coastal area, contain the most extensive stands of both terrestrial and freshwater vegetation (Smith, 1998; Harris, 2001). Smith (1988, 1997) reported the bryophyte vegetation is generally found in patches of about 10 to 50 m², with some stands up to 625 m², occurring from around 5 m to 40 m altitude on the north and east-facing gentle slopes of the main valleys. Harris (2001) recorded large stands of near-continuous bryophyte vegetation of up to approximately 8000 m² on gentle southeast-facing slopes on the south-eastern coast of the Area, at an elevation of approximately 10 m, close to where the Jupiter Glacier joins George VI Ice Shelf. A continuous stand of approximately 1600 m² was recorded on moist slopes in lower Striation Valley. Several large patches of continuous moss (of up to 1000 m²) were observed on SW/NW-facing eastern slopes of Flatiron Valley, at elevations of 300-400 m. Small discontinuous patches of moss were recorded in this vicinity up to an elevation of 540 m. Mosses were observed on peaks above Ablation Valley at elevations of up to approximately 700 m.

The dominant bryophyte in the wettest areas is frequently the liverwort Cephaloziella varians, which forms a blackish mat of densely interwoven shoots. Although the most southerly record of C. varians has been reported at 77°S from Botany Bay, Cape Geology (ASPA No. 154) in Victoria Land, the extensive mats it forms in the Ablation Valley – Ganymede Heights massif represent the most substantial stands of this species this far south and in the maritime Antarctic. Cyanobacteria, notably Nostoc and Phormidium spp., are usually associated either on the surface of the liverwort or soil, or with moss shoots. Beyond the wettest areas, undulating carpets of pleurocarpous mosses dominated by Campylium polygamum forms the greenest stands of vegetation, with associated Hypnum revolutum. These carpets overlie up to 10-15 cm of peat composed of largely undecomposed moribund moss shoots. Intermixed with these mosses, but often predominating on the drier margins, Bryum pseudotriquetrum grows as isolated cushions that may coalesce to develop a convoluted turf. In these drier, peripheral areas, several other turf-forming bryophytes are often associated with Bryum. Besides the more hydric species already cited, these include the calcicolous taxa Bryoerythrophyllum recurvirostrum, Didymodon brachyphyllus, Distichium capillaceum, Encalypta rhaptocarpa, E. procera, Pohlia cruda, Schistidium antarctici, Tortella fragilis, Syntrichia magellanica, Tortella alpicola, and several unidentified species of Bryum and Schistidium.

A significant characteristic of the vegetation in the Ablation Valley – Ganymede Heights massif is the unusual occurrence of a number of fertile bryophytes. Antarctic bryophytes seldom produce sporophytes, yet Bryum pseudotriquetrum, Distichium capillaceum, Encalypta rhaptocarpa, E. procera and Schistidium spp. have all been recorded in the Area as frequently fertile. Most unusually, small quantities of the moss Bryoerythrophyllum recurvirostre and the liverwort Cephaloziella varians have been observed fruiting in Ablation Valley, which was the first time this had been recorded anywhere in Antarctica (Smith pers comm., cited in Convey, 1995; Smith, 1997; Smith and Convey, 2002); in addition, D. capillaceum has never before been recorded with sporophytes throughout the maritime Antarctic (Smith, 1988). E. procera has only been reported as fertile in one other Antarctic location (on Signy Island, South Orkney Islands; Smith, 1988). Beyond the permanent seepage areas, bryophyte vegetation is extremely sparse and restricted to habitats where there is free water for at least a few weeks during the summer. Such sites occur sporadically on the valley floors, stone stripes on slopes, and also in crevices in north-facing rock faces. Most of the species occurring in the bryophyte patches have also been observed in these habitats, including lichens, most frequently in the shelter of, or even in crevices beneath, larger stones – especially at the margins of patterned ground features. At elevations of over 100 m aridity increases, and at higher altitudes only Schistidium antarctici (at 500 m in Moutonnée Valley) and Tortella fragilis (near the summit of the highest peak south-west of Ablation Valley (775 m) have been recorded. In these drier habitats lichens tend to become more frequent, especially where the substratum is stable. Lichens are widespread and locally abundant on the more stable screes, ridges, and plateau above the valleys, the most predominant species being Usnea sphacelata, giving rock surfaces a black hue. This species is often associated with Pseudephebe minuscula, several crustose lichen species and, rarely, Umbilicaria decussata reaching the highest part of the massif; all but the latter species are also common in Moutonnée Valley. Epiphytic and terricolous lichens, predominantly the white encrusting species Leproloma cacuminum, are often frequent where the marginal bryophyte surface is driest. Other taxa such as Cladonia galindezii, C. pocillum and several crustose lichens are also sometimes present. Various lichens colonise the dry soil and pebbles in these localities, occasionally spreading onto cushions of moss. These include Candelariella vitellina, Physcia caesia, Physconia muscigena, occasional Rhizoplaca melanophthalma, Usnea antarctica, Xanthoria elegans, and several unidentified crustose taxa (especially species of Buellia and Lecidea). An abundance of Physcia and Xanthoria in isolated places suggests nitrogen enrichment deriving from south polar skuas (Stercorarius maccormicki) which nest in the Area (Bentley, 2004). A few ornithocoprophilous lichens occur on occasional boulders used as bird perches. Many of the bryophytes and lichens are at the southern limit of their known distributions and several species are very rare in the Antarctic. Rare moss species within the Area include Bryoerythrophyllum recurvirostrum, Campylium polygamum, Encalypta rhaptocarpa, Tortella alpicola, and Tortella fragilis. Several

Bryum species, Encalypta rhaptocarpa, Schistidium occultum and Schistidium chrysoneurum are all at the southern limit recorded for these species. Of the lichen flora, Ablation Valley is the only known site where Eiglera flavida has been observed in the S. Hemisphere, and Mycobilimbia lobulata and Stereocaulon antarcticum are also rare. Lichen species with furthest-south records are Cladonia galindezii, Cladonia pocillum, Ochrolechia frigida, Phaeorrhiza nimbosa, Physconia muscigena, and Stereocaulon antarcticum.

- *Invertebrates, fungi, bacteria*

The microinvertebrate fauna thus far described is based on ten samples from Ablation Valley, and comprises seven confirmed taxa (Convey and Smith, 1997): two Collembola (Cryptopygus badasa, Friesea topo); one cryptostigmatid mite (Magellozetes antarcticus); and four prostigmatid mites (Eupodes parvus, Nanorchestes nivalis (= N. gressitti), Rhagidia gerlachei and Stereotydeus villosus). A number of specimens collected were earlier reported as Friesea grisea, a widespread maritime Antarctic species. However, specimens of Friesia collected subsequently from Alexander Island (i.e., from 1994 onwards) have been described as a distinct new species, F. topo (Greenslade, 1995), which is itself currently thought to be endemic to Alexander Island. The earlier specimens from Ablation Valley have been re-examined, with all those that remain identifiable being reassigned as F. topo. While the same number of species has been described at one other site on Alexander Island, the samples from Ablation Valley exhibited a mean total microarthropod population density about seven times greater than other sites in the region. Diversity at Ablation Valley was also greater than at several other documented sites on Alexander Island. Both diversity and abundance are considerably less than has been described at sites in Marguerite Bay and further north (Starý and Block, 1998; Convey et al., 1996; Convey and Smith, 1997; Smith, 1996). The most populous species recorded in Ablation Valley was Cryptopygus badasa (96.6% of all arthropods extracted), which was particularly common in moss habitats. Friesea topo was found on stones at low population densities and was virtually absent from the moss habitat, showing these species to have distinct habitat preferences. Ablation Valley is the only site on Alexander Island where the predatory mite R. gerlachei has been described. Very little research has been conducted on fungi in the Area; however, one study reported an unidentified nematode-trapping fungus present in a pond in Ablation Valley (Maslen, 1982). While further sampling is required to describe the terrestrial microfauna more fully, available data support the biological importance of the Area.

- *Breeding birds*

The avifauna of Ablation Valley – Ganymede Heights has not been described in detail. A few pairs of south polar skuas (Stercorarius maccormicki) have been reported as nesting close to some of the moist vegetated sites (Smith, 1988). Snow petrels have been noted as “probably breeding” in the vicinity of Ablation Point (Croxall et al., 1995, referring to Fuchs and Adie, 1949). Bentley (2004) reported direct aerial predation by south polar skuas on snow petrels within the Area. No other bird species has been recorded in the Ablation Valley – Ganymede Heights massif.

- *Human activities and impacts*

Human activity at Ablation Valley – Ganymede Heights has been exclusively related to science. The first visit to the Ablation Valley area was by members of the British Graham Land Expedition in 1936, who collected about 100 fossil specimens from near Ablation Point (Howlett, 1988). The next visits were about a decade later, when basic geological descriptions and further fossil collections were undertaken. More intensive palaeontological investigations were made by British geologists in the 1960s through to the 1980s, with detailed studies of the geomorphology (Clapperton and Sugden, 1983). Limnological investigations were undertaken in the 1970s, with a number of expeditions examining the terrestrial biology being initiated in the 1980s and 1990s. Scientific activities since the millennium have focused on palaeoclimatological research. All known expeditions into the Area have been by British scientists. The impacts of these activities have not been fully described, but are believed to be minor and limited to footprints, aircraft tracks at the Moutonnée Valley terrestrial airstrip (see Section 6(ii)), removal of small quantities of geological and biological samples, markers, abandoned items such as supplies and scientific equipment, and the remains of human wastes.

An abandoned depot, consisting of two oil drums (one empty, one full), three 5 l cans of skidoo oil, one food box and ten glacier poles, was located on the moraine bench adjacent to George VI Ice Shelf, approximately 500 m north of Moutonnée Lake (70°51’19”S; 68°19’05”W). The depot was partially removed in November 2012 and two remaining full fuel drum were removed in November 2013. Various expeditions in the 1970s-80s placed empty fuel drums as route markers through pressure ice from George VI Sound into Ablation Valley, and a large onshore rock is painted yellow SE of Ablation Lake (McAra, 1984; Hodgson, 2001). Nearby is a large cross made from red painted rocks and cairns, with a wooden marker board in the centre. Evidence of campsites close to the shore of Ablation Lake remained in 2012. One site is on the SW shore near a rich area of vegetation, and another is approximately four kilometres east on the SE shore. At both sites circles of stones mark old tent sites, and circular structures have been built with low (0.8 m) stone walls. At the former site a number of pieces of wood (including old markers), an old food box, string and human wastes were observed (Harris, 2001; Hodgson, 2001). Several red-painted rocks were found around the southern and western shores of Ablation Lake in February 2001, and paint fragments were sometimes observed in sediments. In 2000-01 some of the abandoned materials in Ablation Valley were removed: three fuel drums on lake ice, an old food box and some wood and string on the SW shore, and numerous fragments from broken perspex acryllic cloches on the SW shore (nine were deployed in January 1993 – Wynn-Williams, 1993; Rossaak, 1997 – all were destroyed by wind) (Harris, 2001; Hodgson, 2001). In November 2012, metal and rubbish near an old camp with a low stone wall (located at 70°49’58”S; 68°22’16”W) was removed. The painted rocks remain. Snowmobiles have been used on lake and glacier ice, and modified snowmobiles with front wheels were used over gravel terrain in a limited vicinity of the SW shore of Ablation Lake in 1983–84 (McAra, 1984). Some evidence of erosional paths forming on steep scree slopes, presumably a result of field work, was recorded in Moutonnée Valley (Howlett, 1988). Cairns have been built on a number of mountain summits and to mark a number of survey sites throughout the Area.

6(ii) Access to the Area

- Access to the Area shall be by aircraft, vehicle or on foot.
- There are no special restrictions on the points of access to the Area, nor on the overland or air routes used to move to and from the Area. Access overland from George VI Ice Shelf may be difficult because of pressure ice, but is considered to be the most reliable and safe access route for visitors arriving in the vicinity of the Area by fixed-wing aircraft, particularly as some routes into the Area from the glaciers to the west are steep, crevassed and arduous.
- Landing of fixed-wing aircraft within the Area is discouraged. If landings are essential for scientific or management objectives, they are restricted to the ice-covered lakes or to a single terrestrial site immediately west of Moutonnée Lake, provided landings are feasible. Pressure deformation of the ice surface of lakes, meltwater and thinning ice-cover may make landing on lake ice impractical later in the summer. Landings at Ablation Lake and the terrestrial site west of Moutonnée Lake were carried out in November 2000. The terrestrial landing site (Map 3) is oriented E–W and consists of approximately 350 m of gently sloping coarse gravel on ground raised approximately 2 m above the surrounding valley. Some red-painted stones mark the western (upper) end in the form of an arrow. Tyre-impressions are evident in the gravel. Due to the poor state of the surface and a risk of damage to the aircraft, use of the terrestrial site west of Moutonnée Lake is not recommended.
- Should helicopter access prove feasible, specific landing sites have not been designated but landings are prohibited within 200 m of lake shores, or within 100 m of any vegetated or moist ground, or in stream beds.
- Access is also possible by aircraft to upper Jupiter Glacier (550 m), immediately west of Ablation Valley and outside of the Area, from where access may be made into the Area overland on foot.
- Pilots, air crew, or other people arriving by aircraft, are prohibited from moving on foot beyond the immediate vicinity of any landing site within the Area unless specifically authorised by Permit.

6(iii) Location of structures within and adjacent to the Area

There are no structures known to be present in the Area. A number of cairns have been installed as survey markers throughout the Area (Perkins, 1995; Harris, 2001) and some low walls have been erected at campsites. Nine plastic bright red reflector markers (30 cm high, held down by rocks) were put in place to mark the airstrip in Moutonnée Valley, but these were removed in November 2012. The nearest structure to the Area appears to be an abandoned caboose at Spartan Cwm, approximately 20 km south of the Area. A summer-only scientific camp facility exists at Fossil Bluff (UK), approximately 60 km to the south on the eastern coast of Alexander Island.

The nearest permanently occupied scientific research stations are in Marguerite Bay (General San Martín (Argentina) and Rothera Research Station (UK)), approximately 350 km to the north (Map 2).

6(iv) Location of other protected Areas in the vicinity

There are no other protected areas in the immediate vicinity of the Area. The nearest protected area to Ablation Valley – Ganymede Heights is ASPA No. 170 Marion Nunataks, Charcot Island, Antarctic Peninsula, approximately 270 km to the east of Alexander Island (Map 2).

6(v) Special zones within the Area

There are no special zones within the Area.

7. Permit conditions

7(i) General 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 compelling scientific reasons which cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental or scientific values of the Area;
- the Permit shall be issued for a finite period;
- the Permit, or an authorised copy, shall be carried when in the Area.

7(ii) Access to, and movement within or over, the Area

- Movement by vehicle within the Area shall be restricted to snow or ice surfaces.
- Movement over land within the Area shall be on foot.
- All movement should be undertaken carefully so as to minimise disturbance to the soil, vegetated surfaces and sensitive geomorphological features such as dunes, walking on snow or rocky terrain if practical. If practical, visitors should avoid walking in stream or dry lake beds, or on moist ground, to avoid disturbance to the hydrology and/or damage to sensitive plant communities.

Care should be taken even when moisture is not obviously present, as inconspicuous plants may still colonise the ground.

- Pedestrian traffic should be kept to the minimum necessary to undertake permitted activities and every reasonable effort should be made to minimise trampling effects.
- The operation of aircraft over the Areas should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the operations of aircraft near concentrations of birds' contained in Resolution 2 (2004).
- Operation of RPAS within or over the Area shall be in accordance with the 'Environmental guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica' (Resolution 4 (2018)) (available at: https://documents.ats.aq/recatt/att645_e.pdf).

7(iii) Activities which may be conducted within the Area,

Activities which may be conducted in the Area include:

- essential management activities, including monitoring;
- compelling scientific research that cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area; and
- sampling, which should be the minimum required for approved research programmes.

Diving in lakes within the Area is normally prohibited unless it is necessary for compelling scientific purposes. If diving is undertaken, great care should be taken to avoid disturbance of the water column and of sensitive sediments and biological communities. The sensitivity of the water column, sediments and biological communities to disruption by diving activities shall be taken into account before Permits are granted for these purposes.

7(iv) Installation, modification or removal of structures

- Permanent structures or installations are prohibited.
- No structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit.
- All markers, structures or scientific equipment installed in the Area must be clearly identified by country, name of the principal investigator or agency, year of installation and date of expected removal.
- All such items should be free of organisms, propagules (e.g., seeds, eggs, spores) and non-sterile soil (see section 7(vi)), and be made of materials that can withstand the environmental condition and pose minimal risk of contamination of the Area.
- Removal of specific structures or 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(v) Location of field camps

When necessary for purposes specified in the Permit, temporary camping is allowed within the Area. One camp site has been designated within the Area: it is located on the north-western (upper) end of the airstrip in Moutonnée Valley (70°51’48"S, 68°21’39"W) (Map 3). The site is not marked, although tents should be erected as close as practicable to the marker on the north-western end of the airstrip. This site should be used by preference when working in this vicinity. Other specific camp site locations have not, as yet, been designated, although camping is prohibited on sites where significant vegetation is present. Camps should be located as far as practicable (preferably at least 200 m) from lakeshores and avoid dry lake or stream beds (which may host an inconspicuous biota). By preference and where practical, camps should be located on snow or ice surfaces. Previously existing campsites should be re-used where possible, except where the above guidelines suggest these were inappropriately located.

7(vi) Restrictions on materials and organisms which may be brought into the Area

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To ensure that ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. Further guidance can be found in the CEP Non-native species manual (Resolution 4 (2016)) and the SCAR Environmental code of conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018)). In view of the possible presence of breeding bird colonies within the Area, no poultry products, including wastes from such products and products containing uncooked dried eggs, 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. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided. Fuel or other chemicals shall not be stored in the Area unless specifically authorised by Permit condition. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period. 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. The appropriate authority should be notified of anything released and not removed that was not included in the authorised Permit.

7(vii) Taking of, or harmful interference with, native flora or fauna

Taking of, or harmful interference with, native flora and fauna is prohibited, except in accordance with a permit issued in accordance with Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved this should, as a minimum standard, be in accordance with the SCAR code of conduct for the use of animals for scientific purposes in Antarctica (Resolution 4 (2019)). Any soil or vegetation sampling is to be kept to an absolute minimum required for scientific or management purposes, and carried out using techniques which minimise disturbance to surrounding soil, ice structures and biota.

7(viii) The collection or removal of materials 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, and which was not brought into the Area by the Permit holder or otherwise authorised may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ: if this is the case the appropriate national authority must be notified and approval obtained.

7(ix) Disposal of waste

All wastes except human liquid and domestic liquid wastes, shall be removed from the Area. Human liquid and domestic liquid wastes may be disposed of within the Area down ice cracks along the margin of George VI Ice Shelf or Jupiter Glacier, or by burying in moraine along the ice margin in these localities as close as practical to the ice. Disposal of human liquid and domestic liquid wastes in this manner shall be more than 200 m from, and avoiding the catchments of, the main lakes in Ablation, Moutonnée or Flatiron valleys, or shall otherwise be removed from the Area. Human solid waste shall be removed from the Area.

7(x) Measures that may be necessary to continue to met the aims of the Management Plan

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis or to carry out protective measures.
- Any long-term monitoring sites shall be appropriately marked, and the markers or signs maintained.
- Scientific activities shall be performed in accordance with the SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)). Geological research shall be undertaken in accordance with the SCAR Environmental Code of Conduct for Geosciences Field Research Activities in Antarctica (Resolution 1 (2021)).

7(xi) Requirements for reports

The principal Permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the Antarctic Specially Protected Area visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Appendix 2). Wherever possible, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

8. Supporting documentation

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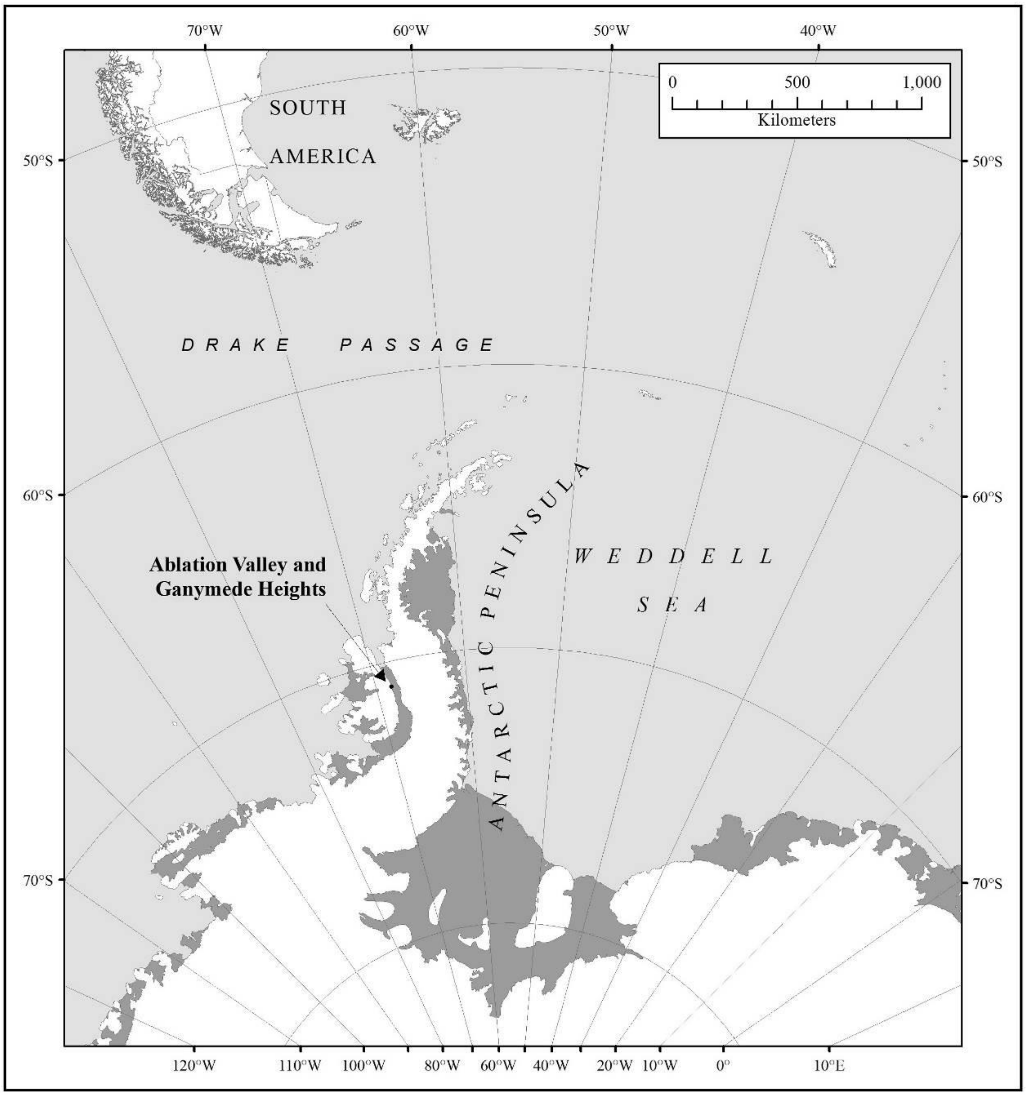
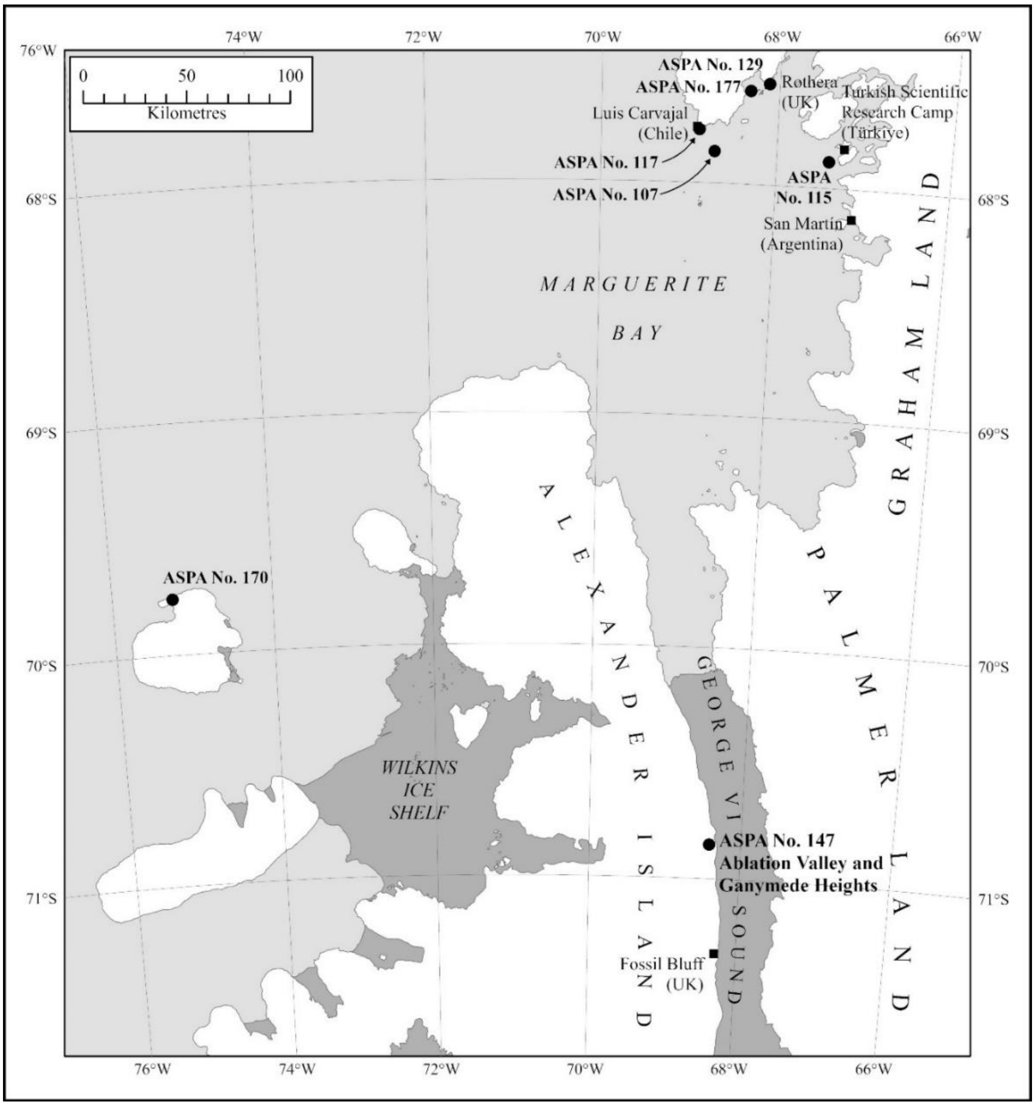
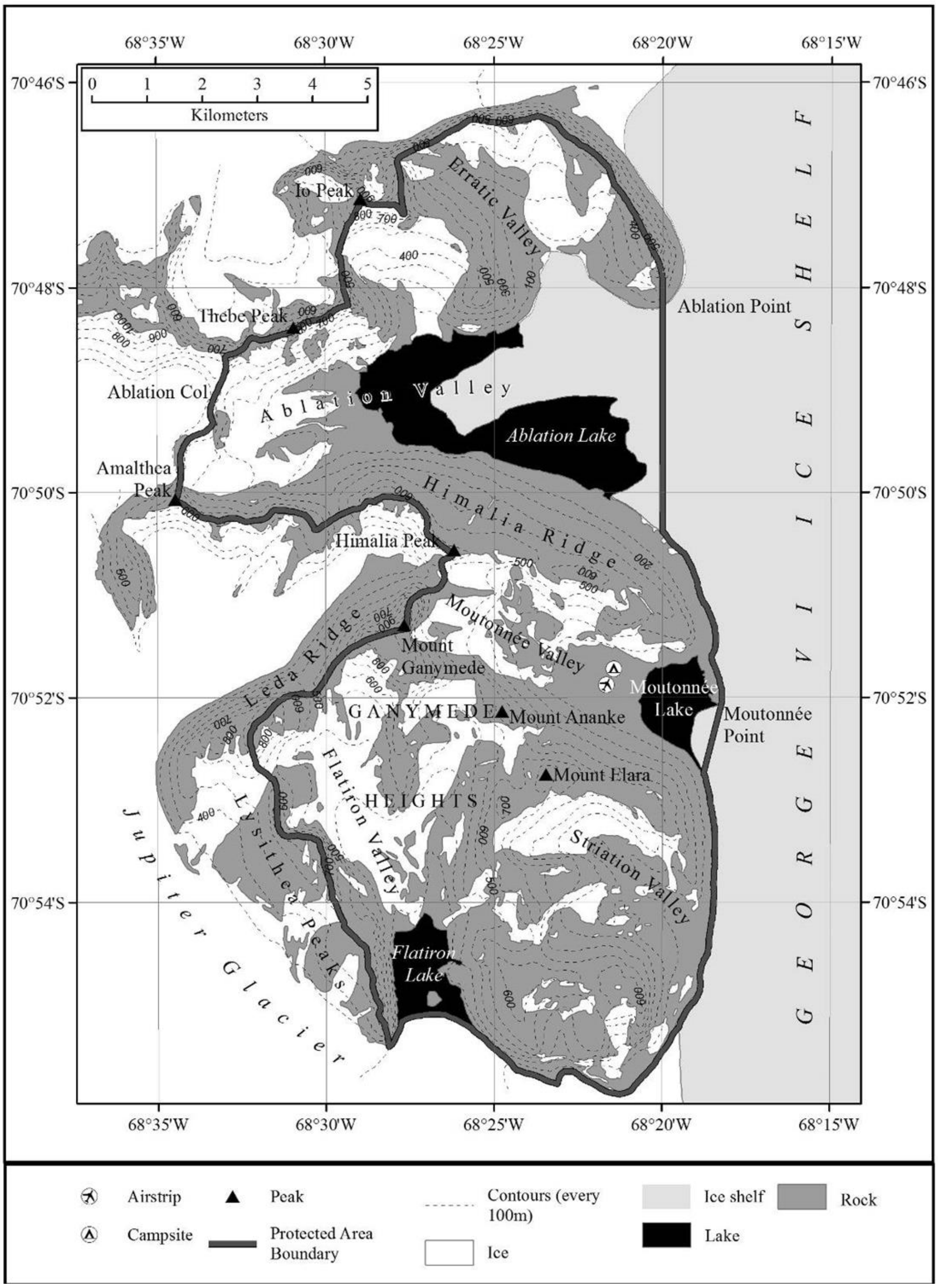
Map 1. Location of Ablation Valley and Ganymede Heights on the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central Meridian -55°, Standard Parallel: -71°.



Map 2. ASPA No. 147, Ablation Valley and Ganymede Heights, location map. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -71°, Standard Parallel: -71°.



Map 3. ASPA No. 147, Ablation Valley and Ganymede Heights, topographic sketch map. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -68.4°, Standard Parallel: -71.0°.



Annex 1.

Boundary coordinates for ASPA No. 147, Ablation Valley and Ganymede Heights, Alexander Island. In large part, the boundary follows natural features, and a detailed description is found in Section 6(i). In the table below, the boundary coordinates are numbered, with number 1 the most northerly co-ordinate and further coordinates numbered sequentially in a clockwise direction around the Area boundary.

Number	Latitude	Longitude
1	70°46’26”S	68°24’01”W
2	70°46’28”S	68°25’48”W
3	70°46’55”S	68°28’27”W
4	70°47’13”S	68°28’15”W
5	70°47’12”S	68°29’33”W
6	70°48’02”S	68°29’58”W
7	70°48’23”S	68°32’55”W
8	70°49’44”S	68°34’38”W
9	70°50’06”S	68°31’13”W
10	70°49’56”S	68°28’52”W
11	70°50’19”S	68°26’51”W
12	70°51’17”S	68°28’19”W
13	70°52’09”S	68°31’59”W
14	70°53’02”S	68°31’06”W
15	70°53’03”S	68°29’59”W
16	70°55’03”S	68°27’58”W
17	70°54’53”S	68°27’40”W
18	70°55’36”S	68°23’26”W
19	70°55’41”S	68°21’30”W
20	70°54’43”S	68°19’11”W
21	70°52’44”S	68°19’03”W
22	70°52’04”S	68°18’25”W
23	70°51’17”S	68°18’41”W
24	70°50’18”S	68°20’27”W
25	70°48’08”S	68°20’44”W
26	70°47’38”S	68°21’23”W
27	70°46’55”S	68°22’16”W

Measure 12 (2023)

Antarctic Specially Protected Area No 149 (Cape Shirreff and San Telmo Island, Livingston Island, South Shetland Islands): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation IV-11 (1966), which designated Cape Shirreff, Livingston Island, South Shetland Islands as Specially Protected Area ("SPA") No 11;
- Recommendation XV-7 (1989), which terminated SPA 11 and redesignated the Area as Site of Special Scientific Interest ("SSSI") No 32 and annexed a Management Plan for the Site;
- Resolution 3 (1996) and Measure 2 (2000), which extended the expiry date of SSSI 32;
- Decision 1 (2002), which renamed and renumbered SSSI 32 as ASPA 149;
- Measures 2 (2005), 7 (2011), 7 (2016) and 16 (2022), which adopted revised Management Plans for ASPA 149;

Recalling that Recommendation XV-7 (1989) and Measure 2 (2000) did not become effective, and that Measure 2 (2000) was withdrawn by Measure 5 (2009);

Recalling that Recommendation XV-7 (1989) and Resolution 3 (1996) were designated as no longer current by Decision 1 (2011);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 149;

Desiring to replace the existing Management Plan for ASPA 149 with the revised Management Plan;

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

1. the revised Management Plan for Antarctic Specially Protected Area No 149 (Cape Shirreff and San Telmo Island, Livingston Island, South Shetland Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 149 annexed to Measure 16 (2022) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 149

CAPE SHIRREFF AND SAN TELMO ISLAND, LIVINGSTON ISLAND, SOUTH SHETLAND ISLANDS

Introduction

The Cape Shirreff Antarctic Specially Protected Area (ASPA) is situated on the northern coast of Livingston Island, South Shetland Islands, at 62°27'30"S, 60°47'17"W, and is approximately 9.7 km² in area. The primary reason for designation of the Area is to protect the biota present within the Area, in particular the large and diverse seabird and pinniped populations which are the subject of long-term scientific research and monitoring. Krill fishing is carried out within the foraging range of these species. Cape Shirreff is thus a key site for ecosystem monitoring, which helps to meet the objectives of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). The Area contains the largest Antarctic fur seal (Arctocephalus gazella) breeding colony in the Antarctic Peninsula region and is the most southerly colony where fur seal reproduction, demography and diet can be monitored. Palynoflora discovered within the Area are of significant scientific interest. The Area also contains numerous items of historical and archaeological value, mostly associated with sealing activities in the 19th Century. The Area was originally designated following proposals by Chile and the United States of America and adopted through Recommendation IV-11 [1966, Specially Protected Area (SPA) No. 11]. The Area was re-designated as Site of Special Scientific Interest (SSSI) No. 32 through Recommendation XV-7 (1989). The Area was designated as CCAMLR Ecosystem Monitoring Program (CEMP) Site No. 2 through CCAMLR Conservation Measure 82/XIII (1994); protection was continued by Conservation Measure (CM) 91/02 (2004) and boundaries were extended through Measure 2 (2005) to include a larger marine component and to incorporate plant fossil sites. Conservation Measure 91-02 was lapsed in November 2009 and protection of Cape Shirreff continues as ASPA No. 149 (SC-CCAMLR-XXVIII, Annex 4, para 5.29). The Management Plan was revised through Measure 7 (2011) and Measure 7 (2016).

The Area lies within 'Environment E – Antarctic Peninsula, Alexander and other islands and 'Environment G – Antarctic Peninsula offshore islands, as defined in the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)). Under the Antarctic Conservation Biogeographic Regions classification (Resolution 3 (2017)) the Area lies within ACBR3 – Northwest Antarctic Peninsula.

1. Description of values to be protected

Cape Shirreff (62°27'30"S, 60°47'17"W, a peninsula of approximately 3.1 km²), Livingston Island, South Shetland Islands, was originally designated as Specially Protected Area (SPA) No. 11 through Recommendation IV-11 (1966). In the light of results from the first complete census of Pinnipedia carried out in the South Shetland Islands (Aguayo & Torres 1966), Chile considered special protection for the site was needed. Formal proposal of the SPA was made by the United States (U.S.). The Area included the ice-free ground of the Cape Shirreff peninsula north of the Livingston Island ice cap margin. Values protected under the original designation included the diversity of plant and animal life, many invertebrates, a substantial population of southern elephant seals (Mirounga leonina) and a small colony of Antarctic fur seals (Arctocephalus gazella).

Following designation, the size of the Cape Shirreff Antarctic fur seal colony increased to a level at which biological research could be undertaken without threatening continued colony growth. A survey of the South Shetland Islands and the Antarctic Peninsula identified Cape Shirreff – San Telmo Island as the most suitable site to monitor Antarctic fur seal colonies potentially affected by fisheries around the South Shetland Islands. In order to accommodate the monitoring program, the SPA was redesignated as Site of Special Scientific Interest (SSSI) No. 32 through Recommendation XV-7 (1989) following a joint proposal by Chile, the United Kingdom and the United States. Designation was on the grounds that the "presence of both Antarctic fur seal and penguin colonies, and of krill fisheries within the foraging ranges of these species, make this a critical site for inclusion in the ecosystem monitoring network being established to help meet the objectives of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). The purpose of the designation is to allow planned research and monitoring to proceed, while avoiding or reducing, to the greatest extent possible, other activities which could interfere with or affect the results of the research and monitoring program or alter the natural features of the Site". The boundaries were enlarged to include San Telmo Island and associated nearby islets. Following a proposal prepared by Chile and the United States, the Area was subsequently designated as CCAMLR Ecosystem Monitoring Program (CEMP) Site No. 2 through CCAMLR Conservation Measure 82/XIII (1994), with boundaries identical to SSSI No. 32. Protection of Cape Shirreff as a CCAMLR Ecosystem Monitoring Program (CEMP) was continued by Conservation Measure (CM) 91/02 (2004).

The boundaries of the Area were further enlarged through Measure 2 (2005) to include a larger marine component and to incorporate two new sites where plant fossils were discovered in 2001 (Map 3). The designated Area (9.7 km²) comprises the entire Cape Shirreff peninsula north of the Livingston Island permanent ice cap, the adjacent part of the Livingston Island permanent ice cap where the fossil discoveries were made in 2001, the San Telmo Island group, and the surrounding and intervening marine area enclosed within 100 m of the coast of the Cape Shirreff peninsula and of the outer islets of the San Telmo Island group. The boundary extends from the San Telmo Island group to the south of Mercury Bluff.

Conservation Measure 91-02 lapsed in November 2009, with the protection of Cape Shirreff continuing under the Management Plan for ASPA No. 149 (SC-CCAMLR-XXVIII, Annex 4, para 5.29). The change was made with the aim of harmonizing protection under both CCAMLR and the Protocol on Environmental Protection to the Antarctic Treaty (The Protocol) and to eliminate any potential duplication in management requirements and procedures.

The current Management Plan reaffirms the exceptional scientific and monitoring values associated with the large and diverse populations of seabirds and pinnipeds which breed within the Area, and in particular those of the Antarctic fur seal colony. The Antarctic fur seal colony is the largest in the Antarctic Peninsula region and is the most southerly that is large enough to study growth, survival, diet, and reproduction parameters. The last complete census of Cape Shirreff and San Telmo Island estimated the total population at 5,727 individuals (Krause & Hinke 2021). Monitoring of the Antarctic fur seal colony began in 1965 (Aguayo and Torres 1966, 1967) and seasonal data are available from 1991, making this one of the longest continuous Antarctic fur seal monitoring programs. As part of the CCAMLR Ecosystem Monitoring Program (CEMP), monitoring was established to detect and avoid possible adverse effects of fisheries on dependant species such as pinnipeds and seabirds, as well as target species such as Antarctic krill (Euphausia superba). Long-term studies are assessing and monitoring the survival, feeding ecology, growth, condition, reproduction, behavior, vital rates, abundance, and population genetics of pinnipeds and seabirds that breed within the Area. Data from these studies will be evaluated in context with environmental and other biological data and fisheries statistics to help identify possible cause-effect relationships between fisheries and pinniped and seabird populations.

In 2001/02 imprints of megaflora were discovered in rocks incorporated within moraines of the Livingston Island glacier (Palma-Heldt et al. 2004; 2007) (Map 2). The fossiliferous rocks were found to contain two distinct palynological assemblages, indicative of different time periods and climatic conditions, and formed part of a study into the geological history of Antarctica and Gondwana. Studies of microbial research were carried out within the Area in 2009/10, to assess the influence of microhabitats on microbial diversity and metabolic capacity (INACH 2010).

The original values of the area considered for special protection, including floral and faunal communities, all remain present at Cape Shirreff. Regular research and monitoring has focused largely on the land-breeding vertebrate community. However, future research to assess extant floral and invertebrate communities would provide a welcome update on the state of these specially protected values.

The Area contains a number of pre-1958 human artifacts. Historic Site & Monument (HSM) No.59, a rock cairn commemorating those who died when the Spanish ship San Telmo sank in the Drake Passage in 1819, lies within the Area. The wreck of the San Telmo, the last position of which was recorded near Livingston Island, is recognized as HSM No.95 (Measure 2 (2021)). Remnants of a 19th Century sealing community also can be found within the Area. A human skull and two femurs, possibly associated with historic sealing activities, were collected at Yamana Beach (Torres 1992; Contantinsecu & Torres 1995; Torres 1999).

2. Aims and objectives

Management at Cape Shirreff aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human presence, disturbance and sampling within the Area;
- avoid activities that would harm or interfere with CEMP research and monitoring activities;
- allow scientific research associated with the CEMP on the ecosystem and physical environment in the Area;
- allow other scientific research within 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;
- allow archaeological and historical research and measures for artifact protection, while protecting the historic artifacts present within the Area from unnecessary destruction, disturbance, or removal;
- minimize the possibility of introduction of alien plants, animals and microbes to the Area;
- minimize the possibility of the introduction of pathogens that may cause disease in faunal populations within the Area; and
- 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:

- Notices showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently at the following locations, where copies of this Management Plan and maps of the Area shall also be made available:
  - Guillermo Mann (Chile) and Cape Shirreff Field Camp (United States), Cape Shirreff, Livingston Island;
  - Saint Kliment Ohridski Station (Bulgaria), Hurd Peninsula, Livingston Island;
  - Arturo Prat Station (Chile), Discovery Bay/Chile Bay, Greenwich Island;
  - Base Juan Carlos I (Spain), Hurd Peninsula, Livingston Island;
  - Julio Escudero Station (Chile), Fildes Peninsula, King George Island; and
  - Eduardo Frei Station (Chile), Fildes Peninsula, King George Island.
- A sign showing the location and boundaries of the Area with clear statements of entry restrictions should be placed at Módulo Beach, Cape Shirreff, to help avoid inadvertent entry;
- Copies of this Management Plan shall be made available to all vessels and aircraft visiting the Area, and the appropriate national authority shall inform all personnel operating in the vicinity of, accessing or flying over the Area, of the location, boundaries and restrictions applying to entry and overflight within the Area;

- National programs shall take steps to ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- Markers, signs or other structures should not be installed within the Area except for essential scientific or management purposes. If installed, they shall be recorded, secured and maintained in good condition and removed when no longer required by the responsible National Antarctic program;
- 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 for the purpose of ensuring that the above provisions are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: ASPA No. 149 Cape Shirreff and San Telmo Island: regional overview. Map specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 62°00'S; 2nd 63°00'S; Central Meridian: 60°45'W; Latitude of Origin: 62°00'S; Spheroid: WGS84; Horizontal accuracy: < ±100 m. Bathymetric contour interval 50 m and 200 m; vertical accuracy unknown. Data sources: land features from SCAR Antarctic Digital Database v7.2 (2020); bathymetry supplied by the U.S. Antarctic Marine Living Resources (U.S. AMLR) Program, NOAA (2002) and IBCSO (v1.0 2013) (http://ibcso.org).
Inset: location of Map 1 in relation to the South Shetland Islands and the Antarctic Peninsula.

Map 2: ASPA No. 149 Cape Shirreff and San Telmo Island: access. Map specifications as per Map 1, except the vertical contour interval is 20 m and the horizontal accuracy is expected to be greater than ±5 m. Data source: from digital data supplied by Instituto Antártico Chileno (INACH) (2002) (Torres et al. 2001), except small boat landing sites supplied by M. Goebel (Dec 2015).

Map 3: ASPA No. 149 Cape Shirreff and San Telmo Island: wildlife and human features. Map specifications and data sources as per Map 2 with the exception of the vertical contour interval, which is 5 m. Seal tracking station and HSM: D. Krause (2021). Walking routes and fauna: INACH, updated by M. Goebel and D. Krause (Dec 2015).

6. Description of the Area

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

- *Overview*

Cape Shirreff (62°27'30"S 60°47'17"W) is situated on the northern coast of Livingston Island, the second largest of the South Shetland Islands, between Barclay Bay and Hero Bay (Map 1). The cape lies at the northern extremity of an ice-free peninsula of low-lying, hilly relief. To the west of the peninsula lies Shirreff Cove, to the east Black Point, and to the south lies the permanent ice cap of Livingston Island. The peninsula has an area of approximately 3.1 km², being 2.6 km from north to south and ranging from 0.5 to 1.5 km from east to west. The interior of the peninsula comprises a series of raised beaches and both rounded and steep-sided hills, rising to a high point at Toqui Hill (82 m) in the central northern part of the peninsula. The western coast is formed by almost continuous cliffs 10 to 15 m high, while the eastern coast has extensive sand and gravel beaches.

A small group of low-lying, rocky islets lie approximately 1200 m west of the Cape Shirreff peninsula, forming the western enclosure of Shirreff Cove. San Telmo Island, the largest of the group, is 950 m in length, up to 200 m in width, and of approximately 0.1 km² in area. There is a sand and pebble beach on the southeastern coast of San Telmo Island, separated from a sand beach to the north by two irregular cliffs and narrow pebble beaches.

- *Boundaries and coordinates*

The designated Area comprises the entire Cape Shirreff peninsula north of the permanent Livingston Island ice cap, the San Telmo Island group, and the surrounding and intervening marine area (Map 2). The marine boundary encloses an area that extends 100 m from, and parallel to, the outer coastline of the Cape Shirreff peninsula and the San Telmo Island group. In the north, the marine boundary extends from the northwestern extremity of the Cape Shirreff peninsula to the southwest for 1.4 km to the San Telmo Island group, enclosing the intervening sea within Shirreff Cove. The western boundary extends southwards for 1.8 km from 62°28'S to a small island near 62°29'S, passing around the western shore of this small island and proceeding a further 1.2 km south-east to the shore of Livingston Island at 62°29'30"S, which is approximately 300 m south of Mercury Bluff. From this point on the coast, the southern boundary extends approximately 300 m due east to 60°49'W, from where it proceeds in a northeasterly direction parallel to the coast for approximately 2 km to the ice sheet margin at 60°47'W. The southern boundary then extends due east for 600 m to the eastern coast. The eastern boundary is marine, following the eastern coastline 100 m from the shore. The boundary encompasses an area of 9.7 km² (Map 2).

- *Climate*

Meteorological records for Cape Shirreff have been collected for a number of years by Chilean and U.S. scientists and are currently recorded by instruments mounted on the Cape Shirreff Field Camp buildings. During recent summer seasons (Nov – Feb inclusive, 2005/06 to 2009/10) the mean air temperature recorded at Cape Shirreff was 1.84ºC (U.S. AMLR Program data, 2005-2010). The maximum air temperature recorded during this period was 19.9ºC and the minimum was -8.1ºC. Wind speed averaged 5.36 m/s and the maximum recorded wind speed reached 20.1 m/s. Wind direction over the data collection period was predominantly from the west, followed by WNW and ENE. Meteorological data are available for two recent winters, with mean daily temperature for Jun-Aug 2007 of -6.7ºC with a minimum of -20.6ºC and a maximum of +0.9ºC, and a mean daily temperature for Jun-Sep 2009 of -5.8ºC with a minimum of -15.2ºC and a maximum of +1.9ºC.

- *Geology, geomorphology and soils*

Cape Shirreff is composed of porphyritic basaltic lavas and minor volcanic breccias of approximately 450 m in thickness (Smellie et al. 1996). The rocks at Cape Shirreff are deformed into open folds, which trend in a NW-SE direction, and subvertical axial surfaces that are intruded by numerous dykes. A rock sample obtained from the southern side of Cape Shirreff was identified as fresh olivine basalt and was composed of approximately 4% olivine and 10% plagioclase phenocrysts in a groundmass of plagioclase, clinopyroxene and opaque oxide. Rock samples at Cape Shirreff have been K-Ar dated as of late Cretaceous age with a minimum age of 90.2± 5.6 million years old (Smellie et al. 1996). The volcanic sequences at Cape Shirreff form part of a broader group of relatively fresh basalt and andesite lavas covering eastern-central Livingston Island that are similar to basalts found on Byers Peninsula.

The Cape Shirreff peninsula is predominantly a raised marine platform, 46 to 53 m above sea level, (Bonner & Smith 1985). The bedrock is largely covered by weathered rock and glacial deposits. Two lower platforms, covered with rounded water-worn pebbles, occur at elevations of approximately 7-9 m and 12-15 m above Mean Sea Level (MSL) (Hobbs 1968).

There is little information on the soils of Cape Shirreff. They are mainly fine, highly porous, ash and scoria. The soils support a sparse vegetation and are enriched by bird and seal colonies which inhabit the Area.

- *Paleontology*

A fossilized wood specimen belonging to the Araucariaceae family (Araucarioxylon sp.) was recorded from Cape Shirreff (Torres 1993). It is similar to fossils found at Byers Peninsula (ASPA No. 126), a site with rich fossil flora and fauna 20 km to the southwest. Several fossil specimens have also been found at the northern extremity of the Cape Shirreff peninsula. In 2001/02 fossiliferous rocks of two different ages were discovered incorporated within frontal and lateral moraines of the Livingston Island permanent ice cap (Map 3). Study of the palynomorphs found within the moraines identified two distinct palynological assemblages, arbitrarily named ‘Type A’ and ‘B’ (Palma-Held et al. 2004, 2007). The ‘Type A’ association was dominated by Pteridophyta, mainly Cyatheaceae and Gleicheniaceae, and by Podocarpidites spp. and also contained Myrtaceidites eugenioides and epiphyllous fungal spores. The assemblage is believed to be indicative of warm and humid conditions of Early Cretaceous in age (Palma-Heldt et al. 2007). The ‘Type B’ assemblage was characterized by a subantarctic flora with Nothofagidites, Araucariacites australis, Podocarpidites otagoensis, P. marwickii, Proteacidites parvus and also epiphyllous fungal spores, which indicate a cold and humid temperate climate (Palma-Heldt et al. 2007). The age of the assemblage is estimated to be Late Cretaceous-Paleogene (Palma-Heldt et al. 2004; Leppe et al. 2003). Palynological investigations were undertaken at Cape Shirreff in order to investigate the evolution of the southern Pacific margin of Gondwana and to develop a model of the Mesozoic-Cenozoic evolution of the Antarctic Peninsula. It has been noted that other fossils may be revealed by further recession of the Livingston Island permanent ice cap (D. Torres, A. Aguayo and J. Acevedo, pers. comm. 2010).

- *Streams and lakes*

There is one permanent lake ('Lago Oculto') on Cape Shirreff, located north and at the base of Toqui Hill (Map 3). The lake is ~2-3 m deep and 12 m long at full capacity, diminishing in size after February (Torres 1995). Moss banks grow on surrounding slopes. There are also several ephemeral ponds and streams on the peninsula, fed by snow-melt, especially in January and February. The largest of the streams is found draining southwestern slopes toward the coast at Yamana Beach.

- *Vegetation and invertebrates*

Although a comprehensive survey of the vegetation communities at Cape Shirreff has not been undertaken, Cape Shirreff appears to be less well vegetated than many other sites in the South Shetland Islands. Observations to date have recorded one grass, five species of moss, six of lichen, one fungi and one nitrophilous macroalgae (Torres 1995).

Patches of Antarctic hairgrass (Deschampsia antarctica) can be found in some valleys, often growing with mosses. Mosses are predominantly found inland from the coast. In a valley running northwest from Half Moon Beach, there is a moderately well-developed wet moss carpet of Warnstorfia laculosa (=Calliergidium austro-stramineum, also =Calliergon sarmentosum) (Bonner 1989, in Heap 1994). In areas with better drainage, Sanionia uncinata (=Drepanocladus uncinatus) and Polytrichastrum alpinum (=Polytrichum alpinum) are found. The raised beach areas and some higher plateaus have extensive stands of the foliose nitrophilous macroalga Prasiola crispa, which is characteristic of areas enriched by animal excreta and has been observed to replace moss-lichen associations damaged by fur seals (Bonner 1989, in Heap 1994).

