The Antarctic Treaty

Measures adopted at
the Forty-fourth Consultative Meeting

Berlin, 23 May – 2 June 2022

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by the Secretary of State for Foreign, Commonwealth and Development Affairs
by Command of His Majesty
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THE ANTARCTIC TREATY - MEASURES ADOPTED AT THE FORTY-FOURTH ANTARCTIC TREATY CONSULTATIVE MEETING

Berlin, Germany 23 May – 2 June 2022

The Measures[1] adopted at the Forty-fourth 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 17 (2022).

The approval procedures set out in Article 8 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty apply to Measures 18 (2022).

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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 and Forty-third 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 Berlin, Germany 23 May – 2 June 2022

Measure 1 (2022)

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

The Representatives,

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

Recalling

- Measure 1 (2008), which designated Southwest Anvers Island and Palmer Basin as Antarctic Specially Managed Area No 7 and annexed a Management Plan for the Area;
- Measures 2 (2009), 14 (2010) and 11 (2019) which adopted a revised Management Plan for ASMA 7;

Noting that the Committee for Environmental Protection ("CEP") has endorsed a revised Management Plan for ASMA 7;

Noting Measure 14 (2022) concerning Antarctic Specially Protected Area ("ASPA") No 139 (Biscoe Point, Anvers Island), Measure 5 (2022) concerning ASPA 113 (Litchfield Island, Arthur Harbor, Anvers Island, Palmer Archipelago) and Measure 19 (2021) concerning ASPA 176 (Rosenthal Islands, Anvers Island, Palmer Archipelago), which are all located within ASMA 7;

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

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

That:

1. the revised Management Plan for Antarctic Specially Managed Area No 7 (Southwest Anvers Island and Palmer Basin), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Managed Area No 7 annexed to Measure 11 (2019) be revoked.

Management Plan for Antarctic Specially Managed Area No. 7

SOUTHWEST ANVERS ISLAND AND PALMER BASIN

Introduction

The region that includes southwest Anvers Island, the Palmer Basin and its fringing island groups has a wide range of important natural, scientific and educational values and is an area of considerable and increasing scientific, tourist and logistic activities. The importance of these values and the need to provide an effective means to manage the range of activities was recognised with adoption of the area as a Multiple-Use Planning Area for voluntary observance at the XVIth Antarctic Treaty Consultative Meeting (1991). With the acquisition of new data and information and changes to logistics and the pressures arising from human activities in the region, the original plan was comprehensively revised and updated to meet current needs as an Antarctic Specially Managed Area (ASMA) in 2008 and 2019, such that the Area now encompasses 3238 km². The present plan remains consistent with that adopted in 2019, although has been brought up to date to reflect zoning changes within the Area.

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

Antarctic Specially Protected Area (ASPA) No.113 Litchfield Island, ASPA No.139 Biscoe Point and ASPA No.176 Rosenthal Islands lie within the Area. Antarctic Important Bird Areas (IBAs) Nos. 085 Cormorant Island, 086 Litchfield Island, 087 Joubin Islands and 088 Rosenthal Islands have been identified within the Area. The Area is situated within Environment B – Antarctic Peninsula mid-northern latitudes geologic and Environment E – Antarctic Peninsula, Alexander and other islands, based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)). Areas of ice-free ground classified as Region 3 – Northwest Antarctic Peninsula under the Antarctic Conservation Biogeographic Regions classification (Resolution 3 (2017)) lie within the Area.

1. Values to be protected and activities to be managed

- *Scientific values*

The diverse and easily accessible assemblages of marine and terrestrial flora and fauna in the southwest Anvers Island and Palmer Basin area are particularly valuable for science, with some datasets spanning more than 100 years and intensive scientific interest beginning in the 1950s. Studies have been carried out on a wide variety of topics, including long-term monitoring of seal and bird populations, surveys of plants and animals in both the terrestrial and sub-tidal environments, investigations of the physiology and biochemistry of birds, seals, terrestrial invertebrates and zooplankton, the behavior and ecology of planktonic marine species, physical oceanography, and marine sedimentology and geomorphology. While the United States maintains the only permanent research station within the Area, research in these fields has been undertaken by scientists from a broad range of Antarctic Treaty Parties, often as collaborative projects with scientists from the United States. Some important examples from the Palmer Long Term Ecological Research (PAL-LTER) program (https://pal.lternet.edu) are described below.

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

In particular, the United States Antarctic Program has a major and ongoing commitment to ecosystem research in the Antarctic Peninsula region, which was formalized through the designation in 1990 of the area around Palmer Station (United States) as a Long Term Ecological Research (LTER) site. The PAL-LTER site is part of a wider network of LTER sites, and one of only two in the Antarctic, designed specifically to address important research questions related to environmental change over a sustained period spanning more than several decades. Since 1991, the PAL-LTER program has included spatial sampling during annual and seasonal cruises within a large-scale (200,000 km²) regional grid west of the Antarctic Peninsula, as well as temporal sampling from October to April in the local area adjacent to Palmer Station. The PAL-LTER and the British Antarctic Survey (BAS) are collaborating on research comparing the marine ecosystem in the Palmer Basin region with that in Marguerite Bay approximately 400 km further to the south. In the Palmer region, the ecosystem is changing in response to the rapid regional warming first documented by BAS scientists. In addition, collaboration has been established as part of the International Polar Year with scientists from France and Australia using metagenomic tools to understand microbial community adaptations to the polar winter.

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

Extensive seabird research has focused on the ecology of Adélie penguins and their avian predators and scavengers within the inshore 50 km² PAL-LTER grid close to Palmer Station. Colonies on 18 islands in this area are visited every 2-7 days in the summer season, and three more distant control sites within the ASMA are also visited infrequently to assess the extent of possible disturbance from activities around Palmer Station. Sea ice forms a critical winter habitat for Adélie penguins, and interdisciplinary research has focused on the impacts of changes in the frequency, timing and duration of sea-ice on the life histories of this and other bird species, as well as on prey populations.

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

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

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

- *Flora and fauna values*

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

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

The two native Antarctic vascular plants, Deschampsia antarctica and Colobanthus quitensis, are commonly found on surfaces with fine soil in the area around Arthur Harbor, although they are relatively rare along the Antarctic Peninsula (Komárková et al. 1985). The vascular plant communities found at Biscoe Point (ASPA No.139) are some of the largest and most extensive in the Anvers Island region, and are particularly abundant for such a southerly location. Dense communities of mosses and lichens are also found on Litchfield Island (ASPA No.113) – a site specially protected for exceptional vegetation values – and at several other locations around Arthur Harbor such as Norsel Point and Cormorant, Hermit and Limitrophe islands. Some of these sites have been heavily damaged by Antarctic fur seal (Arctocephalus gazella) and Elephant seal (Mirounga leonina) activity, which has increased over the past 30 years.

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

- *Educational and visitor values*

The southwest Anvers Island area holds a special attraction to tourists because of its biological diversity, accessibility and the presence of Palmer Station. These features offer tourists the opportunity to observe wildlife, and gain an appreciation of Antarctic environments and scientific operations. Outreach to tourists via local tours and shipboard lectures is a valuable educational tool, and information is also made available to school students in the United States by initiatives through the Palmer science community.

2. Aims and objectives

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

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

- Facilitate scientific research while maintaining stewardship of the environment;

- Assist with the planning and coordination of human activities in the region to manage actual or potential conflicts among different values (including those of different scientific disciplines), activities and operators;
- Ensure that any marine harvesting activities are coordinated with scientific research and other activities taking place within the Area. This coordination could include the development of a plan for harvesting within the Area in advance of any such activities taking place.
- Ensure the long-term protection of scientific, ecological, and other values of the Area by minimizing disturbance to or degradation of these values, including disturbance to natural features and fauna and flora, and by minimizing the cumulative environmental impacts of human activities;
- Prevent the unintended introduction of species not native to the Area, and minimize as far as practicable the unintended transfer of native species within the Area;
- Minimize the footprint of all facilities and scientific experiments established in the Area, including the proliferation of field camps and boat landing sites;
- Minimize any physical disturbance, contamination and wastes produced within the Area, and take all practical steps to contain, treat, remove or remediate these whether produced in the course of normal activities or by accident;
- Promote use of energy systems and modes of transport within the Area that have the least environmental impact, and minimize as far as practicable the use of fossil fuels for the conduct of activities within the Area;
- Improve the understanding of natural processes and human impacts in the Area, including through the conduct of monitoring programs; and
- Encourage communication and co-operation between users of the Area, in particular through dissemination of information on the Area and the provisions that apply.

3. Management activities

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

- National Programs operating within the Area should establish a Southwest Anvers Island and Palmer Basin Management Group to oversee coordination of activities in the ASMA. The Management Group is established to:
  - facilitate and ensure effective communication among those working in or visiting the Area;
  - provide a forum to resolve any actual or potential conflicts in use;
  - help minimize the duplication of activities;
  - maintain a record of activities and, where practical, impacts in the Area;
  - develop strategies to detect and address cumulative impacts;

- disseminate information on the Area, in particular on the activities occurring and the

  management measures that apply within the Area; including through maintaining this information electronically;
- review past, existing, and future activities and evaluate the effectiveness of

  management activities; and
- make recommendations on the implementation of this Management Plan.