The six lichen species thus far described at Cape Shirreff are Caloplaca spp, Umbilicaria antarctica, Usnea antarctica, U. fasciata, Xanthoria candelaria and X. elegans. The fruticose species Umbilicaria antarctica, Usnea antarctica and U. fasciata form dense growths on cliff faces and on the tops of steep rocks (Bonner 1989, in Heap 1994). The bright yellow and orange crustose lichens Caloplaca spp, Xanthoria candelaria and X. elegans are common beneath bird colonies and are also present with the fruticose species. The identity of the single recorded fungal species is unknown.

The invertebrate fauna at Cape Shirreff has not been described.

- *Microbial ecology*

Field studies of the microbial ecology at Cape Shirreff were carried out 11-21 January 2010 and results were compared with the bacterial communities present at Fildes Peninsula, King George Island. The study aimed to evaluate the influence of the different microhabitats on the biodiversity and metabolic capacities of bacterial communities found at Cape Shirreff and Fildes Peninsula (INACH, 2010).

- *Breeding birds*

The avifauna of Cape Shirreff is diverse, with ten species known to breed within the Area, and several non-breeding species present. Chinstrap (Pygoscelis antarcticus) and gentoo (P. papua) penguins breed within the Area; Adélie penguins (P. adeliae) have not been observed to breed on Cape Shirreff or San Telmo Island, although are widely distributed throughout the region. Both chinstrap and gentoo penguins are found in small colonies on the northeastern and northwestern coasts of Cape Shirreff peninsula (Map 3). Data have been collected on the chinstrap and gentoo penguin colonies every summer season since 1996/97, including reproductive success, demography, diet, foraging and diving behaviour (e.g. Hinke et al. 2007; Polito et al. 2015). Chinstrap and gentoo penguins at Cape Shirreff have been tagged with telemetry devices episodically since 2005 to study their over-winter behaviours (e.g, Hinke & Trivelpiece 2011, Hinke et al. 2015, Hinke et al. 2017).

Data available on penguin numbers are presented in Table 1 (see Section 8). In 2019/20 there were 17 active breeding sub-colonies at Cape Shirreff, with a total of 708 gentoo and 2179 chinstrap penguin nests (U.S. AMLR unpublished data). Since regular census work started in 1997/98, the numbers of chinstrap penguins at Cape Shirreff have declined by 71.5%, whilst gentoo abundance has declined by 12.5% (Table 1 (Section 8)). The differing magnitude in trends in chinstrap and gentoo populations at Cape Shirreff have been attributed to the higher winter juvenile mortality rate experienced by chinstrap penguins (Hinke et al. 2007) and a greater flexibility in feeding patterns exhibited by gentoo penguins (Miller et al. 2009).

In general, the chinstrap penguins nest on higher escarpments at Cape Shirreff, although they are also found breeding on small promontories near the shore. Gentoo penguins tend to breed on more gentle slopes and rounded promontories. During the period of chick rearing, foraging by both species of penguin is confined to the shelf region, approximately 20 to 30km offshore from Cape Shirreff (Miller & Trivelpiece 2007). Research on the use of unmanned aerial systems to aid in estimating penguin abundance and colony distribution, initiated in 2010/11 (Goebel et al. 2015), remains under development.

Several other species breed within the Area (Map 3), although data on numbers are patchy. Kelp gulls (Larus dominicanus) and brown skuas (Catharacta antarctica) nest in abundance along the entire coastline of the Area. Kelp gull census work began in

2000/01 and data indicate stable chick production, averaging 29 ± 14 (sd) chicks per year (U.S. AMLR, unpublished data). The number of breeding pairs of brown skuas has nearly doubled from 16 in 1997/98 to 29 in 2019/20 (U.S. AMLR, unpublished data). Over that time, average annual reproductive success of brown skuas has averaged 0.54 ± 0.25 (sd) fledglings/pair but exhibits a negative trend (U.S. AMLR, unpublished data).

Historically, sheathbills (Chionis alba) nested in two places: one pair was recorded nesting on the western coast of the Cape Shirreff peninsula; a second pair was observed breeding among rocks at the northern beach on San Telmo Island, near an Antarctic fur seal breeding site (Torres, pers. comm. 2002). Antarctic terns (Sterna vittata) breed in several locations, which vary from year to year. Since 1990/91 a small colony of approximately 11 pairs of Antarctic shag (Leucocarbo atriceps bransfieldensis) have nested on Yeco Rocks, on the western coast of the peninsula (Torres 1995). Cape petrels (Daption capense) breed on cliffs on the western coast of the Area; 14 pairs were recorded in January 1993, nine in January 1994, three in January 1995 and eight in 1999. Wilson's storm petrel (Oceanites oceanicus) also breed on the western coast of the Area. Black-bellied storm petrel (Fregetta tropica) have been observed to breed near the field camp on the eastern coast. Updates on breeding activity for these species are currently unavailable.

Other bird species recorded but not breeding within the Area include macaroni penguin (Eudyptes chrysolophus), king penguin (Aptenodytes patagonicus), emperor penguin (Aptenodytes forsteri), snow petrel (Pagodroma nivea), white-rumped sandpiper (Calidris fuscicollis), black-necked swan (Cygnus melanocoryphus), and the cattle egret Bubulcus ibis (Torres 1995; Olavarría et al. 1999). Additional bird species recorded as foraging close to Cape Shirreff include the black-browed albatross (Thalassarche melanophris) and gray-headed albatross (T. chrysostoma), although neither species has yet been recorded within the Area (Cox et al. 2009). A large number of non-breeding southern giant petrels (Macronectes giganteus) frequent the Area in the summer, but a report of a breeding colony on the peninsula (Bonner 1989, in Heap 1994) is incorrect (Torres, pers. comm. 2002).

- *Breeding mammals*

Cape Shirreff (including San Telmo Island) is presently the site of the largest known breeding colony of the Antarctic fur seal in the Antarctic Peninsula region. Antarctic fur seals were once abundant throughout the South Shetland Islands but were hunted to local extinction between 1820 and 1824. The next observation of Antarctic fur seals at Cape Shirreff was on 14 January 1958, when 27 animals were recorded, including seven juveniles (Tufft 1958). The following season, on 31 January 1959, a group of seven adult males, one female and one live male pup were recorded, along with one dead male pup (O'Gorman, 1961) (Table 2, Figure 1 (see Section 8)). A second female arrived three days later, and, by mid-March, 32 Antarctic fur seals were present. The Cape Shirreff and San Telmo colony continued to grow until its recent peak in 2002, when 8,577 pups were born (Goebel et al. 2003) (Table 2, Figure 1 (Section 8)). The total population at that time is estimated to be between 21,190 and 35,165 individuals depending on a conservative (Hucke-Gaete et al. 2004) or a more widely-used (Payne 1979) conversion rate, respectively. That peak was an order of magnitude lower than pre-exploitation population levels in the area (Hucke-Gaete et al. 2004), and has given way to a rapid population decrease of over 87% since 2007 (Krause & Hinke 2021; Krause et al. 2022). Although it remains the largest Antarctic fur seal breeding center in the Antarctic Peninsula, the breeding population is precariously low and further study is needed to identify the minimum sustainable population level.

Antarctic fur seal breeding sites at Cape Shirreff are concentrated around the coastline of the northern half of the peninsula (Map 3). At San Telmo Island, breeding is concentrated on sandy beaches at the southern and central sections of the island (Krause pers. comm. 2021). Long-term monitoring of Antarctic fur seals has been carried at Cape Shirreff since 1991, with the primary objective of studying breeding success in relation to prey availability, environmental variability and human impacts (Osman et al. 2004). Researchers have studied various aspects of the fur seal colony, including pup production, predation, growth, female attendance behavior, seal diet, and foraging behavior (Goebel et al. 2014). Genetic analysis to investigate the recolonization of Antarctic fur seals at Cape Shirreff from the putative source population at South Georgia indicated highly significant genetic differentiation (Bonin et al. 2013; Paijamans et al. 2020), which emphasizes the importance of the genetic diversity within the Cape Shirreff population (Bonin et al. 2013; Krause et al. 2022). The Antarctic fur seal colony at Cape Shirreff has also been used to study the genetic analysis of twin pups, which are rare among pinnipeds (Bonin et al. 2012).

A number of extremely rare color patterns in fur seal pups have been recorded within the Area. Antarctic fur seals with pie-bald or light colorings were documented for the first time and an albino Weddell seal (Leptonychotes weddellii) represented the first confirmed case of albinism in Weddell, leopard (Hydrurga leptonyx), Ross (Ommatophoca rossii) or crabeater seals (Lobodon carcinophagus) (Acevedo et al. 2009a, 2009b). In December 2005 an adult male subantarctic fur seal was observed among Antarctic fur seals at Cape Sherriff, which is more than 4000 km from the nearest subantarctic fur seal breeding colony (Torres et al. 2012).

Growth rates of fur seal pups within the Area have been studied in relation to sex, breeding season and maternal foraging and attendance (Vargas et al. 2009; McDonald et al. 2012a, 2012b). Studies on population dynamics indicate that the Cape Shirreff and San Telmo colony is likely being reduced by both worsening prey availability and predation of pups by leopard seals (Hydrurga leptonyx) (Schwarz et al. 2013; Krause et al. 2020; Krause et al. 2022).

Probably as a result of drastic reductions in their preferred ice habitat within the Antarctic Peninsula region (Forcada et al. 2012), the numbers of summer-resident leopard seals have substantially increased at Cape Shirreff and San Telmo in recent decades (Krause et al. 2015). As such a comprehensive research program conducted by both INACH and U.S. AMLR researchers has revealed important ecological connections between this apex predator and other species breeding at Cape Shirreff.

Monitoring of leopard seal predation on the Antarctic fur seal pup population was initiated in 2000/01 and was expanded during the 2003/04 Antarctic season (Vera et al. 2004). Leopard seals hauling out at Cape Shirreff have been fitted with HD video cameras, GPS and time-depth recorders to monitor their foraging range, and hunting strategies (Krause et al. 2015). While no more than two leopard seals were seen foraging concurrently before 1996 (Boveng et al. 1998), their numbers rose rapidly between 1998 and 2011 (Vera et al. 2005; Goebel et al. 2014). Between 2011 and 2020 the maximum number of leopard seals observed foraging concurrently at Cape Shirreff averaged 20 (range = 11 to 41). Fur seal pups appear to be preferentially targeted by large, adult female leopard seals who use specialized hunting tactics to achieve high rates (> 92%) of prey capture success (Hiruki et al. 1999; Krause et al. 2015). Between 2013 and 2017 Antarctic fur seal pups alone contributed an estimated 21.3 – 37.6% of female leopard seal summer diets (Krause et al. 2020). High leopard seal density, focused feeding on fur seal pups, and the associated intraspecific competition (Krause et al. 2016), including kleptoparasitism and food caching behavior (Krause & Rogers 2019), have significantly elevated rates of pup mortality at Cape Shirreff. In addition to fur seal pups, leopard seals regularly consumed brush-tailed penguins, and two species of demersal fish (Gobionotothen gibberifrons and Notothenia coriiceps) (Krause et al. 2020).

A small number of southern elephant seals breed in October on several eastern beaches (U.S. AMLR, pers. comm. 2000; Torres, pers. comm. 2002). On 2 Nov 1999 34 pups were counted on beaches south of Condor Hill (U.S. AMLR, unpublished data). Since that time a majority of pups have been born near Playa Media Luna, and between 2009 and 2017 the annual pup production has ranged widely from 58 in 2016 to a low of 17 in 2017 (U.S. AMLR, unpublished data). Groups of non-breeding southern elephant seals also haul out regularly at Cape Shirreff to rest and molt. Since 2009, weekly censuses found over 200 individuals hauled out concurrently at some point every year (U.S. AMLR, unpublished data). The foraging behavior of southern elephant seals has been studied using satellite tracking of animals tagged at Cape Shirreff and analyzed in relation to the physical properties of the water column (Huckstadt et al. 2006; Goebel et al. 2009). Seals were found to forage as far afield as the Amundsen Sea and one animal was observed travelling 4,700 km due west of the Antarctic Peninsula.

Crabeater seals have been observed hauling out at Cape Shirreff throughout the study period. The maximum number observed was 8 during the 2017/18 season. While the vast majority of individuals observed are non-resident , crabeater seals have been observed both pupping and copulating on land, a rare behaviour, in 2015 and 2017 (U.S. AMLR, unpublished data). Weddell seals are also regular residents at Cape Shirreff, including a small number of breeding females. The highest number of Weddell seal pups born was 6 in 2017, and the highest number of concurrently hauled out adult and juvenile individuals was 48 during the 2010/11 season (Goebel et al. 2014; U.S. AMLR, unpublished data).DNA samples are frequently collected from four seal species at Cape Shirreff and stored in the Southwest Fisheries Science Center DNA archives (Goebel et al. 2009). During the 2009/10, 2010/11, 2011/12, and 2014/15 summer seasons, researchers deployed archival tags on Antarctic fur seals, along with Weddell seals and leopard seals, to monitor their behavior over the winter period (Goebel et al. 2014; Hinke et al. 2017). Unoccupied aerial system (UAS) surveys have been conducted every season since 2011/12, and have been shown to be robust to Antarctic conditions, as accurate as traditional ground methods for counting and measuring seabirds and pinnipeds (Goebel et al. 2015; Krause et al. 2017), and often less invasive than traditional ground methods (Krause et al. 2021).

Humpback (Megaptera novaeangliae), fin (Balaenoptera physalus), minke (Balaenoptera bonaerensis) and killer (Orcinus orca) whales have been observed in the offshore area immediately to the north-east of the Area (Cox et al. 2009; U.S. AMLR, unpublished data). A stranded Southern Right whale (Eubalaena australis) was found at 'Papua Beach' in 1997/98 (Torres et al. 1998).

- *Marine environment and ecosystem*

The seafloor surrounding the Cape Shirreff peninsula slopes relatively gently from the coast, reaching depths of 50 m approximately 2-3 km from the shore and 100 m at about 6-11 km (Map 1). This relatively shallow and broad submarine ridge extends to the NW for about 24 km before dropping more steeply at the continental shelf edge. The ridge is about 20 km in width and flanked on either side by canyons reaching depths of around 300-400 m. There is abundant macroalgae present in the intertidal zone. The limpet Nacella concinna is common, as elsewhere in the South Shetland Islands.

The waters offshore from Cape Shirreff have been identified as one of three areas of consistently high krill biomass density in the South Shetland Islands area, although absolute krill populations fluctuate significantly over time (Hewitt et al. 2004; Reiss et al. 2008). The spatial distribution, demography, density and size of krill and krill swarms have been studied in the nearshore region at Cape Shirreff, using small scale acoustic surveys and Autonomous Underwater Vehicles (AUV) (Warren et al. 2005; Reiss et al. 2008; Reiss et al. 2021). Acoustic surveys of the nearshore environment indicate that krill in this area are most abundant to the south and SE of Cape Shirreff and at the margins of the two submarine canyons, which are believed to be a source of nutrient-rich water that may increase productivity in the nearshore area surrounding Cape Shirreff (Warren et al. 2006, 2007). Nearshore net tows indicated that the organisms identified in acoustic surveys were primarily the euphausiids, Euphausia superba, Thysanoessa macrura and Euphausia frigida, and may also include chaetognaths, salps, siphonophores, larval fish, myctophids and amphipods (Warren et al. 2007).

The nearshore environment surrounding Cape Shirreff has been identified as a primary feeding ground for penguins resident at the site, particularly during the breeding season when chick provisioning limits foraging range (Cox et al. 2009). Fur seals and penguins at Cape Shirreff depend strongly upon krill for prey. Predator foraging ranges are known to overlap with areas of commercial krill fisheries (Hinke et al. 2017) and changes in the abundance of both predators and krill have been linked to climatic change (Hinke et al. 2007; Trivelpiece et al. 2011). Research at Cape Shirreff therefore aims to monitor krill abundance in combination with predator populations and breeding success, in order to assess the potential effects of commercial fishing (e.g., Watters et al. 2020), as well as environmental variability and climatic change on the ecosystem.

Numerous studies of the marine environment have been conducted in the region offshore from Cape Shirreff as part of research carried out within the U.S. AMLR survey grid, including both summer (Reiss et al. 2008) and winter surveys (Reiss et al. 2017). These studies include investigations into various aspects of the marine environment, including physical oceanography, environmental conditions, phytoplankton distribution and productivity, krill distribution and biomass and the distribution and density of seabirds and marine mammals (U.S. AMLR 2008, 2009). Currently, at-seas studies include annual deployments of a mooring array, that spans two cross-shelf marine canyons and the shallow shelf in between, remotely-piloted glider surveys (Reiss et al. 2021), and episodic surveys based on the U.S. AMLR survey grid by fishing vessels and National Antarctic programs. These studies continue to provide data for assessing ecosystem response to climate change and fishing in the vicinity of Cape Shirreff.

- *Historical features*

Following discovery of the South Shetland Islands in 1819, intensive sealing at Cape Shirreff between 1820 and 1824 exterminated almost the entire local populations of Antarctic fur seals and southern elephant seals (Bonner 1968; Smith & Simpson 1987). In January 1821, 60–75 British sealers were recorded living ashore at Cape Shirreff and 95,000 skins were taken during the 1821/22 season (O'Gorman 1963). Evidence of the sealers' occupation remains, with ruins of at least one sealers' hut in the northwestern region of the peninsula and remains of sealer's settlements recorded on a number of the beaches (D. Torres, A. Aquayo and J. Acevedo, pers. comm. 2010). The shoreline of several bays is also littered with timbers and sections of wrecked sealers' vessels. Other evidence of sealing activity includes the remains of stoves, pieces of glass bottles, a wooden harpoon, and a handcrafted bone figure (Torres & Aguayo 1993). Fildes (1821) reported that sealers found spars and an anchor stock from the Spanish ship San Telmo on Half Moon Beach around the time she was lost. The ship sank in the Drake Passage at around 62°S 70°W on 4 September 1819, with 644 persons aboard (Headland 1989; Pinochet de la Barra 1991). These were possibly the first people to die in Antarctica, and the event remains the greatest single loss of life yet to occur south of 60°S. A cairn has been erected on the northwestern coast of Cape Shirreff peninsula to commemorate the loss, which is designated as Historic Monument No. 59 (Map 3). The San Telmo wreck is recognized as HSM No.95 (Measure 2 (2021)), although the wreck location remains unknown.

The remains of a camp were found close to the site of present camp facilities (Torres & Aguayo 1993). On the evidence of the script on items found at the site, the camp is believed to be of Russian origin and date from the 1940-50s, although its exact origins have yet to be determined. Items found include parts of an antenna, electrical wires, tools, boots, nails, battery cells, canned food, ammunition and a wooden box covered by a pyramid of stones. Several notes in Russian, dating from later visits, were found in this box (Torres 2007).

In January 1985 a human skull was found at Yamana Beach (Torres 1992), determined to be that of a young woman (Constantinescu and Torres 1995). In January 1987 part of a human femur was found on the ground surface nearby, inland from Yamana Beach. After a careful surface survey, no other remains were evident at that time. However, in January 1991, another part of a femur was found in close proximity to the site of the earlier (1987) find. In January 1993 an archaeological survey was carried out in the area, although no further human remains were found. The original samples were dated as from approximately 175 years BP, and it was hypothesised they belong to a single individual (Torres 1999).

- *Human activities / impacts*

The modern era of human activity at Cape Shirreff has been largely confined to science. During the past three decades, the population of Antarctic fur seals in the South Shetland Islands grew to a level at which tagging and other research could be undertaken without threatening the existence and growth of the local population. Chilean studies on Cape Shirreff began in 1965 (Aguayo & Torres 1966, 1967), with a more intensive program initiated by Chilean scientists in 1982, including an ongoing Antarctic fur seal tagging program (Cattan et al. 1982; Torres 1984; Oliva et al. 1987). United States investigators have conducted pinniped and seabird surveys at Cape Shirreff and San Telmo Island since 1986/87 (Bengtson et al. 1990).

CEMP studies at Cape Shirreff began in the mid-1980s, initiated by Chilean and U.S. scientists. Cape Shirreff was designated as a CEMP Site in 1994 to protect the site from damage or disturbance that could adversely affect long-term CEMP monitoring. As part of the CEMP, long-term studies are assessing and monitoring the feeding ecology, growth and condition, reproductive success, behavior, vital rates, and abundance of pinnipeds and seabirds that breed in the Area. The results of these studies will be evaluated in context with environmental data, offshore sampling data, and fishery statistics to identify possible cause-effect relationships between krill fisheries and pinniped and seabird populations. Recent analyses using US AMLR time series of CEMP monitoring data (Watters et al. 2020) have revealed potentially negative effects of locally high harvest rates of krill, particularly during years with poor environmental conditions.

Brucella and herpes virus antibodies were detected in tissue samples taken from Antarctic fur seals at Cape Shirreff over summer seasons from 1998-2001, and Brucella antibodies were also detected in Weddell seal tissue (Blank et al. 1999; Blank et al. 2001a & b). Studies on the mortality of Antarctic fur seal pups from diseases began in the 2003/04 Antarctic season (Torres & Valdenegro 2004). Enteropathogenic Escherichia coli (EPEC) has been recorded in swabs from Antarctic fur seals at Cape Shirreff, with two out of 33 pups sampled testing positive for the pathogen. The findings were the first reports of EPEC in Antarctic wildlife and in pinnipeds, and the effects of the pathogen on Antarctic wildlife is unknown (Hernandez et al. 2007).

Plastic rubbish was first reported at Cape Shirreff by Torres and Gajardo (1985), and marine debris monitoring studies have been carried out regularly since 1992 (Torres & Jorquera 1995). Debris remains an ongoing problem at the site, with over 1.5 tons of material removed from the area by Chilean scientists to date (D. Torres, A. Aquayo and J. Acevedo, pers. comm., 2010). Surveys yielded large numbers of articles, mostly made of plastic, but have also included vegetable waste from ships, metal oil drums, rifle shells and an antenna. For example, the 2000/01 season survey recorded a total of 1,774 articles, almost 98% of which were made of plastic and the remainder made of glass, metal and paper. It is significant that 34% of the plastic items found in 2000/01 were packing bands, representing approximately 589 bands. Of these, 40 were uncut and another 48 had been knotted into a loop. Several articles found in this survey were oiled, and some plastic articles were partially burnt. Antarctic fur seal entanglement in marine debris has been recorded frequently at Cape Shirreff (Torres 1990; Hucke-Gaete et al. 1997c, 2009), primarily in fishing equipment such as nylon ropes, net fragments and packing bands. Between 1987-2019 a total of 42 Antarctic fur seals were recorded with 'neck collars' from such debris (U.S. AMLR, unpublished data). Plastic fibers are also found in kelp gull and chinstrap penguin nests (Torres & Jorquera 1992), as well as those of sheathbills (Torres & Jorquera 1994). Recently a study to identify microplastics in seabird diet samples was initiated (J.Hinke, pers comm. 2022).

The waters surrounding Cape Shirreff represent an historically important fishing area for Antarctic krill. Catch data in CCAMLR Statistical subarea 48.1 for the Drake's Passage West small-scale management unit, which encompasses the foraging ranges of penguins and seals from Cape Shirreff, are publically available from 1994 (CCAMLR 2020a). Catches in the waters around Cape Shirreff have declined over time coincident with a shift in fishery operations from summer to winter in areas further south (Nicol & Foster 2016). Mean annual catches of krill in waters adjacent to Cape Shirreff were 24,510 tonnes from 1994 to 2000, 14,371 tonnes from 2001 to 2010, and 6,255 tonnes from 2011 to 2020. However, within the broader Statistical Area 48, catches have steadily increased to record levels, exceeding 450,000 tonnes in 2020. Catches in subarea 48.1 are currently capped at 155,000 tonnes and the fishery has been closed mid-season in nine of the last eleven seasons when catches have reached this level (CCAMLR 2020a).

Catches of finfish occurred historically in smaller quantities and included Champsocephalus gunnari, Champsocephalus gunnari, Nototheniops nybelini, Notothenia coriiceps, Notolepis spp, Notothenia gibberifrons, Notothenia neglecta, Notothenia rossii, Pseudochaenichthys georgianus and Chaenocephalus aceratus (CCAMLR 2010). Currently, directed fishing for all finfish in Subarea 48.1 is prohibited except for scientific research permitted under CCAMLR Conservation Measure 24-01 (CCAMLR 2020b).

6(ii) Access to the Area

Access to the Area may be made by small boat, by aircraft or across sea ice by vehicle or on foot. Historically seasonal sea ice formation in the South Shetlands area generally began in early April and persisted until early December, although more recently the South Shetland Islands can be ice-free year round as a result of regional warming.

Air access is discouraged, and restrictions apply to routes and landing sites for the period 01 November – 31 March inclusive. Details of these restrictions are given in Section 7(ii) below, and of the Helicopter Access Zone in Section 6(v).

Two anchorages have been identified close to the Area (Map 2) and when access to the Area is made from the sea, small boats should land at one of the locations defined in Section 7(ii). Sea states are generally between 1 and 4 m, decreasing closer to shore or in lea of Cape Shirreff (Warren et al. 2006, 2007).

When sea-ice conditions allow, the Area may be accessed over sea ice on foot or by vehicle. However, vehicle use on land within the Area is restricted to the coastal zone between Módulo Beach and the Chilean / U.S. camp facilities and to following the access route shown on Map 3 to allow re-supply of the bird blind / emergency hut (see Section 7(ii) for more details).

6(iii) Location of structures within and adjacent to the Area

A semi-permanent summer-only research camp has been established on the eastern coast of the Cape Shirreff peninsula, located at the base of Condor Hill (62°28.249'S, 60°46.283'W) (Map 3). Buildings for the camp remain in situ year-round. In 2021 the Cape Shirreff Field Camp (U.S.) consisted of four small buildings and an outhouse (Krause pers. comm. 2021). The camp 'Dr Guillermo Mann-Fischer' (Chile) is located around 50 m from the U.S. camp and comprised of a main hut, laboratory, store house, a fiberglass igloo, an outhouse and a defunct wind-powered generator tower (D. Torres, A. Aquayo and J. Acevedo, pers. comm., 2010)). The Chilean fiberglass igloo was originally installed in 1990/91, while the U.S. camp was established in 1996/97. Storage areas are also present, and tents are erected seasonally nearby as required. An All-Terrain Vehicle (ATV) shed, with secondary containment for summer use and winter storage of the ATV, was constructed at the U.S. camp in 2009/10. The site was selected to remain within the existing field camp footprint and to avoid interference with seal movements. A 'Weatherhaven' polar tent is stored at Cape Shirreff as additional accommodation for visiting scientists and is erected within 10 m of the south side of the U.S. camp when needed.

Two automatic weather stations are mounted on the exterior of existing buildings at Cape Shirreff. Two remote receiving stations used for seal tracking studies are stored within a box (90x60x100cm) located to the east of helicopter landing site 'A' on the northeastern slopes of Condor Hill and on the northern tip of Maderas Ridge (see Map 3).

A boundary sign, replaced in 2018, stating that the Area is protected and that access is prohibited is located at Módulo Beach, close to the Chilean and U.S. camps (Krause pers. comm. 2021). The boundaries of the Area are not otherwise marked.

The remains of a camp, believed to be of Russian origin, are present near the Chilean and U.S. camps. In other parts of the peninsula, sparse evidence may be found of 19th Century sealers' camps (Smith and Simpson 1987; Torres 1993; Stehberg and Lucero 1996). A cairn (Historic Monument No. 59) has been erected on Gaviota Hill on the northwestern coast to commemorate the loss of those aboard the San Telmo in 1819 (Map 3). In 1998/99 a 5x7 m bird observation / emergency hut (62°27.653'S, 60°47.404'W) was installed by U.S. scientists on the northern slopes of Enrique Hill above Bahamonde Beach, close to the penguin colonies (Map 3).

6(iv) Location of other protected areas in the vicinity

The nearest protected areas to Cape Shirreff are Byers Peninsula (ASPA No. 126), which lies about 20 km to the southwest; Port Foster (ASPA No. 145, Deception Island) and other parts of Deception Island (ASPA No. 140), which are approximately 30 km to the south; and 'Chile Bay' (Discovery Bay) (ASPA No. 144), which lies about 30 km to the east at Greenwich Island (Map 1).

6(v) Special zones within the Area

A zone in the north and west of the Area is designated as a Restricted Zone, due to its high concentrations of wildlife. Restrictions apply to air access only and prohibit overflight below 2000 ft (~610m), unless specifically authorized by permit. The Restricted Zone is defined as the area north of 62°28'S (Map 2), and west of 60°48'W and north of 62°29'S.

A Helicopter Access Zone (Map 2) has been defined which applies to aircraft entering the Area and accessing the designated landing sites. The Helicopter Access Zone extends from the Livingston Island permanent ice cap northward following the main ridgeline of the peninsula for 1200 m (~ 0.65 n. mi.) towards Selknam Hill. The Helicopter Access Zone then extends east by 300 m (~0.15 n. mi) (to helicopter landing site 'B' at Ancho Pass and a further 400 m (~0.23 n. mi) east to the summit of Condor Hill at the helicopter landing site 'A'. The southern boundary of the Helicopter Access Zone is coincident with the southern boundary of the Area.

7. Terms and conditions for entry permits

7(i) General 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, in particular for research associated with the CEMP, or for compelling scientific, archaeological or historic purposes that cannot be served elsewhere, or for reasons essential to the management of the Area such as inspection, maintenance or review;
- the actions permitted are in accordance with this Management Plan;

- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental and scientific values of the Area;
- It is issued for compelling educational or outreach purposes that cannot be served elsewhere, and which do not conflict with the objectives of this Management Plan;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried within the Area.

7(ii) Access to, and movement within or over, the Area

Access to the Area shall be by small boat, by helicopter, on foot or by vehicle. Persons entering the Area may not move beyond the immediate vicinity of their landing site unless authorised by permit.

- *Foot access and movement within the Area*

With the exception of the restricted use of vehicles described below, movement on land within the Area shall be on foot. Pilots, air, boat or vehicle crew, or other people in aircraft, boats, or vehicles are prohibited from moving on foot beyond the immediate vicinity of their landing site or the hut facilities 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 impacts.

- *Vehicle access and use*

Access by vehicle over land may be made to the Area boundary. Access by vehicle over sea ice may be made to the shore within the Area. Vehicles may be used:

- in the coastal zone between Módulo Beach and the Chilean / U.S. camp facilities (Map 3); and
- for access to the location of the U.S. field hut at Enrique Hill (Map 3) when the following conditions are met:
  - Large and / or heavy items need to be transported for essential facility maintenance and / or reconstruction purposes provided it is impractical and / or presents unacceptable risks to personnel safety to carry the required items on foot. Other purposes for use of a vehicle along the designated route, including for research, are prohibited (except in an emergency);
  - The designated routes to / from the field hut from Módulo Beach and / or Alcázar Beach, as shown on Map 3, shall be strictly followed. By preference, the shortest of these routes that is practical to transport materials by vehicle shall be selected;
  - By preference, vehicles should be used at times when the ground is frozen, either early or late season or at times of the day when this is more likely;

- The vehicle and any towed trailer, if used, are of a size and design that minimizes potential damage to soils and vegetation along the designated vehicle route, such as a small ‘quad bike’ with four-wheel drive traction and with wide tyres installed to spread loads (including on any trailer);
- The weights carried by the vehicle and / or trailer are not overloaded so as to cause tyres to sink into ground and / or result in loss of vehicle traction which could otherwise be avoided;
- Potential damage to soils and / or vegetation by vehicles should be monitored closely, and vehicles should avoid visible vegetation and / or soft (potentially waterlogged) soils to the maximum extent practicable while adhering to the designated route. Where unavoidable, at the first sign of any damage to soils and / or vegetation, vehicle users should implement mitigation measures to prevent further damage. Measures may include laying removable boarding or matting to avoid the necessity for route deviations. Any materials laid should be removed when no longer necessary and not left in situ in order to prevent their uncontrolled release into the environment.

• The use of vehicles elsewhere within the Area is prohibited.

- *Boat access*

Access by small boats should be at one of the following locations (Map 2):

- the eastern coast of the peninsula at El Módulo Beach, 300 m north of the camp facilities, where a deep channel enables relatively easy access;
- the northern end of Half Moon Beach, on the eastern coast of the peninsula;
- the northern end of Yámana Beach, on the western coast (suitable at high tide only);
- the north coast at Alcazar Beach near the bird blind / emergency hut;
- the southern end of the northern beach on San Telmo Island.

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. Two positions have been identified close to the Area for stationing support ships: 1,600 m north-east of the main camp facilities and approximately 800 m north of San Telmo Island (Map 2). Visitors should, where practicable, avoid landing where pinniped or seabird colonies are present on or near the coast.

- *Aircraft access and overflight*

Due to the widespread presence of pinnipeds and seabirds over the Cape Shirreff peninsula during the breeding season (01 November – 31 March), access to the Area by aircraft in this period is strongly discouraged. Where possible and by preference, access should be by small boat. All restrictions on aircraft access and overflight apply between 01 November – 31 March inclusive, when aircraft shall operate and land within the Area according to strict observance of the following conditions:

• It is recommended that aircraft maintain a horizontal and vertical separation distance 2000 ft (~610 m) from the Antarctic Specially Protected Area boundary (Map 2), unless accessing the designated landing sites through the Helicopter Access Zone or otherwise authorized by permit;

- Overflight of the Restricted Zone is prohibited below 610 m (2,000 ft) unless authorized by permit. The Restricted Zone is defined as the area north of 62°28'S, or north of 62°29'S and west of 60°48'W (Map 2), and includes the areas of greatest wildlife concentration;
- Helicopter landing is permitted at two designated sites (Map 2). The landing sites with their coordinates are described as follows:

  (A) on a small area of flat ground, ~150 m northwest of the summit of Condor Hill (50 m, or ~150 ft) (62°28.257'S, 60°46.438'W), which is the preferred landing site for most purposes; and
  (B) on the wide flat area on Ancho Pass (25 m), situated between Condor Hill and Selknam Hill (62°28.269'S, 60°46.814'W).
- Aircraft accessing the Area should follow the Helicopter Access Zone to the maximum extent practicable. The Helicopter Access Zone allows access from the south across the Livingston Island permanent ice cap and extends along the main ridgeline of the peninsula for 1,200 m (~ 0.65 n. mi.) towards Selknam Hill (elevation = 50 m, or ~150 ft). The Helicopter Access Zone then extends east by 300 m (~ 0.15 n. mi) to Ancho Pass, where helicopter landing site 'B' is situated, and a further 400 m (~0.23 n. mi) east to the summit of Condor Hill (elevation = 50 m, or ~150 ft), close to helicopter landing site 'A'. Aircraft should avoid overflight of the hut and beach areas on the eastern side of Condor Hill.
- The preferred approaches to the Helicopter Access Zone are from the south across the Livingston Island permanent ice cap, from the southwest from the direction of Barclay Bay, and from the southeast from the direction of Hero Bay (Maps 1 and 2).
- Weather with a low cloud ceiling often prevails at Cape Shirreff, particularly in the vicinity of the permanent ice cap, which can make snow/ice ground definition difficult to discern from the air. On-site personnel who may be advising on local conditions before aircraft approaches should be aware that a minimum cloud base of 150 m (500 ft) AMSL over the approach zone of the Livingston Island ice cap is necessary in order for access guidelines to be followed;
- Overflight below 2000 ft (610 m) and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are prohibited except in accordance with a permit issued by an appropriate national authority. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

7(iii) Activities which may be conducted in the Area

- Scientific research that will not jeopardize the values of the Area, in particular those associated with the CEMP;
- Essential management activities, including monitoring and inspection;
- Activities with educational aims (such as documentary reporting (e.g. visual, audio or written) or the production of educational resources or services) that

cannot be served elsewhere. Activities for educational and / or outreach purposes do not include tourism.
- Activities with the aim of preserving or protecting historic resources within the Area.
- Archaeological research that will not threaten the values of the Area.

7(iv) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit;
- The principal camp facilities shall be limited to the area within 200 m of the existing Chilean and U.S. field camps (Map 3). Small temporary hides, blinds or screens may be constructed for the purpose of facilitating scientific study of the fauna;
- 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 free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of harm to fauna, contamination, or of damage to the values of the Area;
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to flora and fauna, preferably avoiding the main breeding season (1 November – 31 March);
- Removal of specific structures, equipment, hides or markers 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(v) Location of field camps

Camping is permitted within 200 m of the facilities of the Chilean and U.S. field camps, on the eastern coast of the Cape Shirreff peninsula (Map 3). Temporary camping is permitted at the northern extremity of Yamana beach to support fieldwork on the San Telmo islets (Map 3). The U.S. bird observation hut on the northern slopes of Enrique Hill (62°27'41"S, 60°47'28"W) may be used for temporary overnight camping for research purposes, although should not be used as a semi-permanent camp. Camping is permitted on San Telmo Island when necessary for purposes consistent with plan objectives. The preferred camping location is at the southern end of the northern beach on the island. Camping is prohibited elsewhere within the Area.

7(vi) Restrictions on materials and organisms which may be brought into the Area

In addition to the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, restrictions on materials and organisms that may be brought into the Area are:

- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);

- Visitors shall ensure that sampling equipment and / or markers are clean. To the maximum extent practicable, clothing, footwear and other equipment (including e.g. backpacks, carry-bags, tents, walking poles, tripods, etc.) shall be thoroughly cleaned prior to entry. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2019), and in the Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018));
- Dressed poultry should be free of disease or infection before shipment to the Area and, if introduced to the Area for food, all parts and wastes of poultry shall be completely removed from the Area or treated, incinerated, or boiled long enough to kill any potentially infective bacteria or viruses;
- Herbicides or pesticides are prohibited from 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 shall not be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted. In general, all materials introduced shall be for a stated period only and shall be removed at or before the conclusion of that stated period;
- All materials 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(vii) Taking of, 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 Article 3 of Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where animal taking or harmful interference is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica. CEMP research programs in progress within the Area should be consulted before other permits for taking or harmful interference with animals are granted.

7(viii) Collection or removal of materials 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. This includes biological samples and rock or soil specimens.

- 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 and approval obtained.
- Material found that is likely to possess important archaeological, historic or heritage values should not be disturbed, damaged, removed or destroyed. Any such artifacts should be recorded and referred to the appropriate authority for a decision on conservation or removal. Relocation or removal of artifacts for the purposes of preservation, protection, or to re-establish historical accuracy is allowable by permit.
- The appropriate national authority should be notified of any items removed from the Area that were not introduced by the permit holder.

7(ix) Disposal of waste

All wastes shall be removed from the Area, except human wastes and domestic liquid wastes, which may be removed from the Area or disposed of into the sea.

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

Permits may be granted to enter the Area to:

- carry out monitoring and Area inspection activities, which may involve the collection of a small number of samples or data for analysis or review;
- install or maintain signposts, markers, structures or scientific equipment;
- carry out protective measures;
- carry out research or management in a manner that avoids interference with long-term research and monitoring activities or possible duplication of effort. Persons planning new projects within the Area should consult with established programs working within the Area, such as those of Chile or the United States, before initiating the work;
- In view of the fact that geological sampling is both permanent and of cumulative impact, visitors removing geological samples from the Area shall complete a record describing the geological type, quantity and location of samples taken, which should, at a minimum, be deposited with their National Antarctic Data Centre or with the Antarctic Master Directory.

7(xi) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable after the visit has been completed in accordance with national procedures.
- Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit

report to the Parties that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.

- Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures that might have exceptionally been undertaken, and / or of any materials released and not removed, that were not included in the authorized permit.

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Table 1: Chinstrap (*Pygoscelis antarcticus)* and gentoo (*P. papua*) penguin numbers at Cape Shirreff.

Year	Chinstrap (pairs)	Gentoo (pairs)	Source
1958	2000 (N3[1])	200-500 (N1[1])	Croxall and Kirkwood, 1979
1981	2164 (A4)	843 (A4)	Sallaberry and Schlatter, 1983 [2]
1987	5200 (A3)	300 (N4)	Woehler, 1993
1997	6907 (N1)	682 (N1)	Hucke-Gaete *et al.* 1997a
1997/98	7617 (N1)[a]	810 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
1998/99	7581 (N1)[a]	830 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
1999/00	7744 (N1)[a]	922 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2000/01	7212 (N1)[a]	975 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2001/02	6606 (N1)[a]	907 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2002/03	5809 (N1)[a]	722 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2003/04	5635 (N1)[a]	751 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2004/05	4907 (N1)[a]	818 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2005/06	4847 (N1)[a]	807 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2006/07	4543 (N1)[a]	781 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2007/08	3032 (N1)[a]	610 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2008/09	4026 (N1)[a]	879 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2009/10	4339 (N1)[a]	802(N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2010/11	4127 (N1)[a]	834 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2011/12	4100 (N1)[a]	829 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2012/13	4200 (N1)[a]	853 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2013/14	3582 (N1)[a]	839 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2014/15	3464 (N1)[a]	721 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2015/16	3325 (N1)[a]	655 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2016/17	3060 (N1)[a]	771 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2017/18	2449 (N1)[a]	705 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2018/19	2095 (N1)	674 (N1)	U.S. AMLR unpublished data
2019/20	2170 (N1)	708 (N1)	U.S. AMLR unpublished data

1. Alphanumeric code refers to the type of count, as in Woehler (1993).
2. Reported data did not specify species. It has been assumed that the higher number referred to chinstrap penguins. Data were reported as individuals, which have been halved to derive 'pairs' in the table.

Table 2. Census counts of live and dead Antarctic fur seal (*Arctocephalus gazella*) pups from Cape Shirreff and San Telmo Island (references available from U.S. AMLR).

Year (season ending)	Cape Shirreff	+/- SD	San Telmo Island
1959	2	NA	NA
1966	12	NA	NA
1971	27	NA	NA
1973	83	NA	218
1987	718	NA	1875
1992	2973	NA	2340
1993	3672	NA	2050
1994	3474	NA	2583
1995	4036	NA	2083
1996	4968	NA	2684
1997	5689	NA	3326
1998	4943	NA	2808
1999	5497	NA	NA
2000	5865	NA	2699
2001	5951	NA	2328
2002	6453	NA	2124
2003	5845	NA	NA
2004	6428	NA	NA
2005	6032	NA	NA
2006	5791	NA	NA
2007	6119	NA	NA
2008	4574	NA	1525
2009	4598	79	NA
2010	4007	80	NA
2011	3677	13	NA
2012	3328	79	NA
2013	2796	55	NA
2014	2306	21	NA
2015	2130	23	NA
2016	1681	24	NA
2017	1546	17	NA
2018	1267	29	NA
2019	1064	25	333
2020	860	11	NA

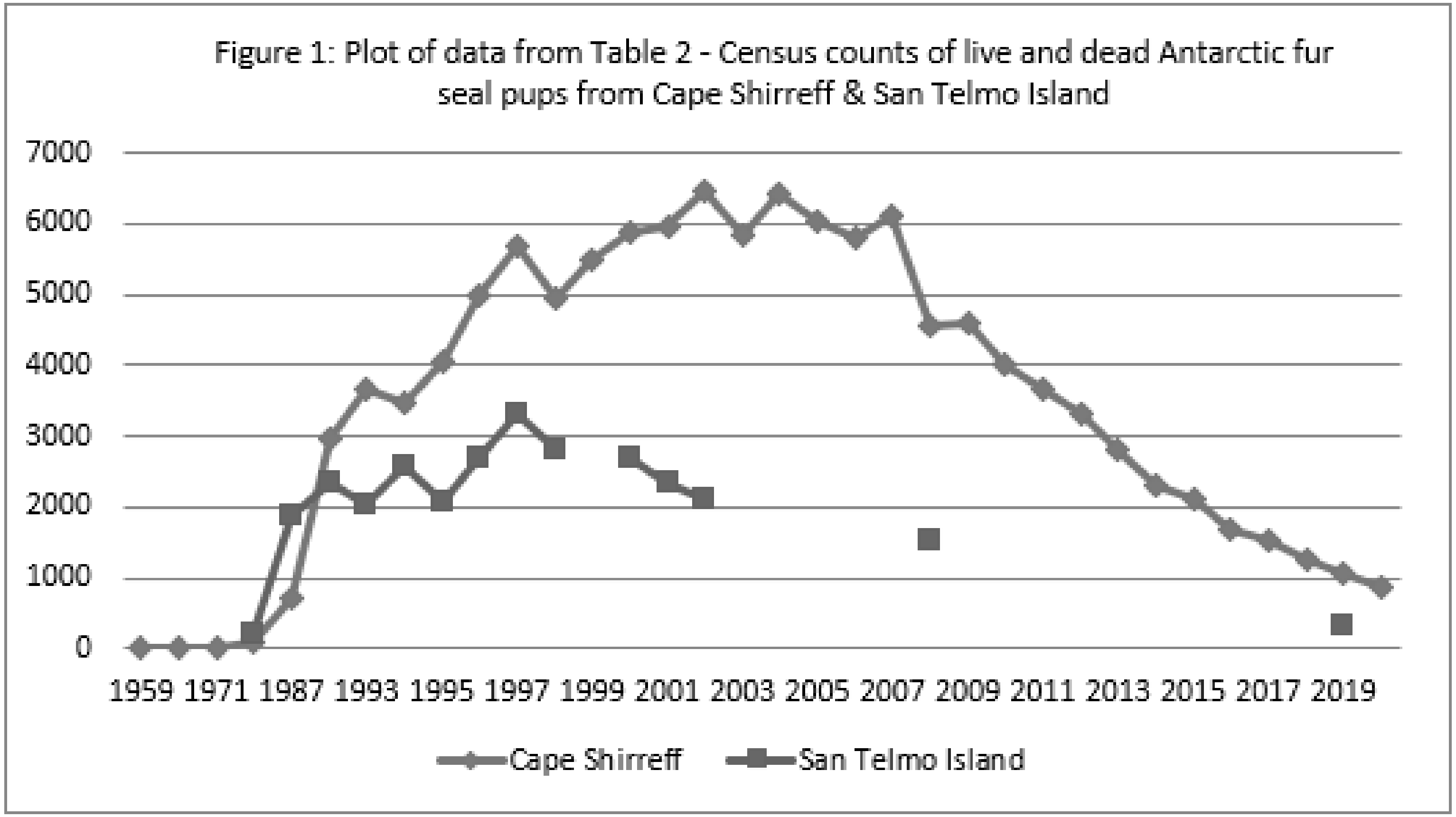
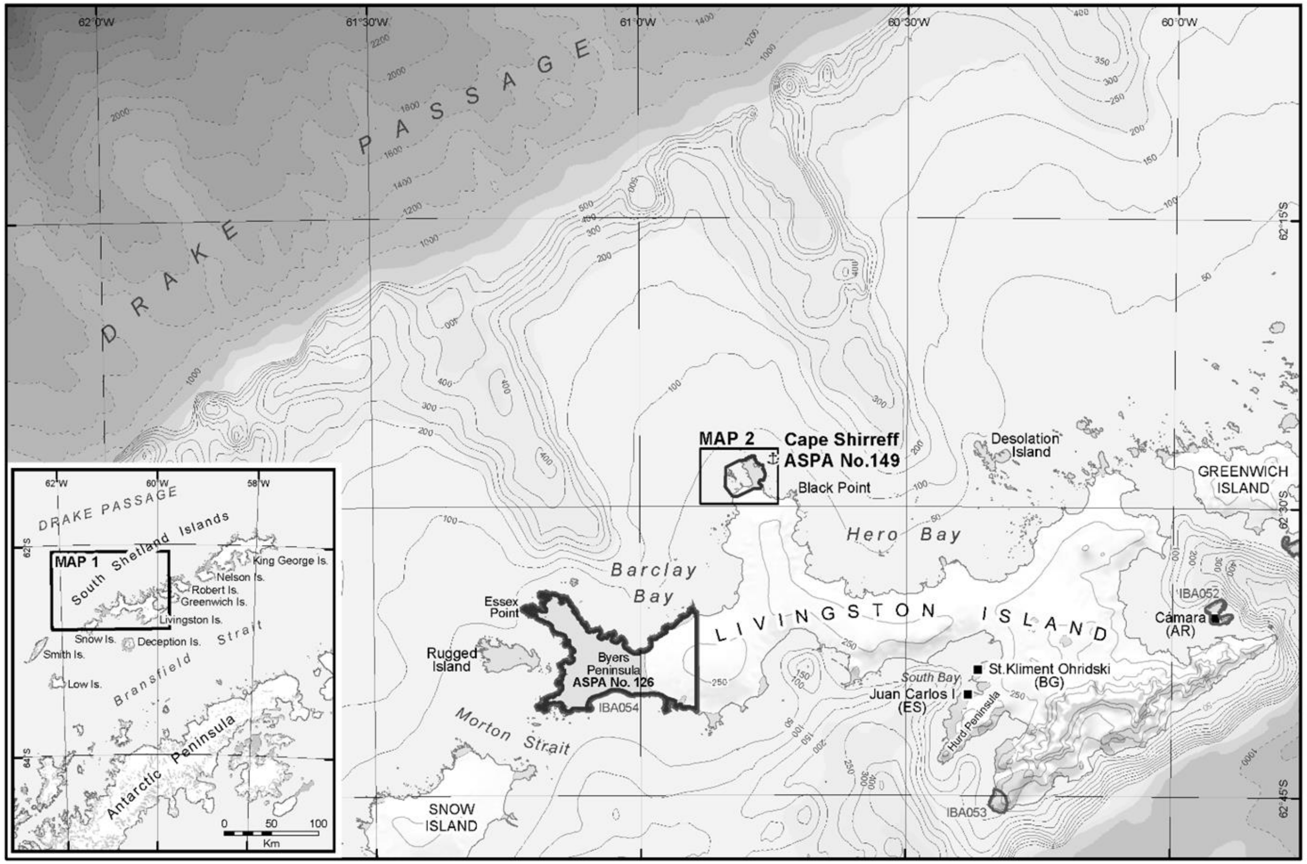


Figure 1: Plot of data from Table 2 - Census counts of live and dead Antarctic fur seal pups from Cape Shirreff & San Telmo Island



Map 1: ASPA No.149 Cape Shirreff & San Telmo Island - Regional overview

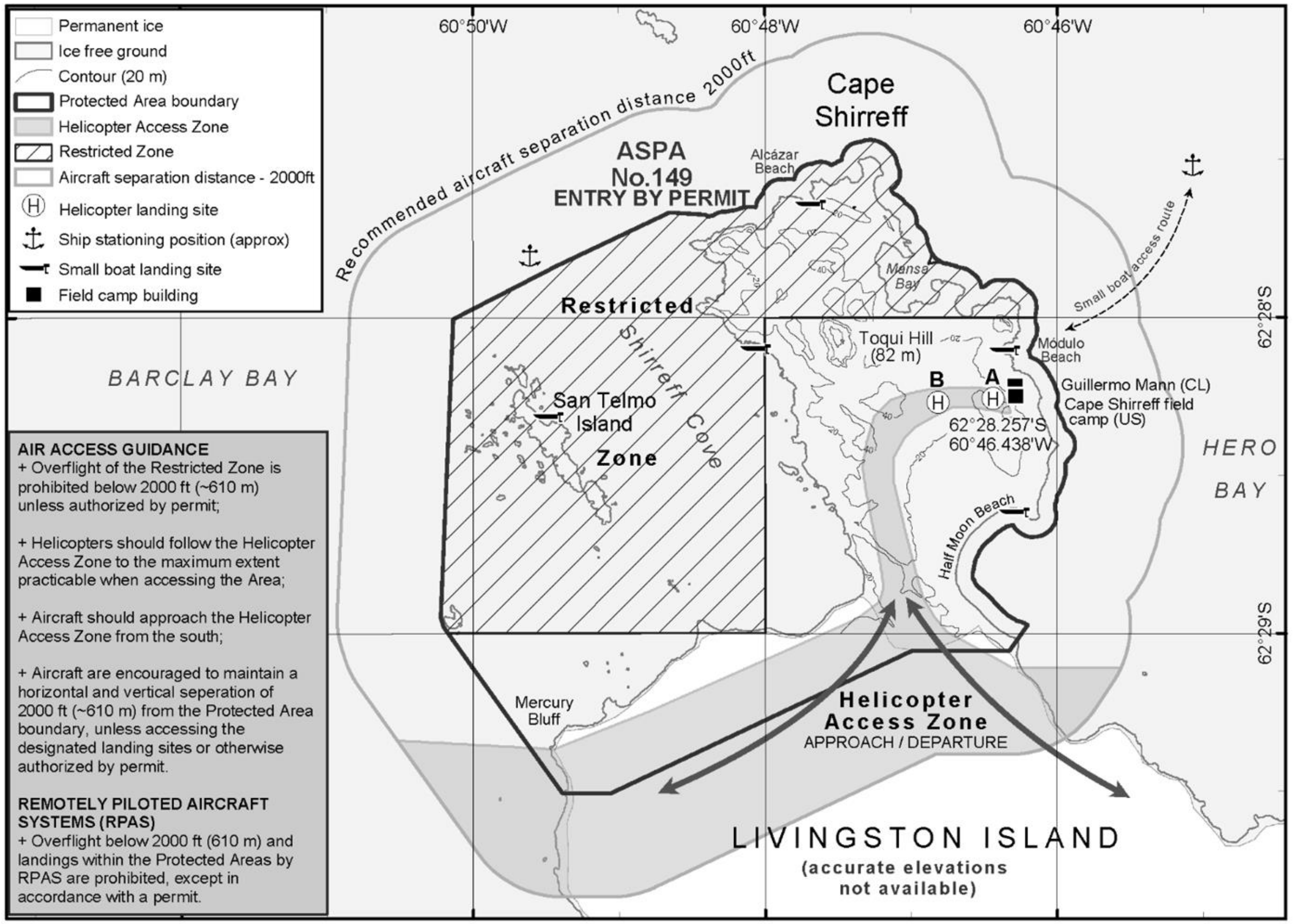
14 Apr 2023 (v1)
United States Antarctic Program / INACH
Environmental Research & Assessment

0 10 20
Kilometers

N

- Permanent ice
- Ice shelf
- Ice-free ground
- Contour (ice) - 250 m
- Contour (rock) - 250 m
- Bathymetry (50 m)
- Bathymetry (200 m)
- Antarctic Specially Protected Area (ASPA) boundary
- Important Bird Area
- Permanent Station
- Ship stationing position (approx)

Projection: Lambert Conic Conformal
Spheroid and horizontal datum: WGS84
Data sources: Facilities: COMNAP (2021);
Topography: SCAR Antarctic Digital Database (v7.2-7.4, 2020-2022);
Hillshade derived from OSU RAMP 200 m DEM (v2).
Bathymetry: D. Demer & U.S. AMLR, NOAA, 2002 & IBCSO (v1 2013).