* National Programs operating within the Area shall maintain copies of the current version of the management plan and supporting documentation in appropriate stations and research hut facilities and make these available to all persons in the Area, as well as electronically;
* National Programs operating within the Area and tour operators visiting should ensure that their personnel (including staff, crew, passengers, scientists and any other visitors) are briefed on, and are aware of, the requirements of this Management Plan, and in particular the Environmental (Appendix A), Scientific (Appendix B), and Non-Governmental Visitor (Appendix C) Guidelines, and guidelines for Restricted Zones (Appendix D) that apply within the Area;
* Tour operators and any other group or person responsible for planning and / or conducting non-governmental activities within the Area should coordinate their activities with National Programs operating in the Area in advance to ensure they do not pose risks to the values of the Area and that they comply with the requirements of the Management Plan;
* The United States Antarctic Program determines annually the number of tourist vessel visits to Palmer Station (approximately 12 per season) through a pre-season scheduling and approval process;
* National Programs operating within the Area should seek to develop best practices with a view to achieving the objectives of the Management Plan, and to exchange freely such knowledge and information;
* Signs and / or markers should be installed where necessary and appropriate to show the location or boundaries of ASPAs, zones, research sites, landing sites and / or campsites within the Area. Signs and markers should be installed on a case-by-case basis and re-evaluated periodically. They should be informative and obvious, yet unobtrusive. Signs and markers 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 Evaluate whether the Management Plan is effective and to ensure management measures are adequate. The Management Plan, Code of Conduct and Guidelines shall be revised and updated as necessary; and
* National Programs operating within the Area shall take such steps as are necessary and practical to ensure the requirements of the Management Plan are observed.

4. Period of Designation

Designated for an indefinite period.

5. Maps and photographs

Table 1: List of Management Plan maps.

Map	Title	Source Scale	Estimated Error (+/- m)
Overviews			
Map 1	Regional map and ASMA boundary	1:400,000	100
Map 2	Southwest Anvers Island	1:130,000	100
Map 3	Arthur Harbor & Palmer Station access	1:45,000	2
Operations Zone			
Map 4	Palmer Station Operations Zone	1:4000	1
Restricted Zones			
Map 5	Norsel Point	1:5000	1
Map 6	Humble Island	1:2500	1
Map 7	Elephant Rocks	1:2500	1
Map 8	Torgersen Island	1:3000	1
Map 9	Bonaparte Point / Kristie Cove	1:2500	1
Map 10	Shortcut Island / Shortcut Point	1:5000	1
Map 11	Christine Island	1:5000	1
Map 12	Hermit Island	1:7000	1
Map 13	Laggard Island	1:5000	1
Map 14	Limitrophe Island	1:5000	1
Map 15	Stepping Stones	1:2500	1
Map 16	Cormorant Island	1:5000	1
Map 17	Dream Island	1:5000	2
Map 18	Joubin Islands	1:50,000	10

6. Description of the Area

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

- *General description*

Anvers Island is the largest and most southerly island in the Palmer Archipelago, located approximately 25 km west of the Antarctic Peninsula. It is bounded by Neumayer Channel and Gerlache Strait in the southeast and Bismarck Strait to the south (Map 1). Anvers Island is heavily glaciated, the southwestern half being dominated by the Marr Ice Piedmont, a broad expanse of permanent ice rising gently from the coast to around 1000 m elevation. The southern and western coastlines of Anvers Island within the Area comprise mainly ice cliffs on the edge of the Marr Ice

Piedmont, punctuated by small rocky outcrops, ice-free promontories and numerous small near-shore islands. Other prominent land features within the Area include ice-free Cape Monaco at the southwestern extremity of Anvers Island, and Cape Lancaster in the southeast. These ice-free areas form important sites for animal and plant colonisation.

Six main island groups exist within the Area: in the north are the Rosenthal Islands (~22 km NW of Palmer Station, ASPA No.176). Fringing the Palmer Basin are the Joubin Islands, the Arthur Harbor island group (location of Palmer Station), the Wauwermans Islands, the Dannebrog Islands and the Vedel Islands. These island groups are of low relief, generally of less than 100 m in elevation, although local topography can be rocky and rugged together with small relict ice-caps.

Palmer Station (United States) (64° 46.45'S, 64° 03.25'W) is located within Arthur Harbor on Gamage Point, an ice-free promontory on the southwestern coast of Anvers Island at the edge of the Marr Ice Piedmont (Maps 3 & 4).

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

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

- *Boundaries of the Area*

The Southwest Anvers Island and Palmer Basin ASMA encompasses an area of approximately 3238 km², including both terrestrial and marine components. For ease of navigation, the boundaries of the Area follow geographic features where practical and latitude/longitude lines in open ocean areas remote from prominent land features. The northeastern boundary of the Area is defined as a line extending parallel to and approximately one kilometer inland from the southwest Anvers Island coastline. This terrestrial boundary extends from a northerly location at 64° 33'S, 64° 06'W, ~3.1 km north of Gerlache Island, to 64° 51.35'S, 63° 42.2'W at Cape Lancaster in the south. From Cape Lancaster, the eastern boundary is defined as the 63° 42.2'W line of longitude extending 7.9 km across Bismarck Strait to 64° 55.6'S on Wednesday Island, the most easterly of the Wauwermans Islands. The boundary then follows a general southwesterly direction to 65° 08.55'S, 64° 14.37'W , at the southern extremity of the Vedel Islands, following the eastern coastlines of the Wauwermans, Dannebrog and Vedel island groups. The southern boundary of the area is defined as the 65° 08.55'S line of latitude extending due west from 64° 14.37'W in the Vedel Islands to 65° 00'W.

The northern boundary is defined as the line of latitude extending from 64° 33'S, 64° 06'W to the coast (~3.1 km north of Gerlache Island) and thence due west to the 65° 00'W line of longitude. The western boundary of the Area is defined as the 65° 00'W line of longitude, extending between 64° 33'S in the north and 65° 08.55'S in the south.

The boundaries of the Area have been designed to include areas of high ecological value while also maintaining a practical configuration for ease of use and navigation. The original Multiple-use Planning Area boundary has been extended northwards to include the Rosenthal Islands (ASPA No.176), which contain several large colonies of chinstrap and gentoo penguins that may function as source populations for other colonies in the southwest Anvers Island region (W. Fraser pers. comm. 2006). The original boundary has also been extended westwards and southwards to include the full extent of the Palmer Basin, because of the biological, palaeoecological and oceanographic importance of this feature.

The extensive ice fields on the Marr Ice Piedmont are excluded because they do not possess values related to the core objectives of the management plan. The boundary encompasses all ice-free coastal areas, the Palmer Basin which plays a key role in regional ecosystem processes, and the nearby associated island groups, which are biologically important and also the focus of most human activity in the region.

- *Climate*

The western Antarctic Peninsula is experiencing the most rapid warming of any marine ecosystem on the planet (Ducklow et al. 2007). Between 1974-96 the mean annual temperature at Palmer Station was –2.29° C, with an average monthly air temperature in August of –7.76° C and in January 2.51° C (Baker 1996). Between 2010-17 the mean annual temperature at Palmer Station was –1.8° C, with an average monthly air temperature in August of –5.94° C, and in January 1.72° C. The maximum temperature recorded April 1989 through October 2018 was +11.6° C on 08 March 2010, while the minimum was -26.0° C on 24 August 1995. Data from Faraday / Vernadsky Station 53 km to the south demonstrate a statistically significant trend of annual average temperature rise, from –5.4° in 1951 to –2.5° in 2001, an average rate of 0.058° C per annum (Smith et al. 2003). Storms and precipitation are frequent, with an annual average of approximately 636 mm water equivalent of precipitation received in the form of snow and rain, with an average annual snowfall depth of 344 cm. Winds are persistent but generally light to moderate in strength (~10-11 knots on average), prevailing from the northeast.

- *Glaciology, geology and geomorphology*

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

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

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

- *Freshwater habitat*

Throughout the Area there are no significant lakes or streams, although there are numerous small ponds and temporary summer melt streams (Lewis Smith 1996). These are mainly on Norsel Point and some of the offshore islands in Arthur Harbor: notably on Humble Island, and also found on Breaker, Shortcut, Laggard, Litchfield and Hermit islands, and at Biscoe Point (W. Fraser, pers. comm. 2006), although many are heavily contaminated by neighboring penguin colonies and groups of non-breeding skuas. The streams possess few biota other than marginal mosses (e.g. Brachythecium austrosalebrosum, Sanionia uncinata), which are a favored habitat for the larvae of the Antarctic wingless midge, Belgica antarctica. However, the ponds support a diverse micro-algal and cyanobacterial flora, with over 100 taxa being recorded, although numbers vary considerably between ponds (Parker & Samsel 1972). Of the freshwater fauna there are numerous species of protozoans, tardigrades, rotifers, and nematodes, and a few free-swimming crustaceans of which the anostracan Branchinecta gaini (Antarctic fairy shrimp) and copepods Parabroteus sarsi and Pseudoboeckella poppii are the largest and most conspicuous (Heywood 1984).

- *Flora*

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

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

Lichen-dominated (e.g. species of Usnea, Pseudephebe, Umbilicaria and many crustose forms) communities of the fruticose and foliose lichen sub-formation (often referred to as fellfield) are widespread on most stable, dry stony ground and exposed rock surfaces, often with associated cushion-forming mosses (e.g. species of Andreaea, Hymenoloma, Orthogrimmia and Schistidium) (Lewis Smith & Corner 1973). Rocks and boulders close to the shore, especially where influenced by nutrient (nitrogen) input from nearby penguin and petrel colonies, usually support various communities of the crustose and foliose lichen sub-formation. Many of the species (e.g. Acarospora, Amandinea, Buellia, Caloplaca, Haematomma, Lecanora, Lecidea, Xanthoria) are brightly coloured (orange, yellow, gray-green, brown, white).