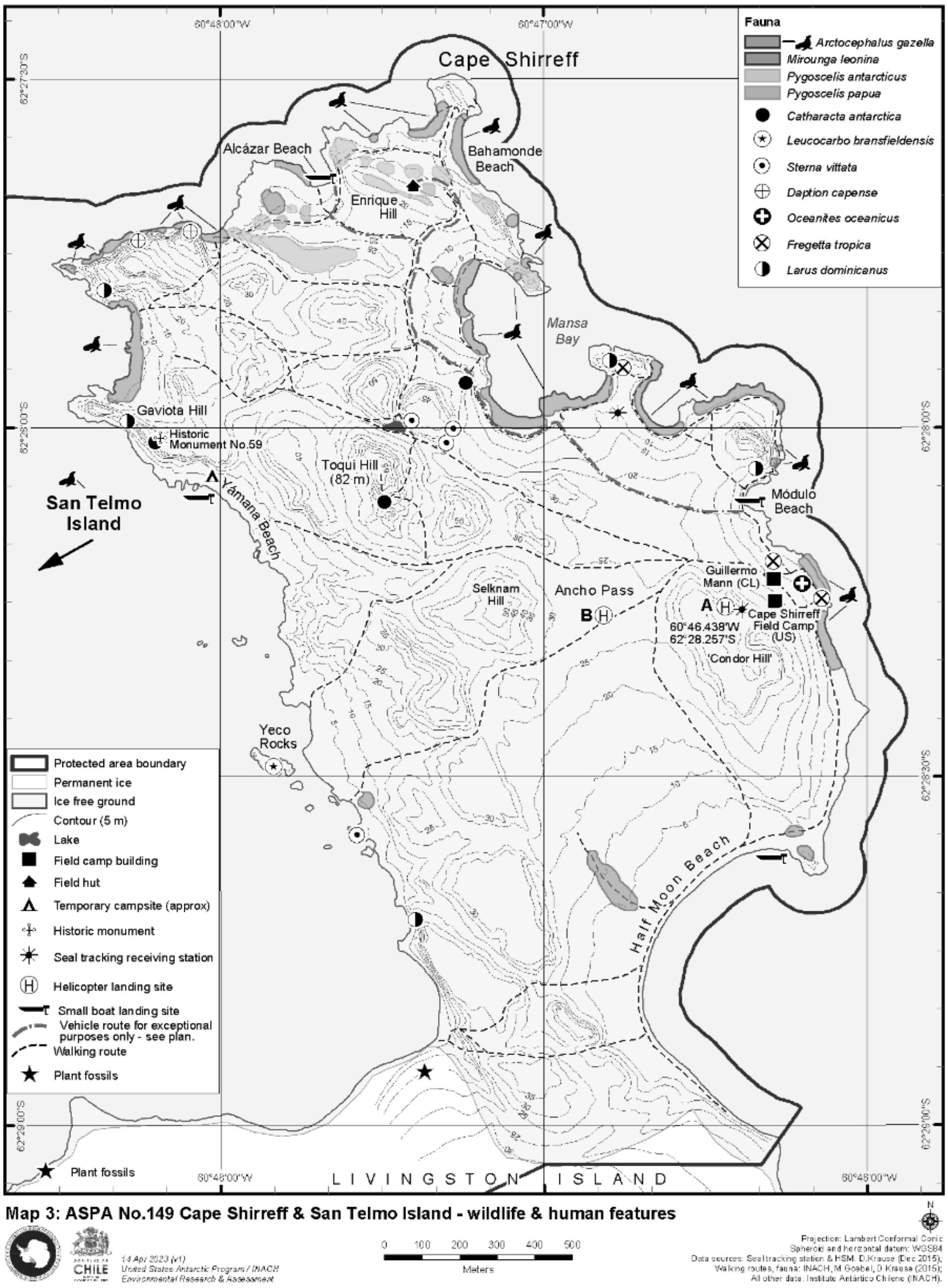


Map 2: ASPA No.149 Cape Shirreff & San Telmo Island - access

14 Apr 2023 (v1)
United States Antarctic Program / INACH
Environmental Research & Assessment

0 0.5 1 Nautical Miles
0 0.5 1 2 Kilometers

Projection: Lambert Conic Conformal;
Spheroid and horizontal datum: WGS84;
Data sources: Small boat landing sites: M. Goebel (2015);
Topographic data: Instituto Antártico Chileno (INACH).



Map 3: ASPA No.149 Cape Shirreff & San Telmo Island - wildlife & human features

Measure 13 (2023)

Antarctic Specially Protected Area No 156 (Lewis Bay, Mount Erebus, Ross Island): Revised Management Plan

The Representatives,

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

Recalling

- Measure 2 (1997), which designated Lewis Bay, Mount Erebus, Ross Island as Specially Protected Area ("SPA") No 26 and adopted a Management Plan for the Area;
- Decision 1 (2002), which renamed and renumbered SPA 26 as ASPA 156;
- Measures 2 (2003) and 13 (2013), which adopted revised Management Plans for ASPA 156;

Recalling that the Committee for Environmental Protection ("CEP") XI (2008) reviewed and continued without changes the Management Plan for ASPA 156, which is annexed to Measure 2 (2003);

Recalling that Measure 2 (1997) has not become effective and was withdrawn by Measure 8 (2010);

Recalling that the CEP XXI (2018) reviewed and continued without changes the Management Plan for ASPA 156, which is annexed to Measure 13 (2013);

Noting that the CEP has endorsed a revised Management Plan for ASPA 156;

Desiring to replace the existing Management Plan for ASPA 156 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 156 (Lewis Bay, Mount Erebus, Ross Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 156 annexed to Measure 13 (2013) be revoked.

Management Plan For Antarctic Specially Protected Area No. 156

LEWIS BAY, MOUNT EREBUS, ROSS ISLAND

Introduction

An area on the lower slopes of Mount Erebus, above Lewis Bay on the north side of Ross Island, was originally declared a tomb in Recommendation XI-3 (1981) after notification by New Zealand that 257 people of several nationalities lost their lives when the DC-10 aircraft in which they were travelling crashed at this site on 28 November, 1979.

In spite of the determined and courageous actions of the New Zealand and United States Antarctic expeditions the bodies of some of those who died could not be recovered.
Expressing deep sympathy with the relatives of those who died and with the Government and people of New Zealand, the tomb was declared in order to ensure that the area be left in peace. Because the site is a tomb, its values are enduring.

The Area was designated as a Specially Protected Area No. 26 by Measure 2 (1997) primarily to ensure the Area is kept inviolate as a mark of respect in remembrance and in order to protect the site's emotional values. The site was re-designated as Antarctic Specially Protected Area No. 156 by Decision 1 (2002) and a revised management plan was adopted by Measure 2 (2003). The management plan was reviewed and continued without changes at CEP XI (2008). A new revised Management Plan was adopted in Measure 13 (2013) and in 2018 it was agreed that no changes were required and the adopted plan should remain in force.

1. Description of values to be protected

The designated Area is the crash site of Air New Zealand flight TE-901, on the slopes of the north side of Mount Erebus, Ross Island. The Area encompasses the crash site and the surrounding glacial ice, 2km to either side of this site down to within 200m of the coastline, and includes the airspace above this region to an altitude of 1000m (3280ft). The remains of the aircraft and the bodies of some of those who died that could not be recovered remain in the Area now designated as a tomb.

In late 1979 a six-foot Oregon timber cross was erected close to the crash site as a memorial to those who lost their lives. After damage by wind this cross was replaced on 30 January 1987 with a cross of stainless steel, located on a rocky promontory overlooking and approximately 3km from the crash site (Figure 1). This site is not part of the protected area, but was designated as Historic Site and Monument (HSM) No. 73 in recognition of the commemorative and symbolic values of the cross. In November 2009, a stainless steel koru time capsule was installed next to the cross containing messages from the victims’ families.

Based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) Lewis Bay is located within Environment O West Antarctic Ice Sheet (also includes inland Coats Land, Taylor Dome, Ross Island ice cap).

2. Aims and objectives

The management plan at Lewis Bay aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- ensure the crash site is kept inviolate and prevent unnecessary human disturbance to the Area;
- allow visits to the nearby site of the memorial cross for the purposes of commemoration or to pay respects;
- allow visits for purposes in support of the aims of the management plan.

3. Management activities

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

- All pilots operating in the region shall be informed of the location, boundaries and restrictions applying to entry and over-flight of the Area;
- The Area shall be visited as necessary to assess whether it continues to serve the purposes for which it was designated and to ensure the management activities are adequate;
- National Antarctic Programmes operating in the region shall consult together with a view to ensuring the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: ASPA No. 156 Lewis Bay Regional overview. Data sources: Coastline, glaciology and icefree ground from Land Information New Zealand (LINZ) 1:50,000 digital data; icefree ground edited using Sentinel 2 imagery (Jan 2023). Topography from contours derived from REMA 2.0 in SCAR Antarctic Digital Database v7.3 (2021). Map specifications: Projection: Lambert conformal conic; Standard parallels: 1st 77° 25' S; 2nd 77° 30' S; Central Meridian: 167° 30' E; Latitude of Origin: 77° 00' S; Spheroid: WGS84.

Map 2: ASPA No. 156 Lewis Bay Topography. Data sources as for Map 1, with coordinates of crash site and HSM No. 73 from management plan. Map specifications as for Map 1, except Central Meridian: 167° 27' E.

6. Description of the Area

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

The designated Area on the slopes of Mount Erebus (Map 2) encompasses the crash site, centred on 77° 25' 30"S, 167° 27' 30"E, at an elevation of 520 m (1,720ft). The Area includes the surrounding glacial ice 2km to either side of the crash site. The Area extends as a 4km wide ‘rectangle’ down to within a distance of 200m from the coastline, and includes the airspace above this region to an altitude of 1,000m (3,280ft).

The west boundary of the Area is the 167° 23' 33" E meridian; the east boundary of the Area is the 167° 33' 27" E meridian. The south boundary is the 77° 26' 33" S parallel, while the north boundary is defined by a line 200m inland from the coastline (Map 2).

The aircraft’s primary impact occurred at an elevation of 446.7m. Debris from the wreckage was spread up-slope 570m from that point, over an area 120m wide to an elevation of 580m (1,900ft). Much of the aircraft wreckage is now buried in ice and is slowly moving down-slope with the glacier to the sea. The bodies of some of those who died could not be recovered and remain in the Area.

Boundary markers have not been placed to mark the Area for two reasons: their presence is considered detrimental to the inviolate values of the site, and their maintenance would be impractical on the moving glacier.

6(ii) Access to the area

Land vehicles are prohibited within the Area and access shall be by foot or by helicopter. Overflight of the Area is prohibited below 1,000m (3,280ft) above sea level. There is a 200m wide air access ‘corridor’ located along the coastline which allows transit of aircraft along the northern boundary of the Area (Map 2). No special restrictions apply to the air routes or landing sites used to move to and from the Area by helicopter when access is permitted.

6(iii) Location of structures within and adjacent the Area

The stainless-steel memorial cross (HSM No. 73) is located on Te Puna Roimata Peak (~890m), a rock outcrop (77° 26' 38"S, 167° 33' 43"E), at an elevation of 810m (2,660ft) approximately 3km southeast of the crash site, and is a symbol of the special significance of the Area. A stainless-steel koru time capsule was installed next to the cross containing messages from the victims’ families in November 2009.

No other structures exist within or near the Area. Debris from the aircraft remains in situ.

6(iv) Location of other protected areas in the vicinity

The nearest protected areas to Lewis Bay are:

- ASPA 175 High Altitude Geothermal sites of the Ross Sea region, (parts of the summit of Mount Erebus), ~13.5km south near the summit of Mount Erebus;
- ASPA 116 Caughley Beach, New College Valley, Cape Bird approximately 35km northwest on Ross Island;
- ASPA 121 Cape Royds and ASPA 157 Backdoor Bay, approximately 35km west on Ross Island; and
- ASPA 124 Cape Crozier, 40km to the east on Ross Island.

6(v) Special zones within the Area

There are no special zones within the Area.

7. Terms and conditions for entry permits

7(i) General 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 reasons that are in support of the aims of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the actions permitted will not compromise the values of the Area;
- the Permit shall be issued for a finite period;
- the Permit, or an authorized copy, shall be carried when in the Area; and
- a visit report shall be supplied to the authority named in the Permit.

7(ii) Access to, and movement within or over, the Area

Land vehicles are prohibited within the Area and access shall be by foot or by helicopter. Overflight of the Area is prohibited below 1,000m (3,280ft) above sea level, except for essential access related to the values for which this site is protected, or for inspection and monitoring of the site. No special restrictions apply to the air routes used to move to and from the Area by helicopter when access is permitted. There is a 200m wide air access 'corridor' located along the coastline which allows transit of aircraft to the north of the northern boundary of the Area (Map 2). Use of helicopter smoke grenades within the Area is prohibited unless absolutely necessary for safety, and then these should be retrieved. Overflight and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are strictly prohibited.

7(iii) Activities which may be conducted within the Area

All visits to the Area for any purpose shall be made recognising the principal values to be protected in the Area, and as far as possible the Area should be left in peace.

Visits may be made for essential management activities including inspection to ensure the values of the Area are being maintained and to determine if materials at the site present a problem by emergence from the ice and then possible wind dispersal, or for securing or removal of such items. Visits may also be made for removal of materials introduced into the Area subsequent to its designation, if appropriate.

7(iv) Installation, modification or removal of structures

No new structures are to be erected within the Area, or scientific equipment installed except as specified in a Permit.

7(v) Location of field camps

Camping is prohibited within the Area, unless under exceptional circumstances for management. Where camping is required for such activities, the site selected shall be no closer than 200m from the location of the wreckage at the time of the visit (77° 25' 30"S, 167° 27' 30"E) (co-ordinates approximate as of 1981 Royal Commission Report).

7(vi) Restrictions on materials and organisms which may be brought into the Area

It is prohibited to introduce any materials into the Area. Smoke grenades used when absolutely necessary for safety of air operations should be retrieved.

7(vii) Taking of, or harmful interference with, native flora or fauna

Taking of, or harmful interference with, native flora or fauna is prohibited except in accordance with a permit issued in accordance with Annex II of the Protocol on Environmental Protection to the Antarctic Treaty.

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

7(viii) The collection or removal of materials not brought into the Area by the Permit holder

Unless specifically authorized by permit, visitors to the Area are prohibited from interfering with or from handling, taking or damaging anything not brought into the

Area by the Permit holder. If it has been determined that materials at the site are emerging from the ice and dispersal by wind presents a management problem, such materials should be collected or disposed of as appropriate with due regard to the families of victims and according to national procedures. Materials introduced into the Area subsequent to designation 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. The wreckage of flight TE-901 and associated debris are considered ‘materials’ within this management plan.

7(ix) Disposal of waste

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

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

Permits may be granted to enter the Area for compelling reasons that are in support of the aims of the Management Plan. To help maintain the site's emotional value, visits to the Area should be minimised as far as practicable.

7(xi) Requirements for reports

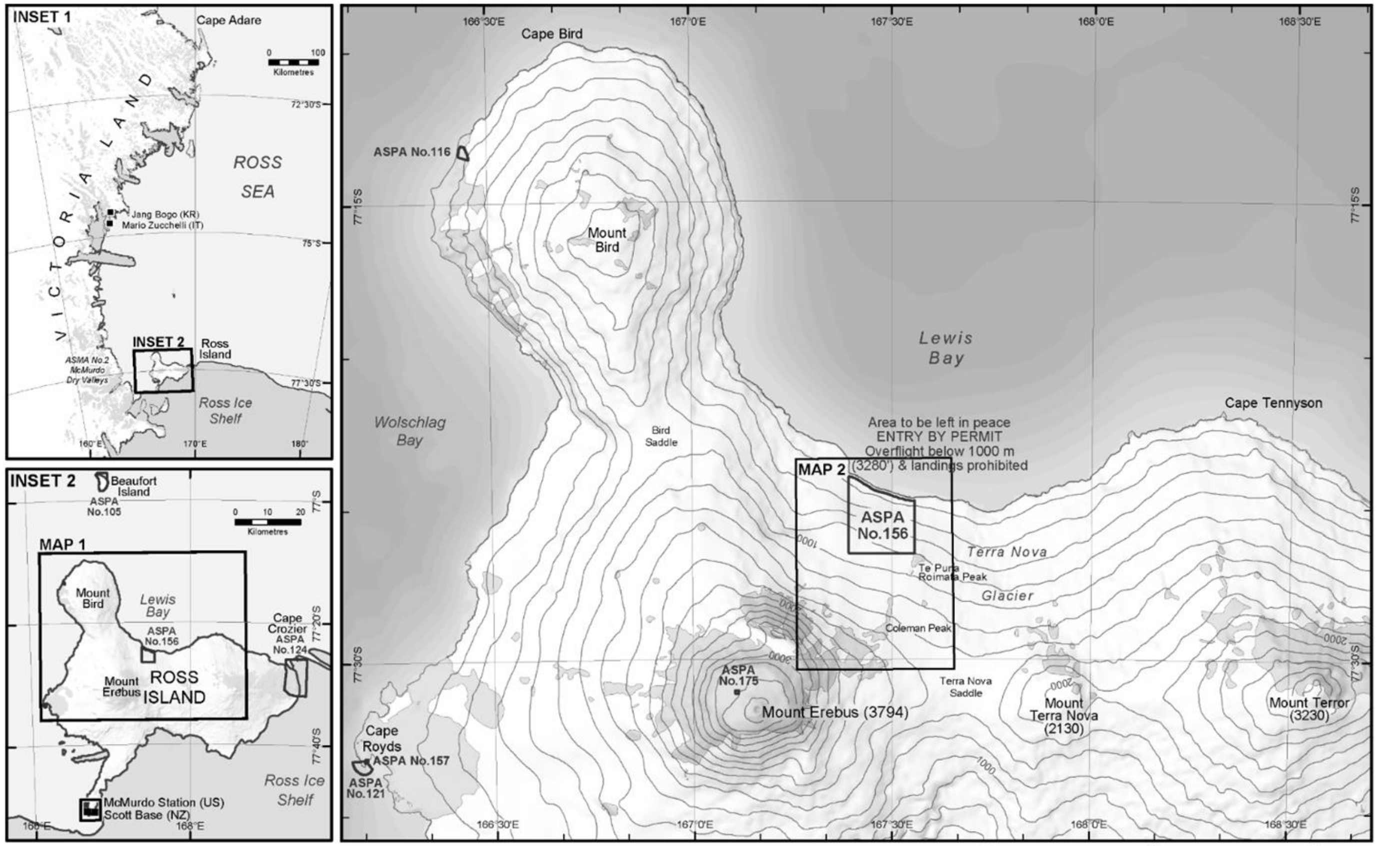
The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such visit reports should include, as applicable, the information identified in the recommended visit 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)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.

Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the use of the Area.

8. Supporting Documentation

Report of the Royal Commission to Inquire into the Crash on Mount Erebus, Antarctica, of a DC10 Aircraft Operated by Air New Zealand Limited, 1981 / presented to the House of Representatives by command of the Governor-General. (natlib.govt.nz)

Figure 1: Memorial cross for the 1979 Mount Erebus crash victims (HSM No.73) and koru time capsule (installed in November 2009), overlooking the crash site (© Antarctica New Zealand Pictorial Collection: K322 09/10)



Map 1: ASPA No.156 Lewis Bay regional overview

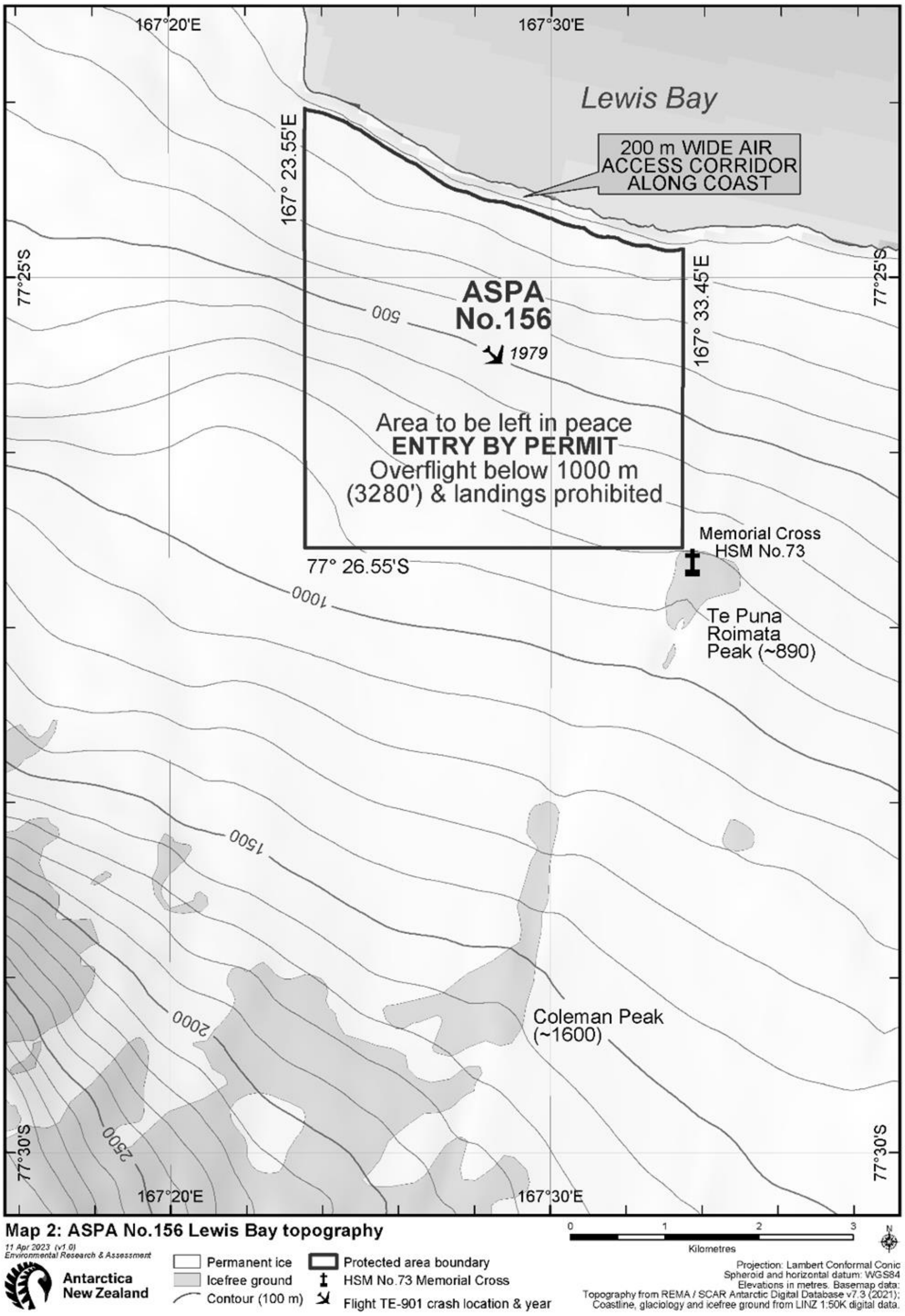
11 Apr 2023 (v1.0)
Environmental Research & Assessment

Antarctica New Zealand

Permanent ice
Icefree ground
Contour (200 m)
Protected area boundary
Permanent station

0 10 20
Kilometres

Projection: Lambert Conformal Conic
Spheroid and horizontal datum: WGS84
Elevations in metres. Basemap data:
Topography from REMA / SCAR Antarctic Digital Database v7.3 (2021);
Coastline, glaciology and icefree ground from LINZ 1:50K digital data.


167°20'E
167°30'E
Lewis Bay
200 m WIDE AIR ACCESS CORRIDOR ALONG COAST
167° 23.55'E
167° 33.45'E
77°25'S
77°25'S
ASPA No.156
1979
500
Area to be left in peace
ENTRY BY PERMIT
Overflight below 1000 m (3280') & landings prohibited
Memorial Cross HSM No.73
77° 26.55'S
1000
Te Puna Roimata Peak (~890)
1500
2000
Coleman Peak (~1600)
2500
77°30'S
77°30'S
167°20'E
167°30'E
Map 2: ASPA No.156 Lewis Bay topography
11 Apr 2023 (v1.0)
Environmental Research & Assessment
Antarctica New Zealand
Permanent ice
Icefree ground
Contour (100 m)
Protected area boundary
HSM No.73 Memorial Cross
Flight TE-901 crash location & year
0 1 2 3
Kilometres
N
Projection: Lambert Conformal Conic
Spheroid and horizontal datum: WGS84
Elevations in metres. Basemap data:
Topography from REMA / SCAR Antarctic Digital Database v7.3 (2021);
Coastline, glaciology and icefree ground from LINZ 1:50K digital data.

Measure 14 (2023)

Antarctic Specially Protected Area No 165 (Edmonson Point, Wood Bay, Ross Sea): Revised Management Plan

The Representatives,

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

Recalling

- Measure 1 (2006), which designated Edmonson Point, Wood Bay, Ross Sea as ASPA 165 and annexed a Management Plan for the Area;
- Measures 8 (2011) and 7 (2017), which adopted revised Management Plans for ASPA 165;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 165;

Desiring to replace the existing Management Plan for ASPA 165 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 165 (Edmonson Point, Wood Bay, Ross Sea), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 165 annexed to Measure 7 (2017) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 165

EDMONSON POINT, WOOD BAY, VICTORIA LAND, ROSS SEA

Introduction

Edmonson Point (74°20' S, 165°08' E, 5.49 km^2) is located in Wood Bay, Victoria Land, Ross Sea. The total Area of the ASPA is 5.49 km^2 and comprises the ice-free area of Edmonson Point (1.79 km^2), the smaller but similar ice-free area at Colline Ippolito (1.12 km^2) approximately 1.5 km to its north which is designated a Restricted Zone, and the adjacent marine environment (2.58 km^2) extending 200 m offshore from Edmonson Point and Colline Ippolito and including Baia Siena (Siena Bay) (Map 1).

The primary reasons for the designation of this Area as an ASPA are the outstanding ecological and scientific values which require protection from possible interference that might arise from unregulated access. An exceptional diversity of freshwater habitats is present, with numerous streams, lakes, ponds and seepage areas. The site is considered one of the best in Antarctica for studies of algal ecology.

The Area hosts a colony of Adélie penguins (Pygoscelis adeliae) and is an important breeding site of South Polar Skua (Stercorarius maccormicki).

The Area was first designated as an Antarctic Specially Protected Area (ASPA) through Measure 1 (2006) after a proposal by Italy; the Area was reviewed in 2011 (Measure 8 (2011)) and in 2017 (Measure 7 (2017)).

The Area is classified as Environment D – East Antarctic coastal geologic based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) and is classified as Region 8 – North Victoria Land under the Antarctic Conservation Biogeographic Regions (ACBR) classification (Resolution 3 (2017)). The area is identified as Important Bird Area 175 according to Resolution 5 (2015).

1. Description of values to be protected

The terrestrial and freshwater ecosystem at Edmonson Point is one of the most outstanding in northern Victoria Land. An exceptional diversity of freshwater habitats is observed, showing nutrient conditions ranging from eutrophic to oligotrophic. Such a wide range of freshwater habitats is rare in Victoria Land. These habitats support a high diversity of algal and cyanobacterial species, with over 120 species so far recorded, and the stream network is the most extensive and substantial in northern Victoria Land. The volcanic lithology and locally nutrient-enriched (by birds) substrata, together with a localised abundance of water, provides a habitat for relatively extensive bryophyte development. Plant communities are highly sensitive to changes in the hydrological regime and environmental gradients produce sharply defined community boundaries. Thus, the range of vegetation is diverse, and includes epilithic lichen communities, some of which are dependent on high nitrogen input from birds, communities associated with late-lying snow patches, and moss-dominated communities that favour continually moist or wet habitats. The site represents one of the best examples of the latter community-type in Victoria Land. Invertebrates are unusually abundant and extensively distributed for this part of Antarctica.

The nature and diversity of the terrestrial and freshwater habitats offer outstanding scientific opportunities, especially for studies of biological variation and processes along moisture and nutrient gradients. The site is considered one of the best in Antarctica for studies of algal ecology. These features were among those that led to the selection of Edmonson Point as a key site in the Scientific Committee on Antarctic Research's Biological Investigations of Terrestrial Antarctic Systems (BIOTAS) programme in 1995-96. A coordinated multinational research programme, known as BIOTEX-1, established study sites and made extensive collections of soil, rock, water, snow, guano, bacteria, vegetation (cyanobacterial mats, fungi, algae, lichens, bryophytes) and of terrestrial invertebrates.

The scientific value of Edmonson Point is also considered exceptional for studies on the impact of climate change on terrestrial ecosystems. Its location at approximately the mid-point in a north-south latitudinal gradient extending along Victoria Land is complementary to other sites protected for their important terrestrial ecological values, such as Cape Hallett (ASPA No. 106) and Botany Bay, Cape Geology (ASPA No. 154), which are about 300 km to the north and south respectively. This geographical position is recognised as important in a continent-wide ecological research network (e.g., the Scientific Committee on Antarctic Research 'RiSCC' programme). In addition, the lakes are among the best in northern Victoria Land for studies of biogeochemical processes with short- and long-term variations. Together with the unique properties of the permafrost active layer, which is unusually thick in this location, these features are considered particularly useful as sensitive indicators of ecological change in response to levels of UV radiation and in shifting climate.

A colony of approximately 2000-2500 pairs of Adélie penguins (Pygoscelis adeliae) has been a focus of ongoing research since 1994-95 together with a colony of approximately 120 pairs of south polar skuas (Stercorarius maccormicki). The Edmonson Point Adélie penguin colony is included in the ecosystem monitoring network of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). The site is considered a good example of this species assemblage, which is representative of those found elsewhere. It is unusual, however, for the diverse range of breeding habitat available for south polar skuas, and also because of the unusually high skua to penguin ratio (1:20). The geographical position, the size of the colonies, the terrain and habitat features of the site, the natural protection given by the summer fast ice extension and the distance from the research stations at Terra Nova Bay (which isolates the colony from research station disturbance but allows for logistic support) make Edmonson Point particularly suitable for the research being undertaken on these birds. The research contributes to the CCAMLR Ecosystem Monitoring Programme (CEMP), focusing on population monitoring, reproductive success, feeding and foraging strategies, migration, and behaviour. This research is important to broader studies of how natural and humaninduced variations in the Antarctic ecosystem may affect the breeding success of Adélie penguins, and to understand the potential impact of harvesting of Antarctic krill (Euphausia superba). The purpose of protected area designation is to allow planned research and monitoring to proceed, while avoiding or reducing, to the greatest extent possible, other activities which could interfere with or affect the results of the research and monitoring programme of alter the natural features of the site.

The near-shore marine environment is a good and representative example of the sea-ice habitat used by breeding Weddell seals to give birth and wean pups early in the summer season. Only one other ASPA in the Ross Sea region has been designated to protect Weddell seals (ASPA No. 137 Northwest White Island, McMurdo Sound), although this site is designated because the small breeding group of seals in that locality is highly unusual; in contrast, inclusion here is as a representative example similar to breeding sites throughout the region.

In addition to the outstanding biological values, a diversity of geomorphic features is present, including a series of ice-cored moraines incorporating marine deposits, raised beaches, patterned ground, a cuspate foreland, and fossil penguin colonies. The cuspate foreland at Edmonson Point is a rare feature in Victoria Land and is one of the best examples of its kind. It is unusual in that it is not occupied by a breeding colony of penguins, as is the case at Cape Hallett and Cape Adare. The glacial moraines that incorporate marine deposits, including seal bones and shells of the bivalves Laternula elliptica and Adamussium colbecki, are particularly valuable for dating regional glacier fluctuations. Sedimentary sequences in the north-west of Edmonson Point contain fossils from former penguin colonies. These are useful for dating the persistence of bird breeding at the site, which contributes to reconstructions of Holocene glacial phases and palaeoclimate.

The wide representation and the quality of phenomena at Edmonson Point have attracted interest from a variety of disciplines and research has been carried out at the site for more than 20 years. Over this period, substantial scientific databases have been established, which adds to the value of Edmonson Point for current, on-going and future research. It is important that pressures from human activities in the Area are managed so that the investments made in these long-term data sets are not inadvertently compromised. These factors also make the site of exceptional scientific value for multi-disciplinary studies.

Given the duration and range of past activities, Edmonson Point cannot be considered pristine. Some environmental impacts have been observed, such as occasional damage to soils and moss communities by trampling, dispersal of materials from scientific equipment by wind, and alteration of habitat by construction of facilities. In contrast, the ice-free area at Colline Ippolito (Ippolito Hills) (1.67 km^2) approximately 1.5 km to the north-west, has received relatively little visitation and human disturbance at this site is believed to be minimal. As such, Colline Ippolito is considered particularly valuable as a potential reference area for comparative studies to the main Edmonson Point, and it is important that this potential scientific value is maintained. While the precise effects of scientific research and human presence at both sites are uncertain, because detailed studies on human impact have not yet been undertaken, contaminants in the local marine ecosystem remain very low and human impacts on the ecosystem as a whole, particularly at Colline Ippolito, are considered to be generally minor.

The biological and scientific values at Edmonson Point and Colline Ippolito are vulnerable to human disturbance. The vegetation, water-saturated soils and freshwater environments are susceptible to damage from trampling, sampling and pollution. Scientific studies could be compromised by disturbance to phenomena or to installed equipment. It is important that human activities are managed so that the risks of impacts on the outstanding values of the Area are minimised.

2. Aims and objectives

Management at Edmonson Point aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance;
- allow scientific research and long-term monitoring of terrestrial and marine ecosystems, provided that such activities are for compelling reasons that cannot be served elsewhere;
- allow scientific research while ensuring protection from mutual interference and/or over-sampling;
- preserve a part of the natural ecosystem as a potential reference area for the purpose of future comparative studies;
- prevent, to the maximum extent practicable, the introduction of non-native species and pathogens that may endanger or alter the local ecosystems;
- allow visits for management purposes in support of the aims of the Management Plan and for educational and outreach purposes provided that such activities will not jeopardise the natural ecological system in that Area.

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 all permanent stations that operate in the vicinity of the area, and permit holders shall be specifically instructed on the contents of the management plan;
- Structures, markers, signs, fences or other equipment erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer necessary;
- Markers, which should be clearly visible from the air and pose no significant risk to the environment, should be placed to mark the designated helicopter landing sites and should be placed to mark the preferred inland walking

routes between the Adélie penguin colony and the designated helicopter landing sites;

- Any abandoned equipment or material shall be removed to the maximum extent practicable provided doing so does not adversely impact on the environment and the values of the Area;
- 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 are encouraged to promote international collaboration and to consult together to coordinate sampling and bird mapping activities thus reducing cumulative impact and preventing oversampling of soil, flora and fauna within the Area.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: Edmonson Point ASPA No. 165, Wood Bay, Victoria Land, Ross Sea. Map specifications: Projection: UTM Zone 58S; Spheroid: WGS84; Ice-free areas and coastline derived from rectified Quickbird satellite image with a ground pixel resolution of 70 cm, acquired 04/01/04 by Programma Nazionale di Ricerche in Antartide (PNRA), Italy. Horizontal accuracy approx ±10 m; elevation information unavailable. Inset 1: the location of Wood Bay in Antarctica. Inset 2. The location of Map 1 in relation to Wood Bay and Terra Nova Bay. The location of Mario Zucchelli Station (Italy), Gondwana Station (Germany), and the nearest protected areas are shown.

Map 2: Edmonson Point, ASPA No. 165, Physical / human features and access guidelines. Map derived from digital orthophotograph with ground pixel resolution of 25 cm, from ground GPS surveys and observations, and from Quickbird satellite image (04/01/04).

Map specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 72° 40' 00" S; 2nd 75° 20' 00"S; Central Meridian: 165° 07' 00" E; Latitude of Origin: 74° 20' 00" S; Spheroid: WGS84; Vertical datum: Mean Sea Level. Vertical contour interval 10 m. Horizontal accuracy: ±1 m; vertical accuracy expected to be better than ±1 m.

Map 3: Restricted Zone, Colline Ippolito: Edmonson Point ASPA No. 165. Map derived from Quickbird satellite image (04/01/04). Map specifications as for Map 2, except for horizontal accuracy which is approx ±10 m, and elevation information is not available. Sea level is approximated from coastline evident in satellite image.

Map 4: Edmonson Point ASPA No. 165, topography, wildlife and vegetation. Map specifications as for Map 2, except for contour interval which is 2 m.

Map data and preparation: PNRA, Dipartimento di Scienze Ambientali (Università di Siena), Environmental Research & Assessment (Cambridge), Gateway Antarctica (Christchurch).

6. Description of the Area

- *Geographical coordinates, boundary markers and natural features*

Edmonson Point (74°20' S, 165°08' E) is a coastal ice-free area situated at Wood Bay, 50 km north of Terra Nova Bay, and 13 km east of the summit and at the foot of Mount Melbourne (2732 m), Victoria Land. The Area comprises a total of 5.49 km², including the entire ice-free ground of Edmonson Point (1.79 km²), the separate ice-free area of Colline Ippolito (Ippolito Hills) (1.12 km²) approximately 1.5 km north-west of Edmonson Point, and the nearshore marine environment and intervening sea of Baia Siena (Siena Bay) between these ice-free areas (2.58 km²), which lie east and at the foot of the permanent ice sheet extending from Mount Melbourne (Map 1). Part of the glacier from Mount Melbourne separates the two ice-free areas on land. A broad pebbly beach extends the length of the coastline of Edmonson Point, above which cliffs rise up to 128 m towards the south of the Area. The topography of the Area is rugged, with several hills of volcanic origin of up to 134 m in height, and ice-free slopes rising to around 300 m adjacent to the ice sheet, although accurate elevation information in these areas is not currently available. Undulating ice-cored moraines, boulder fields and rock outcrops are separated by small ash plains and shallow valleys. The Area is dissected by numerous valleys and melt streams, with several small lakes, and seepage areas being common features throughout the Area. In the central region of Edmonson Point there are several wide shallow basins, at about 25 m elevation, covered by fine scoria and coarse sand, mixed with extensive carpets of vegetation and areas of patterned ground. The northern coast of Edmonson Point is a cuspate foreland comprising several raised beaches.

The environmental character of Colline Ippolito is similar to that of Edmonson Point. This area has a narrow boulder beach backed by a ridge running parallel to the coast. Small meltwater streams run through shallow gullies and across flats into two lakes behind the coastal ridge in the north. Ridges and cones rise to about 200 m before merging with the snow fields and glaciers of Mount Melbourne in the south.

- *Boundaries*

The margin of the permanent ice sheet extending from Mount Melbourne is defined as the boundary in the west, north and south of the Area (Maps 1-3). The eastern boundary is marine, which in the southern half of the Area follows the coastline 200 m offshore from the southern to northern extremities of the ice-free area of Edmonson Point. From the northern extremity of Edmonson Point, the eastern boundary extends NW across Baia Siena for a distance of 2 km to a position 200 m due east from the coast of the northern extremity of Colline Ippolito. Baia Siena is thus enclosed within the Area. The ice sheet margin and the coast represent obvious boundary references.

- *Climate*

Since November 1999, a weather station installed near the penguin colony at Edmonson Point provides continuous meteorological records. The average mean temperature of the whole period recorded is -9.9 ºC. Mean monthly temperature ranges from -25.2°C in July to -0.9°C in January. During summer, Edmonson Point Area experiences extended periods with temperatures above 0 ºC. The mean annual snow accumulation is about 20-50 cm, equivalent to 10-20 mm of water (Bargagli et al., 1997). Relative humidity is low (15-40% day, 50-80% night), precipitations are occasional, in the form of light snow, and wind speeds are mostly low (average is about 5 knots). Weather conditions deteriorate from late January, with frequent subzero daytime temperatures, snow-fall and high winds. Available data for the summer season at Edmonson Point indicate prevailing winds from North North-East and South-South-West, while they blow from North-West during wintertime. Average daily wind speeds are generally in the range of 3-6 knots, with daily maximums usually being of 6-10 knots, and only occasionally reaching up to 25-35 knots. Daily average air temperatures ranged from around -25°C in July and August, -17°C in October, about -10°C in November, -2.5°C in December, -1°C in January, and decrease to -5°C in February. The highest daily maximum temperatures were recorded from December 2013 to January 2014 when they reached +11.3°C. Average daily relative humidity generally ranged between 40-60%.

- *Geology and soils*

The geological setting of Edmonson Point is dominated by the Cenozoic eruptive activity of Mount Melbourne (Melbourne Volcanic Province), that is part of the McMurdo Volcanic Group (Kyle, 1990). The bedrock is overlaid by glacial deposits from the marine-based ice sheet that covered much of the Victoria Land coastline during the last glacial maximum (7500 to 25000 years BP) (Baroni and Orombelli, 1994). The volcanic complex is composed of a large subaerial tuff ring, scoria cones, lava flows, and subaquatic megapillow lava sequences (Wörner and Viereck, 1990). The rocks are mainly of basaltic and/or trachytic composition, with accumulations of tuffs, pumices and debris deposits (Simeoni et al., 1989; Bargagli et al., 1997). The ground surface is composed mainly of dry, coarse-textured volcanic materials with a low proportion of silt and clay (Bargagli et al., 1997). These exposed surfaces, as well as beneath the surfaces of stones and boulders, are often coated with white encrustations or efflorescences of soluble salts. Most of the ground is dark-coloured, with brownish or yellowish patches of scoria and tuffite. Unstable, dry and mostly unvegetated screes are common on the hill slopes. Valley and basin floors are covered by fine scoria and coarse sand (Bargagli et al., 1999). A survey of soils across Edmonson Point indicated considerable variation in types and elemental composition, ranging from dry fellfield to guano-enriched ornithogenic soil (Smykla et al. 2015, 2018a).

- *Geomorphology*

A series of marine deposits are visible on the cuspate foreland at the northern extremity of Edmonson Point. The gently sloping raised beaches of the foreland are composed of differing ratios of sands, pebbles and boulders distributed over lava flows (Simeoni et al., 1989). Numerous small crater-like pits, many containing melt-water or ice, can be observed just above the high tide mark in this locality. They were likely formed by extreme tides and melting of coastal ice accumulations. South of the cuspate foreland, volcanic bedrock exposures are common over much of the ground extending up to about 800 m inland from the coast. They are most evident in the prominent hills of about 120 m in height in the central northern part of Edmonson Point. A series of late-Pleistocene moraines and related tills lay on the western side of these exposures, with bands of Holocene ice-cored moraine, talus and debris slopes adjacent to the glacier ice which extends from Mount Melbourne (Baroni and Orombelli, 1994).

- *Streams and lakes*

Six lakes up to 350 m long and 1600 m² to 15,000 m² in area (Map 2) are reported at Edmonson Point. Two more lakes occur behind the coastal ridge at Colline Ippolito, the largest of which is approximately 12,500 m² in area (Map 3). In addition, there are approximately 22 smaller ponds less than 30 m in diameter (Broady, 1987). The larger ponds are permanently ice-covered, with peripheral moats forming during the summer. Detailed physico-chemical characteristics and limnology of the lakes of Edmonson Point are reported in Guilizzoni et al. (1991). There are numerous streams throughout the Area, some of which are supplied with meltwater from the adjacent ice sheet, while others are fed by lakes and general ice / snow melt. Several stream beds have flood terraces of fine soil covered by pumice-like pebbles of 5-10 mm diameter. Many of the streams and pools are transient, drying up shortly after the late snow patches in their catchments disappear.

- *Terrestrial Ecology*

Studies of terrestrial ecology at Edmonson Point were initiated in the 1980s. In the 1990s, Edmonson Point became the location of BIOTEX 1, the first SCAR Biological Investigation of Antarctic Terrestrial Ecosystems (BIOTAS) research expedition. Three countries participated in a variety of scientific projects which included: taxonomic, ecological, physiological and biogeographical studies on cyanobacteria, algae, bryophytes, lichens (including chasmolithic and endolithic communities), nematodes, springtails and mites; studies of soil and freshwater biogeochemistry; microbial metabolic activity and colonisation studies; and investigations into the photosynthetic responses to ambient and controlled conditions of mosses, lichens and plant pigments that may act as photoprotectants (Bargagli, 1999). While the BIOTAS programme has now formally concluded, further studies of this type are on-going at Edmonson Point (IPECA project). Microbiological analyses were carried out on permafrost active layer (Bargazza et al., 2019; Papale et al., 2018; Canini et al., 2020, 2021; Severgnini et al., 2021) and in water and sediment of four coastal lakes (Papale et al. 2022). In the active layer, taxonomical composition showed that Proteobacteria and Actinobacteria (27.3 and 18.4%, respectively) dominated the prokaryotic community, with most of their members playing crucial roles in organic matter turnover (Papale et al. 2018). Acidobacteria, Nitrospirae, Chloroflexi and Bacteroidetes ranged between 3.6 and 7.8% of total sequences. Firmicutes (2.6%), Gemmatimonadetes (2.5%), Parcubacteria (1.9%), Latescibacteria (1.7%), Cyanobacteria (1.5%) constituted a minor component.

The Edmonson Point beach has been also studied through remote sensing techniques in Ponti et al. (2021) that remarked as the beach has been interested by permafrost with probable saline talik underlying that can change the topography of the beach with the progressive active layer thickening but also the effect of the storms that can bring huge amount of iceberg on the beach shaping the beach itself.

- *Plant biology*

Compared to several other sites in central Victoria Land, Edmonson Point does not have a particularly diverse flora, and there are only a few extensive closed stands of vegetation. Six moss species, one liverwort, and at least 30 lichen species have been recorded within the Area (Broady, 1987; Lewis Smith, 1996, 1999; Lewis Smith pers. comm., 2004; Castello, 2004; Smykla et al. 2010). Cavacini (1997, 2001) reported at least 120 alga and cyanobacteria species present at Edmonson Point. These are present in a range of forms including algal mats on soil and as epiphytes on mosses, and in a range of habitats such as in lakes, streams and snow, and on moist ornithogenic and raw mineral soils. At the onset of summer, snow melt reveals small stands of algae and moss on valley floors, although much of these lie buried by up to 5 cm of wind-blown and melt-washed fine mineral particles. This community is capable of rapid growth during December, when moisture is available and soil temperatures are relatively high, bringing shoot apices up to a centimetre above the surface as the surface accumulation of sand is washed or blown away. Increased water flow or strong winds can quickly bury these stands, although sufficient light for growth can penetrate 1-2 cm below the surface (Bargagli et al., 1999). The principal moss communities occur on more stable substrata which are not subjected to burial by sand, for example in sheltered depressions or along the margins of ponds and meltwater streams, and seepage areas below late snow beds where moisture is available for several weeks. Some of these are among the most extensive stands found in continental Antarctica, being of up to 3000 m², most notably the stand of Bryum subrotundifolium (= B. argenteum) several hundred metres west of the main Adélie colony (Map 4). Other, less extensive, notable stands occur near the lake adjacent to the Adélie colony (Map 4), and smaller localized stands of Ceratodon purpureus (with relatively thick deposits of dead organic material) being found in a valley in the north of Edmonson Point and in the upper area of the principal stream in the northern ice-free area. Greenfield et al. (1985) suggested that, apart from Cape Hallett, no area in the Ross Sea has a comparable abundance of plants, although in 1996 a similarly extensive area colonised almost exclusively by Bryum subrotundifolium (= B. argenteum) was discovered on Beaufort Island (ASPA No. 105), approximately 280 km to the south of Edmonson Point.

The moss-dominated communities comprise up to seven bryophyte species, several algae and cyanobacteria and, at the drier end of the moisture gradient, several lichens encrusting moribund moss (Lewis Smith, 1999; Bargagli et al., 1999). There are mixed communities or zones of Bryum subrotundifolium (= B. argenteum), B. pseudotriquetrum and Ceratodon purpureus. In some wetter sites the liverwort Cephaloziella varians occurs amongst C. purpureus. Dry, very open, often lichen-encrusted moss communities usually contain Hennediella heimii, and often occur in hollows which hold small late snow patches. Sarconeurum glaciale occurs in a stable scree above the large lake in the south of the Area (Lewis Smith, 1996). The upper portions of moss colonies are often coated with white encrustations of soluble salts (Bargagli et al., 1999). The changes in the recent time, due to the warming in the area were stressed in Cannone et al. (2021) that pointed out as a warming trend and an active layer thickening in the last 20 years leaded important changes of vegetation (mosses) but also a progressive soil alkalinization, especially where soil were covered by scarce vegetation cover or were bare. The effect of the vegetation and in particular, of the different species of mosses and their water holding capacity has been also underlined thanks to the thermal and vegetation monitoring within the Edmonson Point area (Hrbaceck et al., 2020).

The lichen communities are relatively diverse, with 24 species identified and at least six crustose species so far unidentified, although few are abundant (Castello, 2004; Lewis Smith, pers. comm. 2004). Epilithic lichens are generally sparse and not widespread, being mainly crustose and microfoliose species restricted to rocks used as skua perches and occasionally on stable boulders in scree, moist gullies and temporary seepage areas. Macrolichens are scarce, with Umbilicaria aprina and Usnea sphacelata found in a few places. The former species is more abundant on the gently sloping intermittently inundated outwash channels of Colline Ippolito, together with Physcia spp. and associated with small cushions of Bryum subrotundifolium (= B. argenteum) (Given, 1985, 1989), B. pseudotriquetrum and Ceratodon purpureus (Lewis Smith, pers comm. 2004). Buellia frigida is the most widespread crustose lichen on the hard lavas, but a distinct community of nitrophilous species occurs on rocks used as skua perches (Caloplaca, Candelariella, Rhizoplaca, Xanthoria). In gravelly depressions below late snow beds, moss turves are often colonised by encrusting cyanobacteria and ornithocoprophilic lichens (Candelaria, Candelariella, Lecanora, Xanthoria) and, where there is no bird influence, by the white Leproloma cacuminum (Lewis Smith, 1996).

Early work on the algal flora at Edmonson Point identified 17 species as Cyanophyta, 10 as Chrysophyta and 15 as Chlorophyta (Broady, 1987). More recent analyses have identified 120 alga and cyanobacteria species, which is considerably more than the numbers of species of Cyanophyta (28), Chlorophyta (27), Bacillariophyta (25) and Xanthophyta (5) recorded previously (Cavacini, 1997, 2001; Fumanti et al., 1993, 1994a, 1994b; Alfinito et al., 1998). Broady (1987) observed few areas of algal vegetation on ground surfaces; the most extensive were oscillatoriacean mats in moist depressions in areas of beach sand, which may have been temporary melt ponds prior to when the survey was undertaken. Similar mats were found adjacent to an area of moss with a Gloeocapsa sp. as an abundant associate. Prasiococcus calcarius was observed in the vicinity of the Adélie penguin colony, both as a small area of rich green crusts on soil and growing on an area of moribund moss cushions. Other epiphytic algae include Oscillatoriaceae, Nostoc sp., unicellular chlorophytes including Pseudococcomyxa simplex, and the desmid Actinotaenium cucurbita. Substantial stream algae were observed with waters containing oscillatoriacean mats over the stream beds, wefts of green filaments attached to the surface of stones (mainly Binuclearia tectorum and Prasiola spp.), small ribbons of Prasiola calophylla on the under-surfaces of stones, and dark brown epilithic crusts of cyanophytes (dominated by Chamaesiphon subglobosus and Nostoc sp.) coating boulders. Ponds present in beach sand contained Chlamydomonas sp. and cf. Ulothrix sp., while ponds fertilized by penguin and skua guano contained Chlamydomonas sp. and black benthic oscillatoriacean mats. Other ponds also contained rich benthic growths of Oscillatoriaceae, frequently associated with Nostoc sphaericum. Other abundant algae were Aphanothece castagnei, Binuclearia tectorum, Chamaesiphon subglobosus, Chroococcus minutus, C. turgidus¸ Luticola muticopsis, Pinnularia cymatopleura, Prasiola crispa (particularly associated with penguin colonies and other nitrogen-enriched habitats), Stauroneis anceps, various unicellular chlorophytes, and – in the highest conductivity pond in beach sand – cf. Ulothrix sp.