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

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

- *Invertebrates*

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

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

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

- *Birds*

Three species of penguin, Adélie (Pygoscelis adeliae), Chinstrap (P. antarcticus) and Gentoo (P. papua), breed in the southwest Anvers Island area (Parmelee & Parmelee 1987, Poncet & Poncet 1987). In the past the most abundant species was the Adélie penguin, which breeds on Biscoe Point, Christine, Cormorant, Dream, Humble, and Torgersen islands, as well as the Joubin and Rosenthal islands (Maps 2-18). Numbers of Adélie penguins have declined significantly over the last 30 years, thought to be linked to the effects of the changing climate on sea-ice conditions, snow accumulation and prey availability (Fraser & Trivelpiece 1996, Fraser & Hofmann 2003, Fraser & Patterson 1997, Trivelpiece & Fraser 1996). Numbers of Adélie penguins breeding on Litchfield Island declined from 884 pairs to 143 pairs between 1974/75 and 2002/03, with no pairs breeding in 2017/18 (W. Fraser pers. comm. 2018). Today, the Gentoo penguin is locally the most abundant penguin species (Fraser pers. comm. 2019). Chinstrap penguins are present on Dream Island, on small islands near Gerlache Island, and on the Joubin Islands. The Rosenthal Islands contain source populations of Chinstrap and Gentoo penguins that are likely to be closely linked to other colonies in the southwest Anvers Island region. In the last decade there has been an expansion of ice-intolerant Gentoo penguins and a coincident decrease in ice-obligate Adélie penguins near Palmer Station (Fraser et al. 2013; Ducklow et al. 2013). Gentoo penguins are thought to be increasing in the region in response to the regional warming, and are colonising new sites in recently deglaciated areas or sites vacated by Adélie penguins. In particular, small glaciers on the Wauwermans Islands are retreating and may provide important habitat for new Gentoo colonies and a new colony was discovered near Dream Island in 2019 (W. Fraser pers. comm. 2019).

Southern Giant petrels (Macronectes giganteus) breed at numerous locations within the Area. Imperial shags (Leucocarbo atriceps bransfieldensis) breed on Cormorant Island and in the Joubin and Rosenthal islands. Imperial shags continue to roost on Elephant Rocks, although no longer breed there (Patterson-Fraser pers. comm. 2019). Other breeding bird species occurring in the Area include Kelp gulls (Larus dominicanus), Wilson's Storm petrels (Oceanites oceanicus), Snowy sheathbills (Chionis alba), South Polar skuas (Catharacta maccormicki), Brown skuas (C. antarctica) and Antarctic terns (Sterna vittata). Common non-breeding visitors include Southern fulmars (Fulmarus glacialoides), Antarctic petrels (Thalassoica antarctica), Cape petrels (Daption capense) and Snow petrels (Pagadroma nivea). A full list of breeding, frequent and less common or transient visitors recorded in the Area is provided in Appendix E.

Antarctic Important Bird Area (IBA) No. 085 Cormorant Island (Map 16) qualified for the large number of Imperial shags (729 pairs) present on the island based on data recorded in 1985 (Harris et al. 2015). The breeding colony has declined substantially and in recent years ~30 breeding pairs have been present (Fraser pers. comm. 2019). IBA No.086 Litchfield Island (Map 3), qualified on the basis of the South Polar skua colony, with up to 50 breeding pairs present on the island. IBA No. 087 Joubin Islands (Map 18), qualified for the large number of Imperial shags (>250 pairs) present in the northern part of the island group, also based on data collected by S. and J. Poncet in 1985 (Harris 2015), although a census undertaken in 2019 indicated only ~50 pairs present (Fraser pers. comm. 2019). IBA No. 088 Islet South of Gerlache Island, Rosenthal Islands (Map 2; see maps for ASPA No.176 for more detail), qualified on the grounds of the large Gentoo penguin colony present. Improved mapping data show this site was incorrectly located in the IBA assessment (Harris et al. 2015), and this colony lies not on Island 303 but on Peninsula 306. More recent data show that 2442 pairs were present in February 2016 (Fraser pers. comm. 2018), which is less than the threshold for IBA qualification. Nevertheless, for penguins in aggregate and taking other species into consideration, the number of breeding individuals present within the boundary of the ASPA is more than sufficient to qualify as an IBA (IBA Criteria A4iii – at least 10,000 seabirds present).

- *Marine mammals*

There are few published data on the marine mammals within the area. Cruises conducted in Gerlache Strait have observed Fin (Balaenoptera physalus), Humpback (Megaptera novaeangliae) and Southern Bottlenose (Hyperoodon planifrons) whales (Thiele 2004). Recent data indicates a rapidly growing Humpback whale population in the region (Pallin et al. 2018). Anecdotal observations by Palmer Station personnel and visitors have noted Fin, Humpback, Sei (Balaenoptera borealis), Southern Right (Eubalaena australis), Minke (Balaenoptera bonaerensis) and Killer (Orcinus orca) whales within the Area, as well as Hourglass dolphins (Lagenorhynchus cruciger) (W. Fraser pers. comm. 2007). Weddell (Leptonychotes weddellii) and Southern Elephant (Mirounga leonina) seals breed within the Area and haul out on accessible beaches, and Crabeater (Lobodon carcinophagus) and Leopard (Leptonyx hydrurga) seals are also commonly seen at sea and on ice floes within the Area. Numbers of non-breeding Antarctic fur seals (Arctocephalus gazella), mainly juvenile males, have increased in recent years, and depending on the time of year hundreds to thousands of individuals may be found on local beaches throughout the Area. Their increasing abundance is damaging vegetation at lower elevations (Lewis Smith 1996, Harris 2001). Despite the lack of published data concerning marine mammals within the Area, their presence is likely to be related to foraging for Antarctic krill, which forms an important component in their diets (Ducklow et al. 2007). A list of marine mammals observed within the Area is provided in Appendix E.

- *Oceanography*

The Western Antarctic Peninsula is unique as the only region where the Antarctic Circumpolar Current (ACC) is adjacent to the continental shelf. The ACC flows in a northeasterly direction off the shelf, and there is also some southward flow on the inner part of the shelf (Smith et al. 1995). Circumpolar Deep Water (CDW) transports macronutrients and warmer, more saline water onto the shelf, which has significant implications for heat and salt budgets in the southwest Anvers Island and Palmer Basin region. Circulation patterns and the presence of the CDW water mass may also affect the timing and extent of sea ice (Smith et al. 1995). The extent of sea ice cover and the timing of the appearance of the marginal ice zone (MIZ) in relation to specific geographic areas have high interannual variability (Smith et al. 1995; Stammerjohn & Smith 1996), although Smith and Stammerjohn (2001) have shown a statistically significant reduction in overall sea-ice extent in the Western Antarctic Peninsula region over the period for which satellite observations are available. The ice edge and the MIZ form major ecological boundaries, and are of particular interest in the region because of their interaction with many aspects of the marine ecosystem, including phytoplankton blooms and seabird habitat. Within the Area, the Palmer Basin is a focal point of biological and biogeochemical activity and an important area of upwelling.

- *Marine ecology*

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

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

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

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

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

- *Human activities and impact*

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

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

All fin-fishing is currently prohibited in the western Antarctic Peninsula region (CCAMLR Statistical Subarea 48.1) under CCAMLR Conservation Measure 32-02 (2017) (CCAMLR 2018). Krill fishing occurs in the offshore region to the northwest of the Palmer Archipelago, and is currently concentrated mainly around the South Shetland Islands further to the north. The total krill catch for Subarea 48.1 was reported at 154,442 tonnes in the 2015/16 season (CCAMLR 2017). Small-scale management units (SSMU) have been established for Subarea 48.1, with ASMA No. 7 being situated in SSMU Antarctic Peninsula West. The total krill catch for the SSMU was reported at 37,832 tonnes in the 2015/16 season (CCAMLR 2017). CCAMLR-related activities are therefore occurring within or close to the Area.

The krill fishery in SSMU Antarctic Peninsula West is not known to have operated within the Area in recent years. Current human activities in the Area are mainly related to science and associated logistic activities, and tourism. Palmer Station serves as the base for scientific research and associated logistic operations conducted in the western Antarctic Peninsula and Palmer Archipelago by the United States Antarctic Program and collaborators from a number of other Antarctic Treaty Parties. Scientific and logistic support is received from ships operated or chartered by the United States Antarctic Program, which visit the station approximately 15 times per year. Aircraft are not operated routinely from Palmer Station, although helicopters may visit occasionally in summer.

Local scientific transport and support is provided using small open inflatable boats, which are operated throughout the ~5 km (~3 miles) Standard Boating Area during the summer season (Map 3), with more limited trips (weather/season dependent) into the Extended Boating Area (Map 1). Frequent visits are made to islands within the Standard Boating Area for scientific research, and also for recreation by station personnel. The more capable Rigid-Hulled-Inflatable-Bottom (RHIB) boats operate from Palmer Station within the Extended Boating Area (Maps 1 & 2), which includes nearby island groups such as the Wauwermans and Joubins (weather/season dependent), enabling research activities regularly to encompass distances of up to ~30 km (~20 miles) from the station (Maps 1 & 2).

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

Between 1984-91, the number of tour ship visits each season at Palmer Station increased from 4 (340 visitors) to 12 (1300 visitors), and has remained around this level since. However, the number of visitors has increased substantially, with an average of ~6500 visiting annually between 2003-16, of which an average of ~2000 tourists per year landed. Ship visits are arranged prior to the start of the season. Tourists typically visit Palmer Station, make short small-boat cruises around nearshore islands, and in the past an annual average of ~500 tourists landed at the former Visitor Zone on Torgersen Island between 2003-16 (Map 5). Since the mid-2000s kayaking has become popular in Arthur Harbor, with an average of ~50 visitors per season undertaking this activity. Yachts also visit Palmer Station and the surrounding area, with 17 vessels visiting during the 2007/08 season.

Torgersen Island was previously divided into a Restricted Zone (researchers only) and Visitor Zone (tourist and station personnel visitors plus researchers) to enable comparisons of Adélie penguin population trends between the two sides of the island (Map 8). Studies suggested that the impacts of visits by tourists, station personnel, and scientists on breeding performance have been small compared to longer-term climate-related forcing factors (Fraser & Patterson 1997, Emslie et al. 1998, Patterson 2001). However, in recent years the number of breeding Adélie penguins within the Visitor Zone decreased more rapidly than within the Restricted Zone. While the causes and mechanisms of this trend are complex and cannot necessarily be attributed to visitor impacts, the breeding groups are now so small that it was decided to close the Visitor Zone and the whole island is now designated a Restricted Zone (Cimino and Fraser pers. comms. 2021 / 2022).

6(ii) Restricted and managed zones within the Area

This Management Plan establishes two types of zones within the Area: Operations and Restricted. The management objectives of the two types of zone are set out in Table 2. The location of all zones is shown on Maps 2 and 3. Map 4 shows the Operations Zone, and Maps 05-18 show the Restricted Zones in the context of surrounding geography with the detailed features and infrastructure present.

A new zone or zone type may be considered by the Management Group as the need arises, and those no longer needed may be delisted. Zoning updates should be given particular consideration at the time of Management Plan reviews.

Table 2: Management Zones designated within the Area and their specific objectives.

Management Zones	Specific Zone Objectives	Plan Appendix
Operations Zone	To ensure that science support facilities and related human activities within the Area are contained and managed within designated areas.	-
Restricted Zone	To restrict access into a particular part of the Area and/or activities within it for a range of reasons, e.g. owing to special scientific or ecological values, because of sensitivity, presence of hazards, or to restrict emissions or constructions at a particular site. Access into Restricted Zones should normally be for compelling reasons that cannot be served elsewhere within the Area.	D

The overall policies applying within the zones are outlined in the sections below.

- *Operations Zone*

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

- *Restricted Zones*

Fourteen sites of special ecological and scientific value are designated as Restricted Zones (Appendix D). These sites are particularly sensitive to disturbance during the summer months.

The Restricted Zones usually include a buffer extending 50 m from the shore into any adjacent marine area (Map 3 and Maps 5 – 18). A 50 m Restricted Zone buffer also extends around ASPA No. 113 Litchfield Island.

Research in Restricted Zones should be carried out with particular care to avoid or minimize trampling of vegetation and disturbance of wildlife. In order to protect sensitive bird colonies throughout the breeding season to the maximum extent possible, and also plant communities, access to Restricted Zones between 01 October to 15 April inclusive is restricted to those conducting essential scientific research, monitoring or maintenance. All non-essential small boat traffic should avoid transit of, or cruising within, the 50 m marine buffers of Restricted Zones with the exception of the narrow channel between Shortcut Point and Shortcut Island which may be used by small boats for transit when necessary. All visits to, and activities within, Restricted Zones should be recorded, in particular records should be kept of the type and quantity of all sampling.

Site-specific Guidelines for Restricted Zones are included in Appendix D.

6(iii) Structures within and near the Area

Modern Palmer Station (Map 4) consists of two main buildings, a laboratory facility and several ancillary structures including an aquarium, small boathouse, workshops, storage and communications facilities. The station is powered by two diesel-electric generators, the fuel for which is stored in two double-walled tanks. A pier has been constructed adjacent to the station at the entrance to Hero Inlet, which may accommodate medium-sized scientific and logistic support ships. The station is operated year-round and can accommodate approximately 44 people, with a summer occupancy of at least 40, and a winter complement of around 18-32.

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

Entry to an Antarctic Specially Protected Area (ASPA) is prohibited unless a permit for entry has been issued by a national authority. Three ASPAs are designated within the Area (Maps 1 – 3):

- ASPA No. 113 Litchfield Island (Map 3);
- ASPA No. 139 Biscoe Point (Map 1);
- ASPA No. 176 Rosenthal Islands (Maps 1 & 2).

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

7. Code of Conduct

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

7(i) Access to and movement within the Area

Access to the Area is generally by ship (Map 1), with occasional access by helicopter. There are no special restrictions on the transit of vessels through the Area, with the exception of seasonal buffer zones extending 50 m from the shore at a small number of islands designated as Restricted Zones (see Section 6(ii)). Prior to visiting Palmer

Station, radio contact should always be made to obtain guidance on local activities being conducted in the region (Map 3).

Tour ships, yachts and National Program vessels may stand offshore and access Palmer Station and the surrounding coast and islands by small boat, taking into account the access restrictions applying within designated zones and ASPAs.

Small open inflatable boat operations from Palmer Station are normally undertaken during the summer within the Standard Boating Area, which extends up to ~5 km (~3 miles) from the station (Map 3), with more limited trips (weather/season dependent) into the Extended Boating Area (Map 1). Rigid-Hulled-Inflatable-Bottom (RHIB) boats may operate from Palmer Station within the Extended Boating Area, which extends up ~30 km from the station (Maps 1 & 2). Small boats should operate no closer than 300 m from the glacier front along the Anvers Island coastline as a safety precaution against glacier calving. See also Appendix A.

Access to Restricted Zones from 01 October to 15 April inclusive is restricted to those conducting essential scientific research, monitoring or maintenance, including the nearshore marine area within 50 m of the coast of these zones (see Section 6(ii) for details). Access to ASPAs is prohibited except in accordance with a Permit issued by an appropriate national authority.

Overflight of wildlife colonies below 2000 ft (~610 m) should be avoided throughout the Area, and specific overflight restrictions apply at ASPA No.113 Litchfield Island and ASPA No.139 Biscoe Point (Maps 1 & 2) as detailed in the respective management plans. Pilots operating aircraft within the Area should follow the 'Guidelines for the Operation of Aircraft Near Concentrations of Birds in Antarctica' (Resolution 2 (2004)) and the 'Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

The designated Helicopter Landing Site (HLS) at Palmer Station on Gamage Point lies ~400 m (~1/4 nm) east of Palmer Station at 64° 46.475'S, 64° 02.7417'W (Map 4). It is located on flat, well-drained, rocky ground in a depression ~100 x 200 m across at an elevation of 13 m (~45 ft) Above Mean Sea Level (AMSL). Approach to the HLS should be high over the peninsula east of Palmer Station or up the channel from the south, avoiding breeding bird colonies occupying nearby islands to the maximum extent practicable (in particular Shortcut, Christine, Hermit, Laggard, Limitrophe and Cormorant islands, and the Stepping Stones to the east, and all islands to the west of Palmer Station (Map 3)). Communications aerials and wires strung between masts are installed in the proximity of Palmer Station, which are a particular hazard for aircraft.

If aircraft access, overflight or landing is anticipated at Gamage Point or within Arthur Harbor more generally, it is essential that communications are established with Palmer Station prior to such access to get information on the latest site-specific conditions and constraints.

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

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

Activities that may be conducted in the area include scientific research; operations in support of science; media, arts, education or other official national program visitors; management activities including maintenance or removal of facilities; and tourism visits within the Visitor Zone, where these activities do not jeopardize the values of the Area.

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. Any such activities should be conducted in coordination with research and other activities taking place, and could include development of a plan and guidelines that would help to ensure that harvesting activities did not pose a significant risk to the other important values of the Area.

All activities in the Area should be conducted in such a manner as to minimize impacts on the environment. Alternative energy sources (e.g. solar, wind, fuel cells) should be used wherever practicable in order to minimize fossil fuel usage. Specific guidelines for the conduct of activities in the Area are provided in Appendices A-D.

Tourism and non-governmental expeditions should additionally ensure their activities have minimal impact on the scientific activities being conducted within the Area.

7(iii) Installation, modification, or removal of structures

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

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

7(iv) Field camps

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

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

7(v) Taking 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 under Article 3 of Annex II to the Protocol by the appropriate national authority specifically for that purpose. Where animal taking or harmful interference is involved, this should, as a minimum standard, be in accordance with the Scientific Committee on Antarctic Research (SCAR) Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

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

To help maintain the ecological and scientific values of the Area visitors should take special precautions against the introduction of non-native species. Of particular concern are introductions from other Antarctic sites, including stations, or from regions outside Antarctica. Visitors should ensure that sampling equipment and markers brought into the Area are clean. Visitors should thoroughly clean all equipment (including backpacks, carry-bags and tents), clothing and footwear before entering the Area.

7(vii) Collection or removal of material found in the Area

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

7(viii) Waste management

All wastes other than human wastes and domestic liquid waste shall be removed from the Area. Human and domestic liquid wastes from stations or field camps may be disposed of into the sea below the high water mark.

In accordance with Article 4 of Annex III to the Protocol, wastes shall not be disposed of onto ice-free areas, into freshwater systems or onto snow or in deep ice pits in ice which terminates in ice free areas or in areas of high ablation.

7(ix) Requirements for reports

Reports of activities in the Area should be maintained by the Management Group to the maximum extent practicable, and made available to all Parties.

In accordance with Article 10 of Annex V to the Protocol, arrangements shall be made for collection and exchange of reports of inspection visits and on any significant changes or damage within the Area.

Tour operators should record their visits to the Area, including the number of visitors, dates, and any incidents in the Area, and submit these data in accordance with the procedures for reporting on expeditions adopted by the Antarctic Treaty Parties and the International Association of Antarctica Tour Operators (IAATO).

8. Provisions for the exchange of information in advance of proposed activities

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

All tour ships and yachts should, as far as practical, provide the Management Group with details of scheduled visits in advance.

All those planning to conduct marine harvesting activities within the Area should, as far as practical, notify the Management Group in advance of their nature, location and expected duration, and of any special considerations related to how these activities could impact on scientific investigations being carried out within the Area. Information on the location of scientific activities within the Area should be disseminated as far as practical.

9. Supporting documentation

- *Electronic information*

Management plans for ASMA No.7 and for ASPAs within the Area are available from the Antarctic Treaty Secretariat website at https://www.ats.aq.

- *Management Plans*

Management Plan for Antarctic Specially Protected Area No. 113 Litchfield Island, Arthur Harbor, Anvers Island, Palmer Archipelago.

Management Plan for Antarctic Specially Protected Area No. 139 Biscoe Point, Anvers Island, Palmer Archipelago.

Management Plan for Antarctic Specially Protected Area No. 176 Rosenthal Islands, Anvers Island, Palmer Archipelago.

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Appendix A

General Environmental Guidelines

The coastal marine environmental of the West Antarctic Peninsula is an important site for scientific research, with a history of detailed study going back more than sixty years. These guidelines suggest how you can help to protect the values of the area for future generations and ensure that your presence in the region will have as little impact as possible.