Algae and cyanobacteria are locally abundant in moist soils, and filaments and foliose mats of Phormidium spp. (dominant on patches of wet ground and in shallow lake bottoms), aggregates of Nostoc commune and a population of diatoms have been identified (Wynn-Williams, 1996; Lewis Smith pers. comm., 2004). The fungal species Arthrobotrys ferox has been isolated from moss species Bryum pseudotriquetrum (= B. algens) and Ceratodon purpureus. A. ferox produces an adhesive secretion which has been observed to capture springtails of the species Gressittacantha terranova (about 1.2 mm in length) (Onofri and Tosi, 1992).

- *Invertebrates*

There is a high diversity of soil nematodes in the moist soils at Edmonson Point when compared to other areas described in Victoria Land. Nematodes found at Edmonson Point include Eudorylaimus antarcticus, Monhysteridae sp., Panagrolaimus sp., Plectus antarcticus, P. frigophilus, and Scottnema lyndsayea (Frati, 1997; Wall pers. comm., 2000). The latter species, previously only known from the McMurdo Dry Valleys, was found at Edmonson Point in 1995-96 (Frati, 1997). Less abundant are the springtails, most commonly Gressittacantha terranova, which was found under rocks and on soil and mosses in a number of moist microhabitats (Frati, 1997). Red mites (likely to be either Stereotydeus sp. or Nanorchestes, although species not identified) are common in aggregations beneath stones in moist habitats, and Collembola, rotifers, tardigrades and a variety of protozoans are also found (Cakil et al., 2021; Frati et al., 1996; Garlaschè et al., 2020; Lewis Smith, 1996; Smykla et al. 2010).

A survey of microfauna across soil environments at Edmonson Point by Smykla et al. (2017, 2018b) also revealed a high diversity of rotifers (18 of 24 species identified) followed by four nematodes and two tardigrades. The authors consider the Area a biodiversity hot-spot for microfauna in the Ross Sea region.

- *Breeding birds*

Two species of birds are known to breed at Edmonson Point: Adélie penguins (Pygoscelis adeliae); south polar skua (Stercorarius maccormicki). Flocks of snow petrels (Pagodroma nivea) have been observed flying over the Area, and Wilson's storm petrels (Oceanites oceanicus) have been regularly sighted. Neither of these species is known to breed within the Area.

Adélie penguins (Pygoscelis adeliae) breed in two groups near the coast in the central and eastern-most part of Edmonson Point, occupying an area of about 9000 m² (Map 4). Investigations on the colony began in the early 1980s. The number of breeding pairs recorded between 1981 and 2022 is reported in Table 1. Abandoned nesting sites located ~1 km to the northwest of the current colony were occupied approximately 355 – 2000 calendar years B.P., on bedrock adjacent to the cuspate foreland (Baroni and Orombelli, 1994; Lambert et al. 2002; Emslie et al. 2007).

Table 1. Adélie penguins (breeding pairs) at Edmonson Point between 1981-and 2022 (data Woehler, 1993; Olmastroni, et al., 2022 and references therein).

Year	No. of breeding pairs	Year	No. of breeding pairs
1981	1300	**2003**	2588
1984	1802	**2005**	2385
1987	2491	**2007**	2303
1989	1792	**2010**	2112
1991	1316	**2015**	3066
1994	1960	**2016**	2737
1995	1935	**2018**	2704
1996	1824	**2019**	2955
1997	1961	**2020**	3078
1999	2005	**2022**	2889
2001	1988		

The presence at Edmonson Point of breeding penguin colonies and the absence of krill fisheries within their foraging range make this a critical site for comparative studies and inclusion with other CCAMLR Ecosystem Monitoring Program (CEMP) sites in the ecosystem monitoring network established to meet the objectives of CCAMLR. The Adélie Penguin Monitoring Program, a joint research project between Italian and Australian biologists, has been ongoing at Edmonson Point since 1994-95. An Automated Penguin Monitoring System (APMS) along with on-site observations by researchers, forms the basis of a study of at least 500-600 nests within the northern sector of the colony as part of the CEMP (CCAMLR, 1999; Olmastroni et al., 2000). Fences have been installed to direct penguins over a bridge which registers their weight, identity and crossing direction as they move between the sea and their breeding colony.

The studies on Adélie penguin involve population monitoring, experiments with satellite transmitters and temperature-depth recorders to investigate foraging location and duration. Combined with stomach flushing to record the diet of monitored penguins, this programme is developing comprehensive observations of Adélie penguin feeding ecology (Olmastroni, 2002). Diet data (Olmastroni et al., 2004) confirmed the results of studies from krill distribution in the Ross Sea (Azzali and Kalinowski, 2000; Azzali et al., 2000) and indicate that this colony is located at a transition point in the availability of E. superba between northern and more southerly colonies where this species is absent or rare in the diet of penguins (Emison, 1968; Ainley, 2002). These studies also highlighted the importance of fish to the diet of the Adélie penguin, which represented up to 50% of their stomach contents in some years.

Local sea ice and weather data contribute to the understanding of possible factors affecting the breeding biology of this species (Olmastroni et al., 2004). Behavioural studies were also part of the research (Pilastro et al., 2001).

A project called “PenguinERA” of the Italian National Program of Research in Antarctica is being carried out to understand the ecological role of the Adélie penguin. The research, initiated in 2017, is being conducted with an advanced multidisciplinary approach, combining a series of field surveys, remote data acquisition (using a penguin nest camera, an automated monitoring system, and photogrammetry modelling based on surveys conducted by unmanned aerial vehicles (UAVs)) and laboratory analyses.

Abundance estimates and reproductive success data collected during the expeditions on the Adèlie penguin population at Edmonson Point were processed in accordance with CCAMLR Standard Methods and sent to the committee in June 2018 and June 2019, 2020, and 2022, thus updating the historical dataset started in 1994. While total population abundance did not vary greatly, a different arrangement of breeding groups within the colony was observed, probably because of intraspecific competition and the high skua predation pressure over time (Fattorini et al 2019, Olmastroni et al 2022).

Monitoring of reproductive success at the end of breeding seasons showed a relatively stable level, and values were in line with those measured at the two Terra Nova Bay colonies (Adélie Cove and Inexpressible Island; Olmastroni et al 2020, 2022). While large-scale environmental factors affected adult survival, breeding success varied principally according to local variables. Breeding success was particularly low when local stochastic events (storms) occurred at sensitive times of the breeding cycle (immediately after the hatching) (Olmastroni et al. 2004; Pezzo et al, 2007; Ballerini et al., 2009). Also changes in fast-ice extent in front of the breeding area influenced the adult breeders transit times between colony and foraging grounds, and females conducted longer foraging trips, dived for longer periods and made more dives than males. The diving parameters were affected neither by the sex nor by the year, but differed between the breeding stages (Nesti et al, 2010). Annual adult survival probability at Edmonson Point (0.85, range 0.76–0.94) was similar to that estimated from other Adélie penguin populations in which individuals were marked with passive transponders. An annual average survival rate of 0.85 seems to be typical of the species and is consistent with an expected average lifespan of about 11 years (6.6 years after adulthood) (Ballerini et al., 2009).

The study of foraging areas by satellite telemetry was carried out in two years. Foraging trips between the colony and the sea were tracked through Splashtag and Spot tag (Wildlife Computers) transmitters deployed on 30 animals at Edmonson Point during the breeding season. Tracking maps showed that penguins foraged between fast ice and pack ice in the vicinity of Terra Nova Bay and Wood Bay and will contribute to update the long-term dataset existing for this colony (Olmastroni et al 2020, Hindell et al 2018, Ropert-Coudert et al 2018, unpublished data).

Within the Area there is also one of the most numerous breeding colonies of south polar skuas (Stercorarius maccormicki) in Victoria Land, The colony is being monitored together with the penguin population. It consists of over 120 pairs, 36 of which occupy Colline Ippolito (CCAMLR, 1999; Pezzo et al., 2001; Piece et al., 2001, Olmastroni et al. 2022). The overall ratio between south polar skua and penguin is about 1:20. Numbers of breeding skuas nesting around the penguin colony at Edmonson Point ranged 61-81, in line with a previous census of 68 in 2014/15 but suggesting a possible decreasing trend in this area when compared to older values (120 nests measured up to 2010, Pezzo et al. 2001 and unpublished data).The Area also includes two “club sites”, nearby large freshwater ponds, used throughout the breeding seasons by groups of non-breeders ranging between 50 and 70 individuals (Pezzo 2001; Volpi 2005 pers. comm.). Research on the south polar skua colony focuses on breeding biology (Pezzo et al., 2001), population dynamics, biometry, reproductive biology and migratory patterns. Since 1998/99 more than 300 south polar skuas have been banded by metal and coloured rings, which facilitate field research that requires the recognition of individual birds and will allow for identification of birds migrating from the Area.

The inclusion of Edmonson Point area in ASPA 165 has indeed helped to maintain its outstanding ecological and scientific values. Keeping the protection of the site from unregulated access remains essential.

- *Mammals*

At Edmonson Point numerous (>50) Weddell seals (Leptonychotes weddellii) regularly breed in the near shore marine environment (on fast ice) within the Area. Females use this area to give birth and raise pups on the fast ice along the coastline of the whole Area. Later in the summer Weddell seals frequently haul out on beaches within the Area.

- *Human Activities/Impacts*

Edmonson Point was probably first visited on 6 February 1900 when Carsten Borchgrevink landed just north of Mount Melbourne on “a promontory almost free of snow .... about 100 acres in extent” and climbed about 200 m up the slopes (Borchgrevink, 1901: 261). The Wood Bay region was rarely mentioned during the following 70 years, and presumably was visited only infrequently. Activity in the area increased in the 1980s, first with visits by the GANOVEX expeditions (Germany). Botanical research was undertaken in December 1984 (Given, 1985; Greenfield et. al., 1985; Broady, 1987) and in January 1989, at which time the first proposals for special protection of the site were made. Italy established a station in close proximity at Terra Nova Bay in 1986-87 and increased research interest in the site followed.

Human activity at Edmonson Point has been largely confined to science. The impacts of these activities have not been described, but are believed to be minor and limited to items such as campsites, footprints, markers of various kinds, human wastes, scientific sampling, handling of limited numbers of birds (e.g., installation of devices to track birds, stomach lavage, biometric measurements, etc), and potentially some impacts associated with helicopter access and installation and operation of camp and research facilities at the penguin colony and on the northern cuspate foreland. At least one fuel spill of around 500 ml, and other smaller spills, were reported in 1996 as a result of refuelling operations at the generator and fuel store located at the penguin colony (see disturbed sites marked on Map 4). In addition, seaborne litter is occasionally washed onto beaches within the Area. Some plastic cloches, installed at various locations throughout the Area in 1995-96 as part of BIOTEX-1 project as reported in map 2 (Wynn-Williams, 1996) are still present in the area. Their exact number is unknown, as the area is often covered by snow. They are difficult to remove because they are embedded in permafrost and could easily break. Efforts will be made to remove them with no damage for the environment.

The Restricted Zone at Colline Ippolito has received less human activity than Edmonson Point and impacts in this area are expected to be negligible.

6(ii) Access to the Area

The Area may be accessed by land, sea or air. There are no specific routes to enter the Area by land or sea. Overflight and landing restrictions apply within the Area, the specific conditions are set out in Section 7(ii) below.

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

A fibreglass cabin for field observation was installed by PNRA in 1994/95 to support CEMP research. The cabin is located on a rocky knoll at an elevation of 16 m, 80 m from the coast and 40 m south of the northern sub-colony of penguins (Maps 2 and 4).

The Automated Penguin Monitoring System (APMS) weigh bridge is situated adjacent to the northern penguin sub-colony, metal fences 30-50 cm high are installed to direct penguins towards the APMS (Map 4).

In 1990 an automated weather station (AWS) was installed by the Italian Antarctic Meteo Climatological Observatory not far from the old CEMP campsite (Map 4). Since 1999 it has been measuring surface pressure, temperature/relative humidity respect to water, wind speed and direction. In 2021 the AWS was renewed and the old electronics (Vaisala milos 200 model) and sensors were replaced with the newer ones (Vaisala Maws model).

The nearest permanent stations are Mario Zucchelli Station at Terra Nova Bay (Italy), Gondwana Station (Germany) and Jang Bogo Station (Republic of Korea) which lie approximately 50, 44 and 43 Km south respectively.

6(iv) Location of protected areas in the vicinity

The nearest protected areas to Edmonson Point are the High Altitude Geothermal Sites on Mount Melbourne (ASPA No. 175) 13 km to the west, Cape Washington and Silverfish Bay (ASPA No. 173) 24 km south, and the marine area Terra Nova Bay (ASPA No. 161) which lies approximately 52 km to the south (Map 1, Inset 2).

6(v) Special zones within the Area

The ice-free area of Colline Ippolito (1.12 km^2) approximately 1.5 km north-west of Edmonson Point is designated as a Restricted Zone to preserve this part of the Area as a reference site for future comparative studies. The northern, western and southern boundaries of the Restricted Zone are defined by the margins of the permanent ice extending from Mount Melbourne, and are coincident with the boundary of the Area (Maps 1 and 3). The eastern boundary of the Restricted Zone is the mean low water level along the coastline of this ice-free area.

Access to the Restricted Zone is allowed only for compelling scientific reasons or management purposes (such as inspection or review) that cannot be served elsewhere within the Area.

7. Terms and conditions for entry permits

7(i) General 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 research or for compelling scientific reasons that cannot be served elsewhere or for essential management purposes consistent with plan objectives such as inspection, maintenance or review;
- access to the Restricted Zone may be allowed only for compelling scientific reasons or management purposes (such as inspection or review) that cannot be served elsewhere within the Area;
- the actions permitted will not jeopardise the ecological or scientific values of the Area and are in accordance with the Management Plan;
- the Permit, or an authorised 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.

- Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for scientific or operational purposes, in accordance with the Permit and following the recommendations contained in the Environmental Guidelines for Operation of RPAS in Antarctica (Resolution 4, 2018).

7(ii) Access to and movement within or over the Area

Access to the Area shall be by small boat, on foot or by helicopter. Movement over land within the Area shall be on foot or by helicopter. Access to the Area by vehicle is restricted according to the conditions described below.

- *Small boat access*

There are no special restrictions on landings from the sea, although when accessing the main ice-free area of Edmonson Point visitors shall land at the northern cuspate foreland and avoid landing at breeding bird colonies (Map 2). Access by small boats should avoid disturbing birds and mammals.

- *Restricted conditions of vehicle access*

Use of vehicles within the Area is generally prohibited, except at the southern boundary of the Area where they may be used on sea ice to gain access to the shore, from where visitors shall proceed on foot. Vehicle use shall avoid disturbance to birds and mammals. When using vehicles on sea ice care should be exercised to avoid Weddell seals that may be present: speed should be kept low and seals shall not be approached by vehicle closer than 50 m. Vehicle traffic shall be kept to the minimum necessary for the conduct of permitted activities.

- *Aircraft access and overflight*

All restrictions on aircraft access and overflight stipulated in this plan shall apply during the period 15 October – 20 February inclusive. Aircraft may operate and land within the Area according to strict observance of the following conditions and of the Guidelines for the Operation of Aircraft near Concentrations of Birds in Antarctica, Resolution 2 (2004):

All overflight of the Area for purposes other than access shall be conducted according to the height restrictions imposed in the following table:

Minimum overflight heights within the Area according to aircraft type

Aircraft type	Number of Engines	Minimum height above ground	
		Feet	Meter
Helicopter	1	2461	750
Helicopter	2	3281	1000
Fixed-wing	1 or 2	1476	450

Fixed-wing	4	3281	1000

Helicopter landing is allowed only at the landing designated sites A, B and C (Maps 1-4). The landing sites with their coordinates are described as follows:

- A - shall be used for most purposes and is located on the northern cuspate foreland of Edmonson Point (Map 2) (74°19'24"S, 165°07'12"E);
- B - shall be used in support of the Adélie Penguin Monitoring Programme or AWS maintenance or when necessary for transport of heavy equipment / supplies (Map 2) (74°19'43"S, 165°07'57"E
- C - shall be used allowed for access to the Restricted Zone, located at the northern ice-free area (Colline Ippolito, Map 3) (74°18'50"S, 165°04'29"E).

Aircraft approach route is from the west of the Area, from over the lower eastern ice slopes of Mount Melbourne (Maps 1-3). Aircraft shall approach the main designated landing site (A) on the cuspate foreland from the north-west over or near Baia Siena (Siena Bay). Access to landing site (B) should follow the same route and proceed a further 700 m SE. Access to landing site (C) should be from the lower eastern ice slopes of Mount Melbourne and proceed directly to the landing site from the south over the land or, where this is not feasible, over Baia Siena (Siena Bay), avoiding skuas nesting to the north of the landing site. The departure routes are identical in reverse.

- *Foot access and movement within the Area*

Movement on land within the Area shall be on foot. Visitors should move carefully to minimise disturbance to the breeding birds, soil, geomorphological features and vegetated surfaces, and should walk on rocky terrain or ridges if practical to avoid damage to sensitive plants and waterlogged soils. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimise trampling effects. Pedestrians that are not undertaking research or management related to the penguins shall not enter the colonies and should maintain a separation distance from the breeding birds of at least 15 m at all times. Care should be exercised to ensure that existing equipment, fences and other scientific installations are not disturbed.

Pedestrians moving between the helicopter landing sites (A) or (B) to the Adélie colony shall follow the preferred walking route marked by 9 wooden stakes driven into the ground (Maps 2 and 4) or follow a route along the beach.

7(iii) Activities which may be conducted within the Area

- Compelling scientific research which cannot be undertaken elsewhere and will not jeopardise the values of the Area, including CCAMLR-CEMP activities;
- Essential management activities, including maintenance, monitoring and inspection;
- Educational and outreach activities, such as documentary reporting.

7(iv) Installation, modification or removal of structures

No structures should be erected within the Area except as specified in a Permit. All scientific equipment 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 cleaned and made of materials that pose minimal risk of contamination to the Area, also considering the risk of unintentional non-native species introduction. Permanent structures are prohibited. The Party, whose authority granted the original permit shall be responsible for the removal of specific equipment for which the Permit has expired.

7(v) Location of field camps

Semi-permanent camps and temporary camping is permitted within the Area at the two designated camping sites: on the cuspate foreland of Edmonson Point (Map 2) and on the flat area close to helipad B (Map 2 and 4). If absolutely necessary and only for the purposes specified in the Permit, temporary camping is permitted within the Restricted Zone at the designated site (C) (74°18'51"S, 165°04'16"E), approximately 100 m west of helicopter landing site (Map 3).

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

No living animals, plant material, microorganisms or non-sterile soils shall be deliberately introduced into the Area. Raw poultry products and eggs are prohibited from the Area. No processed poultry products and wastes from such products, shall be released into the Area.

No herbicides or pesticides shall be introduced 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 is not to be stored in the Area, unless required for conducting the activities authorised by the Permit. Fuel spill clean-up equipment should be made available for use at locations where fuel is being handled. Visitors must be adequately trained to respond to emergencies.

Anything introduced shall be for a stated period only, shall be stored and handled so that risk of any introduction into the environment is minimised and shall be removed at the conclusion of the stated period. 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. The appropriate authority should be notified of anything released or not removed that was not included in the authorised Permit.

7(vii) Taking of, or harmful interference with, native flora or fauna

Taking or harmful interference with native flora or fauna is prohibited, except in accordance with a Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica should be considered as a minimum standard.

7(viii) Collection or removal of material not brought into the Area by the permit holder

Collection or removal of material from the Area is allowed 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 rock, soil, native flora or fauna that their distribution or abundance in the Area would be significantly affected. Anything 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, shall 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(ix) Disposal of waste

All wastes, including human wastes, shall be removed from the Area. Liquid human wastes may be disposed of into the sea.

7(x) Measures that are necessary to continue to meet the aims of the Management Plan

Permits may be granted to enter the Area to carry out monitoring and site inspection activities, which may involve the small-scale collection of samples for analysis or review, or for protective measures.

Any specific long-term monitoring site shall be appropriately marked.

To help maintaining the ecological and scientific values of the Area special precautions shall be taken against unintentional introductions of species, in particular microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica.

All sampling equipment or markers brought into the Area shall be thoroughly cleaned. 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.

7(xi) Requirements for reports

Parties should ensure that the principal holder for each Permit issued submits a report to the appropriate national authority. Such report should include, as appropriate, the information identified in the visit report form contained in the Revised Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2, 2011). Parties should maintain a record of such activities and, in the Annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organising the scientific use of the Area.

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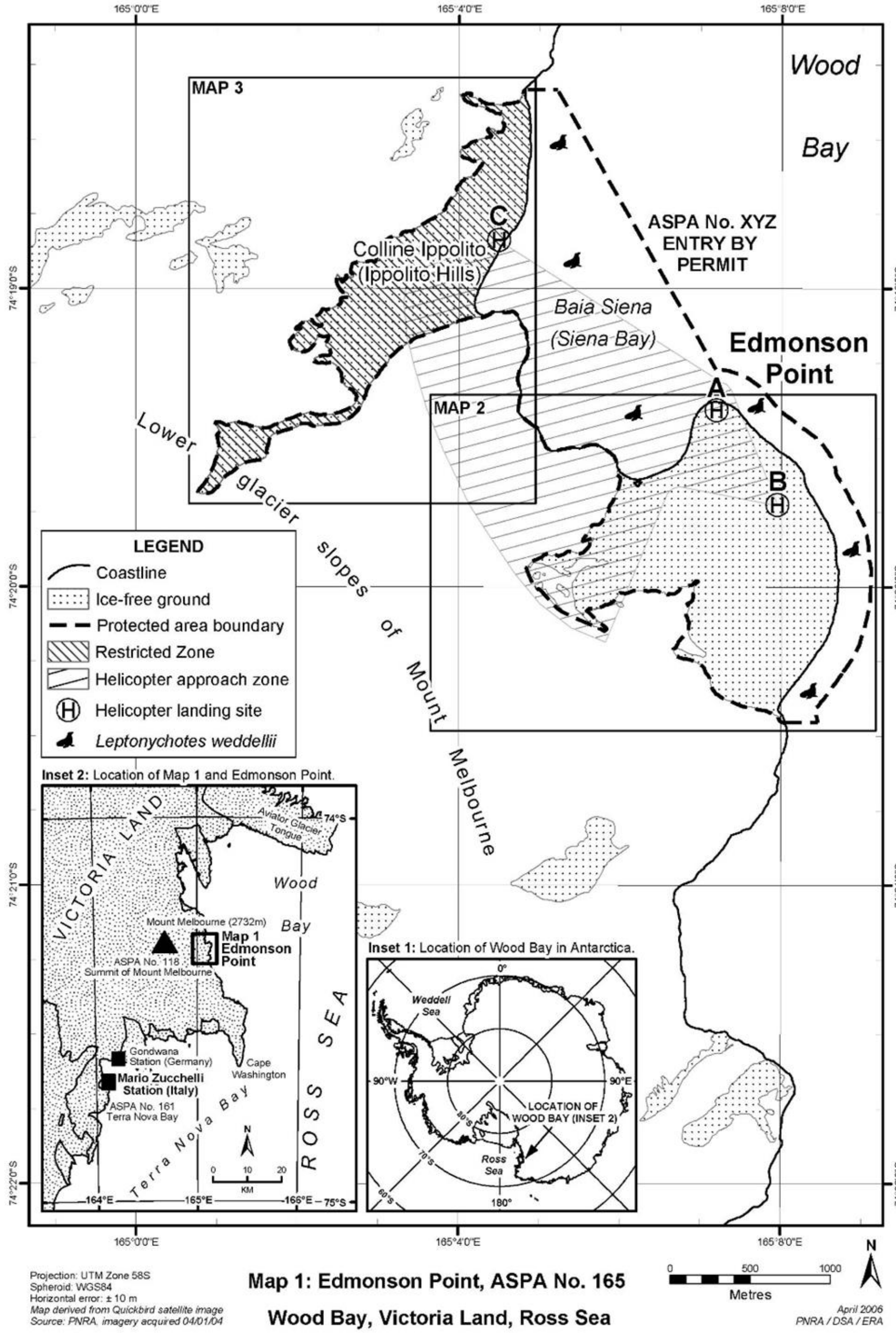
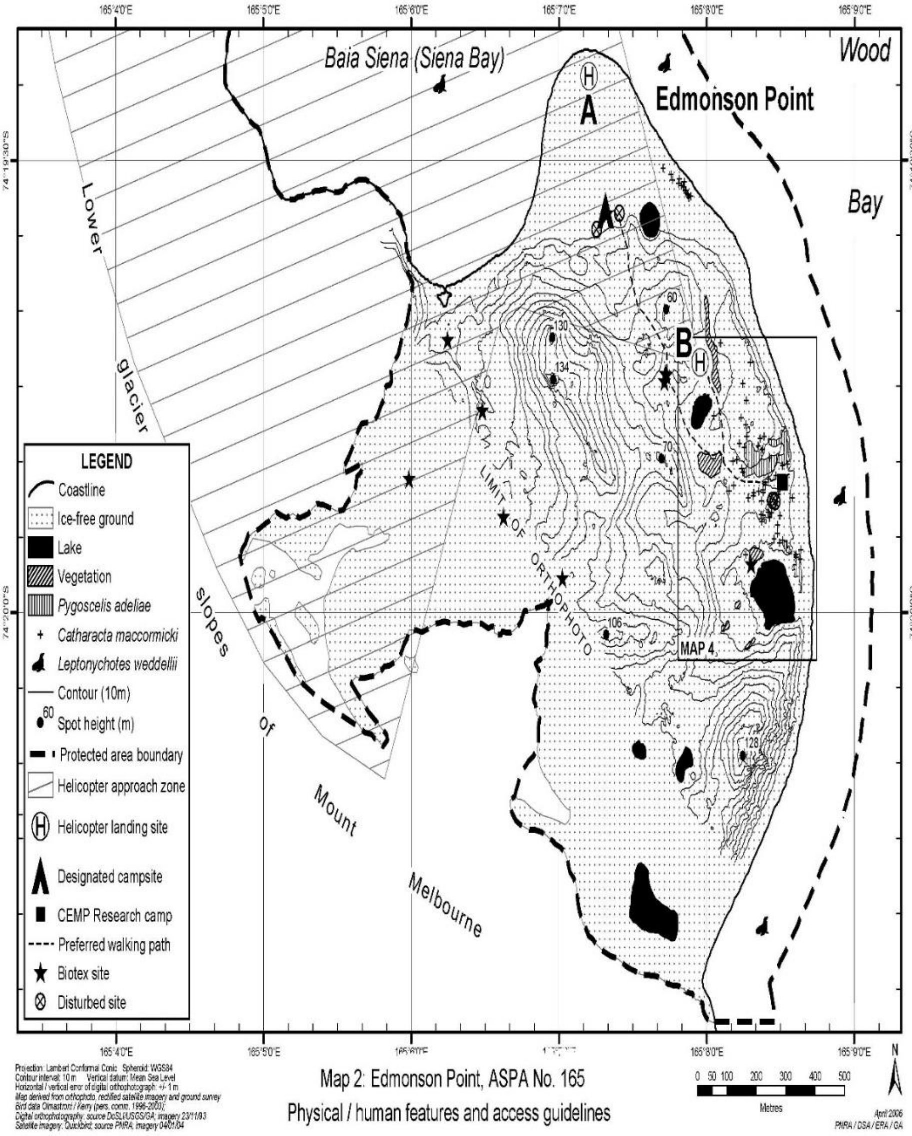
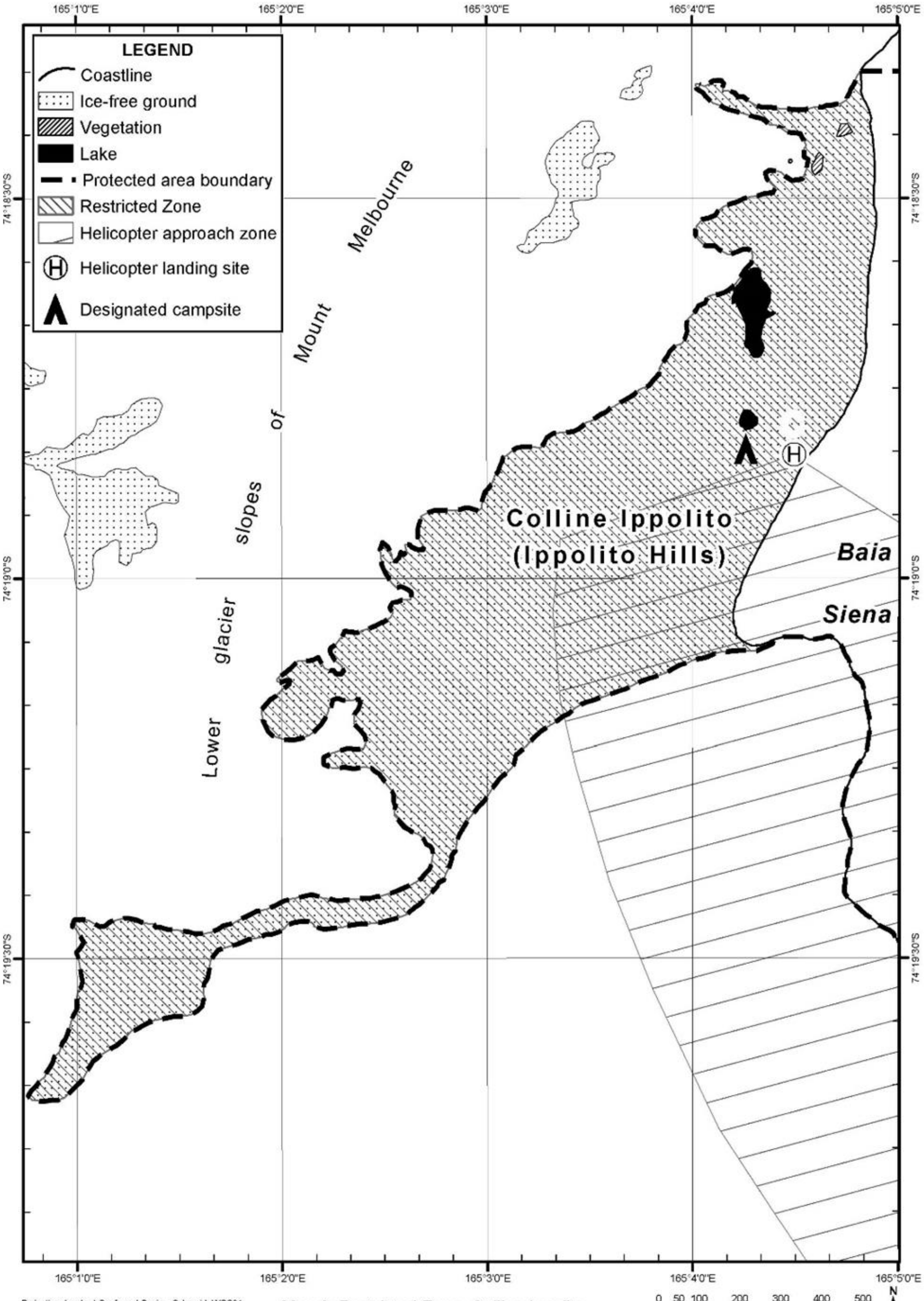
Edmonson Point ASPA 165 Maps





Map 2: Edmonson Point, ASPA No. 165

Physical / human features and access guidelines

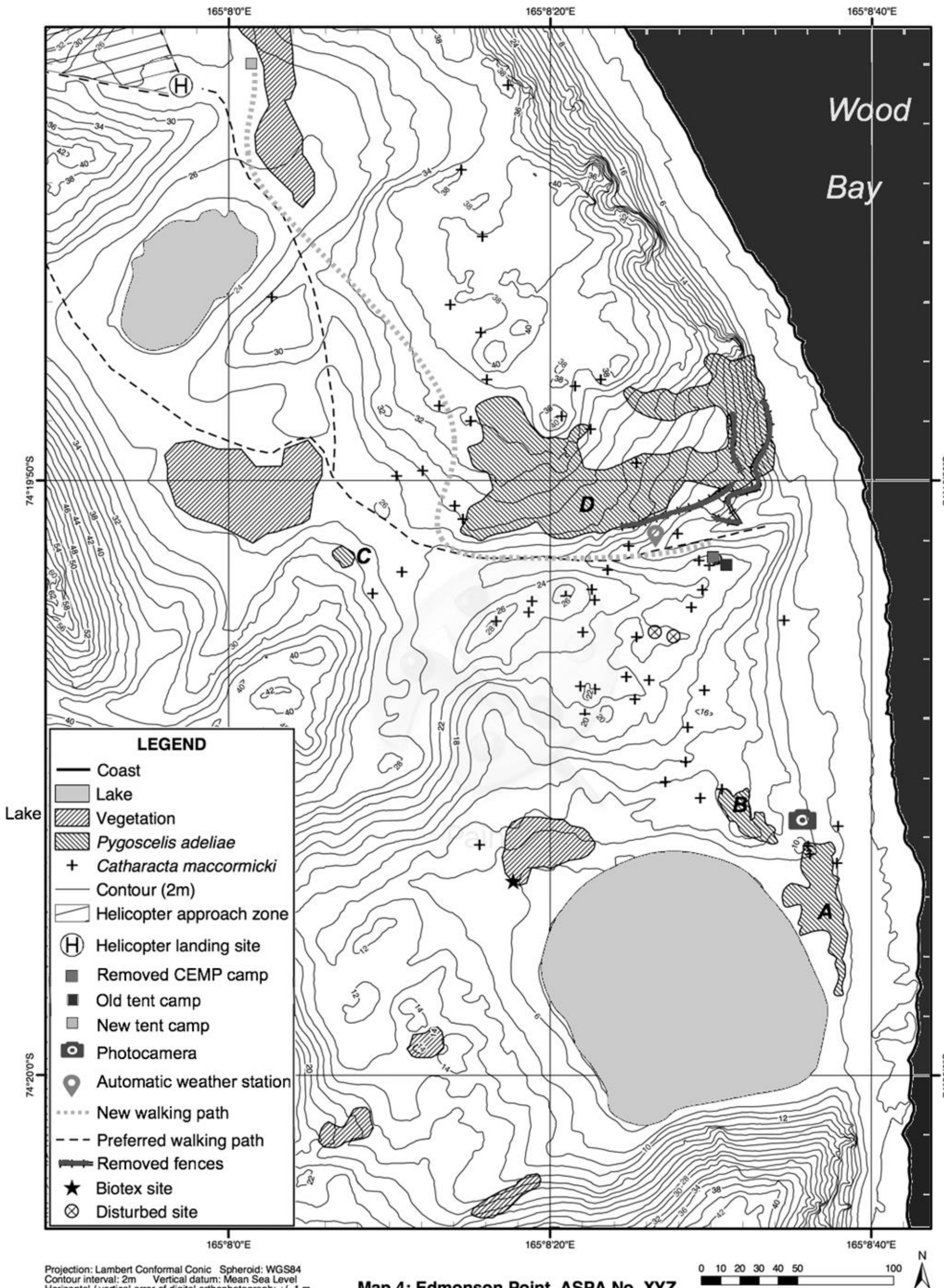


Projection: Lambert Conformal Conic Spheroid: WGS84
Map derived from rectified satellite imagery
Source: Quickbird; PNRA, imagery acquired 04/01/04
Horizontal error of satellite image: +/- 10 m
Elevation information unavailable

Map 3: Restricted Zone, Colline Ippolito
ASPA No. 165 Edmonson Point

0 50 100 200 300 400 500
Metres
N

April 2006
PNRA / DSA / ERA



Map 4: Edmonson Point, ASPA No. XYZ

Topography, wildlife & vegetation

Measure 15 (2023)

Antarctic Specially Protected Area No 168 (Mount Harding, Grove Mountains, East Antarctica): Revised Management Plan

The Representatives,

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

Recalling

- Measure 2 (2008), which designated Mount Harding, Grove Mountains, East Antarctica as ASPA 168 and annexed a Management Plan for the Area;
- Measure 17 (2015), which adopted a revised Management Plan for ASPA 168;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 168;

Desiring to replace the existing Management Plan for ASPA 168 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 168 (Mount Harding, Grove Mountains, East Antarctica), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 168 annexed to Measure 17 (2015) be revoked.

Management Plan for Antarctic Specially Protected Area No 168

MOUNT HARDING, GROVE MOUNTAINS, EAST ANTARCTICA

Introduction

The Grove Mountains (72°20'-73°10'S, 73°50'-75°40'E) are located approximately 400km inland (south) of the Larsemann Hills in Princess Elizabeth Land, East Antarctica, on the eastern bank of the Lambert Rift (Map A). Mount Harding (72°51' -72°57' S, 74°53' -75°12' E) is the largest mount around Grove Mountains region, and located in the core area of the Grove Mountains that presents a ridge-valley physiognomies consisting of nunataks, trending NNE-SSW and is 200m above the surface of blue ice (Map B).

The primary reason for designation of the Area as an Antarctic Specially Protected Area is to protect the unique geomorphological features of the area for scientific research on the evolutionary history of East Antarctic Ice Sheet (EAIS), while widening the category in the Antarctic protected areas system.

Research on the evolutionary history of EAIS plays an important role in reconstructing the paleoclimatic evolution in global scale. Up to now, a key constraint on the understanding of the EAIS behaviour remains the lack of direct evidence of ice sheet surface levels for constraining ice sheet models during known glacial maxima and minima in the post-14 Ma period.

The remains of the fluctuation of ice sheet surface preserved around Mount Harding, will most probably provide the precious direct evidences for reconstructing the EAIS behaviour. There are glacial erosion and wind-erosion physiognomies which are rare in nature and extremely vulnerable, such as the ice-core pyramid, the ventifact, etc. These glacial-geological features have not only important scientific values, but also rare wildness and aesthetic values and the disorderly human activities would cause perpetual, unrepairable damage to it.

The Chinese Antarctic Research Expedition (CHINARE) had visited the Grove Mountains for several times from1998 to 2016 before the latest one in the 2022/2023 season after the pandemic, focusing on research on geological tectonics, glacial geology and landscape, meteorology, ice-cap movement and mass balance, surveying and mapping, especially on fluctuation of Antarctic icecap surface since the Pliocene, and these research results in some new discoveries.

The Australian Antarctic Programme has visited the Grove Mountains to conduct a range of geoscience and glaciology research and support activities for several times. It currently maintains a continuous GPS station on Tianhe Range and expects to continue to access the region for research and operational purposes. Besides, Russian Antarctic Research Expedition has ever tripped there in 1958 and 1973 for a short stay, but whether they have arrived at the Area is unclear.

1. Description of values to be protected

The Mount Harding area designated as the site for the specially protected area (Map A) has the precious physiognomies of glacier erosion preserved in the ice sheet of inland Antarctic, which is of great scientific, aesthetic and wilderness values. The aim of this protected area is to preserve its scientific, aesthetic and wilderness values.

- *Scientific values*

A lot of remains of ice sheet advance and retreat are preserved in Mount Harding, which are the direct evidence of the changes of cold and warm in the global environment since Pliocene. In this Area, the scientists have found the rare extreme cold desert soil, the sedimentary rocks formed in the Neogene Period that are not consolidated completely, as well as the valuable spore pollen assemblages in those paleo-soils and sedimentary rocks. All of these imply there was a warm climate event in this area probably resulting in a large-scale retreat of the EAIS, and its margin might be even beyond the Grove Mountains, 400km south from its present coast of the EAIS.

The unique geomorphological features in this Area includes the integral geologic-geomorphic remains and a series of special physiognomy, such as ice-core pyramid, ventifacts, ice-cored moraine (end moraine and lateral moraine), cold-desert soil, sedimentary erratics, pool of melted water, rochemoutonee, etc.

- *Aesthetic and wilderness values*

There is ice-eroded ice field geomorphology which is rare in nature in the Area, such as the pool of melted water, hanging moraine dyke, ice-core pyramid, ventifact, etc (photos 1-6). These geological and glacial landscapes contract finely with the vast blue ice, producing extremely significance and beauty to make high aesthetic and wilderness values.

2. Aims and objectives

Management of Mount Harding, Grove Mountains, East Antarctica aims to:

- Facilitate long-term scientific research while avoiding direct or cumulative damage to vulnerable geomorphological features;
- Allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardize the values in that Area;
- Allow scientific research in the Area which is consistent with the management aims and objectives and which will not jeopardize the values in that Area;
- Allow visits for management purposes in support of the aims of the Management Plan;
- Minimize the introduction to the Area of alien plants, animals and microbes.

3. Management activities

- Copies of the Management Plan (attached with maps) shall be made available at the Zhongshan Station (China), Davis Station (Australia), Progress Station (Russia), and the map of the protected area should be put up at prominent positions in the stations mentioned above. Personnel in the vicinity of, accessing or flying over the Area shall be specifically instructed, by their national program as to the provisions and contents of the Management Plan.
- National Antarctic Programmes operating in the Area shall consult together with a view to ensuring the above management activities are implemented.
- The Area shall be visited as necessary, and no less than once every five years, to assess whether it continues to serve the purposes for which it was designated and to ensure that management activities are adequate.
- The Management Plan should be reviewed no less than once every five years and, if necessary, updated or revised.
- In case the Antarctic ice sheet continuously retreats so that the new remains of advance and retreat of EAIS are exposed in the vicinity of the protected area and the extent of remains of ice sheet advance and retreat expands, the boundary of the protected area should be updated periodically so as to include the newly exposed remains of ice cap advance and retreat in the area. This should be taken into consideration in examining the Management Plan.

4. Period of designation

Designated for an indefinite period.

5. Maps and photos

Map A, A1: Position of Grove Mountains. A2: Grove Mountains Area, Antarctica

Map B, Protected Area around Mount Harding, Grove Mountains, Antarctica

Map C, Location of Nunataks and Direction of Ice Flow around Mount Harding, Grove Mountains, Antarctica.

Photo 1, Ventifact
Photo 2, Ventifact
Photo 3, Ice-core pyramid
Photo 4, Hanging moraine dyke
Photo 5, Cold-desert soil
Photo 6, Pool of ice melted water
Photo 7, Roches montannees

6. Description of the Area

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

The Area is irregular, and approximately rectangular in shape, with a width of about 10km from east to west, a length of about 12km from south to north and an total area of about 120km² (Map A).

The proposed ASPA boundary was defined to ensure that the unique geomorphological features, formed in ice sheet advance and retreat in Mount Harding, can be specially protected as a whole.

- *Geographical Co-ordinates*

The Specially protected Area of Mount Harding, Grove Mountains, includes the open blue-ice zone from the moraine on the west side of Mount Harding to the east side of the Zakharoff Ridge as well as a number of nunataks, detritus zone, and moraine etc. within it (Map B). Its geographical coordinates are: 72°51' -72°57' S, 74°53' -75°12' E.

- *Boundary marks*

The western boundary of the Area is the moraine on the west side of Mount Harding, with its northern end turning eastward to the open blue-ice detritus zone on the east side of the Zakharoff Ridge via the north flank of the northern ridge of Mount Harding and the northern end of the Zakharoff Ridge, turning southwards to the northern end of Davey Nunataks, and then heading westwards to the southern end of the Xi Lake moraine to close the whole area. The geographical coordinates of the nine control points located at its boundary are counter clockwise: 1. 74°57'E, 72°51' S, 2. 74°54'E, 72°53' S, 3.74°53'E, 72°55' S, 4. 74°54'E, 72°57' S, 5. 75°00'E, 72°57' S, 6.75°10'E, 72°57' S, 7. 75°12'E, 72°55' S, 8. 75°11'E, 72°52' S, 9. 75°08'E, 72°51' S.

No markers or signs are currently in place to mark the boundary.

- *General climate condition in summer*

With an average altitude of more than 2000 meters in the Grove Mountains, the daily temperature range and strong wind frequency are greater than those at Zhongshan Station. When affected by the warm-moist current from the north, snowfall would appear constantly in this area, while under the control of the east current, the weather would mainly be sunny. The trend of daily wind speed change is greater than that at Zhongshan Station, where the maximum wind speed appears at around 05:00 am and minimum wind speed occurs at about 17:00 pm commonly. The daily mean wind speed is 7.5m/s from December 1998 to January 1999. Same as Zhongshan Station, the Grove Mountains area is influenced by the katabatic wind, but with a greater force than Zhongshan Station.

From December 1998 to January 1999, the average highest and lowest air temperature in the Grove Mountains area were -13.1°C and -22.6°C respectively, and the estimated average daily temperature range could be -9.5°C. In this area, in January in particular, the air temperature and snow temperature saw an obvious change during a day, where the average air temperature was -18.5°C, and the snow surface temperature was about -17.9°C, that is, the average snow temperature was higher than the average air temperature.

- *Physiognomy*

Mount Harding in the central GMs is shaped as a crescent open to the north-west. Both the northern and southern ends are steep crests, protruding ~200m above the recent ice surface. The central segment of the ridge-line between two summits descends progressively until it reaches the ice surface in a central col, with a relic ice tongue hanging on the lee side. A stagnant field of blue ice, tens of km^2 wide, lies inside the crescent. All of this, shining each other with the vast blue ice, forms the magnificent, beautiful scene of ice-eroded ice field geomorphology.

The nunataks within the area may be divided into two groups. The one in the west is the tall nunataks represented by Mount Harding, and the other is a small part of the area including the low linear nunatak chain on the Zakharoff Ridge. The stoss slopes of rocky nunataks show smoothly abraded bedrock, with surfaces sparsely erratic till patches. The lee and lateral sides of the nunataks show generally sharp bluffs, resulting from both ice flow scraping and collapse along sub-vertical crevasses of rocks. The nunataks leave pair of “wake zone” of superglacial debris tens km in length on the ice surface, marking the path of present local ice flow.

The upper parts of the higher nunataks are usually jagged ridge populating with well-developed ventifacts on the summits, facing the dominant wind from the SE. The scarcity of glacial erosive imprints, also meters of depth inside the hard rock delved by wind- force blowing out indicate that these higher slopes are ice free since rather long time. But the lower parts of slopes beneath ~100m above ice surface have the features of recent glacial erosion such as fresh trimlines and erratics.

Some of small nunataks are typical “roches moutonnée” resulted from the past ice flow overriding. This regional borderline between wind and glacial erosions are considered to represent a former height of ice surface since certain phase, probably early Quaternary glaciations, and the later rises of ice surface did not exceed this limit.

Mount Harding is the largest nunatak in the Grove Mountains. On the west side of the crescent ridge there is a large stretch of lake shaped stagnant blue ice plain (Kunming Lake, Xi Lake) and a dozen ice-cored pyramids (ice-cored cone) are visible at the juncture of the ice lake and the foot of the rocky nunataks.

The geological and glacial phenomena or landscapes that deserve special protection include (Map C)：Ventifact (photo 1, 2): As a result of long-term blow and erosion by fierce winds, there have developed a large number of ventifacts with peculiar shape around the southern summit of Mount Harding.

These ventifacts are the typical wind-erosion physiognomy rarely seen on the earth and are subject to the perpetual damage by disorderly human activities.

Ice-core pyramids (ice-cored cones, photo 3): Along the northern and southern banks of "Kunming Lake" is scattered a dozen ice-core pyramids. These ice-core pyramids are cone shaped with a height of 20-40m and a base diameter of 50-80m. These pyramids are the best marks for directly measuring the pneumatolysis of blue ice and of great importance to the research on the material balance and evolutionary history of the EAIS. They are extremely vulnerable and any human climbing behaviour will lead to their perpetual alteration and destruction.

Hanging moraine dyke (photo 4): On the north-west side of the stagnant blue ice pool lie some of linear floating moraine. These moraines are about 100m wide, 25-35m high and kilometres long. On the surface of the moraine there is a gravel bed with a thickness of 50-100 cm, below which is the blue ice. These exotic rock masses provide precious source material for studying the tectonics of the underlying base rocks of EAIS. The spore pollen assemblages contained in the sedimentary erratics are the key evidence of the large-scale retreat event of the EAIS during the Pliocene. Any walking or climbing activities will very probably cause the irreparable damage to these moraine dykes.

Cold-desert soil: Several cold-desert soil patches were found on the southern slope of Mount Harding above the regional erosion limit of 100m. The existence of such soils indicates also that the ice fluctuation has never been higher than this limit after the formation of soils because any higher rise of the ice would have scraped all of them away.

Microfossil assemblages in the sedimentary erratics: More than 25 species of Neogene microfossil of plant have been identified from such outwash sedimentary boulders. These spore and pollen assemblages provide useful information on the evolution of the EAIS since they are derived from a suite of glaciogenic strata hidden beneath the EAIS. Most of the pollen and spores are originated from local sources as in situ assemblages, representing a continental flora.

Pool of ice melted water (photo 5): At the foot of the lee side of huge nunataks are often developed pools of ice melted water, large or small, each with an area from several dozen square meters up to a thousand square meters. The surface ice of these pools is extremely smooth and transparent, and the air bubbles are rich inside the ice from the bottom. The occurrence of the pool of ice melted water suggests the existence of a megathermal event.

Blue ice cliff: On the east side of the protected area are distributed blue ice cliffs or blue ice precipices, with the length of several thousand meters, usually 30-50m high, with a slope of 40-70°.

Roche moutonnees (photo 6): Typical roche moutonnees are distributed on the east and south sides of the protected area. They are peculiar in shape, have a large number of footprints of ice flow on their surfaces, and possess very high wilderness, aesthetic and scientific values.

Paleo-sedimentary basin (ice sheet leading edge): A paleo-ice erosion basin with the marginal sedimentary layer, at the front edge of ice sheet in the Pliocene is inferred to lie below the blue ice basin on the west side of Mount Harding. It is probably a brand-new type of subglacial lakes. Exploration of these paleo-sedimentary lake basins may yield the precious sedimentary records on the paleo-climatic and environmental changes during the Pliocene in this area.

- *Geological condition*

These nunataks consist mainly of upper amphibolite to granulite facies metamorphic rocks, syn-orogenic to late orogenic granite, and post tectonic granodioritic aplite and pegmatite. The absence of active structures and earthquakes, and the lack of Cenozoic volcanism suggest that this region, along with Prydz Bay, have been geologically stable at least since the Late Mesozoic Epoch. New geological evidence obtained from this area shows that in the inland East Antarctica there exists a huge "Pan-African" stage orogenic zone from the Prydz Bay, Grove Mountains to the Prince Charles Mountains, which should be the last segmented suture zone of the Gondwana land.

6(ii) Access to the Area

Access to the area may be gained overland by vehicle or by aircraft landing on snow- and ice covered sites within or adjacent to the Area.

6(iii) Location of structures within and adjacent to the site

Australia maintains a continuous GPS station on Tianhe Ridge at 72°54’29.17479"S, 74°54’36.43606"E. The station consists of a GPS antenna mounted on a geodynamic survey pillar, three rugged cases containing batteries and GPS receivers, a solar panel frame holding four solar panels and a wind turbine. In addition there are three survey reference marks surrounding the GPS pillar, approximately 20m distant.

CHINARE maintains 1 geodetic control point in the Area using duel frequency GPS receivers (No: Z003) at 72º53’55.07437"S, 75º02’14.00782"E to meet the requirement of the satellite image mapping. During the 39th CHINARE in 2023, 12 surveying rods for ice flow rate (see attached table 1 for specific GPS points) were laid in the Area. The rods are made of aluminium alloy with the length of 3m.

6(iv) Location of other protected areas in the vicinity

There are no other protected areas nearby.

6(v) Special Zones within the Area

There are no special zones within the Area.

7. Terms and conditions for entry Permits

7(i) General 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 compelling scientific reasons which cannot be served elsewhere, or for reasons essential to the management of the Area. Before the permit is issued, the applicant shall demonstrate to the appropriate competent authorities that the specimens or samples already collected from other parts of the world so far cannot fully meet the needs of the researches proposed;
- The actions permitted are in accordance with this Management Plan;
- The activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the scientific, aesthetic and wilderness values of the Area;
- The Permit or its valid copy shall be carried when in the Area;
- The Permit shall be issued for a finite period;
- Report on the activities must be submitted to the national authorities issuing the Permit and in charge of polar issues.