- *Before you travel to the Area:*

- Ensure that your planned activities follow the requirements of the Code of Conduct in the Management Plan, the Environmental Guidelines in Appendices A and B, the guidelines for Non-Governmental Visitors in Appendix C, and the specific guidelines that apply within Restricted Zones (Appendix D).
- Plan all activities such as scientific experiments, installation of equipment, travel, camps, fuel handling, and waste management, with the aim of minimizing environmental impacts.
- Ensure that all equipment, supplies and packaging are planned so as to minimize the amount of waste generated.
- To help prevent the unintended introduction of non-native species, thoroughly clean all equipment (including backpacks, carry-bags and tents), clothing and footwear before travel to the Area.

- *Travel and activities within the Area*

- To reduce the risk of transfer of species from one part of the region to another, clean equipment, clothing and footwear before travel to another site.
- Do not collect specimens or any natural material of any kind, including fossils, except for approved scientific and educational purposes.
- Avoid Restricted Zones unless access is required for a compelling reason that cannot be served elsewhere within the Area, and if visits to Restricted Zones are necessary be aware of the site-specific guidelines in Appendix D.
- Visit only approved islands at approved times.
- Cairns should not be built in the Area unless authorized by a National Program.
- Do not leave any travel equipment behind (e.g. ice screws, pitons).

- *Pedestrian travel*

- Avoid walking on vegetated areas or disturbing mammals or birds to the maximum extent practicable, and keep to designated or established tracks where practicable. Some of the biological communities have taken several thousand years to develop.

- *Small boat travel*

- Small open inflatable boats may operate during the summer within the Standard Boating Area (Map 3), which extends ~5 km (3 miles) from Palmer Station, with more limited trips (weather/season dependent) into the Extended Boating Area (Map 1).
- Rigid-Hulled-Inflatable-Bottom (RHIB) boats may operate within the Extended Boating Area, which extends up ~30 km (~20 miles) from Palmer Station (Maps 1 & 2).
- Small boats should operate no closer than 300 m from the glacier front along the Anvers Island coastline (Map 3) as a safety precaution against glacier calving.
- More extended boating on suitable vessels should be in accordance with procedures established by national programs.

- *Vehicle use*

- Vehicle use should be restricted to ice surfaces unless specifically authorized otherwise.
- Vehicles should keep to established routes wherever these are present.
- Vehicles should always be parked over a secondary containment unit or a drip tray.

- *Helicopter use*

- Helicopter use in Arthur Harbor is discouraged unless for essential purposes. If helicopters are used, follow the guidelines set out in the Code of Conduct of this plan (Section 7(i)).
- Care should be taken to ensure that helicopter sling loads are properly secured. Trained personnel should supervise these operations.

- *Field camps*

- Use designated, former, or existing campsites to the maximum extent practicable before considering the establishment of new campsites.
- Minimize the footprint of all campsites.
- Campsites should be located as far as practicable from bird breeding or seal haul-out sites.
- The location of field camps should be recorded and submitted to the supporting National Program.

- *Use of materials and energy*

- Everything taken into the Area should generally be removed to the maximum extent practicable.

- Ensure that equipment and supplies are properly secured at all times to avoid dispersal by wind.
- Activities that could result in the dispersal of foreign materials should be avoided (e.g. use of flares, spray paint) or should be conducted inside a building or tent (e.g. when cutting, sawing or unpacking materials).
- Explosives should not be used within the Area, unless approved by a National Program for use in support of essential scientific or management purposes.
- Where possible, ensure that nothing is left frozen into snow or ice that may ablate out and cause later contamination.
- Use energy systems and modes of travel within the Area that have the least environmental impact as far as practicable, and minimize the use of fossil fuels.

- *Fuel and chemicals*

- Steps should be taken to prevent the accidental release of fuel or chemicals. For example, regular checks should be made to ensure all fuel valve positions are correctly set, and fuel line couplings are sealed and secure.
- Ensure that spill kits and secondary containment units appropriate to the volume of the substance are available when using chemicals or fuels. Those working with chemicals and fuels should be familiar with their use and with appropriate spill response procedures.
- Chemical and fuel containers should be securely positioned and sealed, particularly when stored outside.
- All fuel drums should be stored with secondary containment.
- Fuel cans with spouts should be used when refuelling generators, boat engines or vehicles.
- Engine oil changes should be carried out with adequate provision for containment and preferably inside.
- Generators and vehicles should be refuelled over drip trays with absorbent spill pads when outside.

- *Waste and spills*

- Clean up any spills and / or releases to the maximum extent possible and report the location(s) including coordinates, to the appropriate National Program.

Appendix B

Environmental Guidelines for Scientific Research

- *Fuel and chemicals*

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

- *Sampling and experimental sites*

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

- *Glaciers*

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

Appendix C

General guidelines for Non-Governmental Visitors

Palmer Station (United States) and the surrounding area receives a number of visitors associated with Non-Governmental expeditions each austral summer, most of whom are supported by private companies that provide transportation by ship, guides and other logistics. In addition, private yachts commonly visit. Guidelines have been established to improve coordination between the National Program(s) operating in the Area and Non-Governmental Visitors (NGVs) to Palmer Station and Arthur Harbor in particular. The purpose of this Appendix is to inform NGVs about on-site resources and constraints, visit expectations, and potential hazards. The guidelines are also provided for members of other National Antarctic Programs when undertaking recreational activities within the Area.

For the purpose of this management plan, 'Non-Governmental Visitors' includes all individuals or organizations that are not supported by a National Antarctic Program. All visitors to the Palmer Station shall comply with the Protocol on Environmental Protection to the Antarctic Treaty and with their respective national policies governing activities in Antarctica.

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

Appendix D

Guidelines for Restricted Zones

Fourteen sites within the Area are designated Restricted Zones (Table D1).

Table D1: Restricted Zones within ASMA No.7.

Norsel Point / Amsler Island	Hermit Island
Humble Island	Laggard Island
Elephant Rocks	Limitrophe Island
Torgersen Island	Stepping Stones
Bonaparte Point / Kristie Cove	Cormorant Island
Shortcut Island / Shortcut Point	Dream Island
Christine Island	Joubin Islands

Brief site descriptions, guidelines for activities within each Restricted Zone, and maps showing the zone boundaries (Maps 5 – 18) are attached.

The boundaries of all of the Restricted Zones, except Bonaparte Point, are defined as a 50 m marine buffer surrounding the island(s) within each zone (see Maps 2 and 3 and the maps for each Restricted Zone). An additional Restricted Zone comprising only a 50 m marine buffer surrounds ASPA No.113 Litchfield Island. The purpose of the 50 m marine buffer is to restrict small boats from approaching shorelines where wildlife are often present, unless access is necessary for scientific or management purposes. A marine buffer is not defined for Bonaparte Point Restricted Zone so practical access to Hero Inlet can be maintained.

Restricted Zone

Norsel Point / Amsler Island

Location
Situated on Amsler Island ~2 km west of Palmer Station: 64° 45.6'S, 64° 05'W

Purpose
Protect sensitive breeding birds and fragile flora. Birds in the zone are the subject of long-term scientific study.

Three species of breeding birds and extensive moss / lichen vegetation are present on Norsel Point Environmental Research & Assessment 11 Dec 2016.

Description	**Zone area:** 41.4 ha

The Restricted Zone lies 2 km west of Palmer Station and ~200 m SW of Anvers Island. The zone occupies the western half of Amsler Island to Norsel Point and is 1.4 km E-W and approximately 0.4 km N-S. The zone includes adjacent islets and rocks.

Birds: Confirmed breeding: Southern Giant petrel (*Macronectes giganteus*), occupying more elevates slopes in the western extremity and central northern parts of the island. Kelp gull (*Larus dominicanus*) breed on the northern coast. South Polar skua (*Catharacta maccormicki*) and Wilson's Storm petrel (*Oceanites oceanicus*) breed across the island.

Seals: Southern Elephant seals (*Mirounga leonina*) haul out in the central valley and on low slopes on the promontory.

Vegetation: A variety of mosses, lichens, and Antarctic hair grass (*Deschampsia antarctica*) colonize the island, much of which has been subjected to damage by Antarctic Fur seals.

Boundaries

The boundary is a 50 m marine buffer around the western half of island and in the east the zone boundary extends N-S across Amsler Island near its highest point (52 m AMSL).

Impacts

KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.

Access requirements

BOAT ACCESS	Access the mooring on the southern coast, SW of the central valley.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Extensive moss and lichen vegetation within the zone is easily damaged by trampling.
- Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 5

<table>
<tr><td colspan="2">Restricted Zone</td><td rowspan="4"></td></tr>
<tr><td colspan="2">Humble Island</td></tr>
<tr><td colspan="2">Location
Situated ~1.6 km west of Palmer Station:
64° 45.9'S, 64° 05.2'W</td></tr>
<tr><td colspan="2">Purpose
Protect sensitive breeding birds and fragile flora. Birds in the zone are the subject of long-term scientific study.</td></tr>
<tr><td>Description</td><td>Zone area: 16.1 ha</td><td>Scientists check Adélie penguins breeding on Humble Island.
Environmental Research & Assessment 09 Dec 2016</td></tr>
<tr><td colspan="3">The Restricted Zone lies 1.6 km west of Palmer Station and ~1 km SW of Anvers Island. The zone is 350 m by 650 m and includes adjacent islets and rocks.

<u>Birds: Confirmed breeding</u>: Adélie penguin (Pygoscelis adeliae) breed on the eastern part of the island, while Southern Giant petrel (Macronectes giganteus) breed on elevated slopes in the west. Kelp gulls (Larus dominicanus) breed along the NW coast. South Polar skua (Catharacta maccormicki) breed across the island, while Brown skua (Catharacta antarctica) breed in the central part of the northern coast. The Adélie colony has suffered substantial decline over recent decades.