7(ii) Access to, and movement within or over, the Area

- Entry by land vehicles such as snowmobile and aircraft should avoid destroying the local equilibrium line separating the zone of net ablation from the inland zone of net accumulation, paleo-soil distribution zone, ventifacts, blue-ice cliff, ice-core pyramid, and other geological and natural physiognomy of important scientific research and environmental values;
- As there have many ice crevice in this area, it is recommend that entry by snowmobile would drive down the route along the two sides of which Chinese expedition has set colorful poles for the sake of safety;
- Aircraft operations within the Area should be mindful of the mountainous terrain;
- Climbing up the ice-core pyramids, walking on the floating moraine dyke and roches montannees is strictly prohibited.

7(iii) Activities which may be conducted within the Area

- Compelling scientific research which cannot be undertaken elsewhere and which must not damage the value of the Area;
- Major management activities, including monitoring, inspection, maintenance or review;

- Operational activities in support of scientific research or management within or beyond the Area, including visits to assess the effectiveness of the Management Plan and management activities.

7(iv) Installation, modification and removal of structures

- No structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons;
- All the facilities to be set up and installed within the Area shall be specified in the Permit issued by the competent authority of the particular country. Where possible, such installations should avoid sensitive geomorphological features;
- All the facilities installed in the Area must be clearly identified by country, name of the principal investigator or agency and year of installation. All such items should be made of materials that pose minimal risk of contamination of the Area. These facilities must be removed when they are no longer required, and so shall other abandoned equipment or materials as far as possible.

7(v) Location of field camps

For safety reasons, the camping sites must be selected in such a way as not to destroy or affect the special geological and natural physiognomy.

If not destroying the local and adjacent geological and natural physiognomy, Camping is allowed within the Area when necessary for purposes consistent with this Management Plan and where authorized in a Permit. In this area, the encampment near Mount Harding (No 9) and the encampment near Zakharoff Ridge (No 8) are the preferred camping site, shown in Map B. Camping should choose snow or ice surface or rock surface to avoid the remnants of ice sheet.

7(vi) Restrictions on materials and organisms which may be brought into the Area

- No depots of food or other supplies are to be left within the Area beyond the time period or activity for which they are required;
- No living animals, plant material or micro-organisms shall be deliberately introduced into the Area. All necessary precautions shall be taken to prevent accidental introduction;
- All materials introduced shall be for a stated period, shall be removed at or before the conclusion ofthat stated period, and shall be stored and handled so as to minimize the risk of environment impacts.

7(vii) Taking of, or harmful interference with, native flora and fauna

No native flora and fauna are present.

7(viii) Collection or removal of materials not imported 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, and which was not brought into the Area by the Permit holder or otherwise authorized, may be removed unless the impact of the removal is likely to be greater than leaving the material in situ. If this is the case, the appropriate national authority must be notified and approval obtained.

7(ix) Disposal of waste

At a minimum, all wastes, including all human wastes, shall be managed in accordance with Annex III and not disposed of into freshwater streams or lakes, onto ice-free areas, or onto areas of snow or ice which terminate in such areas of high ablation.

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

None.

7(xi) Reporting requirements

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed.
- Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. If necessary, the national authority should also make the visit report copy available to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.
- Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organizing the scientific use of the Area.

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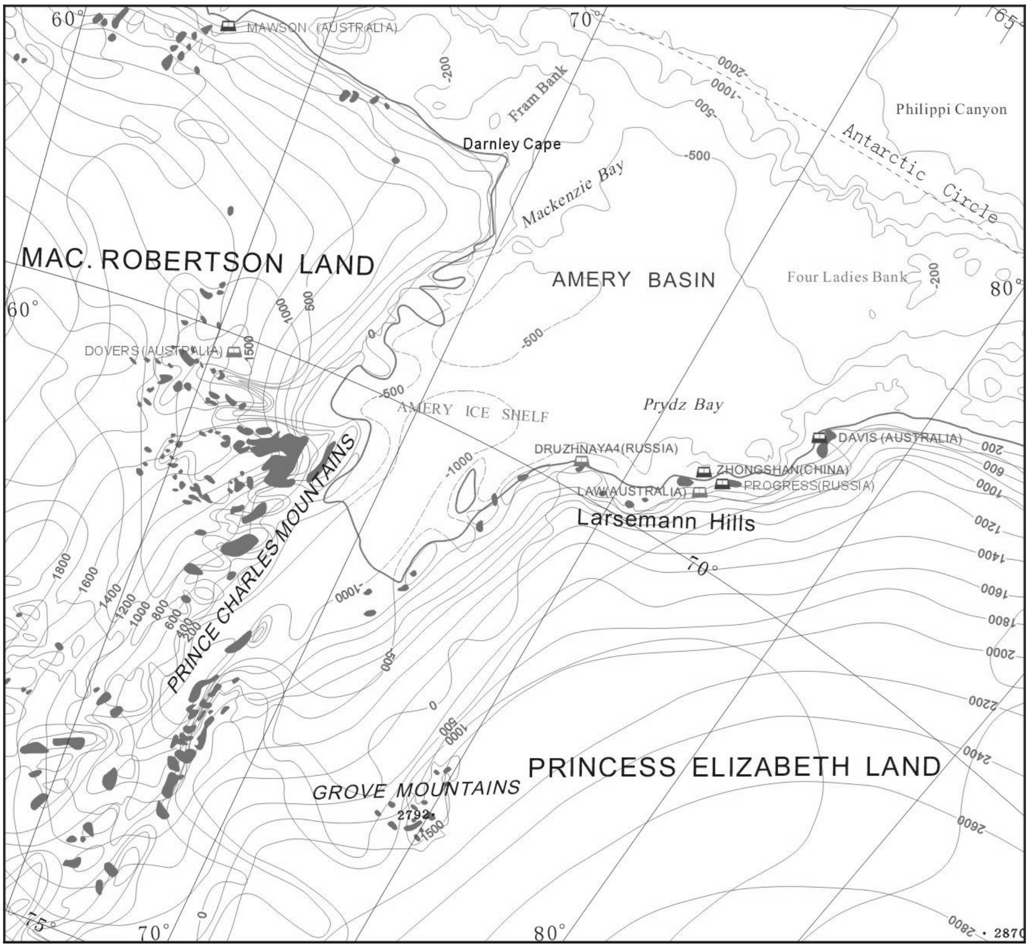
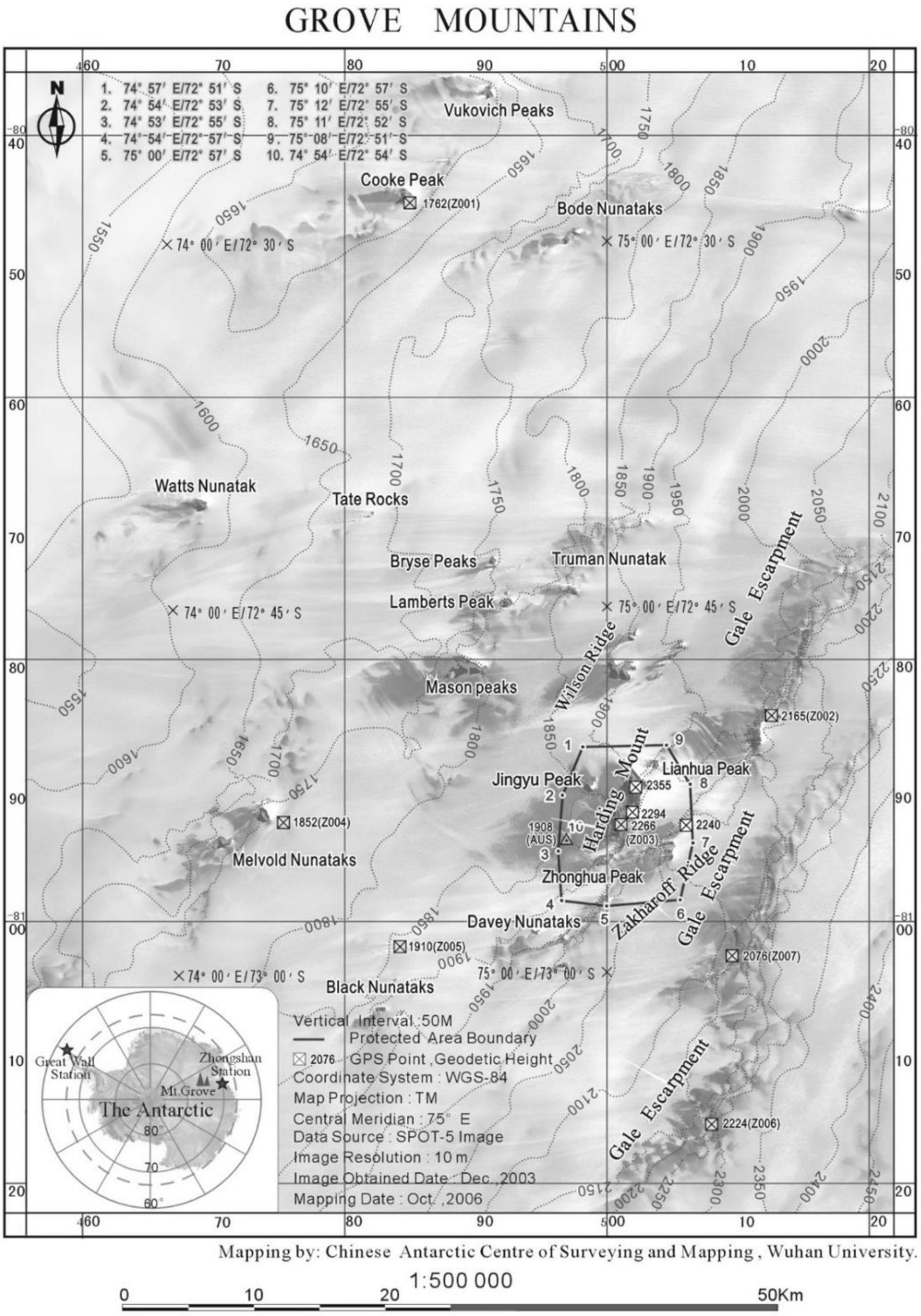
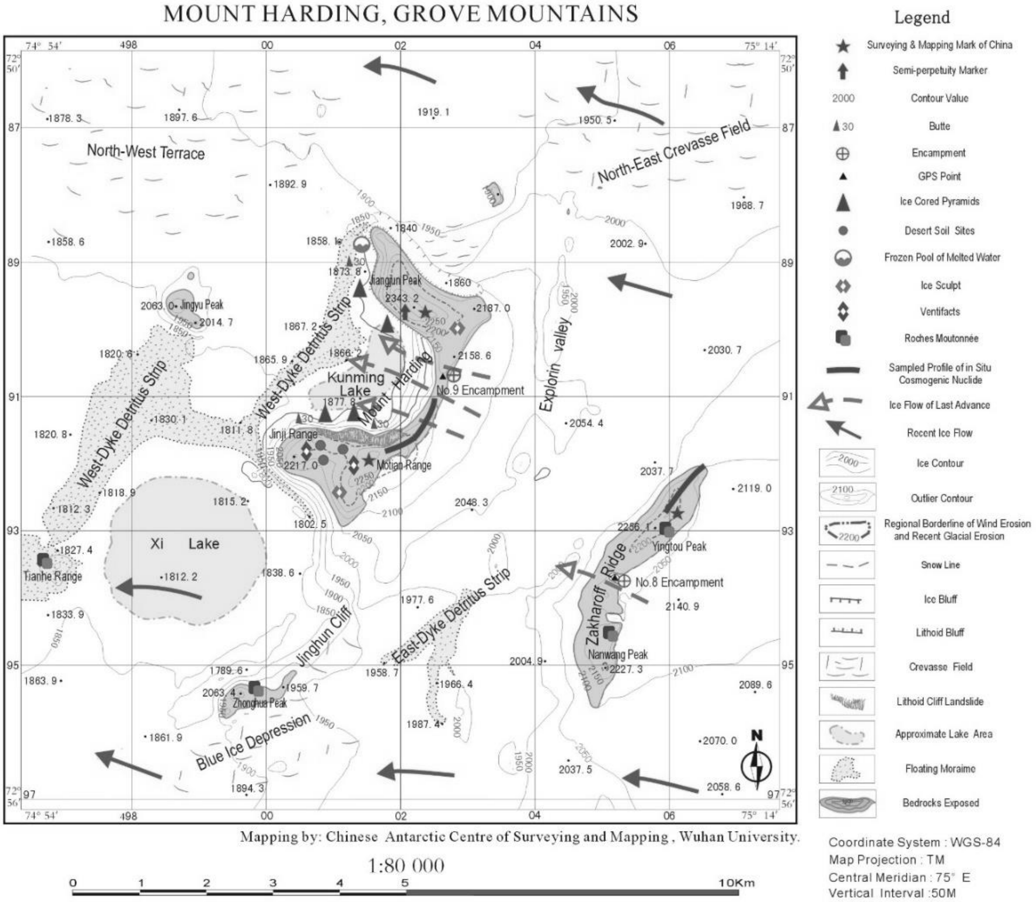
Map A1. Position of Grove Mountains
Mapping Standard: Projection: Normal Stereographic Horizontal datum:WGS-84
Manufacturer: Chinese Antarctic Centre of Surveying and Mapping, Wuhan University



Map A2. Grove Mountains Area, Antarctica
Mapping standards: Projection: TM, Horizontal datum: WGS-84
Manufacturer: Chinese Antarctic Centre of Surveying and Mapping, Wuhan University



Map B. Protected Area around Mount Harding, Grove Mountains, Antarctica
Mapping standards: Projection: TM Horizontal datum: WGS-84
Manufacturer: Chinese Antarctic Centre of Surveying and Mapping, Wuhan University



Map C. Location of Nunataks and Direction of Ice Flow around Mount Harding, Grove Mountains, Antarctica
Mapping standards: Projection: TM Horizontal datum: WGS-84
Manufacturer: Institute of Geology and Geophysics, Chinese Academy of Sciences

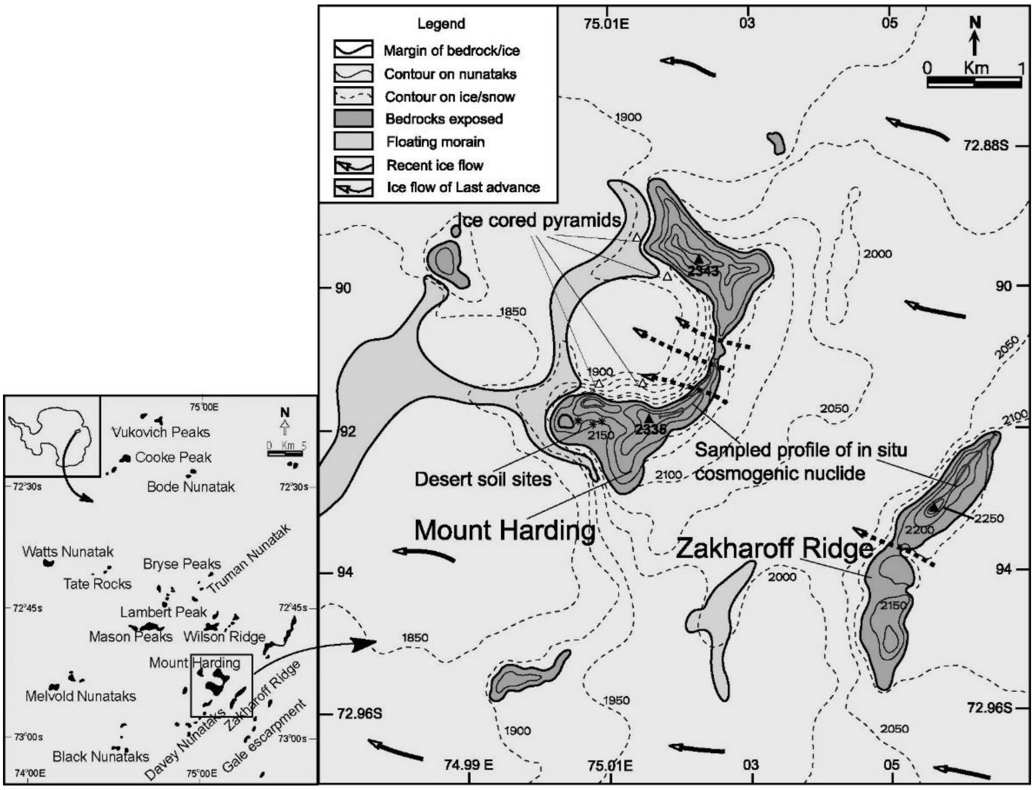


Photo 1: Ventifact, taken on January 13th, 2003

Photo 2: Ventifact, taken on January 13th, 2003

Photo3: Ice-core pyramid, taken on January 12th, 2003

Photo 4: Hanging moraine dyke, taken on February 2nd, 2023

Photo 5:   Cold-desert soil, taken on February 2nd, 2023

Photo 6: Pool of ice melted water, taken on January 14th, 2003

Photo 7: Roches montannees, taken on January 12th, 2003

Table 1. Coordinates of surveying rods for ice flow rate

No.	Latitude	Longitude	Altitude
01	-72.55	74.53	1840.1264
02	-72.54	74.53	1836.2931
03	-72.53	74.53	1850.6056
04	-72.53	74.54	1850.078
05	-72.55	74.54	1886.885
06	-72.56	74.54	1889.0831
07	-72.57	74.54	1911.4972
08	-72.57	74.57	1914.2049
09	-72.56	74.59	1914.551
10	-72.57	75.03	2012.9889
11	-72.56	75.06	2028.7599
12	-72.56	75.08	2072.4784

Measure 16 (2023)

Antarctic Specially Protected Area No 170 (Marion Nunataks, Charcot Island, Antarctic Peninsula): Revised Management Plan

The Representatives,

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

Recalling

- Measure 4 (2008) which designated Marion Nunataks, Charcot Island, Antarctic Peninsula as ASPA 170 and adopted a Management Plan for the Area;
- Measures 16 (2013) and 5 (2018), which adopted revised Management Plans for ASPA 170;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 170;

Desiring to replace the existing Management Plan for ASPA 170 with the revised Management Plan;

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

1. the revised Management Plan for Antarctic Specially Protected Area No 170 (Marion Nunataks, Charcot Island, Antarctic Peninsula), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 170 annexed to Measure 5 (2018) be revoked.

Management Plan for Antarctic Specially Protected Area No. 170

MARION NUNATAKS, CHARCOT ISLAND, ANTARCTIC PENINSULA

Introduction

The primary reason for the designation of Marion Nunataks, Charcot Island, Antarctic Peninsula (69°45'S, 75°15'W) as an Antarctic Specially Protected Area (ASPA) is to protect primarily environmental values, and in particular the terrestrial flora and fauna within the Area.

Marion Nunataks lie on the northern edge of Charcot Island, a remote ice-covered island to the west of Alexander Island, Antarctic Peninsula, in the eastern Bellingshausen Sea. Marion Nunataks form a 12 km chain of rock outcrops on the mid-north coast of the island and stretch from Mount Monique on the western end to Mount Martine on the eastern end. The Area is 106.5 km² (maximum dimensions are 9.2 km north-south and 17.0 km east-west) and includes most, if not all, of the ice-free land on Charcot Island.

Past visits to the Area have been few, rarely more than a few days in duration and focussed initially on geological research. However, during visits between 1997 and 2000, British Antarctic Survey (BAS) scientists discovered a rich biological site, located on the Rils Nunatak at 69°44'56"S, 75°15'12"W.

Rils Nunatak has several unique characteristics including two lichens species that have not been recorded elsewhere in Antarctica, mosses that are rarely found at such southerly latitudes and, perhaps most significantly of all, a complete lack of predatory arthropods and Collembola, which are common at all other equivalent sites within the biogeographical zone. The nunataks are extremely vulnerable to introduction of locally and globally non-indigenous species that could be carried unintentionally to the site by visitors.

ASPA No. 170, Marion Nunataks was originally designated as an ASPA through Measure 4 (2008) after a proposal by the United Kingdom.

The Area fits into the wider context of the Antarctic Protected Area system by protecting the unique species assemblage found on Marion Nunataks and being the first to protect a substantial area of ground that is representative of the permanent ice-cap and nunataks that exist commonly in the southern Antarctic Peninsula. Resolution 3 (2008) recommended that the Environmental Domains Analysis for the Antarctic Continent, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, ASPA No. 170 is contained within Environment Domain C (Antarctic Peninsula southern geologic) and Domain E (Antarctic Peninsula and Alexander Island main ice fields). Other protected areas containing Domain C include ASPA No. 147 (although not specifically stated in Morgan et al., 2007). Other protected areas containing Domain E include ASPA Nos. 113, 114, 117, 126, 128, 129, 133, 134, 139, 147, 149, 152, and ASMA Nos. 1 and 4. Resolution 3 (2017) recommended that the Antarctic Conservation Biogeographic Regions (ACBRs) be used for the ‘identification of areas that could be designated as Antarctic Specially Protected Areas within the systematic environmental-geographic framework referred to in Article 3(2) of Annex V to the Environmental Protocol. The ASPA sits within ACBR 4 Central South Antarctic Peninsula, and is one of only two ASPAs in ACBR 4, the other being ASPA No. 147.

1. Description of values to be protected

The outstanding environmental value of the Area, which is the primary reason for designation as an ASPA, is based on the following unique species assemblage found in the terrestrial environment:

- The terrestrial fauna is unique for the maritime Antarctic in that it appears to contain neither predatory arthropods nor Collembola (springtails), which are otherwise ubiquitous and important members of the terrestrial fauna of the zone. As such, the site provides unique opportunities for the scientific study of terrestrial biological communities from the maritime Antarctic where key ecological components are absent.
- The Marion Nunataks flora includes an exceptional development of three mosses that are encountered only rarely at latitudes south of 65°S (Brachythecium austrosalebrosum, Dicranoweisia crispula and Polytrichum piliferum).
- The Area includes two lichen species that are previously unrecorded from Antarctica (Psilolechia lucida and Umbilicaria aff. thamnodes) and represents the furthest south known occurrence for several lichen species (including Frutidella caesioatra, Massalongia spp., Ochrolechia frigida, Usnea aurantiaco-atra and Usnea trachycarpa).
- The values are vulnerable to human impacts including damage to habitat by, for example, trampling, or the introduction of non-indigenous species that may disrupt ecosystem structure and function.

2. Aims and Objectives

The aims and objectives of this Management Plan are to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microbes;
- minimise the possibility of the introduction of pathogens which may cause disease in fauna populations within the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardize the natural ecological system in that Area; and

- preserve the natural ecosystem of the Area as a reference area for future studies.

3. Management Activities

Management activities that involve visits to the Area and erection of permanent structures may themselves significantly increase the risk of irreversible human impact, through introductions of locally non-native species. Therefore, the emphasis for management of the site should be to avoid unnecessary visits and importation of materials into the Area. The following management activities are to be undertaken to protect the values of the Area:

- Due to the sensitive nature of the Area and the severity of the consequences should non-native species be introduced, management visits shall be kept to an absolute minimum and erection of permanent structures, including notice boards and signs, on ice-free ground shall be avoided.
- Visiting field parties shall be briefed fully by the national authority on the values that are to be protected within the Area and the precautions and mitigation measures detailed in this Management Plan.
- Copies of this Management Plan shall be made available to vessels and aircraft planning to visit the vicinity of the Area.
- The Management Plan shall be reviewed at least every five years and updated as required.
- A copy of this Management Plan shall be made available at Rothera Research Station (UK; 67°34'S, 68°07'W) and General San Martín Station (Argentina; 68°08'S, 67°06'W).
- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I of the Protocol on Environmental Protection to the Antarctic Treaty.
- National Antarctic Programmes operating in the Area shall consult together with a view to ensuring the above management activities are implemented.

4. Period of Designation

Designated for an indefinite period.

5. Maps

Map 1. Charcot Island in relation to Alexander Island and the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -55°, Standard parallel: -71°.

Map 2. Charcot Island, including ASPA No. 170 Marion Nunataks situated in the northwest of the island. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel: -71.0°.

Map 3. ASPA No. 170, Marion Nunataks, Charcot Island, Antarctic Peninsula. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel: -71.0°. Developed from USGS Landsat Image Mosaic of Antarctica, Scene ID: x-2250000y+0450000. Metadata available at http://lima.usgs.gov/.

6. Description of the Area

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

Charcot Island is roughly circular in shape, approximately 50 km across and is separated from northwest Alexander Island (~100 km away) by Wilkins Sound to the east and Attenborough Strait to the south (Maps 1 and 2). Until recently, Charcot Island was connected to Alexander Island by the Wilkins Ice Shelf, but substantial collapse occurred in 2008 and the ice bridge gave way in April 2009 (Vaughan et al., 1993; Braun et al., 2009). Charcot Island is ice-covered with the exception of Marion Nunataks (69°45'S, 75°15'W) that form a 12 km chain of rock outcrops that overlook the mid-north coast of Charcot Island and consist predominantly of steep north–facing cliffs (Map 3). Mount Monique lies towards the western end of the Marion Nunataks chain and Mount Martine to the eastern end. The summits of both peaks are between 750 and 1000 metres above sea level.

The Area boundary is defined as follows:

The point on the northern coast of Charcot Island (at 69°43'07"S, 75°00'00"W) represents the most north-easterly point of the Area. From here, the Area boundary follows the coastline westwards to the point on the coast at 69°48'00"S, 75°19'19"W. The boundary then extends eastward inland to a point on the Charcot Island ice-cap at 69°48'00"S, 75°00'00"W. From there the boundary extends northwards to the coast at 69°43'07"S, 75°00'00"W. The Area also includes Cheeseman Island (located at 69°43'24"S, 75°11'00"W).

There are no boundary markers delimiting the Area. The maximum dimensions of the Area are 9.2 km north-south and 17.0 km east-west (106.5 km²). The Area includes ice cap that extends at least 4 km to the south and east of Marion Nunataks, which is intended to act as a buffer zone to prevent accidental importation of species not native to the Area (see Map 3). The steep ice cliffs on the north coast of Charcot Island, make access from the sea difficult.

- *Climatic conditions*

No climatic data are available, but Charcot Island lies in the track of depressions approaching the Antarctic Peninsula from the west. Satellite imagery indicates that the island is predominantly covered by cloud and may not become free of winter pack ice until late summer, if at all.

- *Biogeography*

Research by Smith (1984) and Peat et al. (2007) describes the recognised biogeographical regions present within the Antarctic Peninsula. Antarctica can be divided into three major biological provinces: northern maritime, southern maritime and continental. Charcot Island lies within the southern maritime zone (Smith, 1984), approximately 600 km north of the major biogeographic discontinuity that separates the Antarctic Peninsula and continental Antarctica known at the Gressitt Line (Chown and Convey, 2007). It also lies within ACBR 4, Central South Antarctic Peninsula (Terauds et al., 2012; Terauds and Lee, 2016)

- *Geology*

The rocks of Marion Nunataks are turbiditic sandstones and mudstones, similar in appearance to those found on nearby Alexander Island. However, geochronology and isotopic analyses from detrital minerals (grains that survive erosion, transport and deposition and so preserve information on the source rock) suggest that Charcot Island rocks are different to those on Alexander Island, and possibly the whole of the Antarctic Peninsula (Michael Flowerdew, pers. comm.). Alexander Island rocks are thought to have formed from sediments eroded off rocks from the Antarctic Peninsula. However, Charcot Island sediments were originally deposited within a deep marine trench that formed as a result of the destruction of the Pacific plate beneath the edge of the ancient continent of Gondwana. The sedimentary rocks were scraped off the Pacific plate as it was destroyed and accreted to the Gondwana continent, causing them to be folded and methamorphosed under high pressure. Charcot Island sedimentary rocks are thought to be Cretaceous (deposited around 120 million years ago), and may have been transported over long distances in a relatively short time interval before becoming juxtaposed to Alexander Island around 107 million years ago.

- *Biology*

The known terrestrial biological site (located on the Rils Nunatak at 69°44’56”S, 75°15’12”W) extends approximately 200 m east-west, by a maximum of 50 m north-south and harbours an extensive biota (Convey et al., 2000). This vegetated bluff consists of rock gently sloping to the north-west, which rapidly steepens to broken cliffs that drop to the sea. Water has been observed to be freely available at the site during all summer visits between December 1997 and January 2000.

Biota in the known terrestrial biological site include:

- Bryophytes: 16 mosses (including Andreaea spp., Bartramia patens, Bryum pseudotriquetrum, Brachythecium austrosalebrosum, Ceratodon purpureus, Dicranoweisia crispula, Grimmia reflexidens, Hennediella heimii, Hypnum revolutum, Pohlia spp., Polytrichum piliferum, Schistidium antarctici, Syntrichia princeps) and one liverwort (Cephaloziella varians). The dominant species are Andreaea spp., Dicranoweisia crispula and Polytrichum piliferum, which are usually only common in the sub-Antarctic. The abundance of B. austrosalebrosum is remarkable as it is a hydric species requiring a continuous supply of water. The mosses generally occur on wet rock slabs irrigated by trickling melt water from late snow patches which has allowed the formation of cushions c. 15 cm deep. (Smith, 1998; Convey et al., 2000).

- Foliose alga: Prasiola crispa (Smith, 1998; Convey et al., 2000).
- Lichens: 34 species, plus two identified to genus level. The dominant lichen species are Pseudophebe minuscule, Umbilicaria decussata, Usnea sphacelata and various crustose taxa (Smith, 1998; Convey et al., 2000). Lichen communities occupy much of the dry, windswept stony ground and ridges. Melt channels on sloping rock slabs are lined with large thalli (up to ~15 cm across) of Umbilicaria antarctica. The Area includes two lichen species that are previously unrecorded from Antarctica (Psilolechia lucida and Umbilicaria aff. thamnodes) and represents the furthest south known occurrence for several lichen species (including Frutidella caesioatra, Massalongia spp., Ochrolechia frigida, Usnea aurantiaco-atra and Usnea trachycarpa). Unusually, the widespread Usnea antarctica was not recorded from the site.
- Invertebrates: Seven species of Acari, seven Nematoda and five Tardigrada were present in collections from Marion Nunataks. Uniquely, neither acarine predators nor Collembola were recorded (Convey, 1999; Convey et al., 2000). A new species of tardigrade, Hebesuncus mollispinus, was identified from samples taken from the Area.
- Vertebrates: A small colony of 60 Adelie penguins (Pygoscelis adeliae) containing many chicks was reported from the small islands just to the northwest of Mount Monique (Henderson, 1976; Croxall and Kirkwood, 1979). The colony was still present at the location in January 2011 with 70 breeding pairs and numerous chicks recorded. This is thought to be the most southerly colony of Adélie penguins on the Antarctic Peninsula. Other than the penguin colony, the Area has little vertebrate influence. South polar skuas (Stercorarius maccormicki) are observed in the Area and a single nest was found on moss turf. Other birds observed and considered likely to breed in the area were small numbers of Antarctic terns (Sterna vittata), snow petrels (Pagodroma nivea), Antarctic petrels (Thalassoica antarctica) and Wilson's storm petrels (Oceanites oceanicus Kühl) (Henderson, 1976; Smith, 1998; Convey et al., 2000).

Although all elements of the biota recorded are typical of the maritime Antarctic biogeographical zone (Smith, 1984), community composition differs strikingly in detail from that found at other sites in the biome. The apparent absence of Collembola, recorded at all other known maritime Antarctic sites, contrasts directly with their importance elsewhere. Numbers of other animal species recovered from Marion Nunataks, suggest population densities comparable with those found in many other coastal maritime Antarctic sites and at least an order of magnitude greater than those usually found in Continental Antarctic sites, or on south-east Alexander Island at the southern limit of the maritime Antarctic. The numerical contribution made by springtails to faunas elsewhere in the maritime Antarctic appears to be replaced by several smaller prostigmatid mites (Nanorchestes nivalis and Eupodes minutes) on Charcot Island. The absence of predatory taxa is also an exceptional element of the Charcot Island arthropod community, particularly given the arthropod population densities.

terrestrial biological communities on Charcot Island are extremely vulnerable to accidental human-mediated introduction of both native Antarctic and non-native biota. Convey et al. (2000) write:

'As visitors to this island will inevitably arrive from other locations within the [Antarctic] Maritime zone, the potential for accidental transfer in soil or vegetation adhering to boots or clothing, rucksacks, etc. is great. Extreme caution is therefore required to avoid the transfer of native species between isolated populations within the Maritime Antarctic, highlighting an urgent need for strict control measures to be applied to all visitors to the site and others like it to conserve them for the future.'

- *Past human activity*

The Area is extremely isolated and difficult to access, other than by air, and as a result has been visited by only a small number of people, and these visits have been generally brief. Charcot Island was discovered on 11 January 1910 by Dr Jean Baptiste Charcot of the French Antarctic Expedition. The first landing on the island was made on 21 November 1947 by the Ronne Antarctic Research Expedition (RARE) when parts of the island were photographed from the air (Searle, 1963).

A temporary hut (30 m²) and airstrip were established by the Chilean Antarctic Expedition and Chilean Air Force (FACH) in November 1982. The camp was situated on ice a few kilometres east of Mount Martine (69°43'S, 75°00'W), on what is now the eastern boundary of the Area. The hut was buried by snow during the winter of 1983 and no evidence of the station remains on the surface (Comite Nacional de Investigaciones Antarcticas, 1983; Veronica Vallejos, pers comm.).

British Antarctic Survey (BAS) geologists and cartographers made brief visits to Marion Nunataks in January 1975, 9-13 February 1976 and 17 January 1995. BAS biologists made day trips to Rils Nunatak on 22 December 1997, 20-21 January 1999, 5 February 1999 and 16 January 2000. Reports suggest that there have been fewer than 10 field party visits to Marion Nunataks since their first visit in 1975. Visits have generally been limited to a few days or hours. Importantly, no further visits have been made to Marion Nunataks, inland from the coast, since the discovery of its unique ecosystems (Convey et al., 2000). As a result, it is probable that the ecosystem still exists in its original pristine state and no introduction of macrobiota has occurred.

Brief boat landings were made at the Adélie penguin colony on the coast northwest of Mount Monique by scientists from the United States in early 2010 and 2011.

6(ii) Access to the Area

No access points are specified, but landings are usually most safely made by aircraft on areas of permanent ice, as accessing inland locations from the sea is made difficult due to step ice cliffs around much of the coastline. Aircraft landing within the Area must comply with the condition described in section 7(ii). In early 2010 and 2011, brief landings were made from the sea by scientist from the United States to visit the Adélie penguin colony situated on ice-free ground to the northwest of Mt. Monique (approximate location 69°45’40” S, 75°25’00” W). The landings were made despite difficult sea ice conditions, which are common in this area. Furthermore, sea ice conditions prevented further landings in 2012. Consequently, this route is not recommended for general access to the Area.

6(iii) Location of structures within and adjacent to the Area

No installations or caches are known to exist in the Area. One cairn was constructed on the highest point (~126 m above sea level) of the small nunatak at 69°44’55” S, 75°15’00” W during the 1975-76 United States Geological Survey (USGS)-British Antarctic Survey Doppler Satellite Programme (Schoonmaker and Gatson, 1976). The 0.6 m high cairn marks the site of Station Jon and contains a standard USGS brass Antarctica tablet stamped ‘Jon 1975-1976’ set loosely in faulted rock. A metal tent pole (2.4 m) was erected in the cairn; however, there was no record of it in visit reports from 1995 onwards (Anonymous, 1977; Morgan, 1995).

6(iv) Location of other protected Areas in the vicinity

There are no other ASPAs or ASMAs in the vicinity, with the nearest protected area being ASPA No. 147 Ablation Valley and Ganymede Heights, which is situated 270 km away on the eastern coast of Alexander Island.

6(v) Special zones within the Area

There are no special zones in the Area.

7. Terms and conditions for entry permits

7(i) General permit conditions

Entry into the Area is prohibited except in accordance with a permit issued by an appropriate national authority under Article 3, paragraph 4, and Article 7 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty.

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

- it is issued for a compelling scientific reason, which cannot be served elsewhere, or for reasons essential to the management of the Area;

- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental and scientific values of the Area;
- the activities permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, shall be carried when in the Area;
- the Permit shall be issued for a finite period;
- a report is supplied to the authority or authorities named in the Permit; and
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

7(ii) Access to, and movement within or over, the Area

Where possible, day visits to the Area are strongly recommended in order to remove the requirement for camping equipment, and therefore reduce the risk of transferring locally non-native species into the Area. If management or scientific requirements cannot be met within the time scale of a single day visit, then longer visits requiring camping within the Area are permitted, but only after all other options have been full explored and rejected.

Entry of personnel or equipment arriving directly from other terrestrial biological field sites to the Area is prohibited. It is a condition of entry into the Area that all visitors and equipment must travel via an Antarctic station or ship where thorough cleaning of clothing and equipment has been performed, as detailed in this Management Plan (section 7(x)).

To protect the values of the Area and minimise the risk of introduction of locally non-native species, the following restrictions apply within the Area:

- *Aircraft and Remotely Piloted Aircraft Systems (RPAS)*

Aircraft are only permitted to land in the Area if they have performed the measures as detailed in this Management Plan (section 7(x)). Otherwise, aircraft must land outside the Area. Within the Area, fixed and rotory wing aircraft are prohibited from landing within 100 m of ice-free ground and the associated flora and fauna. The remaining 100 m of the approach to the ice-free ground must be made on foot.

An Adélie penguin colony is present within the Area on coastal ground to the northwest of Mount Monique (approximate location 69°44’40” S, 75°25’00” W). The operation of aircraft over the Area should be carried out, as a minimum requirement, in compliance with the Guidelines for the Operation of Aircraft near Concentrations of Birds contained in Resolution 2 (2004). Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for compelling scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority. Furthermore, operation of

RPAS within or over the Area shall be in accordance with the ‘Environmental guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica’ (Resolution 4 (2018)) (available at: https://documents.ats.aq/recatt/att645_e.pdf).

- *Ships and small boats*

Little information is available on locations appropriate for ship and small boat landings (see section 6(ii)). Given the unpredictable nature of sea ice conditions in the region, landings by boat are not recommended for general access to the Area. However, boat lands may be appropriate for visiting coastal locations, such as the Adélie penguin colony northwest of Mt. Monique (approximate location 69°45'40" S, 75°25'00" W).

- *Land vehicles and sledges*

Land vehicles shall not be taken into the Area unless essential for scientific, management or safety reasons. Land vehicles and sledges are only permitted within the Area if they are compliant with the measures as detailed in this Management Plan (section 7(x)). Once inside the Area, skidoos, sledges and other land vehicles are prohibited within 100 m of all ice-free ground and associated flora and fauna. The remaining 100 m of the approach to the ice-free ground must be made on foot.

- *Human movement*

Pedestrian traffic shall be kept to an absolute minimum necessary to be consistent with the objectives of any permitted activities. Where no routes are identified, pedestrian traffic should be kept to the minimum necessary to undertake permitted activities and every reasonable effort should be made to minimise trampling effects. Visitors should avoid areas of visible vegetation and care should be exercised walking in areas of moist ground, particularly the stream course beds, where foot traffic can easily damage sensitive soils, plant and algal communities, and degrade water quality.

Strict personal quarantine precautions shall be undertaken as described in section 7(x) of this Management Plan.

7(iii) Activities which may be conducted in the Area

Activities which may be conducted in the Area include:

- compelling scientific research that cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area;
- sampling, which should be the minimum required for approved research programmes; and
- essential management activities, including monitoring.

7(iv) Installation, modification or removal of structures

- No structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit.

- Permanent structures or installations are prohibited.
- All markers, structures or scientific equipment installed in the Area must be clearly identified by country, name of the principal investigator or agency, year of installation and date of expected removal.
- All such items should be free of organisms, propagules (e.g., seeds, eggs, spores) and non-sterile soil (see section 7(x)), and be made of materials that can withstand the environmental condition and pose minimal risk of contamination of the Area.
- Removal of specific structures or 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.
- Existing structures must not be removed, except in accordance with a permit.

7(v) Location of field camps

Camping within the Area is only permitted if scientific and management objectives cannot be achieved during a day trip to the Area. Camping may also occur within the Area during an emergency. Unless unavoidable for safety reason, tents should be erected on permanent snow or ice, at least 500 m from the nearest ice-free area. Field camp equipment must be cleaned and transported as described in section 7(x) of this Management Plan.

7(vi) Restrictions on materials and organisms which may be brought into the Area

In addition to the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, restrictions on materials and organisms which may be brought into the area are as follows:

- The deliberate introduction of animals, plant material, microorganisms and non-sterile soil into the Area shall not be permitted.
- Precautions shall be taken to prevent the unintentional introduction of animals, plant material, microorganisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area). Visitors should also consult and follow, as appropriate, recommendations contained in the CEP non-native species manual (Resolution 4 (2016), and in the Environmental code of conduct for terrestrial scientific field research in Antarctica (SCAR, 2009). Additional site-specific biosecurity measures are listed in section 7(x).
- No poultry products, including food products containing uncooked dried eggs, shall be taken into the Area.
- No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for a compelling scientific purpose specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided.

- 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. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Fuel, food and other materials must only be stored on snow or ice that is at least 500 m from the nearest ice-free ground. Permanent depots are not permitted.
- Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period.

7(vii) 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 issued in accordance with Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved this should, as a minimum standard, be in accordance with the SCAR code of conduct for the use of animals for scientific purposes in Antarctica (Resolution 4 (2019)). Any soil or vegetation sampling is to be kept to an absolute minimum required for scientific or management purposes, and carried out using techniques which minimise disturbance to surrounding soil, ice structures and biota.

7(viii) Collection or removal of materials 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, and which was not brought into the Area by the Permit Holder or otherwise authorised may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ: if this is the case the appropriate national authority must be notified and approval obtained.

7(ix) Disposal of waste

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

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

To help protect the ecological and scientific values derived from the isolation and low level of human impact at the Areas, visitors shall take special precautions against the introduction of non-native species. Further guidance can be found in the CEP non-native species manual (CEP, 2017) and the Environmental code of conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018)). Of particular concern are animal or plant introductions sourced from:

- soils from any other Antarctic sites, including those near stations; and

- soils from regions outside Antarctica

It is a condition of entry to the Area that visitors shall minimize the risk of introductions in accordance with the following measures:

- *Aircraft*

The interior and exterior of aircraft shall have been carefully inspected and cleaned as near as possible to the time of departure of the aircraft from the originating Antarctic station or ship. It is recommended that this include thorough sweeping and vacuuming of the inside of the aircraft and steam-cleaning or brushing of the exterior of the aircraft. Any aircraft that has landed at other rock airstrips or near biologically rich sites since being cleaned at the Antarctic station or ship is not permitted to enter the Area.

Fixed-wing aircraft that departed from a gravel runway must have landed, or trailed their skis, on clean snow outside the Area in an attempt to dislodge any soil from the skis, before landing within the Area.

- *Small boats*

Small boats used to transport visitors from a support vessel to the Area boundary shall be cleaned (with particular attention paid to the inside of the boats) to ensure they are free of soil, dirt and propagules.

- *Land vehicles and sledges*

Before land vehicles and sledges enter the Area, all mud, soil, vegetation and excessive dirt and grease must be removed. Ideally, this should have been completed on the originating Antarctic station or ship before transfer of the vehicles into the field. Land vehicles shall not enter the Area if after cleaning they have been driven over areas of rock or soil outside the Area.

- *Field camp equipment*

All camping equipment, including emergency camping equipment, shall be cleaned thoroughly (i.e. free of soil and propagules and, if practicable, sealed in plastic bags or sheeting) before being taken into the Area. This includes emergency camping equipment carried aboard any aircraft landing in the Area.

- *Sampling equipment, scientific apparatus and field-site markers*

To the greatest extent possible, all sampling equipment, scientific apparatus and markers brought into the Area shall have been sterilized, and maintained in a sterile condition, before being used within the Area. Sterilization should be by an accepted method, including UV radiation, autoclaving or by surface sterilisation using 70% ethanol or a commercially available biocide (e.g., Virkon®) (see the Environmental code of conduct for terrestrial scientific field research in Antarctica (SCAR, 2009)).

- *General field equipment*

General equipment includes harnesses, crampons, climbing equipment, ice axes, walking poles, ski equipment, temporary route markers, pulks, sledges, camera and video equipment, rucksacks, sledge boxes and all other personal equipment.

All equipment used inside the Area should be free of biological propagules such as seeds, eggs, insects, fragments of vegetation and soil. To the maximum extent practicable, all equipment used, or brought into the Area, shall have been thoroughly cleaned at the originating Antarctic station or ship. Equipment shall have been maintained in this condition before entering the Area, preferably by sealing in plastic bags or other clean containers.

- *Outer clothing*

Outer clothing includes hats, gloves, fleeces or jumpers, jackets, fabric or fleece trousers, waterproof trousers or salopettes, socks, boots and any other clothing likely to be worn as a surface layer. Outer clothing worn inside the Area should be free of biological propagules such as seeds, eggs, insects, fragments of vegetation and soil. To the maximum extent practicable, footwear and outer clothing used, or brought into the Area, shall have been thoroughly laundered and cleaned since used previously. Particular attention should be given to removing seeds and propagules from Velcro®. New clothing, taken straight out of the manufacturer's packaging just before entering the Area, need not undergo cleaning.

Further procedures for ensuring non-native species are not transferred into the Area on footwear and clothing depend upon whether the visit is via (i) a direct aircraft landing in the Area, (ii) overland movement into the Area from outside its boundaries or (iii) movement to the Area boundary by small boat:

- Direct aircraft landing in the Area. Sterile protective over-clothing shall be worn. The protective clothing shall be put on immediately prior to leaving the aircraft. Spare boots, previously cleaned using a biocide then sealed in plastic bags, shall be unwrapped and put on just before entering the Area.
- Overland movement into the Area from outside its boundaries. Sterile protective over-clothing is not recommended as, once within the Area, significant amounts of travel over crevassed ground may be required and use of sterile protective over-clothing may interfere with safety equipment such as ropes and harnesses. For overland movement into the Area, alternative measures must be used. Each visitor is required to bring at least two sets of outer clothing. The first set shall be worn for the journey to the Area boundary. The second set of outer clothing, which has previously been cleaned and sealed in plastic bags, shall only be worn inside the Area. Immediately before entering the Area, visitors shall change into their clean set of outer clothing. Spare boots, previously cleaned using a biocide then sealed in plastic bags, shall be unwrapped and put on just before entering the Area. The removed unclean outer clothing shall be stored in sealed, labelled

plastic bags, preferably outside the Area. On leaving the Area by overland travel, the clothing worn in the Area should be removed and stored in a clean, labelled plastic bag until needed for any further trips into the Area, or returned to the originating Antarctic station or ship for cleaning.

- Movement to the Area boundary by small boat. When aboard the support vessel, and immediately prior to entering the small boat to travel to the Area, each visitor, including the boat crew, shall put on clean clothing (including boating suits, life jackets and footwear) which is free of soil, seeds and other propagules. Alternatively, on arrival at the Area boundary, and before exiting the small boat, visitors shall cover all clothing in clean protective over-suits. Additional clothing or footwear required by visitors when within the Area, shall be cleaned before leaving the support vessel, and stored in a sealed container (e.g., plastic bag) until needed.

7(xi) Requirements for reports

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the Antarctic Specially Protected Area visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Appendix 2). In this report, notes should be made of the specific ice-free locations visited within the Area (including, if possible, GPS coordinates), the length of time spent at each location and the activities undertaken. Wherever possible, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

8. Supporting documentation

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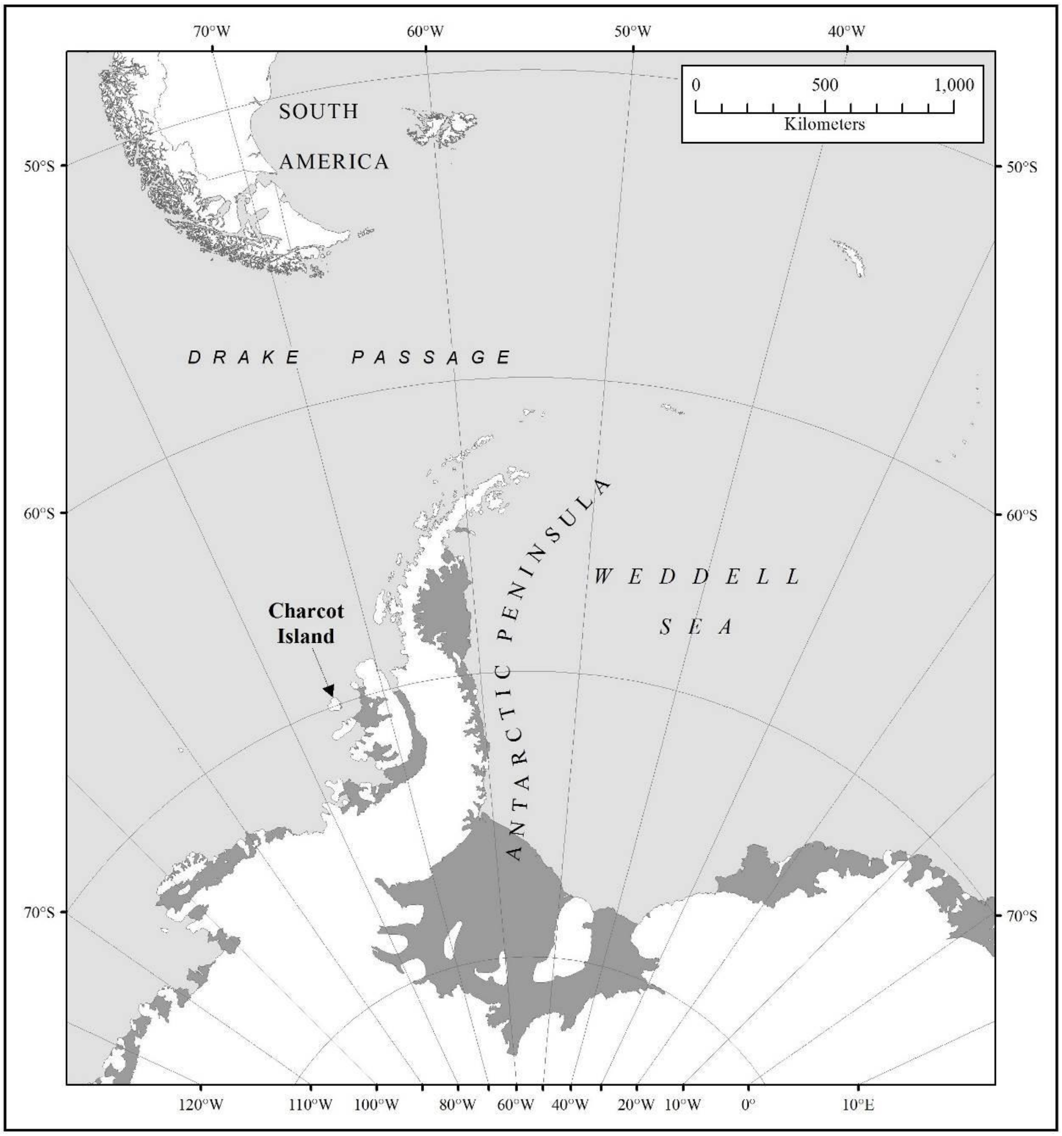
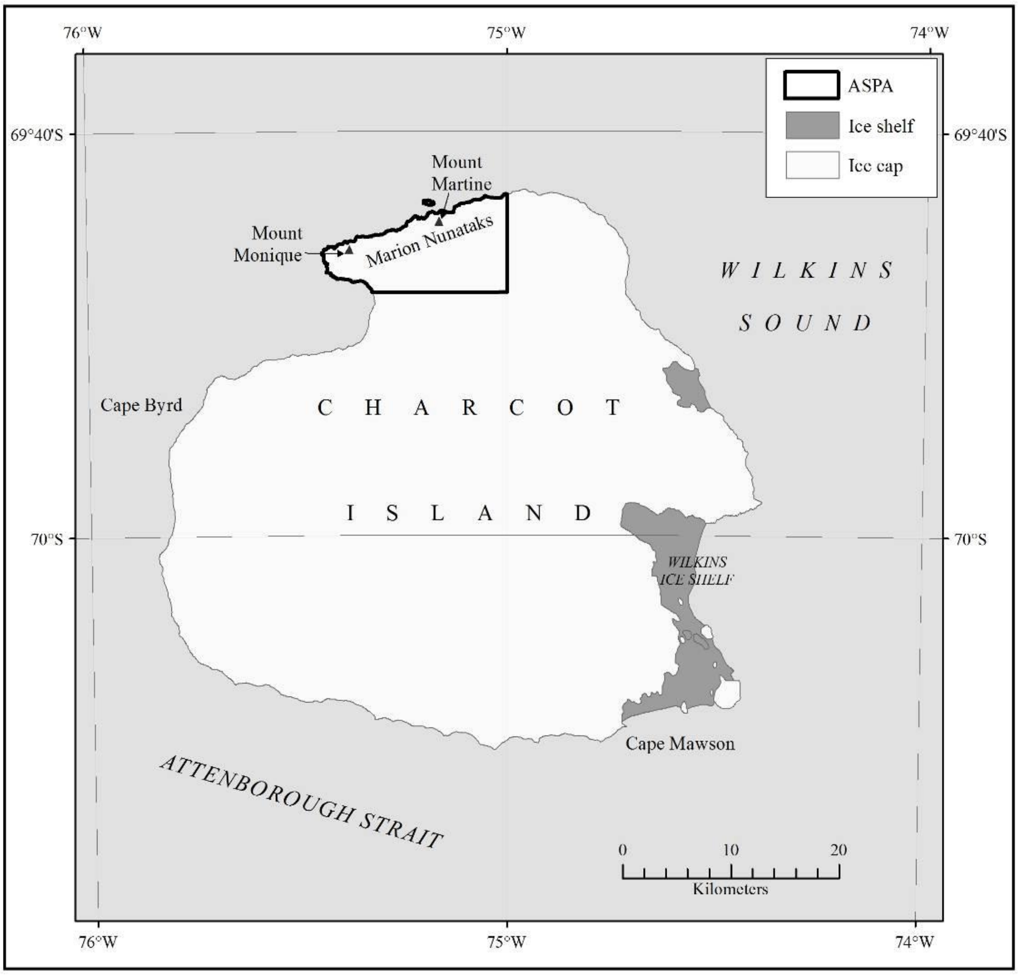
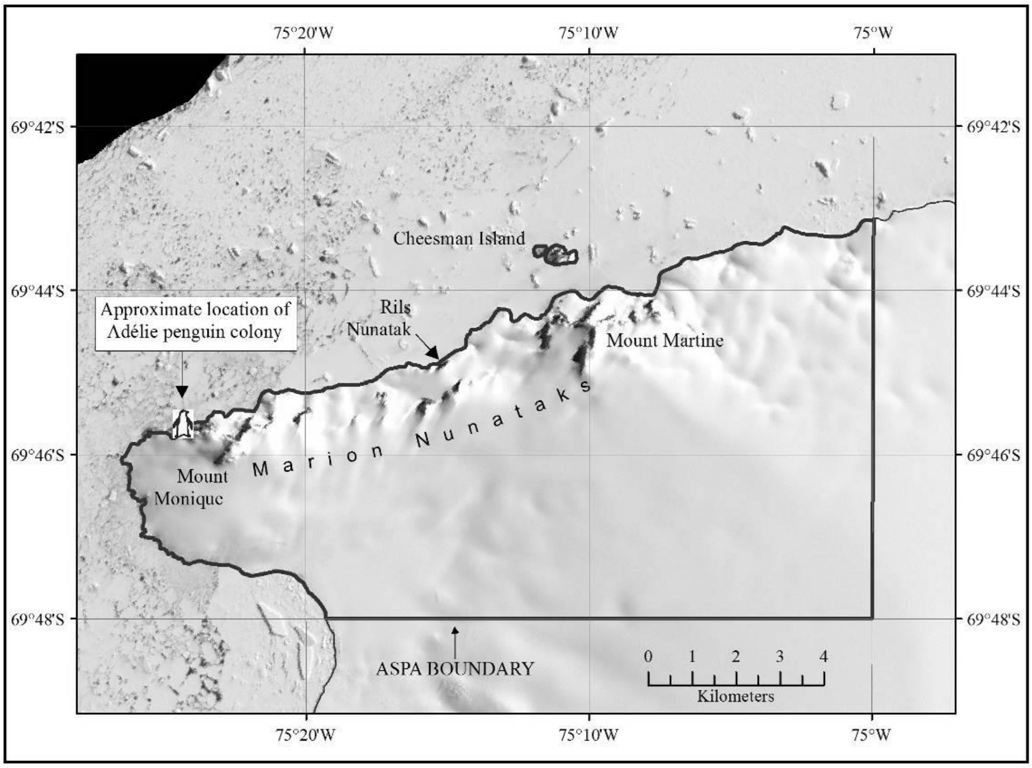
Map 1. Charcot Island in relation to Alexander Island and the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -55°, Standard parallel: -71°.