<u>Seals:</u> Southern Elephant seals (Mirounga leonina) haul out on low slopes in the central-eastern valley.

<u>Vegetation</u>: A variety of mosses and lichens are present, with localized well-developed moss banks.</td></tr>
<tr><td colspan="3">Boundaries</td></tr>
<tr><td colspan="3">The boundary is a 50 m marine buffer around the island and its adjacent islets and rocks.</td></tr>
<tr><td colspan="3">Impacts</td></tr>
<tr><td>KNOWN IMPACTS</td><td colspan="2">USGS survey mark (HUM1) embedded in rock at the eastern summit of the island.</td></tr>
<tr><td>POTENTIAL IMPACTS</td><td colspan="2">Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.</td></tr>
<tr><td colspan="3">Access requirements</td></tr>
<tr><td>BOAT ACCESS</td><td colspan="2">Access the mooring on the eastern coast.</td></tr>
<tr><td>SURFACE ACCESS</td><td colspan="2">Movement on land within the Restricted Zone shall be on foot.</td></tr>
<tr><td colspan="3">Special site guidance</td></tr>
<tr><td colspan="3">• Localized moss vegetation within the zone is easily damaged by trampling.
• Southern Giant petrels breeding on the higher slopes in the west and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
• Walk slowly and avoid sudden movements when carrying out research in this area.</td></tr>
<tr><td colspan="3">Key references</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Site Map – Map 6</td></tr>
</table>

Restricted Zone

Elephant Rocks

Location
Situated ~1 km west of Palmer Station:
64° 46.1'S, 64° 04.4'W

Purpose
Protect sensitive breeding birds and Southern Elephant seals haul out. Birds in the zone are the subject of long-term scientific study.

Description	**Zone area:** 6.9 ha	*Elephant Rocks in middle distance, from Torgersen Island, with Amsler Island in background. Environmental Research & Assessment 09 Dec 2016*

The Restricted Zone lies 1 km west of Palmer Station and 1 km southwest of Anvers Island. The zone is 400 m E-W, and approximately 200 m N-S. The zone includes adjacent islets and rocks.

Birds: Confirmed breeding: Southern Giant petrel (*Macronectes giganteus*), Kelp gull (*Larus dominicanus*).

Seals: An important local haul-out site for Southern Elephant seal (*Mirounga leonina*).

Vegetation: Mosses and lichens present, although observations not recorded.

Boundaries

The boundary is a 50 m marine buffer around the main island and the adjacent islets and rocks.

Impacts

KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife. Disturbance to scientific research.

Access requirements

BOAT ACCESS	Specific access points have not been defined.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Take care not to disturb breeding birds or Southern Elephant seals.
- Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 7

<table>
<tr><td colspan="2">Restricted Zone</td><td rowspan="4"></td></tr>
<tr><td colspan="2">Torgersen Island</td></tr>
<tr><td colspan="2">Location
Situated ~1 km west of Palmer Station and ~0.3 km east of Litchfield Island:
64° 46.39'S, 64° 04.55'W</td></tr>
<tr><td colspan="2">Purpose
Protect sensitive breeding birds in the zone are the subject of long-term scientific study.</td></tr>
<tr><td>Description</td><td>Zone area: 15 ha</td><td>Torgersen Island small boat landing site. Emergency cache (yellow drums) at left. ASPA 113 Litchfield Island in distance.
Environmental Research & Assessment 09 Dec 2016</td></tr>
<tr><td colspan="3">Torgersen Island is roughly circular and approximately 350m across. The island slopes upwards from its rocky shoreline to a summit of 17m, and is bisected by a stony ridge lying in an east-west direction.
<u>Birds: Confirmed breeding</u>: Adélie penguin (Pygoscelis adeliae), South Polar skua (Catharacta maccormicki), Brown skua (Catharacta antarctica), Wilson's storm petrel (Oceanites oceanicus).
<u>Birds: Common visitors</u>: Chinstrap penguin (Pygoscelis antarcticus), Gentoo penguin (Pygoscelis papua).
<u>Seals:</u> Leopard seal (Hydrurga leptonyx), Weddell seal (Leptonychotes weddellii), Southern Elephant seal (Mirounga leonina) and Antarctic Fur seal (Arctocephalus gazella) commonly haul out.
<u>Vegetation</u>: A variety of mosses, including Polytrichum strictum, Chorisodontium aciphyllum and Sanionia uncinata. Antarctic hair grass (Deschampsia antarctica) is also present.</td></tr>
<tr><td colspan="3">Boundaries</td></tr>
<tr><td colspan="3">The Restricted Zone occupies the entire island and includes a 50 m buffer extending from the shore into the adjacent marine area.</td></tr>
<tr><td colspan="3">Impacts</td></tr>
<tr><td>KNOWN IMPACTS</td><td colspan="2">USGS survey mark (TOR1) embedded in rock at summit of island.</td></tr>
<tr><td>POTENTIAL IMPACTS</td><td colspan="2">Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.</td></tr>
<tr><td colspan="3">Access requirements</td></tr>
<tr><td>BOAT ACCESS</td><td colspan="2">Access the designated landing site situated on the northern coast of the island: 64° 46.29' S, 64° 04.51'W.</td></tr>
<tr><td>SURFACE ACCESS</td><td colspan="2">Movement within the Restricted Zone shall be on foot.</td></tr>
<tr><td colspan="3">Special site guidance</td></tr>
<tr><td colspan="3">• An emergency cache is situated at 64° 46.304'S, 64° 04.528'W on slopes opposite the boat landing site.
• Skua and petrel nests are inconspicuous among rocks; observe carefully to avoid disturbance.
• Walk slowly and avoid sudden movements when carrying out research in this area.</td></tr>
<tr><td colspan="3">Key references</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Site Map – Map 8</td></tr>
</table>

Restricted Zone	
Bonaparte Point / Kristie Cove	
Location A promontory situated ~100 m south of Palmer Station: 64° 46.67'S, 64° 03'W	
Purpose Protect sensitive breeding birds and fragile flora. Used as a scientific reference area.	
Description | **Zone area:** 13.7 ha	*View towards Palmer Station from Bonaparte Point. Fragile lichen and moss vegetation are present, as well as sensitive breeding birds.* *Environmental Research & Assessment 08 Dec 2016*

The Restricted Zone lies due south and opposite Palmer Station in the central part of Bonaparte Point. The zone is 485 m E-W, and approximately 350 m N-S. Within the zone the peninsula ranges from ~50 – 150 m across. The zone includes the marine area of Kristie Cove and Diana Island.

Birds: Confirmed breeding: Southern Giant petrel (*Macronectes giganteus*), Kelp gull (*Larus dominicanus*), South Polar skua (*Catharacta maccormicki*), Wilson's Storm petrel (*Oceanites oceanicus*).
Seals: Southern Elephant seal (*Mirounga leonina*), Weddell seal (*Leptonychotes weddellii*), Leopard seal (*Hydrurga leptonyx*) and Antarctic Fur seal (*Arctocephalus gazella*) commonly haul out.
Vegetation: A variety of mosses and lichens grow on Bonaparte Point. Antarctic hair grass (*Deschampsia antarctica*) is also present.

Boundaries

The northern boundary of the Restricted Zone follows the coastline of Hero Inlet. The southern boundary encloses Kristie Cove and Diana Island and follows the coastline of a rocky promontory. The western and eastern boundaries are respectively defined as 64° 02.75'W and 64° 03.37'W.

Impacts

KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.

Access requirements

BOAT ACCESS	Access the mooring adjacent to the Restricted Zone on Bonaparte Point, south and opposite Palmer Station.
SURFACE ACCESS	Movement within the Restricted Zone shall be on foot. If it is necessary to approach the mooring from within the Restricted Zone, walk as close to the coastline as possible to avoid South Polar skua nesting territories on the ridge crest.

Special site guidance

- Fragile foliose and fruticose lichens are prolific within the zone, which are easily damaged by trampling.
- Southern Giant petrels breeding the western half of the zone are particularly sensitive to human presence.
- Kelp gulls breed in the northwestern part of the zone and are sensitive to human presence.
- Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 9

Restricted Zone		
Shortcut Island / Shortcut Point		
Location Situated ~1 km southeast of Palmer Station: 64° 45.9'S, 64° 05.2'W		
Purpose Protect sensitive breeding birds and fragile flora. Birds in the zone are the subject of long-term scientific study.		
Description	**Zone area:** 26.8 ha	*South Polar skuas breed on Shortcut Island* *Polar Oceans Research Group 13 Mar 2017*

The Restricted Zone lies 1 km southeast of Palmer Station and ~1 km SW of Anvers Island. The zone is 350 m by 650 m and includes adjacent islets and rocks.

<u>Birds: Confirmed breeding</u>: Southern Giant petrel (*Macronectes giganteus*) breed across both Shortcut Island and Shortcut Point. Kelp gulls (*Larus dominicanus*) breed on the northern coast of Shortcut Point. South Polar skua (*Catharacta maccormicki*) breed across the area. Antarctic tern (*Sterna vittata*) breed on Shortcut Point.

<u>Seals:</u> Antarctic Fur seal (*Arctocephalus gazella*) haul out on both Shortcut and Shortcut Point.

<u>Vegetation</u>: A variety of mosses and lichens are present. Observations not recorded

Boundaries

The boundary is a 50 m marine buffer around the island and point, and the adjacent islets and rocks. The eastern boundary on Shortcut Point is the glacier margin.

Impacts

KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.

Access requirements

BOAT ACCESS	Access the mooring in a small cove on the north coast of Shortcut Island. Specific access points to Shortcut Point have not been defined. The narrow channel between Shortcut Point and Shortcut Island may be used by small boats for passage as and when necessary, when boats shall move slowly and quietly with no wake to minimize potential wildlife disturbance.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot. Access to Shortcut Point from the glacier is subject to local ice conditions and advice from Palmer Station.

Special site guidance

- Breeding Southern Giant petrels, Kelp gulls and Antarctic terns are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 10

Restricted Zone

Christine Island

Brown skuas are being studied on Christine Island
Environmental Research & Assessment 09 Dec 2016

Location
Situated ~2.4 km southeast of Palmer Station: 64° 47.6'S, 64° 01.5'W

Purpose
Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.

Description	**Zone area:** 30.9 ha

The Restricted Zone lies 2.4 km southeast of Palmer Station and ~1.4 km south of Anvers Island. The zone is 400 m by 1100 m and includes adjacent islets and rocks.

<u>Birds: Confirmed breeding</u>: A small Adélie penguin (*Pygoscelis adeliae*) colony of approx. 10-12 pairs (2016/17). South Polar skua (*Catharacta maccormicki*) breed across the island, and Brown skua (*Catharacta antarctica*) breed at the eastern end of the island.

<u>Seals:</u> Antarctic Fur seal (*Arctocephalus gazella*) and Elephant seal (*Mirounga leonina*) haul out on beaches.

<u>Vegetation</u>: A variety of mosses and lichens are present, including the bright red crustose lichen *Xanthoria* sp. Observations not recorded.

Boundaries

The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.

Impacts

KNOWN IMPACTS	USGS survey mark (CHR1) embedded in rock at the eastern summit of the island (18 m).
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.

Access requirements

BOAT ACCESS	Access the mooring in a small cove on the eastern coast of the island.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Skua nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 11

Restricted Zone		
Hermit Island		
Location Situated ~3 km southeast of Palmer Station: 64° 48.0'S, 64° 01.3'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	**Zone area:** 67.2 ha	View of Anvers Island from above boat landing cove on Hermit Island *Polar Oceans Research Group 24 Feb 2012*

The Restricted Zone lies 3 km southeast of Palmer Station and ~2 km south of Anvers Island, and is the largest of the zones in the Arthur Harbor area. The zone is 550 m by 1700 m and includes adjacent islets and rocks.

<u>Birds: Confirmed breeding</u>: Southern Giant petrel (*Macronectes giganteus*) breed on elevated east-facing slopes in the eastern part of the zone. Kelp gulls (*Larus dominicanus*) breed on the eastern coast of the main island, near the small boat landing site. South Polar skua (*Catharacta maccormicki*) and Wilson's Storm petrel (*Oceanites oceanicus*) breed across the area.

<u>Seals:</u> Antarctic Fur seal (*Arctocephalus gazella*) haul out on beaches and lower vegetated slopes.

<u>Vegetation</u>: A variety of mosses and lichens are present. Observations not recorded.

Boundaries	
The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.	
Impacts	
KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.
Access requirements	
BOAT ACCESS	Access the mooring in a small cove at the southeastern end of the island.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.
Special site guidance	
• Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance. • Walk slowly and avoid sudden movements when carrying out research in this area.	
Key references	
Site Map – Map 12	

Restricted Zone	
Laggard Island	
Location Situated ~4 km southeast of Palmer Station: 64° 48.0'S, 64° 01.3'W	
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.	Antarctic fur seals are common on Laggard Island late season Polar Oceans Research Group 08 Mar 2019
Description **Zone area:** 37.8 ha	

The Restricted Zone lies 4 km southeast of Palmer Station and ~3 km south of Anvers Island. The zone is 420 m by 1200 m and includes adjacent islets and rocks.

Birds: Confirmed breeding: Southern Giant petrel (*Macronectes giganteus*) breed on elevated slopes in the eastern part of the zone. Kelp gulls (*Larus dominicanus*) breed adjacent to them on the eastern coast of the main island. South Polar skua (*Catharacta maccormicki*) breed across the area.

Seals: Antarctic Fur seal (*Arctocephalus gazella*) haul out on beaches and accessible slopes.

Vegetation: A variety of mosses and lichens are present. Observations not recorded.

Boundaries

The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.

Impacts

KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.

Access requirements

BOAT ACCESS	Access the mooring in at the northeastern end of the island, adjacent to Jacobs Island.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 13

Restricted Zone

Limitrophe Island

Location
Situated ~3 km southeast of Palmer Station: 64° 47.6'S, 64° 00.1'W

Purpose
Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.

Nesting birds are inconspicuous among rocks on Limitrophe Island.
Environmental Research & Assessment 09 Dec 2016

Description	**Zone area:** 22.2 ha

The Restricted Zone lies 3 km southeast of Palmer Station and ~1.6 km south of Anvers Island. The zone is 300 m by 900 m and includes adjacent islets and rocks.

<u>Birds: Confirmed breeding</u>: Southern Giant petrel (*Macronectes giganteus*) breed on elevated slopes across the island. South Polar skua (*Catharacta maccormicki*) and Wilson's Storm petrel (*Oceanites oceanicus*) breed across the island.

<u>Seals:</u> Antarctic Fur seal (*Arctocephalus gazella*) haul out on beaches and on accessible slopes. Weddell seal (*Leptonychotes weddellii*) often haul out on beaches and near the landing site.

<u>Vegetation</u>: A variety of mosses and lichens are present. Observations not recorded.

Boundaries

The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.

Impacts	
KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.
Access requirements	
BOAT ACCESS	Access the mooring at a rocky point on the northern coast of the island.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Breeding Southern Giant petrels are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 14

Restricted Zone

Stepping Stones

Southern Giant petrels nest among vegetation severely damaged by Antarctic fur seals on Stepping Stones. Environmental Research & Assessment 09 Dec 2016

Location

Situated ~2.9 km east of Palmer Station: 64° 47.1'S, 63° 59.6'W

Purpose

Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.

Description	**Zone area:** 10.8 ha

The Restricted Zone lies 2.9 km southwest of Palmer Station and ~1.3 km south of Anvers Island. The zone is 450 m by 320 m and includes adjacent islets and rocks.

<u>Birds: Confirmed breeding</u>: Southern Giant petrel (*Macronectes giganteus*) and South Polar skua (*Catharacta maccormicki*) breed across the Stepping Stones. Occasionally a single Kelp gull (*Larus dominicanus*) nest is present.

<u>Seals:</u> Antarctic Fur seal (*Arctocephalus gazella*) haul out across the islands.

<u>Vegetation</u>: Stepping Stones were until recently extremely rich in mosses and lichens, although Antarctic Fur seal activity has largely destroyed cryptogamic vegetation cover across the islands, which has been replaced by large areas of the alga *Prasiola*.

Boundaries

The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.

Impacts

KNOWN IMPACTS	The damage to vegetation by Antarctic Fur seals is substantial and extensive.
POTENTIAL IMPACTS	Disturbance to wildlife and to scientific research.

Access requirements

BOAT ACCESS	Access the mooring on the northern coast of the main island. Specific points of access are not defined for the other islands.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Breeding Southern Giant petrels are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research in this area.

Key references

Site Map – Map 15

Restricted Zone

Cormorant Island

Location

Situated ~4.5 km east of Palmer Station: 64° 47.6'S. 63° 58'W

Purpose

Protect sensitive breeding birds and fragile flora. Used as a scientific reference area.

Description	**Zone area:** 20.6 ha	*Extensive moss, lichen, grass and pearlwort vegetation is present, as are rich communities of invertebrates and five species of breeding birds.* *Environmental Research & Assessment 09 Dec 2016*

The Restricted Zone lies 4.5 km east Palmer Station and 850 m south of Anvers Island. The zone is 430 m E-W, and approximately 500 m N-S. The zone includes adjacent islets and rocks.

<u>Birds: Confirmed breeding</u>: Imperial shag (*Leucocarbo atriceps bransfieldensis*), Adélie penguin (*Pygoscelis adeliae*), Southern Giant petrel (*Macronectes giganteus*), South Polar skua (*Catharacta maccormicki*), Brown skua (*Catharacta antarctica*), Wilson's Storm petrel (*Oceanites oceanicus*) and occasionally Antarctic tern (*Sterna vittata*). The Imperial shag and Adélie colonies have suffered substantial decline over recent decades.

<u>Seals:</u> Antarctic Fur seal (*Arctocephalus gazella*) haul out on beaches and accessible slopes.

<u>Vegetation</u>: A variety of mosses and lichens, Antarctic hair grass (*Deschampsia antarctica*) and the pearlwort *Colobanthus quitensis* are extensive on ledges and island slopes.

Boundaries

The boundary is a 50 m marine buffer around the island and its adjacent islets and rocks.

Impacts

KNOWN IMPACTS	None known.
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.

Access requirements

BOAT ACCESS	Access to the mooring on the northern coast, near Imperial shag nests.
SURFACE ACCESS	Movement within the Restricted Zone shall be on foot.

Special site guidance

- Extensive moss and pearlwort vegetation within the zone is easily damaged by trampling.
- Southern Giant petrels breeding on the higher slopes in the west are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research on the islands where they are present.

Key references

Site Map – Map 16

Restricted Zone	
Dream Island	
Location 9.4 km NW of Palmer Station in Wylie Bay: 64° 43.5'S, 64° 13.6'W	
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.	

Description	**Zone area:** 39.7 ha	*Vegetation on Dream Island with penguin colony in middle distance. Polar Oceans Research Group 08 Mar 2019*

The Restricted Zone lies 9.4 km northwest of Palmer Station and ~1 km south of Anvers Island. The zone is 1000 m by 600 m and includes adjacent islets and rocks.

Birds: Confirmed breeding: Adélie penguin (*Pygoscelis adeliae*), Chinstrap penguin (*Pygoscelis antarcticus*) breed on the lower slopes in the central part of the island. Gentoo penguin (*Pygoscelis papua*) breed on a small, newly-exposed, island close west of Dream Island. Brown skua (*Catharacta antarctica*) breed on north-facing slopes in the southern half of the island. Kelp gull (*Larus dominicanus*) breed on a promontory on the west side of the island. South Polar skua (*Catharacta maccormicki*) breed across the island. Wilson's Storm petrel (*Oceanites oceanicus*) and occasionally Antarctic tern (*Sterna vittata*) also breed.