Map 2. Charcot Island, including ASPA No. 170, Marion Nunataks situated in the northwest of the island. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel 1: -71.0°.



Map 3. ASPA No. 170, Marion Nunataks, Charcot Island, Antarctic Peninsula. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel 1: -71.0°. Developed from USGS Landsat Image Mosaic of Antarctica, Scene ID: x-2250000y+0450000. Metadata available at http://lima.usgs.gov/.



Measure 17 (2023)

Antarctic Specially Protected Area No 172 (Lower Taylor Glacier and Blood Falls, McMurdo Dry Valleys, Victoria Land): Revised Management Plan

The Representatives,

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

Recalling Measure 9 (2012) which designated Lower Taylor Glacier and Blood Falls, McMurdo Dry Valleys, Victoria Land as ASPA 172 and annexed a Management Plan for the Area;

Recalling Measure 6 (2018), which adopted a revised Management Plan for ASPA 172;

Noting that that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 172;

Desiring to replace the existing Management Plan for ASPA 172 with the revised Management Plan;

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 172 (Lower Taylor Glacier and Blood Falls, McMurdo Dry Valleys, Victoria Land), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 172 annexed to Measure 6 (2018) be revoked.

Management Plan for Antarctic Specially Protected Area No. 172

LOWER TAYLOR GLACIER AND BLOOD FALLS, MCMURDO DRY VALLEYS, VICTORIA LAND

Introduction

Blood Falls is an iron-rich saline discharge located at the terminus of the Taylor Glacier, Taylor Valley, McMurdo Dry Valleys. The source of the discharge is believed to be a subglacial extensive brine aquifer located beneath the measureable length (~5 km) of the ablation zone of the Taylor Glacier, estimated to be located between one to six kilometers above Blood Falls. Approximate area and coordinates: sub-surface area 436 km² (centered at 77° 50.220' S, 161° 40.230'E); sub-aerial area 0.11 km² (centered at the Blood Falls discharge at 77° 43.365' S, 162° 15.809' E). The primary reasons for designation of the Area are its unique physical properties, and the unusual microbial ecology and geochemistry. Additionally, Blood Falls appears to be one of the few locations where Antarctic groundwater can be collected at the surface. The Area is an important site for exobiological analog studies and provides a unique opportunity to sample the subglacial environment without direct contact. The influence of Blood Falls on adjacent Lake Bonney is also of significant scientific interest. Furthermore, the ablation zone of the Taylor Glacier is an important site for paleoclimatic and glaciological research. The lower Taylor Glacier subglacial brine reservoir and Blood Falls are globally unique and a site of outstanding scientific importance. Designation of the Area allows for scientific access to ice deep within Taylor Glacier, provided measures are in place to ensure this does not compromise the Blood Falls reservoir and hydrological system.

Under the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) the Area lies within Environment S – McMurdo – South Victoria Land geologic. Under the Antarctic Conservation Biogeographic Regions (v2) (Resolution 3 (2017)) the Area lies within ACBR 9 – South Victoria Land.

1. Description of values to be protected

Blood Falls is a distinctive glacial feature located at 77° 43.329' S, 162° 16.288' E at the terminus of the Taylor Glacier in the Taylor Valley, McMurdo Dry Valleys, southern Victoria Land (Map 1). The feature forms where an iron-rich, saline liquid discharge of subglacial origin emerges at the surface and then rapidly oxidizes and precipitates to give it a distinctive reddish coloration (Sklute et al. 2022) (Figure 1). Available evidence suggests the source of the discharge is a subglacial marine salt deposit and brine reservoir located beneath the Taylor Glacier (Keys 1980; Hubbard et al. 2004; Mikucki et al. 2015) (Map 1). The feature is unique in its physical configuration, microbial biology and geochemistry and has an important influence on the local ecosystem of Lake Bonney. Blood Falls appears to be one of the few locations where Antarctic groundwater can be collected at the surface, adding to its scientific value. Furthermore, the episodic discharge events at Blood Falls provide a unique opportunity to sample the properties of the subglacial reservoir and its ecosystem.

Blood Falls was first observed by Griffith Taylor, Robert F. Scott's Senior Geologist, in 1911. However, scientific research into its unusual morphological and geochemical characteristics did not commence until the late 1950s (Hamilton et al. 1962; Angino et al. 1964; Black et al. 1965). The feature named as Blood Falls is the primary discharge site at the terminus of the Taylor Glacier (Map 2). A secondary lateral saline discharge has been observed to emerge at the surface from under sediments ~40 m north from the Taylor Glacier at the margin of the Santa Fe Stream delta (77° 43.297' S, 162° 16.042' E, Map 2). The exact location and form of the subglacial reservoir source feeding Blood Falls is currently uncertain, although geological, glacio-chemical and geophysical mapping results suggest that the reservoir extends from beneath Lake Bonney and below the glacier terminus to at least 5 km up-valley (Keys 1980; Hubbard et al. 2004; Mikucki et al. 2015, Foley et al. 2015). It has been estimated that the brine reservoir became encased by ice approximately 3 to 5 Ma BP (Marchant et al. 1993) and may represent the oldest liquid feature in the Taylor Valley (Lyons et al. 2005).

The Blood Falls outflow contains a unique microbial community of apparently marine origin. The microbes may survive in the subglacial environment for millions of years without external carbon input. On account of its high iron and salt content, and its physical location below glacier ice, the microbial ecosystem at Blood Falls is an important site for exobiological studies and may provide an analogue for the conditions found beneath the polar ice caps on Mars or ocean worlds such as Enceladus and Europa (Sklute et al. 2022). It is therefore important to ensure that the Blood Falls microbial community, the brine reservoir and associated subglacial hydrological system are protected.

The discharge episodically released from Blood Falls into adjacent Lake Bonney alters the geochemical composition of the lake and provides nutrients that are otherwise limited, making the site valuable for investigation of the impacts of subglacial outflow on lake ecosystems. There is growing evidence that brine from the subglacial aquifer also has a direct, subglacial connection with Lake Bonney bottom waters (Mikucki et al. 2015; Spigel et al. 2018).

The Taylor Glacier is an important site for Antarctic glaciological and paleoclimatic studies. It provides a unique opportunity to study Antarctic outlet glacier behaviour in relation to environmental change, using ice core paleoclimatic data from Taylor Dome, geologic evidence from the Taylor Valley and climatic data from nearby US Long Term Ecological Research (LTER) sites (Kavanaugh et al. 2009a; Bliss et al. 2011). The lower ablation zone of the Taylor Glacier has been identified as a valuable site for paleoclimatic studies, as it exposes ice from the last two glacial periods and allows past concentrations of trace gases to be measured at a high temporal resolution (Aciego et al. 2007; Shackleton et al. 2020). In addition, the Taylor Glacier is of scientific value for glaciological studies, in particular glacier dynamics and the relationships between stresses and glacier flow, and for other glaciological research (Kavanaugh & Cuffey 2009).

The Blood Falls system is a valuable site for study of microbiology, water chemistry, glaciology, and paleoclimatology. The most unusual aspects of the Blood Falls system are its physical configuration, brine chemistry and microbial ecosystem. Blood Falls also exerts considerable influence over the geochemistry and microbiology of Lake Bonney.

The Area possesses outstanding aesthetic values and significant educational value, as the site has been the subject of a range of scientific, educational and media articles in recent years. Blood Falls and the Taylor Glacier brine reservoir merit special protection due to their outstanding scientific values, unique configuration, ancient origin, importance to ecosystems in the local area, and their vulnerability to disturbance by human activities.

On the basis of presently available knowledge, the input of contaminants directly into the subglacial reservoir or into areas of the bed from which subglacial fluids could flow towards the reservoir has been identified as the most likely potential mechanism for contamination of the Taylor Glacier brine reservoir. However, the uncertainties surrounding the location of the subglacial reservoir and its connectivity with the subglacial hydrological system make it difficult to assess the likelihood of this occurring and for this reason a precautionary approach has been adopted when defining the boundaries of the sub-surface component of the Area.

2. Aims and objectives

Management at the lower Taylor Glacier and Blood Falls aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human presence, disturbance and sampling in the Area;
- allow scientific research, in particular on the microbial community, water chemistry and physical configuration of the lower Taylor Glacier and Blood Falls;
- allow other scientific research and visits for education / outreach provided they will not jeopardize the values of the Area;
- prevent or minimize the possibility of chemical contamination and / or introduction of non-native species (e.g. alien plants, animals and microbes) to the Area; and
- 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:

- Markers or signs illustrating the location and boundaries, with clear statements of entry restrictions, should as appropriate be placed at locations on the boundary of the sub-aerial component of the Area to help avoid inadvertent entry;
- 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;
- A copy of this Management Plan shall be kept available in the principal research hut facilities proximal to the Area, in particular the Lake Bonney, Lake Hoare, Lake Fryxell, F6, and New Harbor camps, and at McMurdo Station and Scott Base;
- National Antarctic programs operating in the region shall consult together to ensure the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No.172 – Lower Taylor Glacier and Blood Falls sub-surface boundary. Projection: Lambert Conformal Conic; Standard parallels: 1st 77° 35' S; 2nd 77° 50' S; Central Meridian: 161° 30' E; Latitude of Origin: 78° 00' S; Spheroid and horizontal datum: WGS84; Contour interval 200 m.

Inset 1: Location of the McMurdo Dry Valleys in the Ross Sea region.

Inset 2: Location of the Taylor Glacier in ASMA No.2 McMurdo Dry Valleys.

Map 2: ASPA No.172 – Blood Falls sub-aerial discharge area, topography and boundary. Projection: Lambert Conformal Conic; Standard parallels: 1st 77° 43' S; 2nd 77° 44' S; Central Meridian: 162° 16' E; Latitude of Origin: 78° 00' S; Spheroid and horizontal datum: WGS84; Contour interval 20 m.

Figure 1. Aerial view of the terminus of the Taylor Glacier in 2004, with Blood Falls at center and Lake Bonney at lower left (Photographer unknown: 18 Nov 2004). Note that the camp site shown is now largely submerged by Lake Bonney (November 2022).

Figure 2. Aerial view of the terminus of the Taylor Glacier in 2009, showing the extent of the sub-aerial component of the Area. A comparison with Figure 1 highlights the extent to which the size of the discharge varies over time (C. Harris, ERA / USAP: 10 Dec 2009).

6. Description of the Area

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

- *Overview*

Blood Falls (located at 77° 43.329' S, 162° 16.288' E) is an iron-rich, hypersaline discharge that emerges from a crevasse near the terminus of Taylor Glacier, in the McMurdo Dry Valleys, southern Victoria Land. The brine initially lacks color, but freezes to a bubbly white icing as it flows off the glacier and then oxidises to produce its distinctive red- orange color (Sklute et al. 2022). Many traces of iron colored material remain encapsulated in former crevasses and cracks in the glacier especially near the primary discharge point. A secondary, much smaller and less distinct, surface discharge has been observed twice (1958, 1976) ~40 m north of Taylor Glacier at the margin of the Santa Fe stream delta (77° 43.297' S, 162° 16.042' E, Map 2). The secondary discharge has a similar physical and chemical composition to the primary outlet at Blood Falls (Keys 1980).

The volume and physical extent of the primary Blood Falls surface outflow and icing accumulation varies over time, ranging from a few hundred to several thousand cubic meters of saline icing, and the discharge events occur at intervals of one to three years or more (Keys 1980). An unknown proportion of brine sometimes drains, before it freezes (e.g. 1972, 1978) into Lake Bonney. At its minimum extent, the discharge appears as a small area of discoloration at the Taylor Glacier terminus, but can extend tens of meters across Lake Bonney at its maximum (see e.g., Figures 1 & 2).

The source of the brine discharges is subglacial, and the water in the discharge brine is melted glacial ice (Mikucki et al. 2009) but the original source and formation age and evolution for the subsurface brine remains unclear. Chemical and isotopic analyses indicate that a marine salt deposit or deposits are melting and / or have melted ice of Taylor Glacier (Keys 1980). Deepened subglacial topography beneath the Taylor Glacier between one to six kilometers from the terminus suggests the salt body is likely to be located there but there could be other locations further up glacier. The thickness and extent of the resulting subglacial brine, or the exact location and nature of the resulting reservoir(s) and brine drainage paths have yet to be firmly established (Keys 1980; Hubbard et al. 2004).

- *Boundaries and coordinates*

The boundaries of the Area are designed to protect the values of the subglacial brine reservoir and the Blood Falls surface discharge, taking into account the size of the catchment, likely hydrological connections and practicality. Because there is evidence that hydrological connections and interactions between the surface and bed of the Taylor Glacier are likely to be minimal, restricting access on and / or over the majority of the surface of the catchment is not considered necessary. However, a small area encompassing the confirmed primary and secondary Blood Falls discharges, including a part of the Taylor Glacier surface that drains directly into the primary discharge, is included within the boundary at the surface to provide adequate protection for the confirmed outflow areas (Map 2). The ‘possible discharge’ location examples shown on Map 1 are not currently included within the Area because they remain unconfirmed. They may represent exposures that indicate basal processes that may at one time have involved the reservoir or related features rather than be points of contemporary discharge. Moreover these features do not feed into the reservoir or primary outflow site at Blood Falls.

Subglacial interconnections, on the other hand, could be extensive, so a relatively large sub-surface component extending ~50 km up-glacier aims to protect the main part of the subglacial catchment of the lower Taylor Glacier that could be interconnected with the brine reservoir (Map 1). This extent is currently considered sufficient to protect the values of the reservoir, although it is recognized that some interconnections may extend further since technically the catchment extends far onto the polar plateau; the western boundary was therefore selected in part as a practical limit beyond which the risks to the Area are considered minimal.

In summary, the vertical and lateral extents of the Area were defined on the grounds that the boundary:

- protects the integrity of the subglacial reservoir and the confirmed primary and secondary Blood Falls discharge areas;
- allows for uncertainties in the location of the reservoir and in the connectivity within the subglacial hydrological system;
- provides a practical boundary based on catchments that is straightforward to map and identify in the field; and
- does not unnecessarily restrict activities on and / or over the surface of the Taylor Glacier. Key boundary coordinates are summarized in Table 1.

Table 1: Summary list of key protected area boundary coordinates (see Maps 1 & 2)

Location	Label	Latitude (S)	Longitude (E)
Sub-surface boundary			
Blood Falls primary discharge	A	77° 43.325'	162° 16.305'
Taylor / Ferrar glaciers ice divide, southern margin of Kukri Hills	B	77° 49.100'	161° 57.300'
Knobhead, foot of NE ridge	C	77° 52.257'	161° 44.383'
Kennar Valley, center at Taylor Glacier margin	D	77° 44.547'	160° 25.998'
Beehive Mountain, foot of SW ridge	E	77° 39.670'	160° 33.328'
Mudrey Cirque SW extent	F	77° 39.205'	160° 42.988'
Mudrey Cirque SE extent	G	77° 39.525'	160° 48.710'
Sub-aerial boundary			
Taylor Glacier terminus, ice / moraine outcrop	a	77° 43.356'	162° 16.639'
Supraglacial catchment feeding Blood Falls, western extent	b	77° 43.482'	162° 14.508'
Taylor Glacier, northern margin	c	77° 43.320'	162° 15.758'

Santa Fe Stream delta, western margin	d	77° 43.315'	162° 15.792'
Lawson Creek, boulder on west bank	e	77° 43.268'	162° 16.178'
Lake Bonney, ~180m east from shore at Santa Fe Stream delta	f	77° 43.268'	162° 16.639'

- *Sub-surface*

The sub-surface boundary encompasses the entire ablation zone of the Taylor Glacier, from a depth of 100 m below the surface to the glacier bed. In order to aid identification of the boundary at the surface, and because of practical constraints over the availability of data on the configuration of the 100 m depth within the glacier, the surface margin of the Taylor Glacier is used as a surrogate for the 100 m depth line and thus is used to define the lateral extent of the sub-surface component of the Area. The following description first defines the lateral extent of the sub-surface component of the Area and subsequently defines the vertical extent.

The sub-surface component of the protected area boundary extends from the primary Blood Falls discharge site (77° 43.329' S, 162° 16.288' E) (labelled 'A' in Table 1 and on Maps 1 & 2) and follows the Taylor Glacier terminus southward 0.8 km to the southern margin of the glacier at Lyons Creek. The boundary of the Area thence extends 19.3 km SW (Map 1), following the southern margin of the Taylor Glacier to the western extremity of the Kukri Hills. The boundary thence extends 7.8 km east to an approximate position where the ice divides between the Taylor and Ferrar glaciers along the southern margin of the Kukri Hills, located at 77° 49.10' S, 161° 57.30' E ('B', Table 1, Map 1). The boundary thence extends 7.9 km SW, following the approximate divide between the Taylor and Ferrar glaciers to the eastern extremity of Knobhead at 77° 52.257' S, 161° 44.383' E ('C', Table 1, Map 1). The boundary thence follows the southern margin of the Taylor Glacier westward 11.8 km to Windy Gully, crosses Windy Gully and thence extends 45.2 km NW, following the margins of the Taylor, Beacon and Turnabout glaciers to the Kennar Valley, located at 77° 44.547' S, 160° 25.998' E ('D', Table 1, Map 1). The boundary thence extends NE across the Taylor Glacier 9.5 km to the foot of Beehive Mountain at 77° 39.670' S, 160° 33.328' E ('E', Table 1, Map 1). As a visual reference, the protected area boundary runs parallel to a distinct ridge evident in the surface of the Taylor Glacier immediately downstream from an area of heavy crevassing. From Beehive Mountain, the boundary extends 5km east to the boundary between Mudrey Cirque and the Taylor Glacier at 77° 39.205' S, 160° 42.988' E ('F', Table 1, Map 1). The boundary thence follows the margin of Mudrey Cirque for 9.6 km to rejoin the Taylor Glacier at 77° 39.525' S, 160° 48.710' E ('G', Table 1, Map 1) and thence extends 59.6 km SE to the foot of the Cavendish Icefalls, following the northern margin of the Taylor Glacier. The boundary thence extends north and east along the Taylor Glacier margin for 16.9 km, excluding Simmons Lake and Lake Joyce, and extends a further 15.4 km east to the primary Blood Falls discharge site ('A', Table 1, Map 2).

The vertical extent of the sub-surface component of the Area is defined in terms of depth below the surface of the Taylor Glacier (Figure 3). The sub-surface boundary extends from a depth of 100 m below the Taylor Glacier surface to the glacier bed, which is defined as the underlying bedrock surface below the glacier. The subglacial hydrological system, the Blood Falls brine reservoir, and any layers of mixed ice / sediment and / or unconsolidated sediments are included within the boundary. The sub-surface component of the Area does not impose additional constraints on activities conducted at the surface or within the upper 100 m depth within the body of the Taylor Glacier.

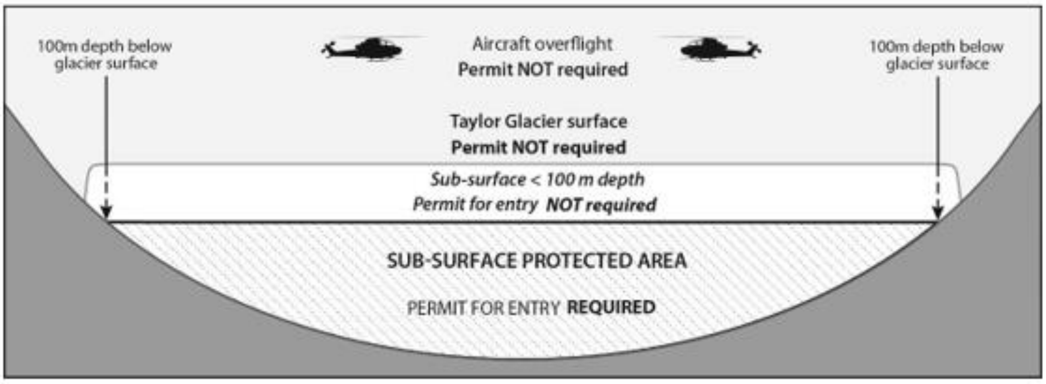


Figure 3: Depth-based definition of the vertical extent of the sub-surface component of the lower Taylor Glacier and Blood Falls protected area.

- *Sub-aerial*

This sub-aerial component of the Area comprises the delta of Santa Fe Stream, part of the western extremity of Lake Bonney, and a small supraglacial catchment surrounding Blood Falls that is defined by a system of ice ridges that persist in the local glacier morphology over at least decadal time-scales. Within the part of the sub-aerial component which includes the lower Taylor Glacier, the vertical boundary includes the entire glacier depth from the surface to the glacier bed. The SE boundary of the sub- aerial component of the Area is indicated by a prominent ice and moraine outcrop extending from the Taylor Glacier terminus at 77° 43.356' S, 162° 16.639' E (labelled ‘a’ in Table 1 and on Map 2). The boundary thence extends SW and up-glacier for 900.8 m, following the southern margin of the supraglacial catchment surrounding Blood Falls to the most westerly extent of the supraglacial catchment, located at 77° 43.482' S, 162° 14.508' E (‘b’, Table 1, Map 2). The boundary thence extends NE by 594.5 m to the Taylor Glacier margin at 77°43.320' S, 162° 15.758' E (‘c’, Table 1, Map 2), following the northern margin of the supraglacial catchment. The boundary of the Area thence extends 16.8 m NE in a straight line, to the top of the river bank above the Santa Fe Stream delta at 77° 43.315' S, 162° 15.792' E (‘d’, Table 1, Map 2). The boundary thence extends NE for 198.7 m, following the top of the bank to the point at which it meets Lawson Creek, at 77° 43.268' S, 162° 16.178' E (‘e’, Table 1, Map 2). The boundary thence extends due east in a straight line for 180.5 m to a point on Lake Bonney at 77° 43.268' S, 162° 16.639' E (‘f’, Table 1, Map 2) and thence due south in a straight line for 166.5 m to the prominent ice and moraine outcrop.

- *Climate*

Two meteorological stations operated by the McMurdo Dry Valleys Long Term Ecological Research (LTER) program are located close to Blood Falls (https://mcm.lternet.edu/): 'Lake Bonney' (Point 'a', 77° 42.881' S, 162° 27.881' E) located ~4.5 km to the east, and 'Taylor Glacier' (77° 44.401' S, 162° 07.881' E), located ~4 km up-glacier. The mean annual air temperature at both stations was approximately –17ºC during the period 1993 – 2015. The lowest temperature at these stations during this period was –48.26ºC, recorded at Lake Bonney in August 2008, whilst the maximum of 10.64ºC was recorded at Lake Bonney in December 2001. August was the coolest month at both stations, with January and December the warmest at Lake Bonney and Taylor Glacier respectively.

Mean annual wind speeds over the same period (1995 – 2009) ranged from 3.89 m/s at Lake Bonney to 5.16 m/s at the Taylor Glacier. A maximum wind speed of 44.12 m/s was recorded at Taylor Glacier on 11 May 2014. Taylor Valley topography, in particular Nussbaum Riegel, encourages formation of isolated weather systems within the Lake Bonney basin and limits the flow of coastal winds into the area (Fountain et al. 1999).

Average mean annual precipitation at Lake Bonney between 1995 and 2009 was 340 mm water equivalent. Ablation rates on the Taylor Glacier are highest in the area surrounding the Cavendish Ice Falls, reaching a maximum at the base of Windy Gully (~ 0.4 m a^{-1}), and are lowest up-glacier of Beacon Valley (~0 to 0.125 m a^{-1}). Ablation rates on the lower Taylor Glacier generally range from 0.15 to 0.3 m a^{-1} (Bliss et al. 2011).

- *Geology and geomorphology*

The Taylor Valley is comprised of a mosaic of tills of varying ages and rock types, including: Precambrian metamorphic basement rocks (Ross Supergroup), early Paleozoic intrusives (Granite Harbor formation), a series of sedimentary rocks of Devonian to Jurassic age (Beacon Supergroup) and the Jurassic age Ferrar Dolerite sills (Pugh et al. 2003).

The Blood Falls subglacial reservoir is thought to be a marine brine originating from a marine incursion into the McMurdo Dry Valleys during the Pliocene (3 to 5 Ma BP) and may represent the oldest liquid water feature in the Dry Valleys (Lyons et al. 2005). It has been proposed that during the subsequent retreat of seawater from the Taylor Valley, the brine was trapped close to the modern-day terminus of the Taylor Glacier and was then 'sealed' beneath the glacier as ice advanced during the late Pliocene or Pleistocene (Marchant et al. 1993). The brine deposit is now thought to form a subglacial reservoir, which episodically emerges at the surface at the primary outflow and the secondary lateral discharge site. It has been suggested the brine has been modified since entrapment, partly due to inputs from chemical weathering (Keys 1980; Lyons et al. 2005; Mikucki et al. 2009).

- *Soils and sediment*

Taylor Valley soils are generally poorly developed and largely composed of sand (95- 99% by weight) (Burkins et al. 2000; Barrett et al. 2004). Taylor Valley soils have some of the lowest organic matter concentrations on Earth (Campbell & Claridge 1987; Burkins et al. 2000) and soils within the Lake Bonney basin are particularly low in organic carbon content (Barrett et al. 2004). In the Taylor Valley, soils generally extend to a depth of 10 to 30cm, below which is permafrost (Campbell & Claridge 1987). In addition to glacial till, the Taylor Valley floor is covered by lacustrine sediments, deposited by the formerly extensive glacial Lake Washburn, which extend to a depth of approximately 300m (Hendy et al. 1979; Stuiver et al. 1981; Hall & Denton 2000).

Moraines at the snout of the Taylor Glacier are composed of reworked lacustrine sediment, which dates from approximately 300 ka BP (Higgins et al. 2000). Sediments at the Taylor Glacier margin are also composed of silty and sandy tills, formed by melt-out from debris-rich basal glacier ice and from erosion by ice marginal streams (Higgins et al. 2000). A thick basal ice sequence characterised by fine-grained sediments and thought to contain salts originating from the Blood Falls subglacial reservoir was documented in a tunnel excavated on the northern margin of the Taylor Glacier (Samyn et al. 2005, 2008; Mager 2006; Mager et al. 2007). These observations suggest that the base of the Taylor Glacier is interacting with the underlying sediment and that localised melting and refreezing may be occurring (Souchez et al. 2004; Samyn et al. 2005; Mager et al. 2007).

- *Glaciology and glacial hydrology*

The Taylor Glacier is an outlet glacier of the East Antarctic Ice Sheet and terminates in the western lobe of Lake Bonney. A comprehensive study has recently been undertaken to investigate the dynamics of the Taylor Glacier ablation zone, including its geometry and surface velocity field (Kavanaugh et al. 2009a), its force balance (Kavanaugh & Cuffey 2009) and its contemporary mass balance (Fountain et al. 2006; Kavanaugh et al. 2009b). Results suggest that the glacier primarily flows through deformation of cold ice and that the Taylor Glacier is approximately in mass balance. Ice samples from the lower Taylor Glacier ablation zone have been used in paleoclimatic studies and the ice has been dated to the last glacial period (Aciego et al. 2007). Recent investigations on the lower Taylor Glacier identified a complete sequence of ice well-preserved in age and structure spanning from 8 to 55 ka BP (Baggenstos et al. 2017), with some ice aged at least 150 ka BP (Severinghaus pers. comm. 2018). Ice cores extracted from this area have been used to analyse changes in atmospheric gas constituents (Bauska et al. 2016; Petrenko et al. 2017). Other recent glaciological studies conducted on the Taylor Glacier have investigated the evolution of the dry ice cliffs at the terminus (Pettit et al. 2006; Carmichael et al. 2007), carried out textural and gas measurements on basal ice within a subglacial tunnel proximal to the primary Blood Falls outlet (Samyn et al. 2005, 2008; Mager et al. 2007) and assessed the surface energy budget of the glacier (Bliss et al. 2011). Studies of the supraglacial hydrology of the Taylor Glacier suggest that meltwater channels cover approximately 40% of the lower ablation zone of the Taylor Glacier and melting within the channels contributes significantly to total runoff into Lake Bonney (Johnston et al. 2005). Two large channels drain across the primary Blood

Falls outlet, but it is considered highly unlikely that direct connections exist between surface meltwater channels and the Blood Falls subglacial reservoir due to the cold temperatures of the near- surface ice and the lack of crevasse penetration beyond 100m depth (Cuffey, Fountain, Pettit and Severinghaus, pers. comms. 2010) and lack of surface oxygen signals, or modern carbon isotopic signatures in brine collected directly from the discharge point (Mikucki et al. 2009).

The extent of subglacial meltwater beneath the Taylor Glacier and its connectivity with the Blood Falls system is currently uncertain. Inferred basal temperatures suggest that the majority of the Taylor Glacier base is substantially below the pressure melting point (Samyn et al. 2005, 2008) and a radar survey conducted by Holt et al. (2006) found no evidence of widespread liquid water beneath the Taylor Glacier. Measurements made by Samyn et al. (2005) recorded a basal temperature of -17°C at the side of the glacier near Blood Falls. However, ice thickness and plausible gradients of englacial temperature are consistent with temperatures around -5 to -7°C at the base of the glacier within 1–3km of Blood Falls, similar to the measured temperatures of brine discharging at the primary and secondary sites (Keys 1980). Ice-penetrating radar surveys suggest that water, probably hypersaline, may exist within an 80 m bedrock depression, located between 4 and 6km from the Taylor Glacier terminus (Hubbard et al. 2004).

Saline water is released episodically from the subglacial reservoir of Blood Falls, usually via the primary outlet and on occasions via the secondary lateral discharge site. However, detailed underwater surveys of the Taylor Glacier terminus conducted by the ENDURANCE (Environmentally Non-Disturbing Under-Ice Robotic Antarctic Explorer) AUV (autonomous underwater vehicle) suggest that the subglacial brine may enter Lake Bonney across the majority of the Taylor Glacier terminus (Stone et al. 2010; Priscu, pers. comm. 2011). In addition, a number of sites have been identified on both the northern and southern margins of the Taylor Glacier where salts and orange discoloration exist in layers (examples of which are identified on Map 1 as ‘Possible discharge’), but the nature of these features has yet to be confirmed (Keys 1980; Nylen, pers. comm. 2010). The trigger for subglacial release events is uncertain, although it has been suggested that after accumulating under pressure beneath the glacier, the brine must travel through a discrete subglacial conduit which controls the location of the primary discharge: this behavior is similar to some aperiodic glacier bursts (jökulhlaups) where basal melting processes and changing stress patterns (such as physical shifts of the Taylor Glacier) may create a passage for the brine through impounding basal ice or force the subglacial liquid out from its bedrock depression (Keys 1980; Higgins et al. 2000; Mikucki 2005). Badgeley et al. (2017) suggest Blood Falls acts as a ‘pressure-release valve’ for the hydrologic system, where pressurized subglacial brine pools upstream from Blood Falls are injected englacially by basal crevassing where it can remain liquid due to cryoconcentration and latent heat release. Ultimately brine is released as an episodic artesian well through connection with surface crevassing events at Blood Falls after it has been advected towards the terminus by ice flow.

The primary Blood Falls discharge is cold (– 5.2ºC), high in dissolved organic carbon, iron and sodium chloride, and has a conductivity approximately 2.5 times seawater (Mikucki et al. 2009; Lyons et al. 2019). A number of lines of geochemical evidence support a marine origin for the Blood Falls outflow, which generally shows very similar characteristics to seawater. Studies have demonstrated that the volume, spatial extent and geochemistry of the Blood Falls discharge varies over time (Black et al. 1965; Keys 1979; Lyons et al. 2005) and differs between normal flow and rapid discharge events (Mikucki 2005).

- *Ecology and microbiology*

The Blood Falls outflow contains a microbial community, apparently of marine origin (Mikucki & Priscu 2007; Mikucki et al. 2009) that is distinct from the surrounding glacier ice and Lake Bonney microbial communities (Mikucki 2005; Campen et al. 2019). The bacteria may be capable of metabolising iron and sulphur compounds, allowing the population to survive in the subglacial environment for extended periods of time, possibly millions of years (Mikucki et al. 2009). The microbes are also thought to play an important role in carbon cycling, allowing the ecosystem to survive without external carbon input (Mikucki & Priscu 2007). Replicate sampling from the brine discharge and the englacial conduit connected to Blood Falls indicate the community composition remains stable, even over decades timescales (Campen et al. 2019). The primary controls on the characteristics of the microbial ecosystem at Blood Falls may provide an analogue for the conditions found beneath the polar ice caps on Mars (Mikucki et al. 2004). A living bacterial assemblage has been identified within the basal ice and sediments sampled within the tunnel excavated on the northern margin of Taylor Glacier (Christner et al. 2010).

Microbial studies have provided further support for a marine origin of the brine reservoir, as the microbial assemblages recorded at Blood Falls are similar to those found in other marine systems (Mikucki et al. 2004; Mikucki & Priscu 2007; Chua et al. 2018; Campen et al. 2019). The ecosystem has been highlighted as an important site for exobiological studies, particularly as an analogue for Martian ice masses (Mikucki et al. 2004; Mikucki 2005). The primary controls on the Blood Falls microbial assemblage are thought to be the pre-glacial history of the ecosystem and the surrounding terrain, the bed lithology and the glacier hydrology, although the extent of contact between the microbial ecosystem and the glacial hydrological system is currently uncertain (Mikucki 2005; Mikucki & Priscu 2007).

The saline subglacial waters of Blood Falls meet the comparatively fresh surface water of western Lake Bonney in the lake perimeter area (often referred to as a 'moat', as this zone is prone to melt in summer). The moat area acts as a transition zone and its geochemical composition becomes less similar to Blood Falls with distance from the primary discharge site (Mikucki 2005; Campen et al. 2019). The Blood Falls discharge is also diluted in the moat area by input from Santa Fe Stream, which is primarily fed by surface melt from the Taylor Glacier and flows along its northern margin (Mikucki 2005). Lawson Creek also flows into the Area and drains into Lake Bonney approximately 100m north of the primary Blood Falls outflow.

Saline discharge, organic carbon and viable microbes from Blood Falls are episodically released into the western lobe of Lake Bonney, altering the geochemistry and biology of the lake and providing nutrients that are otherwise limited (Lyons et al. 1998, 2002, 2005; Mikucki et al. 2004). Discharges into Lake Bonney have been observed at a depth of 20-25 m, and below this depth Lake Bonney exhibits a very similar geochemistry to Blood Falls, including high iron levels and a similar ion chemistry to seawater (Black & Bowser 1967; Lyons et al. 1998, 2005; Mikucki et al. 2004). Studies have shown that bacteria in the deep areas of western Lake Bonney are similar in size to those from Blood Falls, but much smaller than other those found in the deep waters of other lakes in the Dry Valleys (Takacs 1999). A bacterial species isolated from Blood Falls, Marinobacter gelidimuriae, forms a clade with isolates from Lake Bonney water and sediments (Chua et al. 2018).

- *Terrestrial ecology*

Invertebrate communities in the Blood Falls area have not been extensively studied. However, soil samples from the shore of western Lake Bonney identified Scottnema lindsayae as the most abundant nematode in the Lake Bonney basin and also recorded Eudorylaimus antarcticus and Plectus antarcticus (Barrett et al. 2004).

- *Human activities and impact*

Local field camps historically have been located in two main areas on the north-western shore of Lake Bonney, close to the moat area and the primary Blood Falls outflow (Map 2). The camp site contains a number of tent sites marked by stone circles. This has resulted in localized soil disturbance, although activities at the camp site are considered unlikely to have had an impact on Blood Falls (Keys, Skidmore, pers. comms. 2010). Until recently, a helicopter landing site was located approximately 160 m north of the primary Blood Falls outflow, although usage is also unlikely to have adverse effects on Blood Falls (Hawes, Skidmore, pers. comms. 2010). A pedestrian trail has formed to the west of Lawson Creek, which extends parallel to and above Santa Fe Stream around 50 – 100 m from the northern margin of the Taylor Glacier. The trail has become prominent due to foot traffic and shows signs of minor erosion.

Stream monitoring equipment, including a weir, was installed by the LTER in the Santa Fe Stream delta area (Map 2), which was largely removed in January 2010. Parts of the weir embedded into stream sediments proved difficult to extract and have been left in situ because the impact of removal was considered greater than leaving the material in place. A number of items of disused glaciological equipment have been collected from the northern margin of the Taylor Glacier in the Santa Fe Stream delta area, and it is possible some of these items remain either on inaccessible locations on the glacier surface and / or embedded in sediments at the foot of the ice cliffs. Two tunnels cut into the basal ice remain from previous scientific studies, on the northern margin of Taylor Glacier ~ 600m and 1000m from Blood Falls respectively, although in time these will collapse and melt out.

6(ii) Access to the Area

- Access to, movement on, and / or over the surface of the Taylor Glacier within the region covered by the sub-surface component of the Area is not subject to any special restrictions (Figure 3).
- Access to the sub-aerial component of the Area is normally made first by helicopter to the designated landing site on the north-western shore of Lake Bonney (77° 43.17' S, 162° 16.47' E, Map 2), and from there on foot. Access may also be made on foot from the direction of Lake Bonney or from higher up the Taylor Glacier.
- The preferred route for pedestrian access to the sub-aerial component of the Area from the designated helicopter landing site and camp site is from Lake Bonney, avoiding the colored saline icing of the discharge and Santa Fe Stream delta when possible, ascending the terminus of the Taylor Glacier from slopes to the south of the sub-aerial component boundary (Map 2). Steep ice cliffs impede foot access to the sub-aerial component of the Area along the northern margins of the Taylor Glacier. Moats and pools forming around the margin of Lake Bonney may impede access later in the season.
- A pedestrian walking route has formed parallel to and ~50 – 100 m from the northern margin of the Taylor Glacier, providing access several kilometers up-valley from the designated helicopter landing site and camp site. Steep ice cliffs on the northern margin of the Taylor Glacier impede access onto the surface of the glacier from this route.

6(iii) Location of structures within and adjacent to the Area

No permanent structures exist within the Area. Two permanent survey markers are set in a boulder located approximately 175 m north of the Area: NZAP Benchmark TP01 is a tube with female thread (77° 43.175' S, 162° 16.466' E, elevation 72.7 m); UNAVCO benchmark TP02 is a 5/8" threaded bolt (77° 43.175' S, 162° 16.465' E, elevation 72.8 m). The boulder is located on an area of sloping ground on the northern shore of Lake Bonney situated ~15 m S of the helicopter landing site. A stream weir and a stream gauge are located ~80 m NW of the Area at Lawson Creek. Lake Bonney Camp is located ~4.3 km east of the Area.

6(iv) Location of other protected areas in the vicinity

The Area lies within ASMA No.2 McMurdo Dry Valleys. The closest Antarctica Specially Protected Areas (ASPAs) are: Canada Glacier (ASPA No.131) which is located 22 km NE of Blood Falls in the Taylor Valley; Linneaus Terrace (ASPA No.138), which lies 31 km NW of Blood Falls in the Wright Valley; and Barwick Valley (ASPA No.123) situated approximately 43 km NW of Blood Falls.

6(v) Special zones within the Area

None.

7. Terms and conditions for entry permits

7(i) General permit conditions

Entry into the sub-aerial or sub-surface component of 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 compelling scientific, educational or outreach reasons that cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- the activities permitted will give due consideration via the environmental impact assessment process to continued protection of the environmental, ecological, scientific, or educational values of the Area;
- the Permit shall be issued for a finite period;
- the Permit, or a copy, shall be carried within the Area.

7(ii) Access to, and movement within or over, the Area

a) Sub-surface component (lower Taylor Glacier)

- Access to, and movement over, the sub-surface component of the Area by aircraft, vehicle or on foot are not subject to any special restrictions (Figure 3).

b) Sub-aerial component (near Blood Falls)

- *Aircraft access and overflight*

- Overflight below 100 m (328 ft) AGL of, or landings within, the sub-aerial component of the Area by aircraft, including Remotely Piloted Aircraft Systems (RPAS), are prohibited unless authorized by Permit. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018));
- Helicopters facilitating access to Blood Falls should normally avoid landings within the sub-aerial component of the Area, and instead land at the designated landing site on the NW shore of Lake Bonney (77° 43.17' S, 162° 16.47' E, Map 2);
- Helicopters or other aircraft may be used for the acquisition of data within, or delivery of essential equipment into, the sub-aerial component of the Area when necessary for scientific or management purposes for which a Permit has been granted, taking care that to the maximum extent practicable any surface access avoids supraglacial channels.

- *Vehicle access and use*

- Vehicles are prohibited within the sub-aerial component of the Area.

- *Pedestrian access and movement within the Area*

- Access to and movement within the sub-aerial component of the Area shall normally be on foot;
- Visitors accessing the sub-aerial component of the Area should avoid the primary and secondary Blood Falls discharge areas unless permitted activities specifically require access to these sites;
- The preferred route for pedestrian access to the sub-aerial component of the Area from the designated helicopter landing site and camp site is from Lake Bonney, ascending the terminus of the Taylor Glacier from slopes to the south of the sub-aerial component boundary (Map 2).
- Movement within the sub-aerial component of the Area should be limited to that which is necessary for the performance of permitted activities.

7(iii) Activities that may be conducted in the Area

- Scientific research that will not jeopardize the ecosystem or scientific values of the Area or compromise the integrity of the Blood Falls system;
- Essential management activities, including monitoring and inspection;
- Activities with educational aims (such as documentary reporting (photographic, audio or written) or the production of educational resources or services) that cannot be served elsewhere and which will not compromise the values for which the Area is protected. Educational aims do not include tourism;
- Specific conditions apply to activities that are or may be conducted in the sub-surface and sub-aerial components of the Area, which are as follows:

a) Sub-surface component

- All projects proposing to access the sub-surface component of the Area shall consider in advance the uncertainties that exist in the properties of the sub-surface hydrological system, and the risk that such activities could have more than a minor or transitory impact on the values of the Area. As such, prior environmental impact assessment of such activities should include a detailed and robust scientific review with the opportunity for input by relevant experts.
- Such proposals shall take into account the SCAR Code of Conduct for Subglacial Aquatic Environments, and as appropriate other best-practice protocols and procedures which have been developed for safe and environmentally sound access to the subglacial environment (see e.g., Committee on Principles of Environmental Stewardship for the Exploration and Study of Subglacial Environments 2007; Arctic and Antarctic Research Institute 2010; Lake Ellsworth Consortium 2011).
- Any activities involving entry into the sub-surface component of the Area shall monitor the effectiveness of control measures to minimize / prevent releases to the environment.

b) Sub-aerial component

- Meltwater sampling from supraglacial channels draining into the primary Blood Falls outflow is permitted, provided the appropriate measures specified in Section 7(vi) are taken to minimize potential contamination.

7(iv) Installation, modification or removal of structures / equipment

- Structures shall not 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 shall 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 or equipment shall be undertaken in a manner that minimizes disturbance to the environment and to flora and fauna;
- Removal of specific structures / 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;
- If equipment is left in situ in the sub-surface component of the Area for extended periods, provisions shall be made to minimize the risk of contamination and / or loss of the equipment;
- Certain equipment and materials may need to be installed into subglacial aquatic environments for scientific and / or monitoring purposes (e.g., to measure geophysical or biogeochemical processes, or to monitor impacts of human activities on the subglacial environment). Any such installations shall be specifically covered in the environmental impact assessment for the activity, and include consideration of procedures for removal and the risks and benefits should removal not be practical.

7(v) Location of field camps

- Camping on the surface of the Taylor Glacier within the region covered by the sub-surface component of the Area is not restricted.
- Camping within the sub-aerial component of the Area is prohibited.
- A designated field camp is located on the northwestern shore of Lake Bonney ~150 m north of the primary Blood Falls outlet. It covers an area of gently sloping rocky terrain in the vicinity of 77° 43.20' S, 162° 16.34' E, extending ~100 m from the shore of Lake Bonney and ~200 m northeast from Lawson Creek to a permanent survey benchmark (TP02), which is located ~20 m from the lake shore. Individual tent sites are marked by stone circles. Where practicable, use tent sites located furthest from the shore of Lake Bonney.

7(vi) Restrictions on materials and organisms that may 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 Blood Falls and to minimize the risk of microbial introductions to the Blood Falls system 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 should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2019). Precautions shall be taken within the sub-surface and sub-aerial components of the Area as follows:

a) Sub-surface component

All equipment that is proposed to enter the sub-surface component of the Area shall be sterilized prior to deployment into the sub-surface component of the Area to prevent microbial introductions to the maximum extent practicable. Sterilization shall be by acceptable methods and specified in the environmental impact assessment for the activity;

b) Sub-aerial component

- Visitors shall ensure that sampling equipment or markers are clean. To the maximum extent practicable, footwear and other equipment (including crampons, stabilizers, backpacks and carry-bags) shall be thoroughly cleaned prior to entry. Changing into clean footwear (including crampons, etc.) to be worn only inside the Area is also an appropriate option. To reduce the risk of microbial contamination, the exposed surfaces of footwear, sampling equipment and markers should be sterilized before use within the Area. Sterilization should be by an acceptable method, such as by washing in 70% ethanol solution in water or in a commercially available solution such as 'Virkon'. Sterile protective overclothing shall be worn when undertaking sampling within the sub-aerial component of the Area. The overclothing shall be suitable for working at temperatures of -20°C or below and comprise at a minimum sterile overalls to cover arms, legs and body and sterile gloves suitable for placing over the top of cold-weather gloves. Disposable sterile / protective foot coverings are not suitable for glacier travel and should not be used;
- Herbicides and pesticides are prohibited from 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;
- Chemical tracers shall not be introduced into the sub-surface component of the Area, and use of tracers in the sub-aerial component of the Area shall follow the guidelines for 'Streams' in the Environmental Guidelines for Scientific Research contained in Appendix B of the Management Plan for

ASMA No.2 McMurdo Dry Valleys;

- Fuel, food, and other materials shall not be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted;
- In general, all materials introduced shall be for a stated period only and shall be removed at or before the conclusion of that stated period, unless installed into subglacial aquatic environments for scientific and / or monitoring purposes on a permanent basis in which case the conditions for their deployment shall be justified and specified in the environmental impact assessment for the activity;
- All materials 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 should be undertaken only where the impact of removal is not likely to be greater than that of leaving the material in situ.

7(vii) Taking of, or harmful interference with, native flora and 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.

7(viii) 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 soil, 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, and which was not brought into the Area by the permit holder or otherwise authorized, may be removed from 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 and approval obtained.

7(ix) Disposal of waste

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

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

Permits may be granted to enter the Area to:

- carry out monitoring and Area inspection activities, which may involve the

collection of a small number of samples or data for analysis or review;
- install or maintain signposts, markers, structures or scientific equipment; and
- carry out protective measures.

7(xi) Requirements for reports

- The principal Permit holder for each visit to the Area shall submit a report to the appropriate authority after the visit has been completed in accordance with national procedures and permit conditions.
- Such reports should include, as appropriate, the information identified in the visit report form contained in Appendix 2 of the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing 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, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.
- Where access to the sub-surface component of the Area is undertaken, reports shall additionally document the location of drilling sites to an accuracy of ±1m, details of the drilling method and type of drilling fluid used. Any contamination of the sub-surface environment shall be reported. Reports shall include the results of monitoring carried out to assess the effectiveness of contamination control measures, particularly those relating to microbial control.
- The appropriate authority should be notified of any activities / measures that might have exceptionally been undertaken, or anything removed, or anything released and not removed, that were not included in the authorized permit.

8. Supporting documentation

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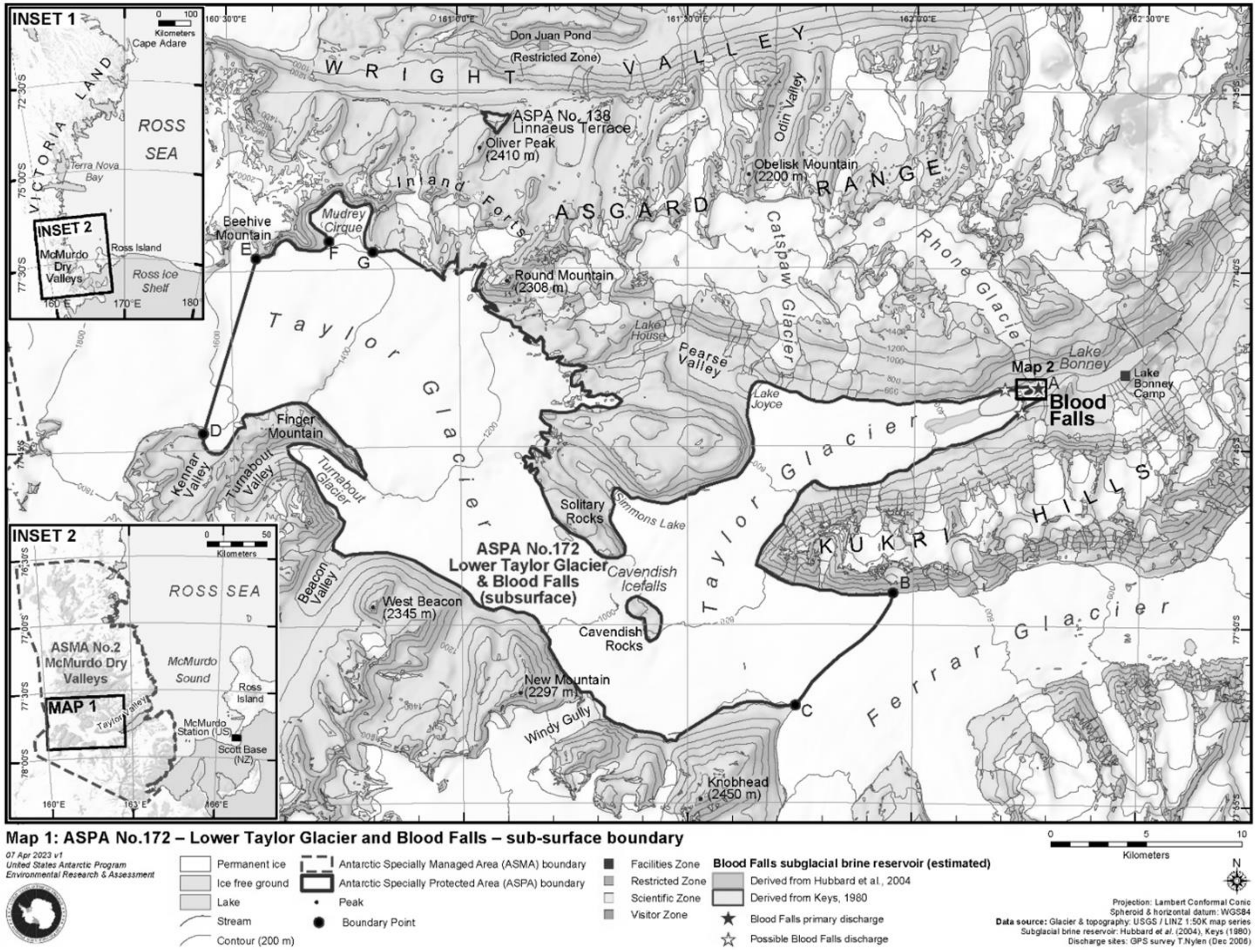
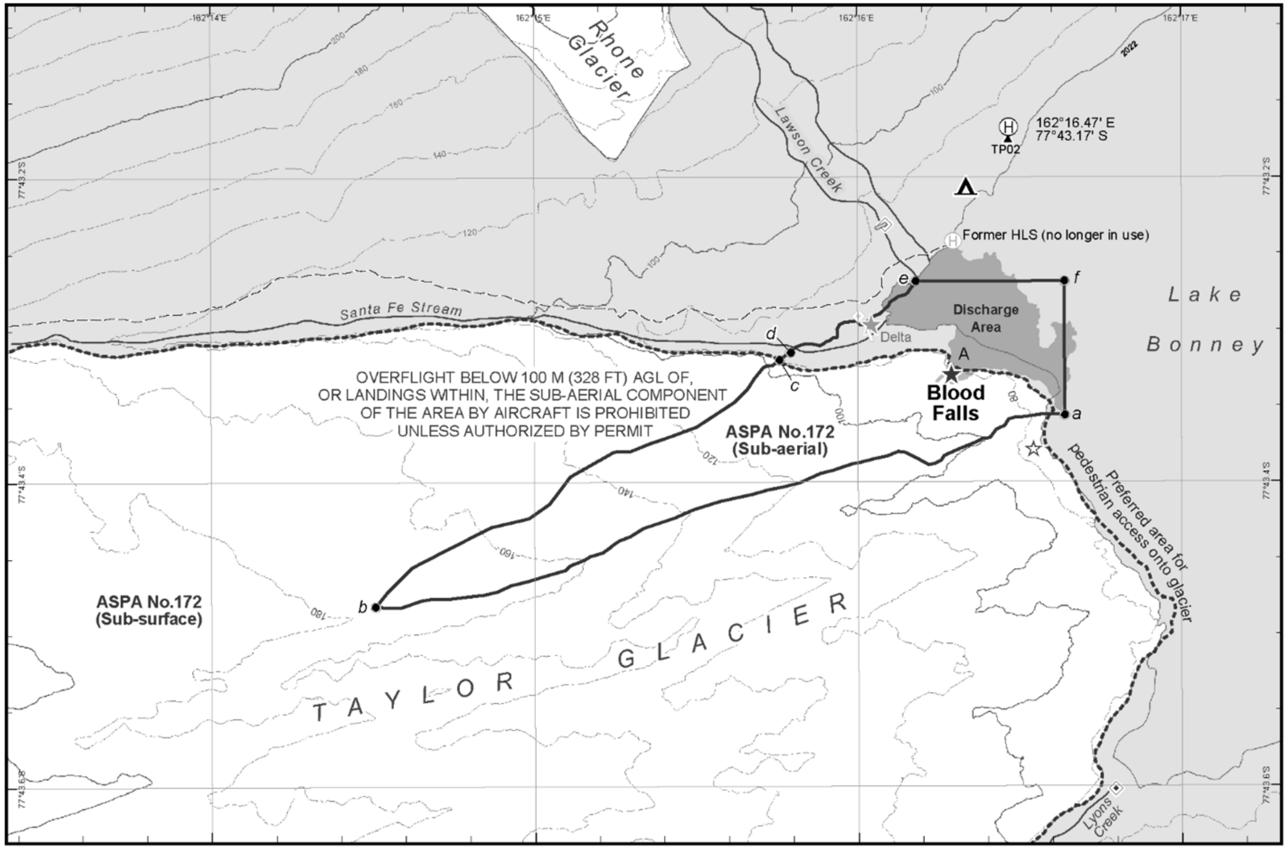


Map 1: ASPA No.172 – Lower Taylor Glacier and Blood Falls – sub-surface boundary



Map 2: ASPA No.172 – Blood Falls sub-aerial discharge area, topography and boundary

15 Dec 2022 v1
United States Antarctic Program
Environmental Research & Assessment

Ice free ground
Glacier
2022 Lake (shoreline year)
Index contour (100 m)
Contour (20 m)
Stream
Stream delta / discharge area
Sub-surface protected area boundary
Sub-aerial protected area boundary
Boundary point
Blood Falls primary discharge
Blood Falls secondary discharge
Blood Falls possible discharge
Survey mark
Designated campsite
Helicopter landing site
Existing walking track
Stream gauge
Stream gauge (removed Jan 10)
Stream weir
Stream weir (removed Jan 10)

0 100 200
Meters

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data source: Contours: derived from USGS 2m LiDAR DEM
Glacier & stream digitised from aerial imagery (1993)
Lake: digitised from orthorectified WorldView-3 imagery (Nov 2022)
Campsite, stream gauges & weirs: ERA field survey (Dec 2009)
HLS: ASC field survey (Jan 2018)
Discharge sites: GPS survey T.Nylen (Dec 2006)

Figure 1.

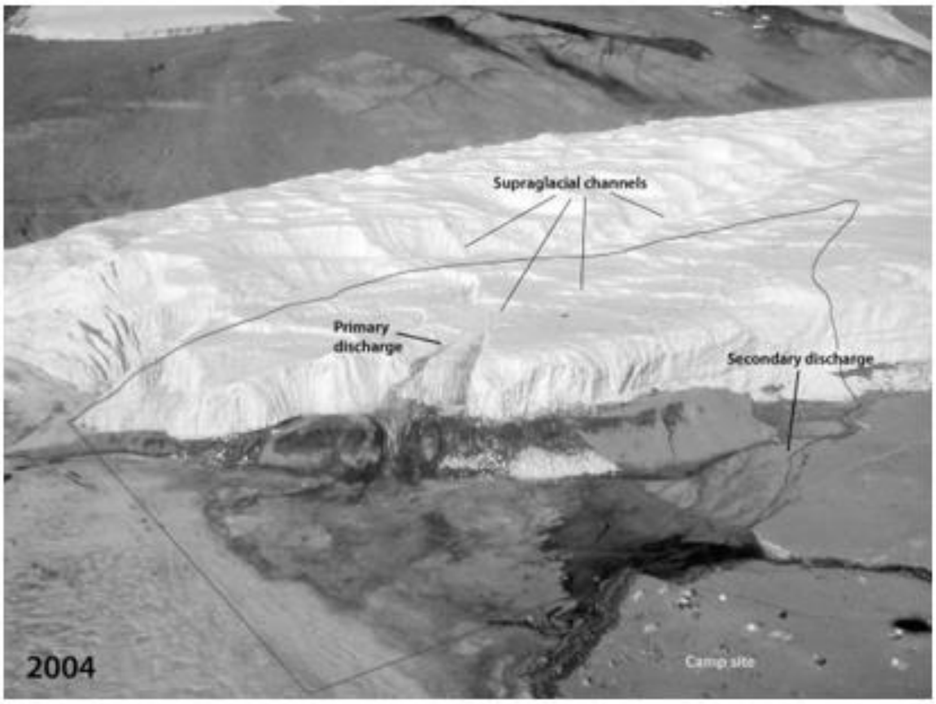
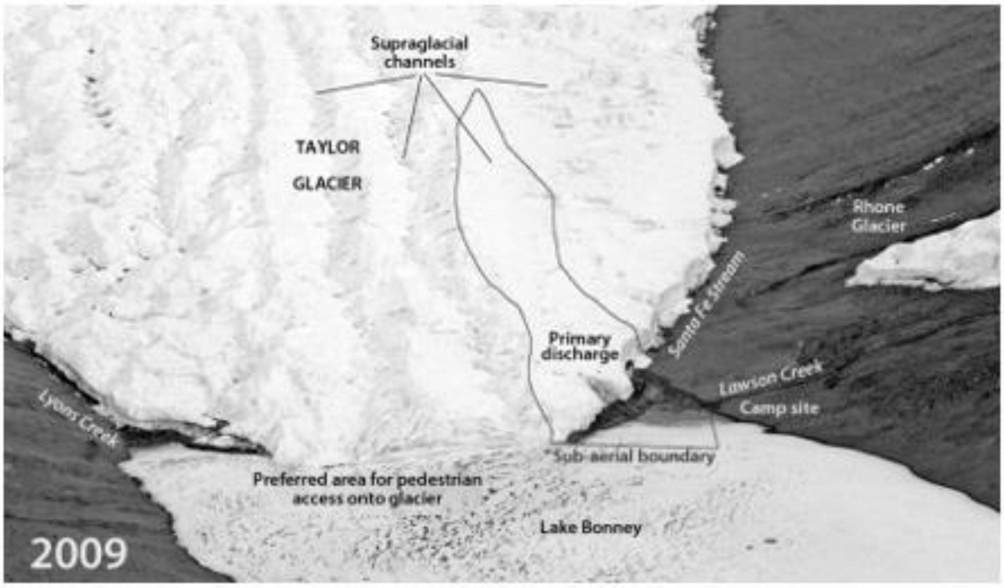


Figure 2.



Measure 18 (2023)

Antarctic Specially Protected Area No 179 (Parts of Western Sør Rondane Mountains, Dronning Maud Land, East Antarctica): Management Plan

The Representatives,

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

Noting that the Committee for Environmental Protection ("CEP") has endorsed a Management Plan for ASPA 179;

Recognising that this area supports outstanding environmental, scientific, historic, aesthetic or wilderness values, or ongoing or planned scientific research, and would benefit from special protection;

Desiring to designate Parts of Western Sør Rondane Mountains, Dronning Maud Land, East Antarctica as ASPA 179, and to approve the Management Plan for this Area;

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

1. Parts of Western Sør Rondane Mountains, Dronning Maud Land, East Antarctica, be designated as Antarctic Specially Protected Area No 179; and
2. the Management Plan, which is annexed to this Measure, be approved.

Management Plan for Antarctic Specially Protected Area No 179

PARTS OF WESTERN SØR RONDANE MOUNTAINS, DRONNING MAUD LAND, EAST ANTARCTICA

Introduction

The primary reason for the designation of several sites of the Western Sør Rondane Mountains as parts of an Antarctic Specially Protected Area (ASPA) is to protect the unique terrestrial biodiversity and ecosystem features of the area. These sites are also subjects of scientific research on the biodiversity, evolution and function of the biological communities, including their (micro)organisms, and the impact of climate change on these values. The biological communities are vulnerable to anthropogenic disturbances, introduction of microbial taxa from other regions or other sites in the region, trampling and oversampling. The selected sites are representative of the natural terrestrial biological communities observed in inland Antarctic mountainous regions. Thus, this ASPA increases the representation of mountainous habitats in the Antarctic protected areas system. In addition to its environmental and scientific values, this protected Area also contributes to the preservation of aesthetic and wilderness values.

The Sør Rondane Mountains (SRM) are located approximately 200 km inland (71°–72° S/20°– 30° E), in the Eastern part of Dronning Maud Land, East Antarctica, and form a typical coastal margin mountainous area, composed of a series of nunataks. They form a 220 km long east-west trending inland mountain range, part of a larger chain of mountains from the Bourg Massif in Western Dronning Maud Land to the Yamato Mountains in Eastern Dronning Maud Land (Mackintosh et al. 2014). The highest point is at about 3000 m a.s.l. Late Proterozoic to Paleozoic metamorphic and plutonic rocks (gneiss, granite and amphibolite) dominate the geological features (Matsuoka et al. 2006).

The multi-site Antarctic Specially Protected Area (ASPA) in parts of the Western Sør Rondane Mountains (71°50’-72°S; 22°50’-23°50’E) includes 7 sites: Tanngarden Nunatak and Ridge (A), Petrellnuten Nunatak (B), a range of seven Pingvinane Nunataks (C), two Nunataks of the Perlebandet range (DN and DS), a part of the Teltet Nunatak (E), and the Yûboku-dani Valley (F). These different sites consist of one or more subsites, which are the ice-free areas where the microbial life, and therefore the main values to be protected by this Area, can be found. These subsites are each surrounded by a buffer zone of 500 meters. The boundaries of the sites include these buffer zones. Because of this buffer zone, the seven Pingvinane Nunataks, which make up seven separate subsites (C1-C7), constitute one single site. Two of the Pingvinane nunataks are designated as ‘Restricted Zones’. Beyond these buffer zones, the ice sheets and glaciers separating the 7 sites are not included in the ASPA. The different sites are shown in the maps in annex to this Management Plan. Throughout this Management plan, the term “site(s)” is used to refer to the 7 sites that compose the ASPA. The term “subsite” is used to refer to the 13 different ice-free areas where the microbial life, and therefore the main values to protected by this

Area, can be found. The term “Area” is used to refer to the collection of all 7 sites or to the ASPA as a whole.

Based on the Environmental Domains Analysis, the ASPA belongs to type 7: Inland continental geologic (Morgan et al. 2007). It is included in Antarctic Conservation Biogeographic Region (ACBR)6: Dronning Maud Land (Terauds et al. 2012 and Terauds and Lee 2016).

There is no Antarctic Important Bird Area (IBA) in the ASPA. However, a first dedicated field survey conducted in the SRM in 2017-2018 found at least 16 to 20 snow petrels breeding sites spread out through the western part of the mountain range. A survey of all accessible nunataks revealed 834 nests, which could be georeferenced and inspected, of which 687 or 82% were occupied during the 2017-2018 breeding season. Despite an apparent but substantial annual variability detected during subsequent years, the 2017-2018 population was estimated to contain between 2,114 and 2,719 breeding pairs, resulting in a calculated breeding population of approximately 4,228 to 5,438 snow petrels in the surveyed area (unpublished data Robert et al.). While this survey did not observe important breeding sites at Pingvinane 3 (subsite C3) and Pingvinane 5 (subsite C5) due to the geomorphology of the nunatak and the granulometry of the rubble pile around it, presence of nest within all proposed sites is possible. Within the ASPA sites, the colony with the largest numbers of more than 200 potential nesting sites was observed on the nunatak at Tanngarden (site A). Other colonies were much smaller, ranging from three nests at Petrelnutten (site B) up to 93 potential breeding sites at Pingvinane 7 (subsite C7). Further research with regard to petrel colonies is ongoing.

Microorganisms dominate Life in the harsh terrestrial environments of Antarctica, including the Sør Rondane Mountains. Foodwebs are strongly truncated, with few metazoans consuming organic matter and microbial biomass. Studies of the microbial diversity are rather recent and inland nunataks, like in the SRM, were far less studied than those in more coastal locations and in the McMurdo Dry Valleys. The first biological survey of lichens and mosses in the ASPA region was performed by Dr Damien Ernst (Royal Botanical Garden of Belgium) in 2007, before the construction of the Princess Elisabeth station (PES). Since that date, research has been carried out on the biodiversity of the terrestrial communities (lichens, mosses, invertebrates, prokaryotic and eukaryotic microorganisms) using molecular taxonomic markers. The ASPA sites in the SRM are valuable because they hold a biodiversity that is representative of harsh Antarctic mountain ecosystems, at the limits of the physicochemical conditions that enable life to occur. Even in austral summer, air temperatures are always negative. Moreover, it is probable that exposed ice- free rock formations have acted as potential refugia for the (micro)organisms during the last glacial maximum and thus played a significant role in these organisms’ evolution and biogeography and that they are still hotspots of unique biodiversity today (Altmaier et al. 2010, Czechowski et al. 2012). A better understanding of the processes shaping biodiversity patterns can also help to predict their shifts in case of climate modifications.

The projects ANTAR-IMPACT, BELDIVA and MICROBIAN, funded by the Belgian Science Policy Office (BELSPO), have involved scientists from Belgium, the Czech Republic, France, Germany, Japan, Russia, and the UK. The results of these studies showed a surprisingly complex microbial and lichen diversity, but also revealed that different nunataks were hosts to genetically distinct populations of Collembola, which underlines the need to protect these biological communities from homogenization by human activities. A general trend observed is the larger development of biological soil crusts (BSC) and higher microbial diversity on granitic bedrocks than on gneiss, and therefore 9 of the 13 ASPA subsites have granitic bedrocks. The subsites at Petrellnuten and Teltet primarily consist of gneiss rocks, whereas Yûboku-dani Valley is made of schists.

The observed conditions for the establishment of biological crusts and communities consist mainly of a combination of (micro)habitat features: exposure to the North (sun), protection from the strong scrubbing katabatic winds, presence of some liquid water from melting snow and stability of the substrate (Namsaraev et al. 2010). These conditions are rarely met and, therefore, the possible habitats are sparse and limited in extent.

In addition, Open-Top Chambers (OTCs) to mimic future climate warming and its effect on the microbial communities were installed in 2010 and 2018 on Tanngarden Ridge (A), the 4th Pingvinane Nunatak (C4), Northern Perlebandet Nunatak (DN) and Teltet Nunatak (E).

In the ACBR 6 of Dronning Maud Land, there are only 2 ASPAs at the moment of adoption of this Management Plan: a coastal one in the Schirmacher Oasis (ASPA 163: Dakshin Gangotri Glacier) and one for the nunatak Svarthamaren (ASPA 142: Mühlig-Hofmannfjella). These two ASPA cover in total less than 11 km², and serve different conservation goals, one being a retreating glacier and the other an important nesting area for petrels and other birds, respectively. The present ASPA complements ASPA 142 (surface of 7.5 km²) as both are representative of terrestrial mountainous habitats (above 1000 m altitude) that are an important feature throughout Dronning Maud Land. However, limited information is available about the terrestrial microbial biodiversity of ASPA 142 (Management Plan in Measure 4 (2019) in contrast to the present ASPA). Its distance from the present ASPA is about 700 km.

An additional rationale for the ASPA designation is the establishment since 2007-08 of the Belgian research station Princess Elisabeth that has given access to these terrestrial ecosystems to a greater number of scientists and visitors. This has enabled the more detailed exploration of the biodiversity in the region and new experimental studies on the impact of climate modifications with OTCs and snow fences. Moreover, the station has expanded its original capacity to about 48 people (from 20 people according to the comprehensive environmental evaluation prepared for the construction of the Belgian Princess Elisabeth research station, prepared in 2007, hereinafter “the CEE, 2007”). In addition, a new airfield (Perseus) was installed at 60 km from the station and is presently used for intercontinental flights, and a general look at the touristic offers in Dronning Maud Land shows that an increased human impact can be expected. Therefore, it is appropriate to apply the provisions of Annex V to the Madrid Protocol and give additional protection to a representative portion of the mountainous terrestrial biotopes in the SRM region.

1. Description of values to be protected

Together, the 7 sites designated to form the ASPA include outstanding environmental and biological features and represent examples of major terrestrial ecosystems, including lakes, in mountainous regions of Antarctica. This region of the SRM was considered pristine in 2007 (CEE, 2007) and the 7 sites have either not or limitedly been accessed for scientific sampling following the rules of the Protocol on Environmental Protection. Two nunataks of the Pingvinane Range (site C) are designated as 'Restricted Zones', strictly managed to minimize as much as possible the impact of human activities.

The aims of this ASPA are to preserve the area's environmental, scientific, aesthetic and wilderness values.

- *Environmental values*

During the BELSPO-funded projects ANTAR-IMPACT (2008-2010), BELDIVA (2009-2012) and MICROBIAN (2017-2021), scientists have determined that the biodiversity of microorganisms and invertebrates was high in ice-free terrestrial habitats of the SRM. This includes biofilms and biological soil crusts on rocks and gravels, hypo- and cryptoendolithic growth. In addition, glacial and aquatic habitats consist of cryoconites and a few lakes. Unique microbial organisms have been cultivated and described from the region (e.g. Peeters et al. 2011; Tahon et al. 2018; Tahon et al. 2021a and 2021b; Ertz et al. 2014). For the terrestrial biotopes, statistical analyses revealed that total organic carbon was the most significant parameter in structuring the prokaryotic communities (studied using metabarcoding through Illumina amplicon sequencing), followed by pH, conductivity, bedrock type and water content. Acidobacteria (Chloracidobacteria) and Actinobacteria (Actinomycetales) dominated the organic carbon-poor samples situated on gneiss, while Proteobacteria (Sphingomonadaceae), Cyanobacteria, Armatimonadetes and candidate division FCB (OP11) mainly occurred in granite samples with a high total organic carbon content (Tytgat et al. 2016). Rotifera, Chlorophyta, Tardigrada, Ciliophora, Cercozoa, Fungi, Bryophyta, Bacillariophyta, Collembola and Nematoda were present with a relative abundance of at least 0.1% in the eukaryotic communities as assessed using the metabarcoding data of 22 samples from various habitats (Obbels et al. 2016). Not only microorganisms but also collembola show interesting phylogeographic patterns. Stevens & D'Haese (2014) determined that the molecular marker divergence in Cryptopygus sverdrupi collected in different nunataks indicate that they have persisted throughout the Miocene and Pliocene in these glacial refugia.

Terrestrial biological communities, mostly biological crusts that can include mosses, lichens, fungi, invertebrates and microorganisms, show specific biogeographic distributions and may have survived the glaciation cycles in ice-free refugia (e.g. nunataks). They are vulnerable to trampling and disturbances by human activities. The local populations could be lost by homogenization due to transfer of microorganisms, invertebrates, propagules, by human vectors (scientists, logisticians, tourists...)(Hughes et al. 2013, 2015) between nunataks or mountains.

Moreover, the Yûboku-dani Valley (Northern side of Svindlandfjellet, also called Nomadedalen, https://stadnamn.npolar.no/Nomadedalen) holds the only lakes currently known in the region and therefore deserves to be included in the ASPA for its environmental value. The valley is protected from the wind and appears to be warmer than the surrounding region. During the abnormally warm summer 2019-20, the presence of 3 lakes was observed but in other years, they might be frozen to the bottom and snow-covered, precluding any sampling. Abundant black and red cyanobacterial mat communities were observed in the lakes and on the shores by the scientists. Though their biodiversity was not yet studied, such inland lakes are sensitive to anthropogenic impacts like cross-contamination and it was suggested that they deserve a high degree of protection (Howard-Williams, et al. 2021).

- *Scientific values*

As indicated in the CEE (2007), no indication of previous human impact could be observed at the Utsteinen site before the construction of PES, and it can indeed be assumed that all the ASPA sites were pristine in 2007. This is illustrated by the study of the rates of carbon accumulation and microbial activity in endoliths carried out by Dr. Ziolkowski (University of South Carolina, US) who received in 2017 the Baillet Latour Antarctica Fellowship for the project “REMACA”. These measurements are based on the natural abundance of radiocarbon and are only meaningful if the samples are not contaminated by anthropogenic carbon, and thus, little impacted by human presence. Published results indicate that the endoliths in the SRM were cycling carbon rather quickly despite the climatic extremes (Tyler and Ziolkowski, 2021).

The characterization of the terrestrial communities in the SRM was started in 2007 and is still on- going. MICROBIAN also studied the functioning of microbial communities through ecophysiological and molecular methods. Therefore, sensors to record the temperature and humidity were placed in many sampling sites in the ice-free areas to understand the microclimatic conditions experienced by the biota. In addition, a combination of remote sensing and close-range field observation techniques has been used to assess the mapping of physical habitat characteristics in relation to the presence/extent of microbial mat and biological crust communities. Satellite remote sensing was used to derive spatially resolved datasets of land surface temperature and site elevation and orientation at metre and decametre scale (Vanhellemont et al., 2021). Site elevation was accurately retrieved from tri-stereo optical imagery from the Pléiades constellation, and the retrieved elevation compared well to other reference datasets. Land surface temperature derived from the thermal infrared imager on board Landsat 8 showed a good correspondence with in situ measurements by sensors, generally within a few degrees. A site dependent performance was identified, related to the deployment location of the data logger and the surrounding environment. The synoptic land surface temperature products could not be used as a representative temperature map of the sites, due to the long day lengths during the austral summer causing different mountain sides to be heated over the course of the day.

Three of the selected ice-free sites are currently hosting climate manipulation experiments. Open- Top Chambers (OTCs) which mimic future climate warming and its effect on the microbial communities were installed in 2010 (BELDIVA project) and 2018 (MICROBIAN project) on the Tanngarden ridge (A), the 4th Pingvinane Nunatak (C4), Perlebandet North (DN) and the Teltet Nunatak (E). Control areas in the vicinity of the OTCs were also delimited to allow a comparison between treated and untreated sites to determine the impact of the climate manipulation on the microbial communities over time (Pushkareva et al. 2018). Temperature and humidity sensors were placed in the OTCs and are read and replaced each year except if the OTC is completely covered with snow at the time of the visits. In this regard, it should be noted that the OTCs on Tanngarden ridge (A) are currently inaccessible, being buried under a thick snow layer that has not melted up to now. It is important to protect these experimental sites from human disturbances and trampling that would affect the results.

The evolutionary history of the (micro)organisms living in the SRM is also of importance to understand their current biogeographic patterns and predict the expansion or contraction of their distribution ranges. Studies based on molecular markers in invertebrate populations and individuals have been started and can help to reveal the factors that shape the population structures (e.g. Czechowski et al, 2012).

Finally, the ASPA contains two Restricted Zones (see section 6 (v)) . One nunatak in the Pingvinane range (C6) has only been visited once by scientists, namely in 2010, and another (C7) has never been visited. By applying a strict protection regime, including strict biosecurity measures ensuring biological (e.g. microorganisms) and abiotic pollution (including plastics and fibers) is not introduced, these nunataks can serve as important reference sites for future comparative studies. ,

- *Aesthetic and wilderness values*

The landscape of the SRM is of striking aesthetic quality, with very scenic views. The darker rocks of the nunataks and peaks, sometimes with bizarre morphologies, contrast beautifully with the white areas of snow and ice from the glaciers that border them, particularly during sunny days. Large boulders of different colours and mineralogies catch the eye, with their striking patterns. The high mountain ranges partially covered by white snow decorate the horizon. Windscoops are sculpted by the wind around nunataks and offer a beautiful show of shades of blue and white nuances, as shown by the pictures of the renowned photographer René Robert (http://www.antarcticstation.org/multimedia/picture_gallery/windscoop/). The Antarctic landscape around PES has inspired the artist Marie Minary for her ‘Penelope’ exhibition held in 2022 at the Musée des Beaux-Arts et d’Archéologie de

Besançon (France) (https://polarjournal.ch/en/2022/02/25/penelope-art-project-at-belgian-antarctic-station/).

Many scientists and visitors also mention the aesthetic quality of the landscape in blogs. Stefania Gili has written: "Landscape is incredible beautiful. Shapes I've never seen before and also sounds I've never heard or experienced. My eyes are just amazed for what I am seeing. I am so lucky to be here, that's all I can think of." (https://belatmos.blogspot.com/2018/11/arrival-at-princess-elisabeth.html, A. Mangold). Pictures of two scientists were selected for the European Research Night 2020 exhibition at ULiège: a picture called "En chemin vers les nunataks de Pingvinane montagnes de Sor Rondane" and a picture called "Biocroute pour coloniser le sol en Antarctique". The second picture, of a biocrust, was also selected by SCAR as 'Image of the month' for the February 2021 edition of the SCAR Newsletter. The first picture, as well as several others that demonstrate the aesthetic values of the landscape, are added in Appendix A to this Management Plan.

Important wilderness values are equally present in the sites of the ASPA. In accordance with a common understanding of the concept of wilderness (Dudley 2008; Bastmeijer 2016), the relevant parts of the ASPA are characterised by a very high degree of naturalness (unmodified native ecosystems) and undevelopedness (absence of and distance from any permanent or semi- permanent infrastructure, artefacts, transport routes or any other evidence of present or past visible human presence). Both characteristics are to a large degree present in the different designated sites, which have seen limited human presence.

Pictures are provided in annex to illustrate both the aesthetic and the wilderness values of the general area and of the specific sites.

2. Aims and objectives

The aims and objectives of this Management Plan are to:

- Avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- Facilitate long-term scientific research while avoiding direct or cumulative damage to vulnerable biological and environmental features;
- Allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere, which is consistent with the management aims and objectives and which will not jeopardize the values in that Area;
- Preserve a part of the natural ecosystem of the Area as an inviolate reference area for future comparative studies;
- Prevent the introduction to the Area of alien plants, animals and microbes and the transfer of species between the different sites of the Area;
- Minimise the possibility of the introduction of pathogens which may cause disease in fauna populations within the Area.

3. Management activities

- Copies of the Management Plan (with maps included) shall be made available at the Princess Elisabeth Station (Belgium), and the map of the protected area with the 7 sites and 13 subsites should be put up at prominent positions in this station. Personnel in the vicinity of, accessing or flying over the Area shall be specifically instructed, by their National Programs as to the provisions and contents of the Management Plan.
- The Area, with the exception of subsites C6 and C7, shall be visited as necessary, and no less than once every five years, to assess whether it continues to serve the purposes for which it was designated and to ensure that management activities are adequate.
- National Antarctic Programs operating in the Area shall consult together with a view to ensuring the management activities are implemented.
- The Management Plan should be reviewed no less than once every five years and, if necessary, updated or revised.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Figure 1. Map with an overview of nearest existing ASPAs, namely ASPAs 142 and 163 in ACBR6 and ASPA 141 in ACBR5.

Figure 2. Map of the Western Sør Rondane Mountains with the positions of the Princess Elisabeth Station, the general area where the ASPA sites are located, Perseus airfield (marked with a plane symbol) and Asuka station.

The map has been provided by the Norwegian Polar Institute (2023).

Figure 3. Map of the Western Sør Rondane Mountains with the positions of the Princess Elisabeth Station and the ASPA sites: the Tanngarden Ridge (A), Petrellnuten Nunatak (B), range of Pingvinane Nunataks (C), Perlebandet range (D), the Teltet Nunatak (E), and the Yûboku-dani Valley (F). The boundaries of the subsites are not provided.

Map contains modified Copernicus Sentinel data [2019]" in the caption) and the Antarctica contour is from Wikimedia Commons (https://commons.wikimedia.org/wiki/File:AntarcticaContour.svg), and was released under a CC BY-SA 4.0 license.

Figure 4. Map of Tanngarden nunatak and ridge (A)

Figure 5. Map of Petrellnuten nunatak (B)

Figure 6. Map of the Pingvinane Range with the 7 nunataks (site C and subsites C1-C7)

Figure 7. Map of Perlebandet Northern (DN)

Figure 8. Map of Perlebandet South (DS)

Figure 9. Map of Teltet Nunatak (E)

Figure 10. Map of Yûboku-dani Valley (F)

On the maps in figure 4-10, the boundaries of the subsites have been marked by a dashed line. The boundaries of the sites, which include the buffer zones, have been marked by a solid line. In addition, the maps mark the location of the different OTCs present at the sites by the use of hexagons, which correspond to the shape of the OTCs.

Appendix A. This appendix contains a number of photographs made by scientists in the Western Sør Rondane Mountains in general and at the different sites protected by the Area in particular.

6. Description of the Area

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

- *General Description*

The ASPA comprises 7 separate sites shown in Figures 4-11 and covers a total area of 35.817 km². Within these 7 sites, there is a total of 13 subsites. These subsites have a combined surface area of 9.921 km². Perlebandet (D) includes two nunataks which make up two different sites (DN and DS) and the Pingvinane (site C) range includes 7 nunataks which are different subsites (C1- C7). The Pingvinane nunataks 6 and 7 (subsites C6 and C7) constitute two Restricted Zones. Maps of each site are shown in Figures 4-11. This fragmented location is due to the mountainous topology, where nunataks, ranges and ridges stick out of the ice, separate from each other. As written earlier, the glaciers between the 7 beyond the buffer zones sites are not part of the ASPA.

The Area's main values are situated in the 13 subsites, which are ice-free zones where microbial communities exist. However, in order to limit the impact of pollution from motorized vehicles on these microbial communities, buffer zones of 500m are drawn around each of the different subsites. The main body of the rules set out in this Management Plan only applies to the subsites. The rules that apply to the buffer zone are aimed at limiting the impact on the subsites from the use of motorized vehicles.

The sites are lettered A to F and referred to by their name. However, for Perlebandet, a distinction is made between two different sites, each with its own subsites, namely Perlebandet North (DN) and Perlebandet South (DS). Furthermore, in order to indicate that the subsites at Pingvinane (site C) are related, these have received the same letter but have subsequently been distinguished by a number. Therefore, these subsites are referred to as C1 to C7.

The boundaries of the subsites generally follow the outline of the rocks that emerge from the surrounding glaciers. However, these outlines are irregular. To facilitate the calculation of GIS positions, vertices were calculated on the basis of polygons that were drawn as close as possible to the natural boundaries. Therefore, the sites' surface indicated in the descriptions will be the surface area of the polygons.

- Tanngarden Ridge – Site A

Area enclosed. The Tanngarden subsite (Fig. 4) includes the nunatak and a ridge covering an area of 0.528 km². The site, including the buffer zone, covers an area of 3.132 km². The bedrock of the ridge is granitic. Apparent depositional age of metacarbonate rocks from the Tanngarden region is estimated as late-Tonian and early-Cryogenian age (880–850 Ma and 820–790 Ma) based on a Sr isotope study (Otsuji et al., 2013).

Soils and crusts formed on granite gravel were sampled in the windscoop near the northeastern slope (72°01'S, 22°56'E) as control sites for the 2 OTCs (OTC 7 & 8) placed in 2010 at the time of sample collection (Puschkareva et al. 2017). The chlorophyll a content in BSC from Tanngarden was 315 mg m^{-2} of the BSC area covered. The soils of Tanngarden had a neutral pH (7.33) and intermediate nutrient concentrations.

Boundaries:

Tanngarden (subsite)		
vertex	longitude	latitude
1	22° 56' 39"	-72° 01' 18"
2	22° 56' 58"	-72° 01' 38"
3	22° 57' 05"	-72° 01' 46"
4	22° 56' 23"	-72° 01' 55"
5	22° 55' 59"	-72° 01' 42"
6	22° 56' 11"	-72° 01' 12"

Tanngarden (site including buffer zone)		
vertex	longitude	latitude
1	22° 57' 24"	-72° 01' 08"
2	22° 57' 49"	-72° 01' 33"
3	22° 58' 04"	-72° 01' 53"
4	22° 56' 05"	-72° 02' 19"

5	22° 55’ 05”	-72° 01’ 45”
6	22° 55’ 29”	-72° 00’ 43”

Scientific value: OTCs 7 and 8 were installed in January 2010 in a windscoop on the Northern side of a granite outcrop on the northern side of Tanngarden Ridge. The coordinates are S 72°01’17.5”, E 22°56’29.5”. One bamboo pole with a flag was placed. They have not yet been sampled since their installation because they were covered by a thick layer of snow during the field campaigns of 2018, 2019 and 2020. These OTCs are not accessible at the time of adoption of this Management Plan.

- Petrellnuten Nunatak – Site B

Area enclosed. The subsite located at the Petrellnuten Nunatak (Fig. 5) covers a surface of 0.283 km². The site, including the buffer zone, covers a surface area of 2.476 km². The bedrock is granitic.

Boundaries:

Petrellnuten (subsite)		
vertex	longitude	latitude
1	22° 50’ 04”	-72° 00’ 25”
2	22° 50’ 21”	-72° 00’ 45”
3	22° 49’ 19”	-72° 00’ 50”
4	22° 49’ 41”	-72° 00’ 25”

Petrellnuten (site including buffer zone)		
vertex	longitude	latitude
1	22° 50' 44"	-72° 00' 07
2	22° 51' 25"	-72° 00' 57"
3	22° 48' 05"	-72° 01' 12"
4	22° 49' 01"	-72° 00' 10"

Scientific value: This nunatak has a granitic bedrock. It has been studied since 2010 and 4 temperature and humidity loggers were placed.

- Range of 7 Pingvinane nunataks – site C and subsites C1-C7

Area enclosed. The seven nunataks of the Pingvinane range (Fig. 6) are enclosed in the ASPA as separate sites. The glacier zones between them are not included in the ASPA. They are composed of typical alkali granite with coarse-grained equigranular texture. (Shiraishi et al., 1992).

The respective surface areas for each of the different subsites are 0.161 km² for Pingvinane 1 (C1), 0.201 km² for Pingvinane 2 (C2), 0.159 km² for Pingvinane 3 (C3), 0.430 km² for Pingvinane 4 (C4), 0.054 km² for Pingvinane 5 (C5), 0.247 km² for Pingvinane 6 (C6), and 0.210 km² for Pingvinane 7 (C7). The surface area of the entire site (C), including the buffer zone, measures 9.867 km².

The 6th nunatak (C6) which was visited in 2010 by scientists and the 7th nunatak (C7) which has never been visited are designated as Restricted Zones inside the ASPA. Both nunataks are designated as Restricted Zones in which rules apply to limit the impact of human activity to an absolute minimum (see section 6 (v)). These Restricted Zones are valuable as reference sites for future comparative studies.

Boundaries:

Pingvinane 1 (subsite C1)		
vertex	longitude	latitude
1	23° 00' 01"	-71° 58' 41"
2	23° 00' 00"	-71° 58' 53"
3	22° 59' 47"	-71° 58' 55"
4	22° 59' 48"	-71° 58' 59"
5	22° 59' 27"	-71° 59' 01"
6	22° 59' 27"	-71° 58' 52"
7	22° 59' 29"	-71° 58' 41"

Pingvinane 2 (subsite C2)		
vertex	longitude	latitude
1	22° 59' 48"	-71° 58' 59"
2	22° 59' 47"	-71° 59' 19"
3	22° 59' 09"	-71° 59' 19"

4	22° 59' 07"	-71° 59' 08"
5	22° 59' 27"	-71° 59' 01"

Pingvinane 3 (subsite C3)		
vertex	longitude	latitude
1	22° 59' 28"	-71° 59' 26"
2	22° 59' 22"	-71° 59' 44"
3	22° 58' 52"	-71° 59' 44"
4	22° 58' 59"	-71° 59' 27"

Pingvinane 4 (subsite C4)		
vertex	longitude	latitude
1	23° 00' 12"	-71° 59' 49"
2	23° 00' 47"	-71° 59' 56"
3	23° 00' 49"	-72° 00' 13"
4	22° 59' 44"	-72° 00' 13"
5	22° 59' 44"	-71° 59' 49"

Pingvinane 5 (subsite C5)		
vertex	longitude	latitude
0	22° 59' 56"	-72° 00' 17"
1	23° 00' 13"	-72° 00' 25"
2	22° 59' 39"	-72° 00' 27"
3	22° 59' 52"	-72° 00' 17"
4	22° 59' 56"	-72° 00' 17"

Pingvinane 6 (subsite C6)		
vertex	longitude	latitude

1	23° 00' 20"	-72° 00' 42"
2	23° 00' 20"	-72° 00' 50"
3	22° 59' 13"	-72° 00' 50"
4	22° 59' 17"	-72° 00' 36"
5	22° 59' 35"	-72° 00' 35"

Pingvinane 7 (subsite C7)		
vertex	longitude	latitude
1	23° 02' 29"	-72° 00' 30"
2	23° 02' 29"	-72° 00' 49"
3	23° 01' 36"	-72° 00' 51"
4	23° 02' 13"	-72° 00' 30"

Pingvinane (site including buffer zone)		
vertex	longitude	latitude
1	23° 00' 09"	-72° 01' 09"
2	23° 00' 07"	-72° 01' 08"
3	23° 00' 10"	-72° 01' 06"
4	22° 58' 15"	-72° 01' 07"
5	22° 58' 22"	-72° 00' 46"
6	22° 58' 16"	-72° 00' 46"
7	22° 58' 15"	-72° 00' 46"
8	22° 58' 23"	-72° 00' 40"
9	22° 58' 29"	-72° 00' 21"
10	22° 58' 51"	-72° 00' 20"
11	22° 58' 52"	-72° 00' 19"
12	22° 58' 52"	-72° 00' 01"

13	22° 57' 52"	-72° 00' 01"
14	22° 58' 13"	-71° 59' 11"
15	22° 58' 16"	-71° 59' 11"
16	22° 58' 14"	-71° 59' 02"
17	22° 58' 35"	-71° 58' 55"
18	22° 58' 35"	-71° 58' 52"
19	22° 58' 39"	-71° 58' 26"
20	23° 00' 54"	-71° 58' 25"
21	23° 00' 52"	-71° 59' 03"
22	23° 00' 42"	-71° 59' 05"
23	23° 00' 44"	-71° 59' 12"
24	23° 00' 40"	-71° 59' 12"
25	23° 00' 39"	-71° 59' 35"
26	23° 01' 39"	-71° 59' 47"
27	23° 01' 41"	-72° 00' 14"
28	23° 03' 21"	-72° 00' 13"
29	23° 03' 21"	-72° 01' 04"

Scientific value: Since 2009, the Pingvinane range of nunataks has been accessed to study its biodiversity, except the third (C3) and seventh nunatak (C7). The bedrock is made of granite and visible microbial mats are present in suitable habitats. In January 2010, OTCs 3 and 4 and control sites were installed on the SW slope of the fourth nunatak (C4). The coordinates are S 72°00'04.6", E 022°59'57.6"and a bamboo pole was placed. The OTC 4 was found to be broken in 2018 and was removed. Five temperature and humidity loggers were placed.

- Perlebandet range – sites DN and DS

Area enclosed. Perlebandet range is one of the westernmost nunataks in the SRM, where granulite facies layered gneisses are exposed (Kawakami et al. 2017). Two nunataks of the Perlebandet range are enclosed as separate sites. The surface area of the subsite of Perlebandet North (DN) (Fig. 7) is 1.038 km². The surface area of the site DN, including the buffer zone, is 4.159 km². The surface area is 0.769 km² for the subsite at Perlebandet South (DS) (Fig. 8). The surface area of site DS, including the buffer zone, measures 3.665 km². They both include marble intrusions in a gneiss bedrock. The glacier areas in between are not included in the ASPA.

Boundaries:

Perlebandet_North (subsite DN)		
vertex	longitude	latitude
1	22° 50' 27"	-71° 50' 35"
2	22° 49' 33"	-71° 51' 12"
3	22° 48' 23"	-71° 51' 18"
4	22° 48' 21"	-71° 51' 02"
5	22° 49' 35"	-71° 50' 26"

Perlebandet_North (site DN with buffer zone)		
vertex	longitude	latitude
1	22° 51' 34"	-71° 50' 28"
2	22° 50' 11"	-71° 51' 26"
3	22° 47' 34"	-71° 51' 39"
4	22° 47' 29"	-71° 50' 57"
5	22° 49' 18"	-71° 50' 05"

Perlebandet_South (subsite DS)		
vertex	longitude	latitude
1	22° 45' 02"	-71° 52' 56"
2	22° 44' 31"	-71° 53' 30"
3	22° 43' 56"	-71° 53' 30"
4	22° 43' 51"	-71° 53' 17"
5	22° 43' 17"	-71° 53' 14"
6	22° 43' 20"	-71° 53' 07"

7	22° 44' 51"	-71° 52' 46"

Perlebandet_South (site DS with buffer zone)		
vertex	longitude	latitude
1	22° 45' 56"	-71° 52' 56"
2	22° 45' 11"	-71° 53' 46"
3	22° 43' 11"	-71° 53' 47"
4	22° 43' 04"	-71° 53' 30"
5	22° 42' 20"	-71° 53' 25"
6	22° 42' 31"	-71° 52' 58"
7	22° 45' 19"	-71° 52' 19"

Scientific value: The two nunataks were sampled to characterize their biodiversity. In the most northern nunatak (DN), OTCs 9, 10, 15, 16 and 17 were installed with the corresponding control areas (sites with similar biomass in the vicinity of the OTCs). OTCs 9 and 10 were installed on a marble vein in January 2018, as this geological feature is very rare. The coordinates for these OTCs are S 71° 50' 38.7", E 22° 50' 2.5". OTCs 15, 16 and 17 were installed on gneiss and marble gravel in February 2019. The coordinates for these OTCs are S 71° 50' 39.3", E 22° 49' 52.2". Temperature and humidity loggers are placed in the OTCs and control areas, except when unavailable, and were read till 2020 annually except when the snow cover hindered their retrieval. Metal poles indicate the position of the OTCs. The Southern nunatak (DS) was accessed in 2010 and 2018. Three temperature and humidity loggers were left in place.

- Part of the Teltet nunatak – Site E

Area enclosed. The northern slope of the nunatak (Fig. 9) where the OTCs and control sites were placed is enclosed in the ASPA. The surface area covered by the subsite measures 0.032 km². The surface area covered by the site, including the buffer zone, measures 1.456 km².

Boundaries:

Teltet (subsite)		
vertex	longitude	latitude
1	23° 29' 43"	-71° 59' 10"

2	23° 29' 31"	-71° 59' 02"
3	23° 29' 24"	-71° 59' 03"
4	23° 29' 23"	-71° 59' 11"

Teltet (site including buffer zone)		
vertex	longitude	latitude
1	23° 28' 34"	-71° 58' 47"
2	23° 30' 02"	-71° 58' 46"
3	23° 31' 03"	-71° 59' 23"
4	23° 28' 29"	-71° 59' 29"

Scientific value: Since 2009, samples were taken from the Teltet nunatak to explore its biodiversity. On this gneiss rocky nunatak, there are hardly any visible Biological Soil Crusts but a microbial diversity is present as shown by molecular methods. OTCs 5 and 6 were installed in January 2010 on a small plateau on the Northern slope of Teltet nunatak. The purpose was to observe whether the obstacles to the establishment of visible communities could be counteracted by the changes in microclimatic conditions thanks to the OTCs, or whether the problems were linked to the substrate properties or other factors. The coordinates are S 71°59'07.4" E 23°29'28.5". One bamboo pole was placed.

- Yûboku-dani Valley – Site F

Area enclosed. The entrance of Yûboku-dani Valley (Fig. 10) with the three lakes that have been observed is enclosed, and the polygon for the subsite measures 5.809 km². On the basis of the limited data available, this polygon also aims to capture the catchment area of the three lakes that have been observed. The polygon for the site, including the buffer zone, measures 11.062 km².

Boundaries:

Yûboku-dani Valley (subsite)		
vertex	longitude	latitude
1	23° 48' 15"	-72° 04' 21"
2	23° 50' 32"	-72° 04' 52"
3	23° 50' 45"	-72° 05' 24"

4	23° 49' 20"	-72° 05' 53"
5	23° 46' 00"	-72° 05' 34"
6	23° 45' 34"	-72° 04' 51"

Yûboku-dani Valley (site including buffer zone)		
vertex	longitude	latitude
1	23° 48' 18"	-72° 04' 01"
2	23° 51' 22"	-72° 04' 43"
3	23° 51' 40"	-72° 05' 30"
4	23° 49' 36"	-72° 06' 12"
5	23° 45' 15"	-72° 05' 46"
6	23° 44' 36"	-72° 04' 44"

Scientific value: In 2011, the Yûboku-dani Valley was entered. It appears to contain 3 lakes, with conspicuous microbial mats on the bottom or floating under the thin ice layer. The mats are also present on gravel and sand moraines outside of the lakes, but their abundance and size decrease with the distance to the shore. Depending on the year and month, the lakes may be in frozen or liquid state. Temperature and humidity data were recorded by loggers in the period 2018-2020.

More information is available on two of the three lakes that have been observed in Yûboku-dani Valley. The first lake (Lake 1) (coordinates: 72 04'53.1", 23 47'37.1") was visited twice in January 2011. It is located in the center of the valley on the moraine. In 2011, the size of the lake was 45m (South-North) by 53m (East-West). A hole was drilled in the ice in the center of the lake. The lake depth in the center was 183 cm, the ice thickness was 177 cm. The pH value of the water was 9.2-9.3, the oxygen level was 10.5-13.2 mg/l and the temperature of the water was 0.0°-0.1° C. At this time, the bottom of the lake was found to consists of rocks with no sediments being present. However, cyanobacterial biofilms covered the bottom between the rocks. Air bubbles were present under the surface of ice. The top layer of the cyanobacterial mat was green. Microscopy showed that it was dominated by Nostoc commune. Leptolyngbya sp was also present. The lower layer was red, dominated by 2 types of Leptolyngbya and Nostoc sp..

The second lake (Lake 2) which is located at the foot of the moraine about 200 m SSW from Lake 1, was also visited in 2011. Lake 2 is L-shaped. In 2011, the size of the lake was 97 m (South- North) by 94 m (East-West). It was probably formed during the retreat of the glacier on the southern side of the lake. On the surface of the ice cover, dry pieces of cyanobacterial mats frozen into the ice were observed. These mats were dominated by Nostoc commune. The depth of the lake and ice thickness in the center were more than 1.5 meters. The pH value of the water was 9.0, the oxygen level was 10 mg/l and the temperature of the water was 0.0° C. Sediments were only found closer to the northern side of the lake.

- *General climate conditions*

An automated weather station (AWS), installed during 2005 at the site of the new PES indicated an average annual temperature of -18°C, varying between -8°C (December) and -25°C (September). The daily maximum air temperature does not exceed zero in summer, while the daily minimum reaches -36°C in winter (CEE, 2007). The primary wind direction near PES is from the east and less often from the south-east (from Gunnestadbreen) so that 90% of the winds at PES come from E-SSE directions. Mean summer wind speeds are around 4.5 ms-1 (Pattyn et al. 2010).

During 12 years, an automated weather station of IMAU, University of Utrecht (NL) was installed from February 2009 to January 2021 (http://www.projects.science.uu.nl/iceclimate/aws/antarctica.php; Gorodetskaya et al., 2013). It is now dismounted. EPFL Lausanne, Switzerland, has moved one of their AWS in December 2020 from the Utsteinen air strip to the eastern side of Utsteinen ridge, a few hundred meters from PEA. WSL, Switzerland, together with the International Polar Foundation, also operates several AWS in the surroundings of PEA, including one at the Utsteinen air strip since 2014. Other meteorological instruments are listed on the website of the AEROCLOUD/HYDRANT project (https://ees.kuleuven.be/hydrant/instruments/index.html), including a Ceilometer, Infrared Radiation Pyrometer and a Micro Rain Radar.

The climatic conditions at the site of PES are milder than in the surrounding regions of the SRM. This can be explained by "two principal factors, namely, a favorable location for warm air advection associated with local intense cyclonic activity, and a lack of drainage of cold air from the high plateau due to the Sør Rondane Mountain sheltering" (Gorodetskaya et al. 2013). AWS data show anomalously low surface and snowdrift sublimation rates at PES and Thiery et al. (2012) hypothesised that this was a twofold effect of the local orography that pro tects "the station from medium-strength katabatic winds and therewith (i) allows for a strong, dampening surface inver- sion to persist throughout most of the year, and (ii) reduces the occurrence of snowdrift by 50– 70 % compared to nearby katabatic stations". The ASPA sites close to the SMR are probably similarly protected from katabatic winds.

A study of the aerosol particles arriving at PES during the austral summer showed that the station area is influenced by both marine air masses originating from the Southern Ocean and coastal areas around Antarctica and continental air masses (Herenz et al. 2019). Further, the overall concentration of such particles is low and mainly restricted to sizes distinctly below 1 µm.

Snowfall originates from oceanic air masses which are transported towards the Antarctic Ice Sheet (AIS) by cyclones in the Antarctic circumpolar trough. Wind-driven accumulation and ablation also occur without snowfall at PES. Souverijns et al. (2021) hypothesised that snow accumulation at PES mainly occurs by transport of freshly fallen snow in synoptic upstream areas.

6(ii) Access to the Area

Access to the area may be gained overland on foot, by skidoos or other vehicles. Visitors accessing the area by land vehicles such as snowmobiles should take care to avoid destroying the local biological and other geological and natural physiognomy. The use of land vehicles should be avoided in ice-free areas within the general environment of the Area, not limited to the specific sites designated as protected, in order to prevent long-term damage to these pristine areas and their vulnerable biological communities.

The use of land vehicles with the boundaries of the sites themselves is prohibited.

Access to the Restricted Zones is allowed only for compelling scientific or management reasons that cannot be served elsewhere in the Area (see 6(v)).

Up-to-date maps with routes of access to the different ASPA sites can be accessed at the Princess Elisabeth Station or can be made available digitally, for planning purposes, upon request.

6(iii) Location of structures within and adjacent to the site

Princess Elisabeth Station (PES) is located on the southern end of the Utsteinen Ridge, 8 km from Teltet Nunatak (Site E) and at 15-20 km from the 6 other sites that are included in the ASPA. OTCs are located in 4 ASPA sites, and temperature and humidity loggers are present in Pingvinane 4 (C4) and Perlebandet North (DN). For air transportation, a seasonal snow landing strip is located NW of the PES (the Utsteinen airstrip) .

Further away, the former Asuka station (Japan) is situated at 55 km from PES (Fig. 1). The Perseus airfield (71°25′09″S 23°31′06″E) is located at a distance of about 60 km. All other structures are hundreds of kilometers away.

6(iv) Location of other protected areas in the vicinity

There are no other protected areas nearby. In ACBR 6, ASPA 142 is about 700 km away and ASPA 163 is about 400 km away. ASPA 141 (Yukidori Valley, Langhovde, Lützow-Holmbukta (69°14’S; 33°45’E) is located in a different ACBR (ACBR5, Enderby Land) and is about 650 km away to the east (Fig. 3).

6(v) Special Zones within the Area

Two Restricted Zones are established, namely at the subsites surrounding the 6th and 7th Pingvinane nunataks (C6 and C7) (See Fig. 6). These zones are of scientific importance to Antarctic microbiology and serve to preserve part of the Area as reference sites for future comparative studies. New metagenomic techniques are predicted to allow future identification of microbial biodiversity (bacteria, fungi and viruses) to an unprecedented level, allowing many fundamental questions regarding microbial dispersal and distribution to be answered. Restricted zones have been designated that are of scientific importance to Antarctic microbiology and greater restriction is placed on access with the aim of preventing microbial or other contamination by human activity. Access to these Restricted Zones is allowed only for compelling scientific and management purposes that cannot be served by visits elsewhere in the Area.

Furthermore, given their importance as reference sites, activities in these subsites shall meet higher quarantine standards than considered necessary within the rest of the Area with the aim of preventing microbial or other contamination by human activity. Within these Restricted Zones, the following additional requirements shall apply:

- In keeping with this aim, within the Restricted Zones sterile protective over-clothing shall be worn. The protective clothing shall be put on immediately prior to entering the restricted zones. Spare boots, previously cleaned using a biocide then sealed in plastic bags, shall be unwrapped and put on just before entering the Restricted Zones.
- To the greatest extent possible, all sampling equipment, scientific apparatus and markers brought into the Restricted Zones shall have been sterilized, and maintained in a sterile condition, before being used within the Area. Sterilization should be by an accepted method, including UV radiation, autoclaving or by surface sterilisation using 70% ethanol or a commercially available biocide (e.g. Virkon®).
- General equipment includes harnesses, crampons, climbing equipment, ice axes, walking poles, ski equipment, temporary route markers, pulks, sledges, camera and video equipment, rucksacks, sledge boxes and all other personal equipment. To the maximum extent practicable, all general equipment used or brought into the Restricted Zones shall have been thoroughly cleaned and sterilized at the originating Antarctic station. Equipment shall have been maintained in this condition before entering the Restricted Zones, preferably by sealing in sterile plastic bags or other clean containers.
- Scientists from disciplines other than microbiology are allowed to enter the restricted areas, but shall adhere to the quarantine measures detailed above.

7. Terms and conditions for entry – Permits

7(i) General 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:

- Outside of the Restricted Zone, it is issued for compelling scientific reasons which cannot be served elsewhere, or for reasons essential to the management of the Area. A permit shall not be issued unless the applicant can demonstrate to the appropriate competent authorities that specimens or samples already collected from other parts of the world cannot fully meet the needs of the research proposed;
- Access to the Restricted Zones is allowed only for compelling scientific or management reasons that cannot be served elsewhere in the Area and in accordance with section 6 (v) of this Management Plan;
- The activities permitted are in accordance with this Management Plan;
- The activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the scientific, environmental, aesthetic and wilderness values of the Area;
- The Permit or its valid copy shall be carried when in the Area, including a copy of all relevant maps from the Management Plan;
- The Permit shall be issued for a finite period;
- A report on the activities must be submitted to the national authorities issuing the Permit.

7(ii) Access to, and movement within or over, the Area

- Access to the sites can be gained by driving on the ice not included within the boundaries of the sites with skidoos or other vehicles. Driving on ice-free areas within the general area of the ASPA, even outside the sites, is strongly discouraged.
- If helicopters are used, their landing within the Area's sites is strictly prohibited.
- Vehicles are prohibited within the ASPA sites and all movement within the ASPA sites should be on foot. Pedestrian traffic shall be kept to the minimum necessary to undertake permitted activities and every reasonable effort shall be made to minimise trampling effects.
- Movement within the Area by foot shall be on snow, ice or bare rocks only (with no visible biomass) for sites A to E. Due to the rocky nature of the substrate of the nunataks, there are no designated tracks. For site F (Yûboku-dani Valley), walking should be on bare rocks, ice or snow and threading on visible biomass shall be avoided as much as possible. For access to the lakes in subsite F, it might be necessary to walk on dried mats. In this case, the same path shall be used as much as possible.
- Visitors shall avoid areas of visible vegetation and care should be exercised when walking in areas of moist ground, particularly near the lakes at subsite F, where foot traffic can easily damage sensitive soils, plant and algal communities, and degrade water quality.

- Recreational climbing and mountaineering activities shall not be undertaken within the Area.
- Visitors shall adhere to the guidelines set out in SCAR's Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)).

- *Aircraft access and overflight*

Pilots operating aircraft over the Area shall observe the following conditions:

- Overflight of the Area by piloted aircraft below 2000 ft (~610 m) is prohibited, except in accordance with a permit issued by an appropriate national authority. Pilots operating within the Area should follow the Guidelines for the Operation of Aircraft near Concentrations of Birds (Resolution 2 (2004)).
- Overflight of breeding birds within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for compelling scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority. Furthermore, operation of RPAS within or over the Area shall be in accordance with the Environmental guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

7(iii) Activities which may be conducted within the Area

Only the following activities shall be allowed within the Area:

- Essential management activities, including monitoring, inspection, maintenance or review;
- Outside the Restricted Zones, compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the biological communities, environmental or scientific values of the Area;
- Outside the Restricted Zones, sampling, which should be the minimum required for approved research programs;
- Outside the Restricted Zones, operational activities in support of scientific research or management within or beyond the Area, including visits to assess the effectiveness of the Management Plan and management activities;
- Within the Restricted Zones, only activities for compelling scientific or management reasons that cannot be served elsewhere in the Area and do not jeopardize their value as reference areas for future comparisons.

7(iv) Installation, modification and removal of structures

- No new structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for pre-established periods, as specified in a Permit.

- All the structures erected and scientific equipment installed within the Area shall be specified in the Permit issued by the competent authority of the particular country. Where possible, such installations should avoid sensitive geomorphological features.
- All the structures erected and scientific equipment installed in the Area must be clearly identified by country, name of the principal investigator or agency and year of installation. All such items shall be made of materials that pose minimal risk of contamination of the Area.
- All structures must be removed when they are no longer required, and so shall other abandoned equipment or materials as far as possible. Removal of specific structures or 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.
- All introduced items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area.

7(v) Location of field camps

Camping is prohibited in the ASPA sites. If it is necessary to establish field camps, these shall be located on areas of permanent ice outside the ASPA sites.

7(vi) Restrictions on materials and organisms which may be brought into the Area

The following restrictions are laid down to help maintain the ecological and scientific values, specifically the unique biological communities, for which the Area is protected, in particular by biological introductions both into and between each of the 7 sites and 13 subsites that comprise the ASPA.

- The deliberate introduction of plants, animals, microorganisms and non-sterile soil into the Area shall not be permitted.
- Precautions shall be taken to prevent the unintentional introduction of animals, plant material, microorganisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area). Furthermore, substantial differences in biodiversity have been recorded between the different sites and subsites that comprise the ASPA. Therefore, precautions shall be taken to prevent the transfer of species between sites and subsites within the ASPA. Visitors should also consult and follow, as appropriate, recommendations contained in the CEP Non- native species manual, and in SCAR’s Environmental code of conduct for terrestrial scientific field research in Antarctica.
- Further guidance for reducing the risk of transfer of non-native species can be found in the COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes.
- No depots of food or other supplies are to be left within the Area;

- Fuel or other chemicals shall not be stored in the Area. They shall be handled in a way that minimises the risk of their accidental introduction into the environment;
- All sampling equipment or markers brought into the Area shall be cleaned or sterilized. Furthermore, in order to avoid the transfer from one of the lakes in Yûboku-dani Valley (site F) to another lake in the same site, sampling equipment should be sterilized before being used in another lake.
- To the maximum extent practicable, footwear, clothing and other equipment – particularly any sampling equipment – used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area or moving between the sites and subsites that comprise 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 a compelling scientific purpose specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided.
- All materials shall be introduced only for a stated, predetermined period. All materials shall be removed at or before the conclusion of that stated period, and all materials shall be stored and handled so as to minimize the risk of environment impacts.
- All introduced items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area.

7(vii) Taking of, or harmful interference with, native flora and fauna

Taking of, or harmful interference with, native flora and fauna into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority and in due respect of the provisions of Annex II of Protocol on Environmental Protection to the Antarctic Treaty.

- Where taking or harmful interference with animals is involved this should, as a minimum standard, be in accordance with the SCAR code of conduct for the use of animals for scientific purposes in Antarctica.
- Any water, sediment, soil or vegetation sampling is to be kept to the minimum required for scientific or management purposes, and carried out using techniques that minimize disturbance to surrounding soil, ice structures and biota.

7(viii) Collection or removal of materials not imported 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. The collection of material should be carried out with sterile (or clean if sterilization would be destructive) equipment, to avoid cross-contamination between sampling sites.

- Material of human origin likely to compromise the values of the Area, and which was not brought into the Area by the Permit holder or otherwise authorized, should be removed unless the impact of the removal is likely to be greater than leaving the material in situ. If this is the case, the appropriate national authority must be notified and approval obtained.

7(ix) Disposal of waste

- All wastes, including all human liquid and solid wastes, shall be removed from the Area.
- Waste generated as a consequence of and during the activities developed in the Area shall be temporarily stored in such a way as to prevent their dispersal into the environment and removed when activities have been concluded.

7(x) Measures that may be necessary to continue to meet the aims of the Management Plan

- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities.
- Visitors planning to sample within the Area shall demonstrate that they have familiarised themselves with earlier collections to minimise duplication.
- Visitors shall adhere to the guidelines set out in SCAR's Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)) and in SCAR's Environmental Code of Conduct for Geosciences Field Research Activities in Antarctica (Resolution 1 (2021)), where appropriate.

7(xi) Reporting requirements

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than three months after the visit has been completed.
- Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. The national authority should also make the visit report copy available to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.
- Parties should, wherever possible, deposit originals or copies of such original visit reports within a year in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organizing the scientific use of the Area.

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Figure 1. Map with an overview of nearest existing ASPAs, namely ASPAs 142 and 163 in ACBR6 and ASPA 141 in ACBR5

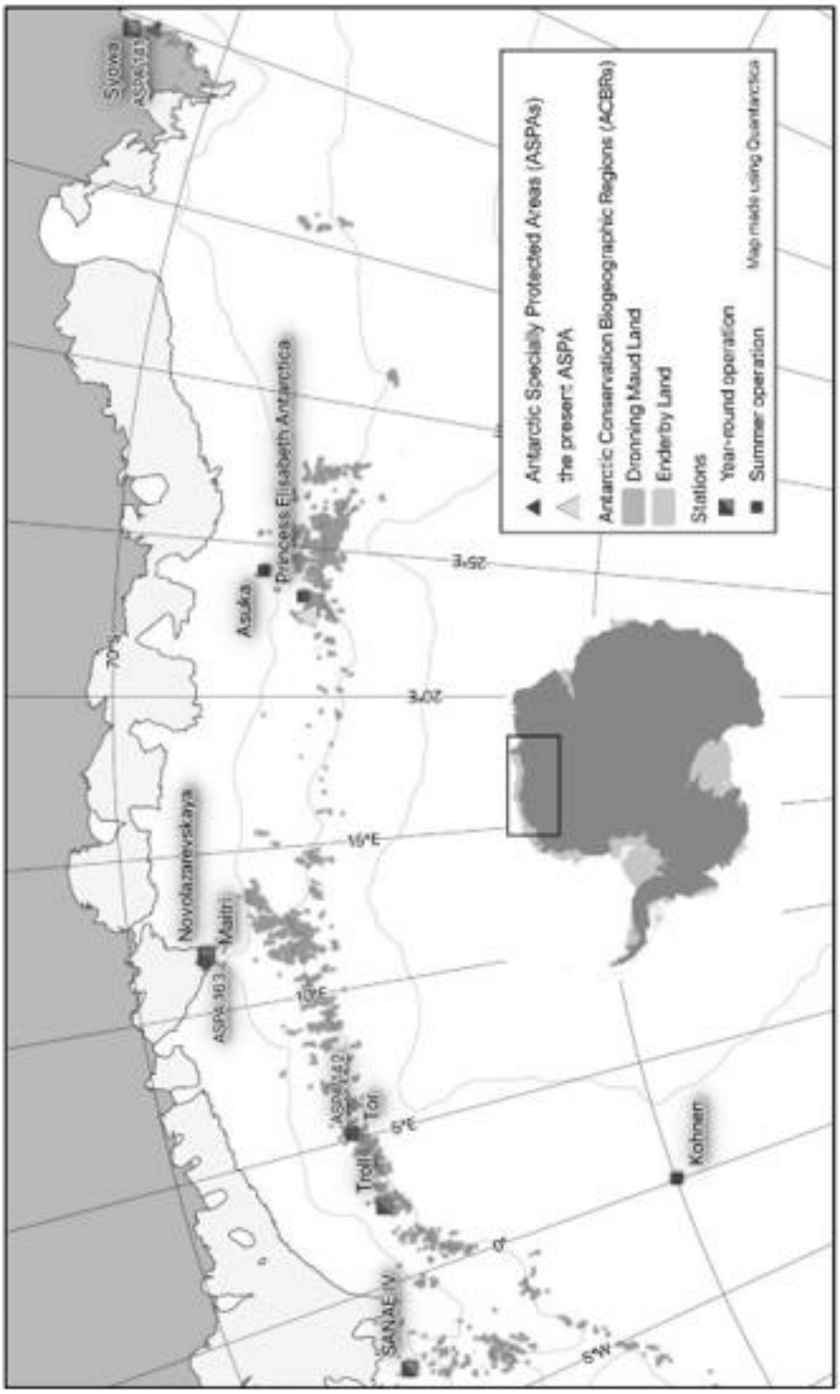


Figure 2. Map of the Western Sør Rondane Mountains with the positions of the Princess Elisabeth Station, Perseus airfield and Asuka station (Japan) and the general area in which the different ASPA sites can be found, marked by the green shaded oval.

Note that not the entire surface covered by the green shaded oval forms part of the Area and that Yûboku-dani Valley (F) is not included due to the distance to the rest of the Area. This is due to the large scale which does not allow for an accurate representation of the separate sites.

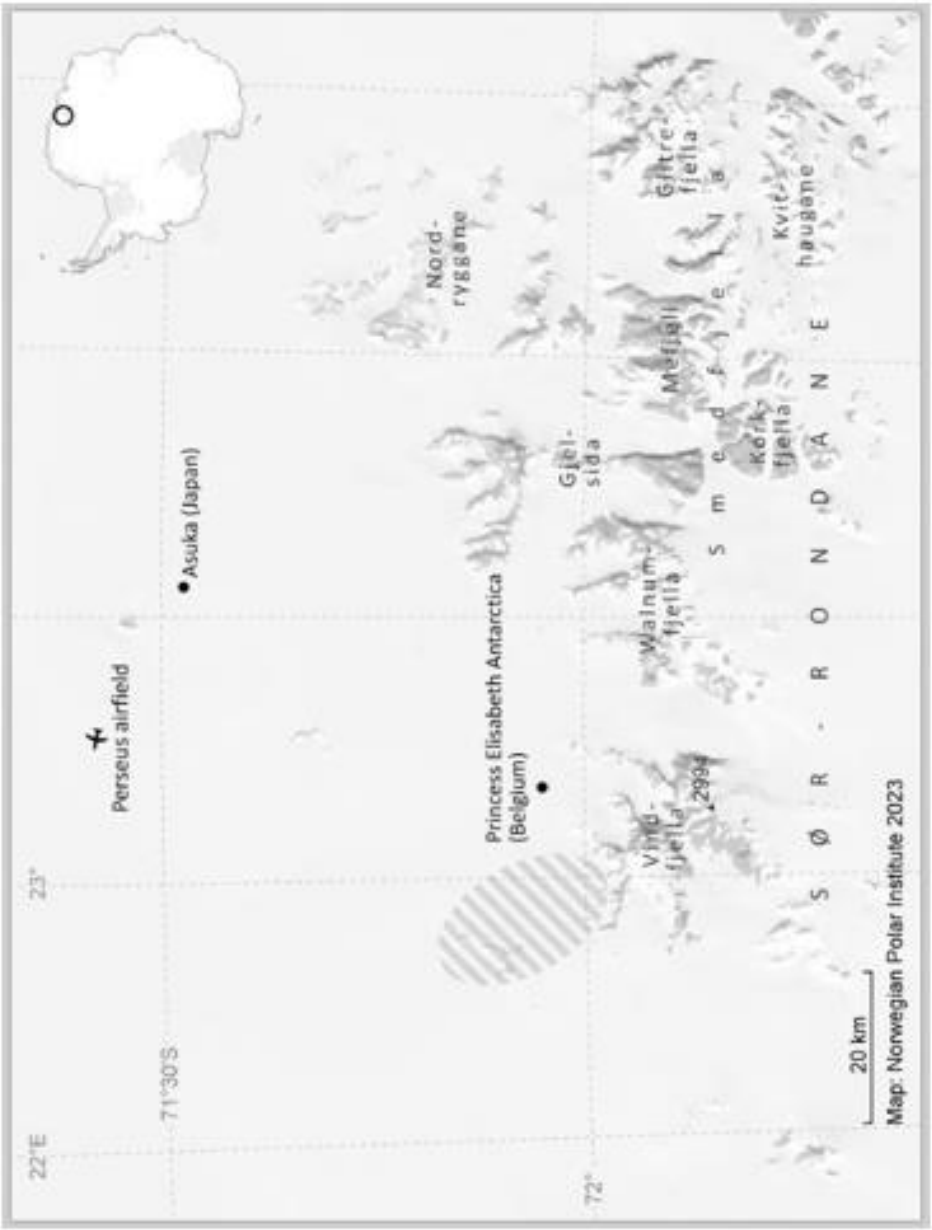


Figure 3. Map of the Western Sør Rondane Mountains with the positions of the Princess Elisabeth Station and the ASPA sites: the Tanngarden Ridge (A), Petrellnuten Nunatak (B), range of Pingvinane Nunataks (C), Perlebandet range (D), the Teltet Nunatak (E), and the Yûboku-dani Valley (F). The boundaries of the subsites are not provided.

Map contains modified Copernicus Sentinel data [2019]" in the caption) and the Antarctica contour is from Wikimedia Commons (https://commons.wikimedia.org/wiki/File:AntarcticaContour.svg), and was released under a CC BY-SA 4.0 license.

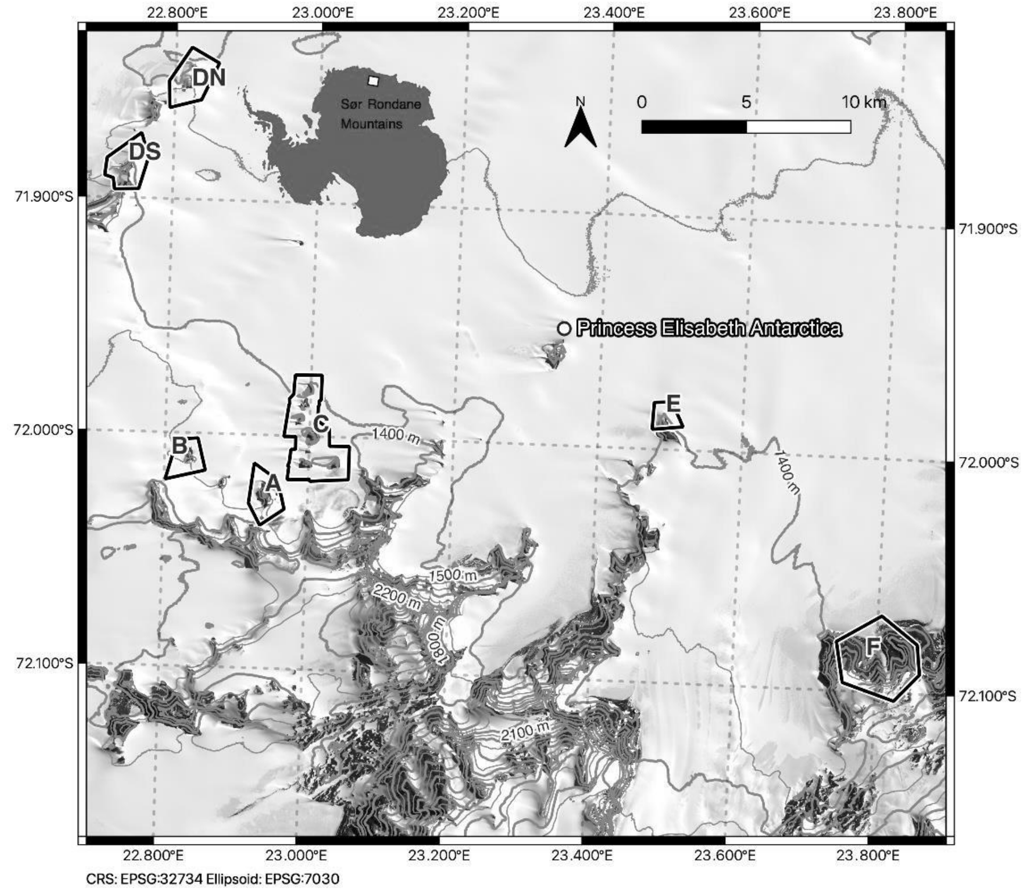


Figure 4. Map of Tanngarden nunatak and ridge (A) with a polygon with dashed line indicating the boundaries of the subsite and a polygon with a solid line indicating the boundaries of the site. The small hexagon marks the location of OTCs 7 and 8. Map contains modified Copernicus Sentinel data [2019].

Legend:

Boundary of the site(s)

Boundary of the subsite(s)

Location of OTCs

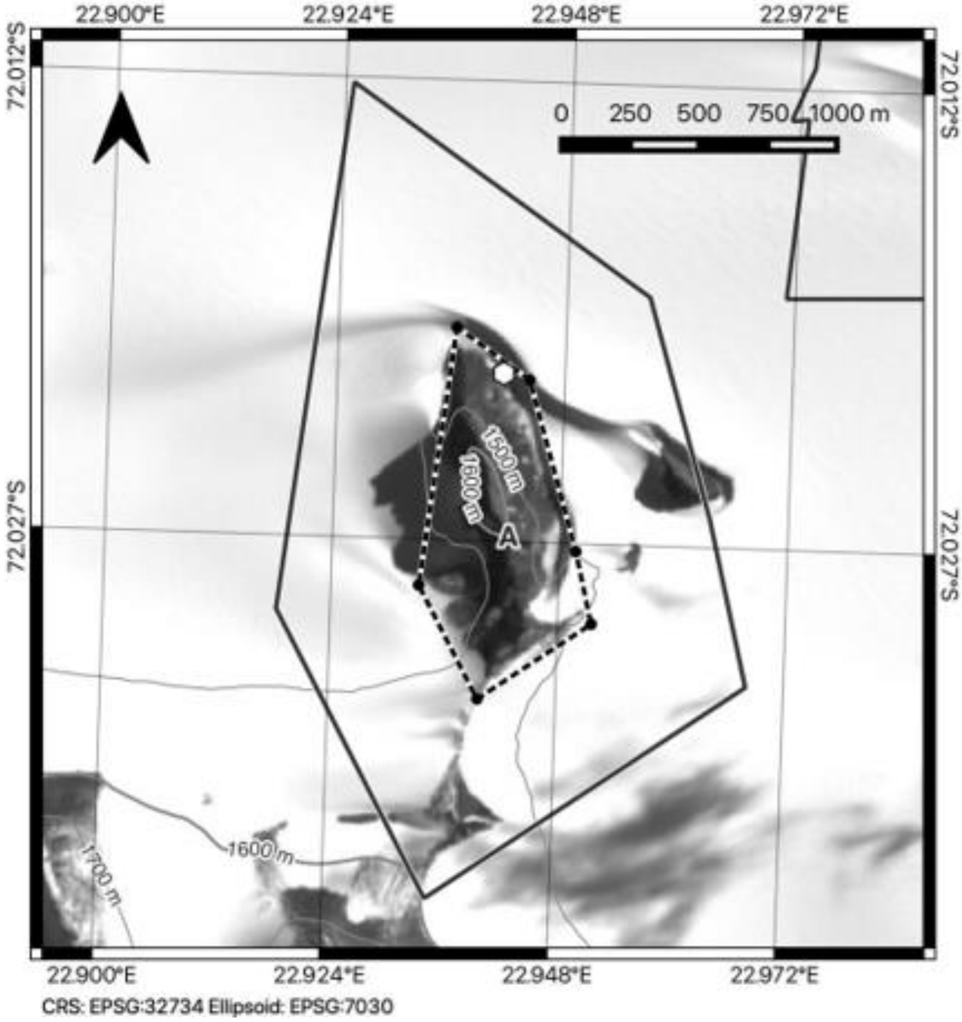


Figure 5. Map of Petrellnuten nunatak (B) with a polygon with dashed line indicating the boundaries of the subsite and a polygon with a solid line indicating the boundaries of the site. Map contains modified Copernicus Sentinel data [2019].

Legend:

Boundary of the site(s)

Boundary of the subsite(s)

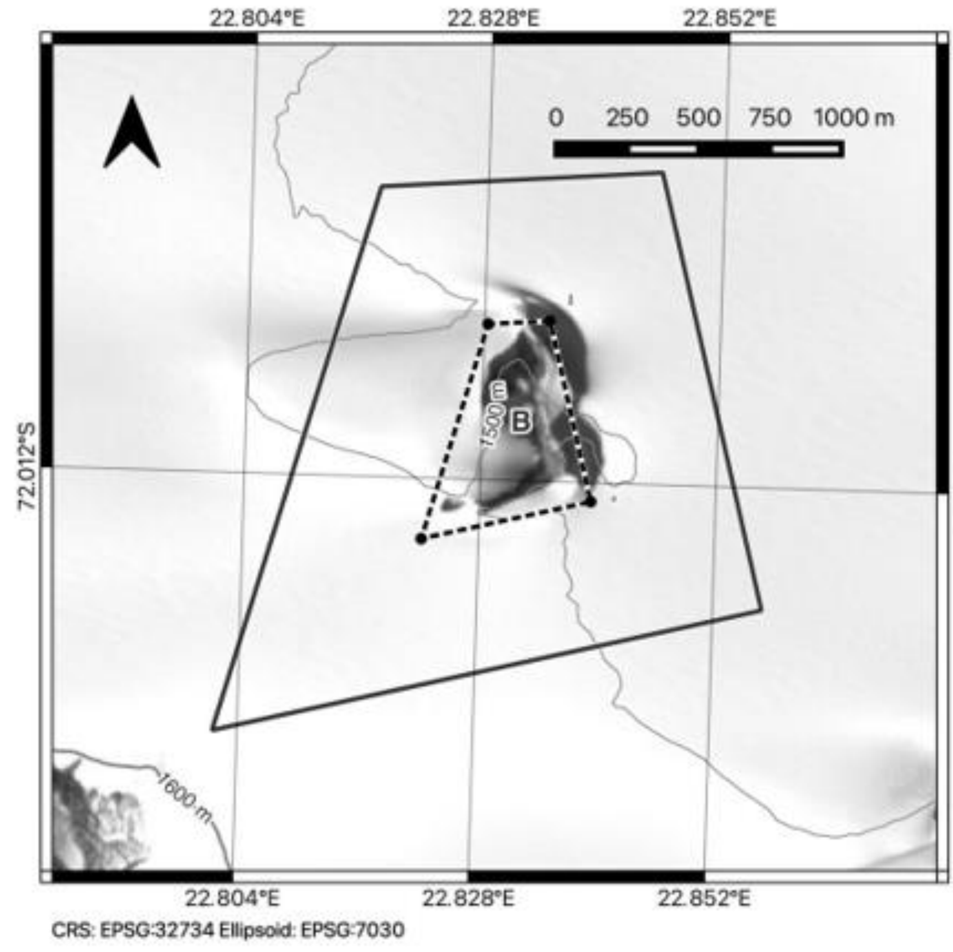
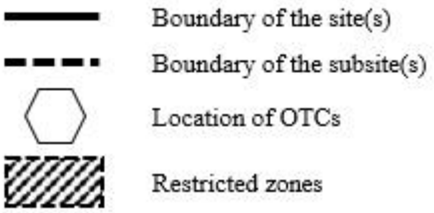


Figure 6. Map of the Pingvinane Range (C) with the 7 nunataks. The different subsites (C1-C7) are marked with a polygon with dashed line. The site (C) consists of the polygon marked by the solid line. The small hexagon marks the location of OTCs 3 and 4 on subsite C4. Map contains modified Copernicus Sentinel data [2019].

Legend:



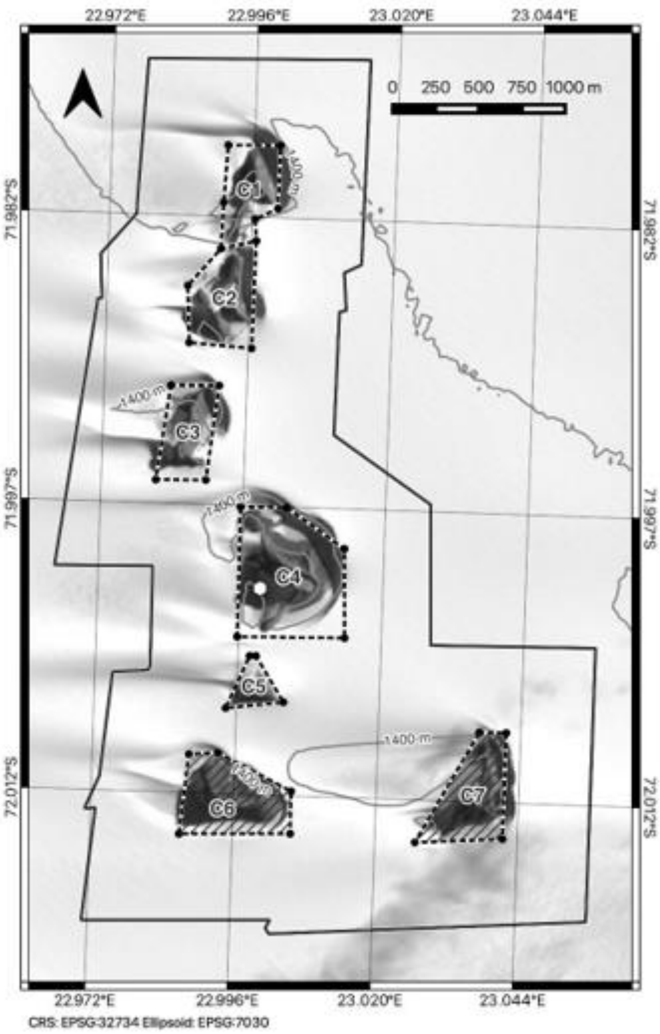


Figure 7. Map of Perlebandet Northern (DN) with a polygon with dashed line indicating the boundaries of the subsite and a polygon with a solid line indicating the boundaries of the site. The small hexagons mark the location of OTCs 9, 10, 15, 16 and 17. Map contains modified Copernicus Sentinel data [2019].

Legend:

Boundary of the site(s)

Boundary of the subsite(s)

Location of OTCs

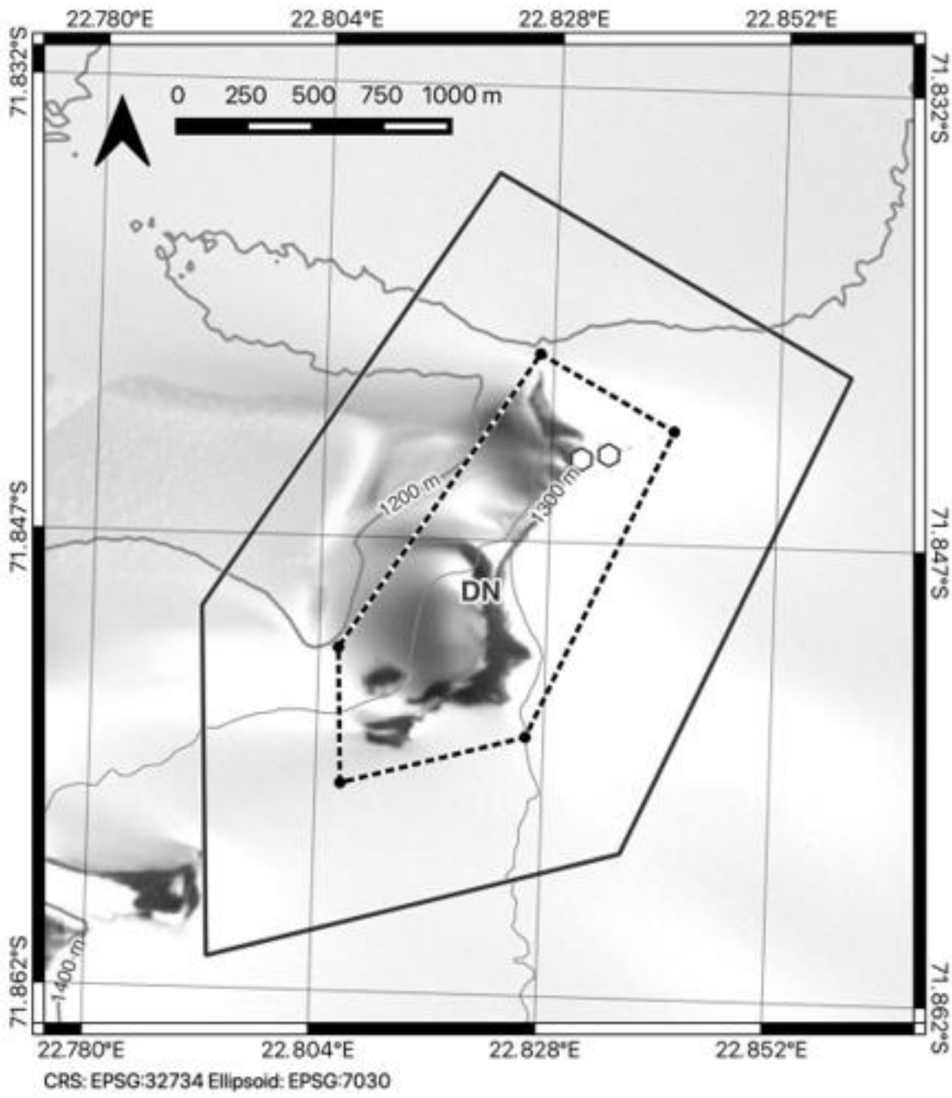


Figure 8. Map of Perlebandet South (DS) with a polygon with dashed line indicating the boundaries of the subsite and a polygon with a solid line indicating the boundaries of the site. Map contains modified Copernicus Sentinel data [2019].

Legend:

Boundary of the site(s)

Boundary of the subsite(s)

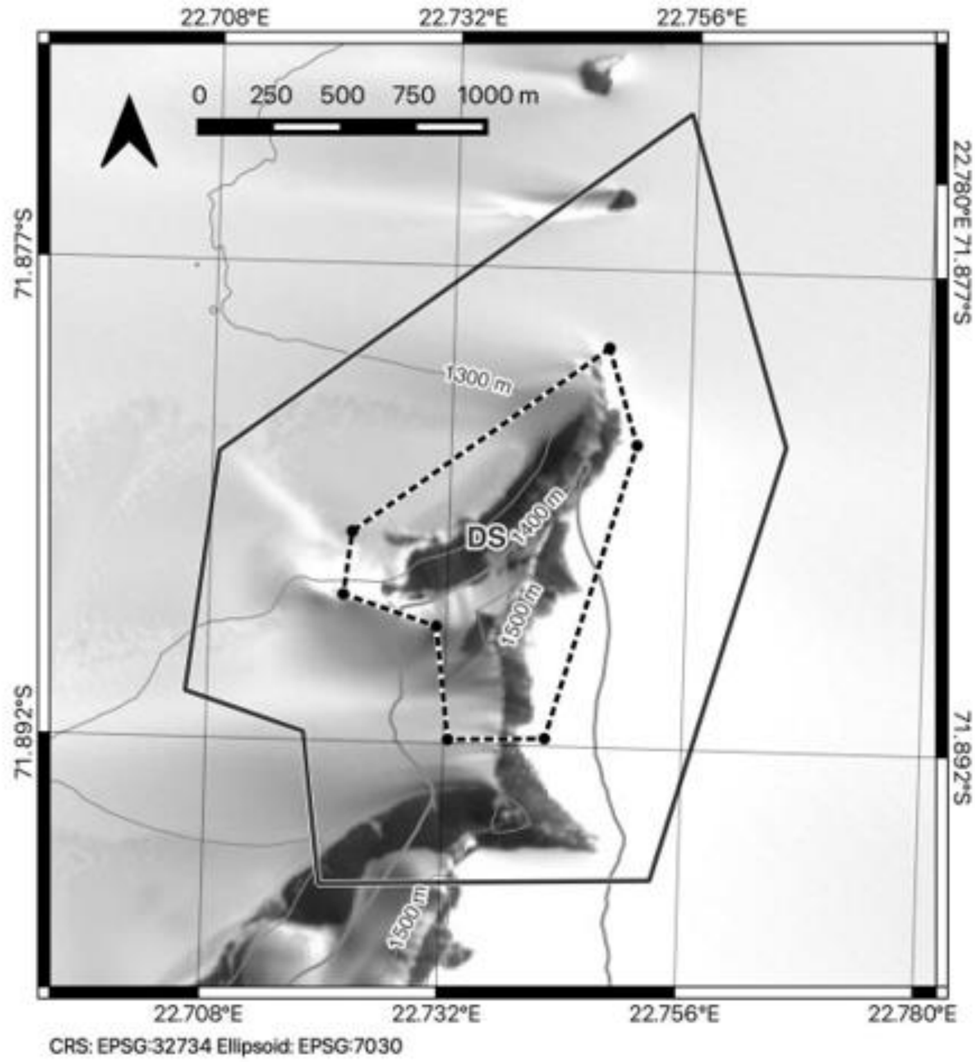
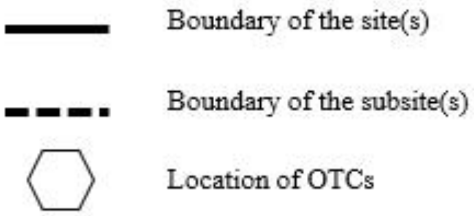


Figure 9. Map of Teltet Nunatak (E) with a polygon with dashed line indicating the boundaries of the subsite and a polygon with a solid line indicating the boundaries of the site. The small hexagons mark the location of OTCs 5 and 6. Map contains modified Copernicus Sentinel data [2019].

Legend:



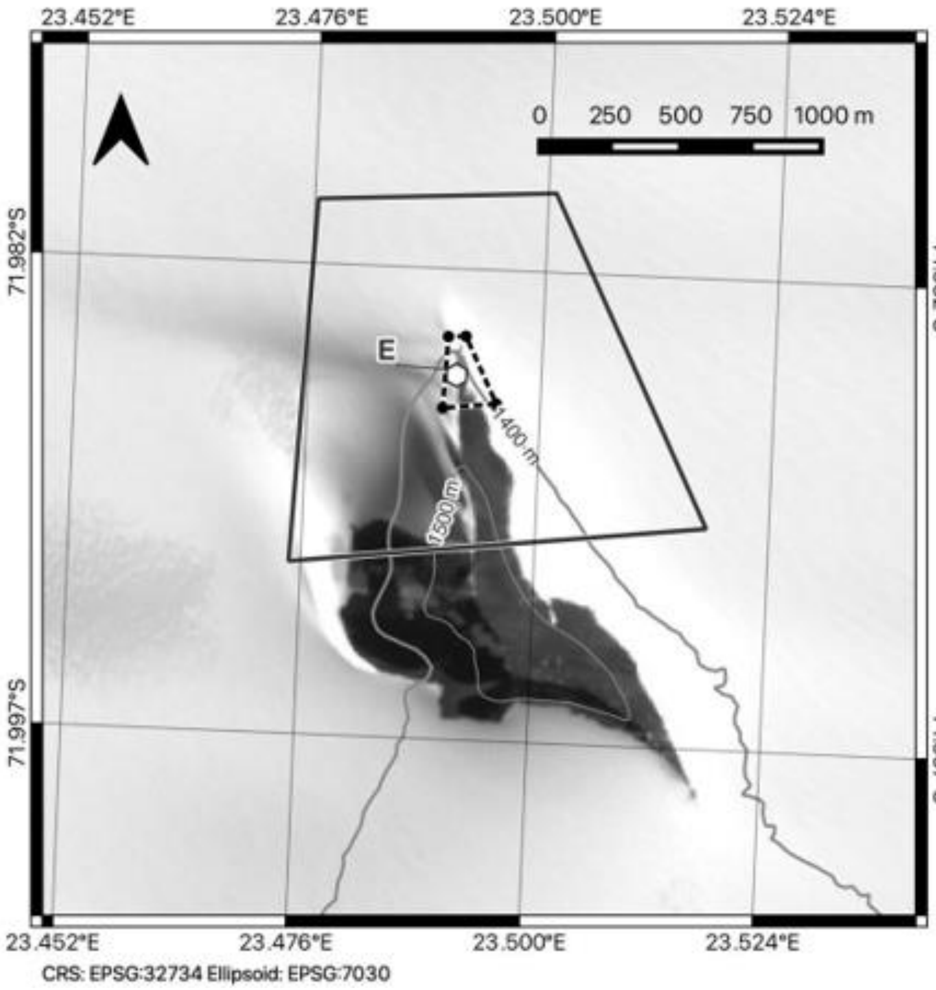
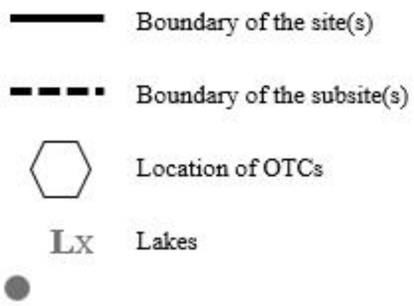
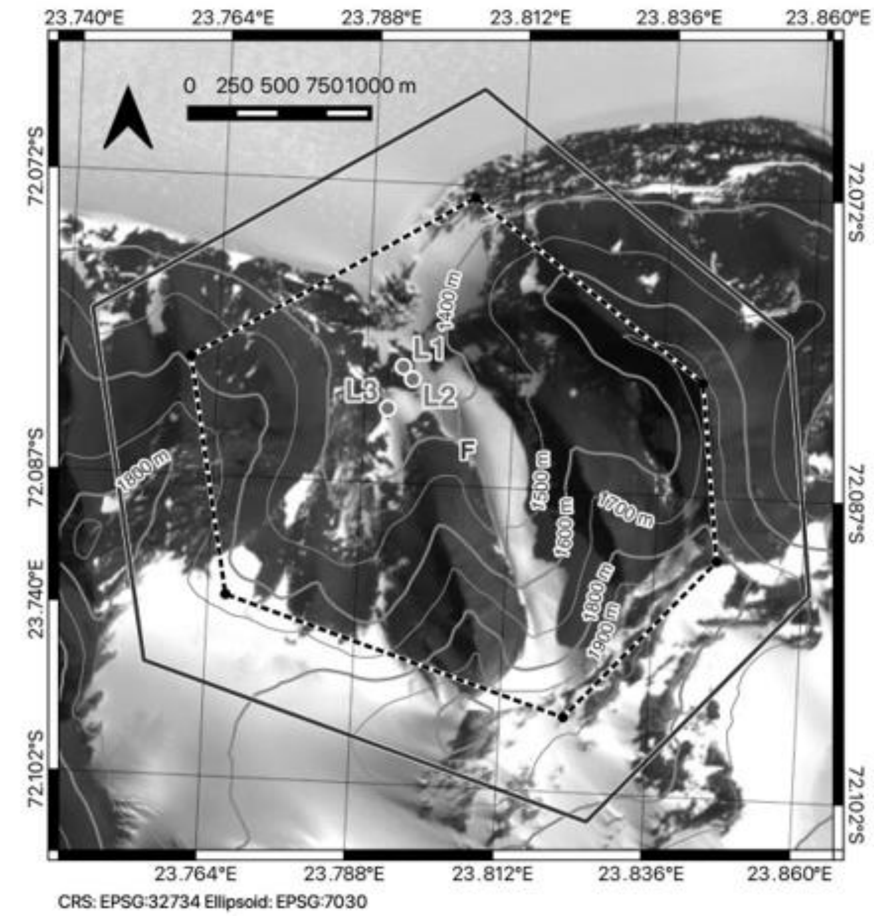


Figure 10. Map of Yûboku-dani Valley (F) with a polygon with dashed line indicating the boundaries of the subsite and a polygon with a solid line indicating the boundaries of the site. The three blue dots named L1, L2 and L3 mark the location of the three lakes present in the valley. Map contains modified Copernicus Sentinel data [2019].

Legend:





Appendix A: pictures by scientists of the Western Sør Rondane Mountains sites of the ASPA.

1) Landscape of Western SRM

© Cyril d'Haese

2) Landscape of the Western SRM

© Cyril d'Haese

3) Landscape of Western SRM

© Karolien Peeters

4) Striking rock patterns in Western SRM

© Cyril d'Haese

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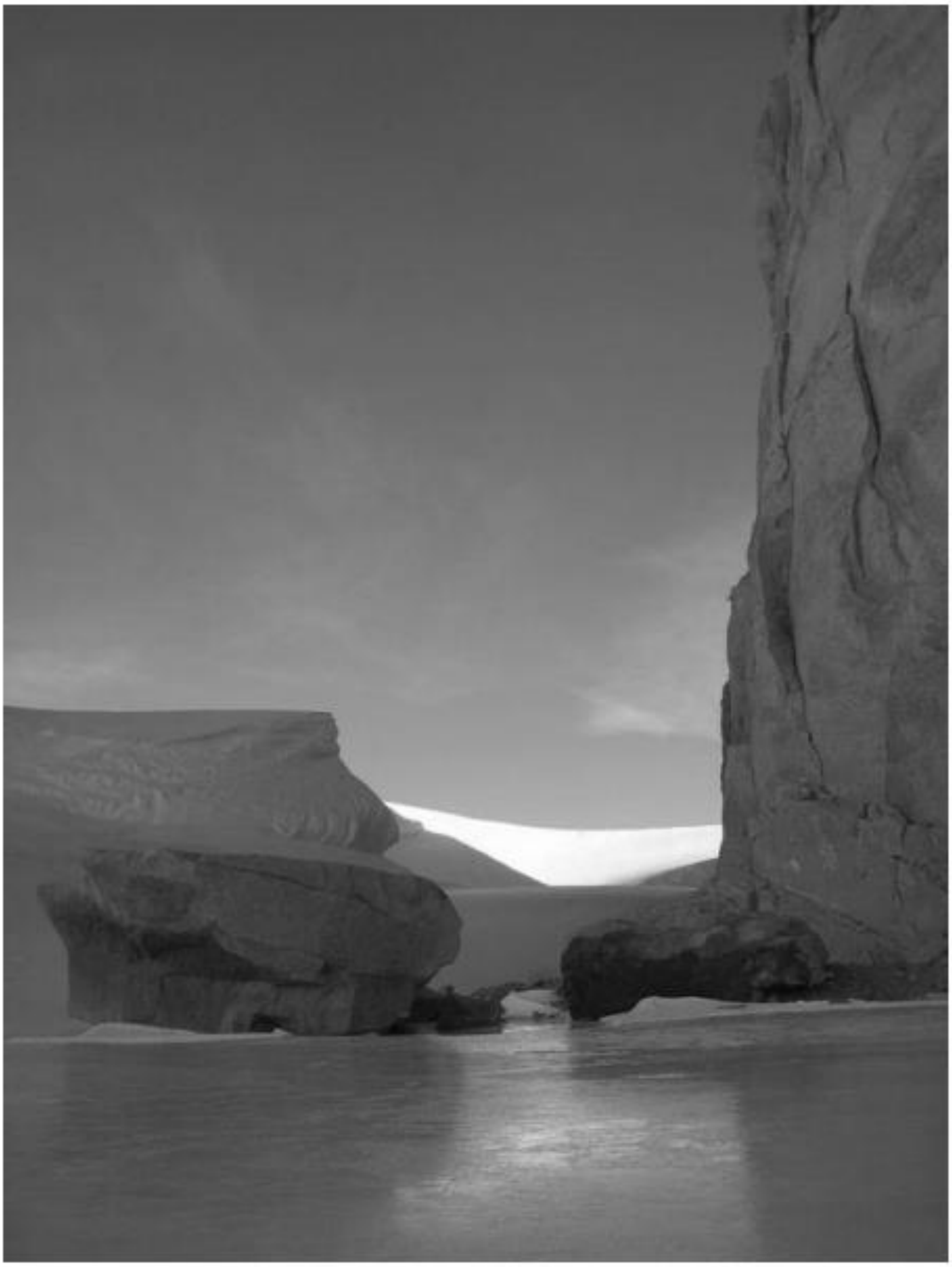
5) Tanngarden Nunatak and Ridge (site A)

6) Windscoop at Petrellnuten Nunatak (site B)



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7) Scientists underway by skidoos to the Pingvinane Nunataks (site C)

This picture was selected for the virtual exhibition 'La Preuve par l'image' of the European Researcher Night of 2020 in the University of Liège

© Valentina Savaglia | Juri Klusak (Orthodrone)

8) View from Pingvinane Nunataks to the South (site C)

© Annick Wilmotte

9) Range of Pingvinane nunataks from the plane (site C)

10) Pingvinane Nunatak 1 (subsite C1)

11) Pingvinane Nunatak 6 (subsite C6)

12) Pingvinane Nunatak 6 (subsite C6)

13)Teltet Nunatak (site E)

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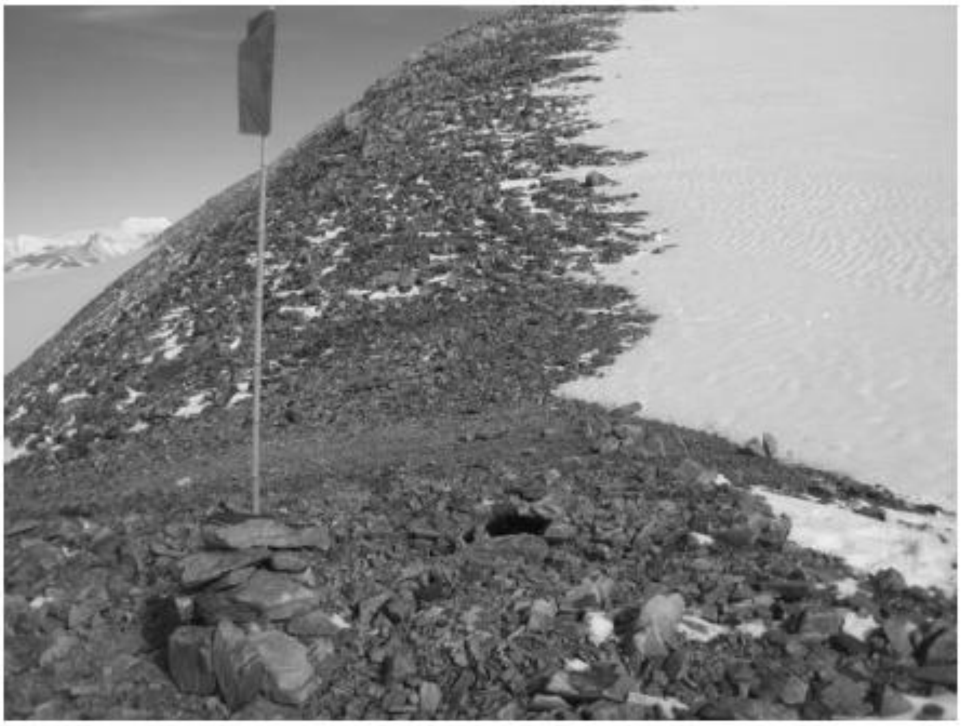
14) OTC on Teltet Nunatak (site E)



15) Yûboku-dani Valley (site F)

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E03096019

978-1-5286-4761-8