Seals: Antarctic Fur seal (*Arctocephalus gazella*) and Southern Elephant seal (*Mirounga leonina*) haul out on the isthmus linking the southern and northern parts of Dream Island and accessible slopes.

Vegetation: Observations not recorded.

Boundaries

The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.

Impacts

KNOWN IMPACTS	USGS survey mark (DRE1) embedded in rock at summit in the south of the island (35 m).
POTENTIAL IMPACTS	Disturbance to wildlife and to scientific research.

Access requirements

BOAT ACCESS	Specific points of access are not defined on Dream Island.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Skua and Kelp gull nests are inconspicuous among rocks. Kelp gulls are particularly sensitive to human presence; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research on the island.

Key references

Site Map – Map 17

Restricted Zone	
Joubin Islands	
Location 15 km west of Palmer Station: 64° 46.3'S, 64° 24.6'W	
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.	
Description / **Zone area:** 4160 ha	Moss vegetation in the Joubin Islands. *Polar Oceans Research Group 21 Feb 2013*

The Restricted Zone lies ~15 km west of Palmer Station and ~6 km southwest of Anvers Island. The zone is 7.5 km by 6.5 km and includes over 100 small islands within the Joubin Islands group.
Birds: Confirmed breeding: Adélie penguin (*Pygoscelis adeliae*) and Gentoo penguin (*Pygoscelis papua*) breed on at least four islands (8, 18, 20, 35). Chinstrap penguin (*P. antarcticus*) breed on one island (8). Southern Giant petrel (*Macronectes giganteus*) breed on at least six islands (4, 11, 12, 14, 15 and 17), and probably more. Kelp gull (*Larus dominicanus*) breed on at least Island 18. South Polar skua (*Catharacta maccormicki*) breed across the island group. Imperial shag (*Leucocarbo atriceps bransfieldensis*) breed on a steep north-facing slope on Island 31. Seals: Various seal species haul out on the Joubin Islands. Specific observations not reported.
Vegetation: Mosses and lichens are present across most islands. Antarctic hairgrass (*Deschampsia antarctica*) present on a number of islands, specifically at the southerly end of Island 17 and on NE slopes of Island 18. The largest of the Joubin Islands (assumed to be Hartshorne Island) has a peat bank composed solely of *Chorisodontium* (Fenton & Lewis Smith 1982). Antarctic Fur seals have since destroyed many sites of rich flora in the region, and the current status is not known. Few other observations on flora at the Joubin Islands have been reported.

Boundaries

The boundary encompasses the island group, including the marine area between islands and rocks, and extends as a 50 m buffer offshore around the outer islands in the group.

Impacts

KNOWN IMPACTS	Automatic Weather Station (AWS) located on the NE point of Howard Island at 64° 47.13'S, 64° 21.38'W, installed 25 Feb 2016. Marine debris commonly observed by scientists.
POTENTIAL IMPACTS	Disturbance to wildlife and to scientific research.

Access requirements

BOAT ACCESS	Specific points of access are not defined in the Joubin Islands.
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.

Special site guidance

- Breeding Southern Giant petrels are particularly sensitive to human presence. Nests are inconspicuous among rocks; observe carefully to avoid disturbance.
- Walk slowly and avoid sudden movements when carrying out research on the islands where they are present.

Key references

W. Fraser and D. Patterson-Fraser, pers. comms. 2018, 2019.
Fenton, J.H.C. & Lewis Smith, R.I. 1982. Distribution, composition and general characteristics of the moss banks of the maritime Antarctic. *British Antarctic Survey Bulletin* **51**: 215-36.

Site Map – Map 18

Appendix E

Plant, bird and mammal species recorded within the ASMA

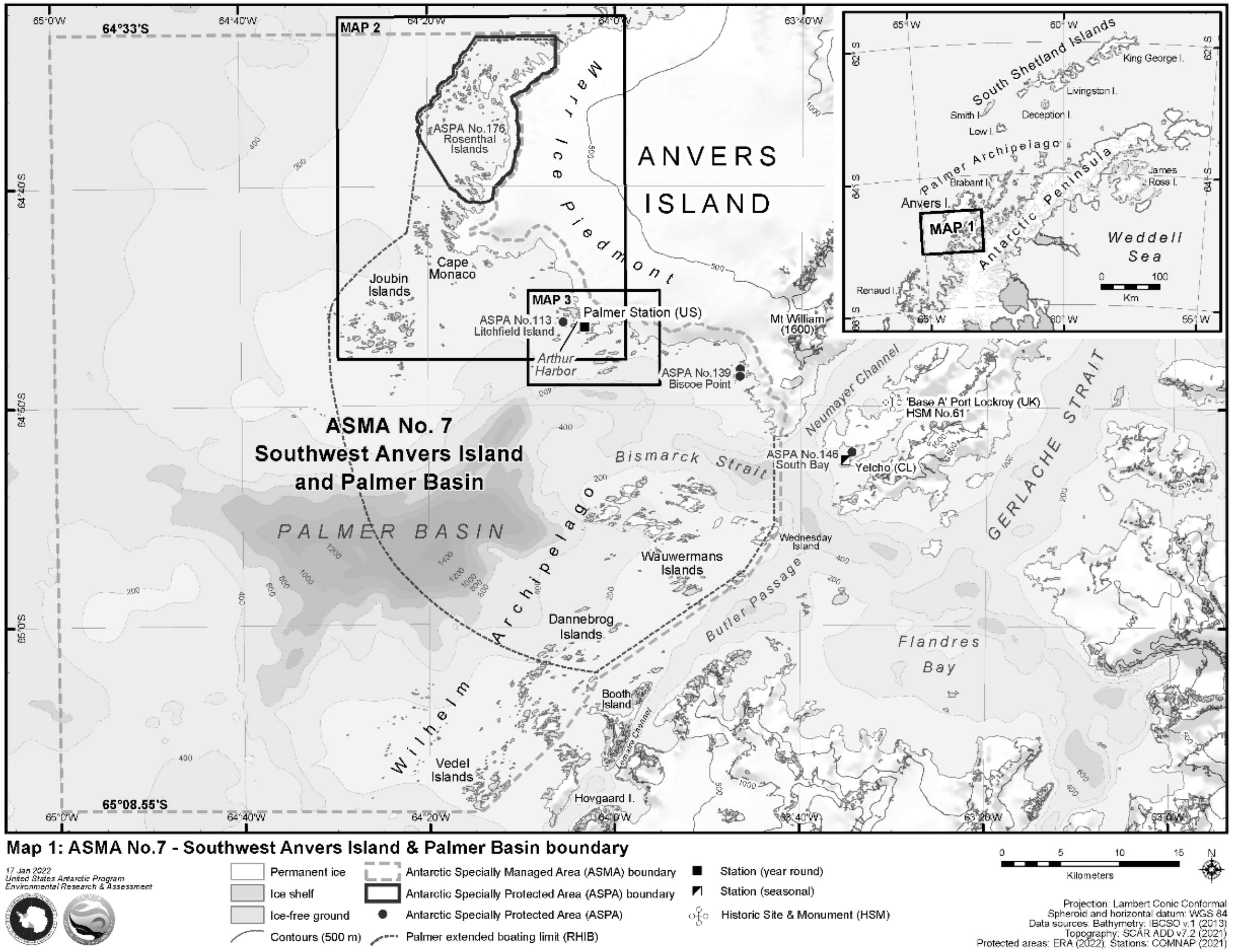
Table E.1: Plant species recorded within the Area (extracted from British Antarctic Survey Plant Database (2007)).

<table>
<tr><th>Flowering plants</th><th>Lichens</th></tr>
<tr><td>Colobanthus quitensis
Deschampsia antarctica</td><td rowspan="5">Acarospora macrocyclos
Amandinea petermannii
Buellia anisomera, B. melanostola, B. perlata, B. russa
Catillaria corymbosa
Cetraria aculeata
Cladonia carneola, C. deformis, C. fimbriata, C. galindezii, C. merochlorophaea var. novochloro, C. pleurota, C. pocillum, C. sarmentosa, C. squamosa
Coelopogon epiphorellus
Haematomma erythromma
Himantormia lugubris
Lecania brialmontii
Lecanora polytropa, L. skottsbergii
Leptogium puberulum
Massalongia carnosa
Mastodia tessellata
Melanelia ushuaiensis
Ochrolechia frigida
Parmelia cunninghamii, P. saxatilis
Physcia caesia, P. dubia
Physconia muscigena
Pseudephebe minuscula, P. pubescens
Psoroma cinnamomeum, P. hypnorum
Rhizoplaca aspidophora
Rinodina turfacea
Sphaerophorus globosus
Stereocaulon alpinum
Umbilicaria antarctica, U. decussata
Usnea antarctica, U. aurantiaco-atra
Xanthoria candelaria
Xanthoria elegans</td></tr>
<tr><th>Liverworts</th></tr>
<tr><td>Barbilophozia hatcheri
Cephaloziella varians
Lophozia excisa</td></tr>
<tr><th>Mosses</th></tr>
<tr><td>Andreaea depressinervis, A. gainii var. gainii, A. regularis M
Bartramia patens
Brachythecium austrosalebrosum
Bryum archangelicum, B. argenteum, B. boreale, B. pseudotriquetrum
Ceratodon purpureus
Chorisodontium aciphyllum
Dicranoweisia crispula, D. dryptodontoides
Grimmia reflexidens
Hymenoloma grimmiaceum
Kiaeria pumila
Platydictya jungermannioides
Pohlia cruda, P. nutans
Polytrichastrum alpinum
Polytrichum juniperinum, P.piliferum, P. strictum
Sanionia uncinata
Sarconeurum glaciale
Schistidium antarctici, S. urnulaceum
Syntrichia magellanica
Syntrichia princeps, S. sarconeurum
Warnstorfia laculosa</td></tr>
</table>

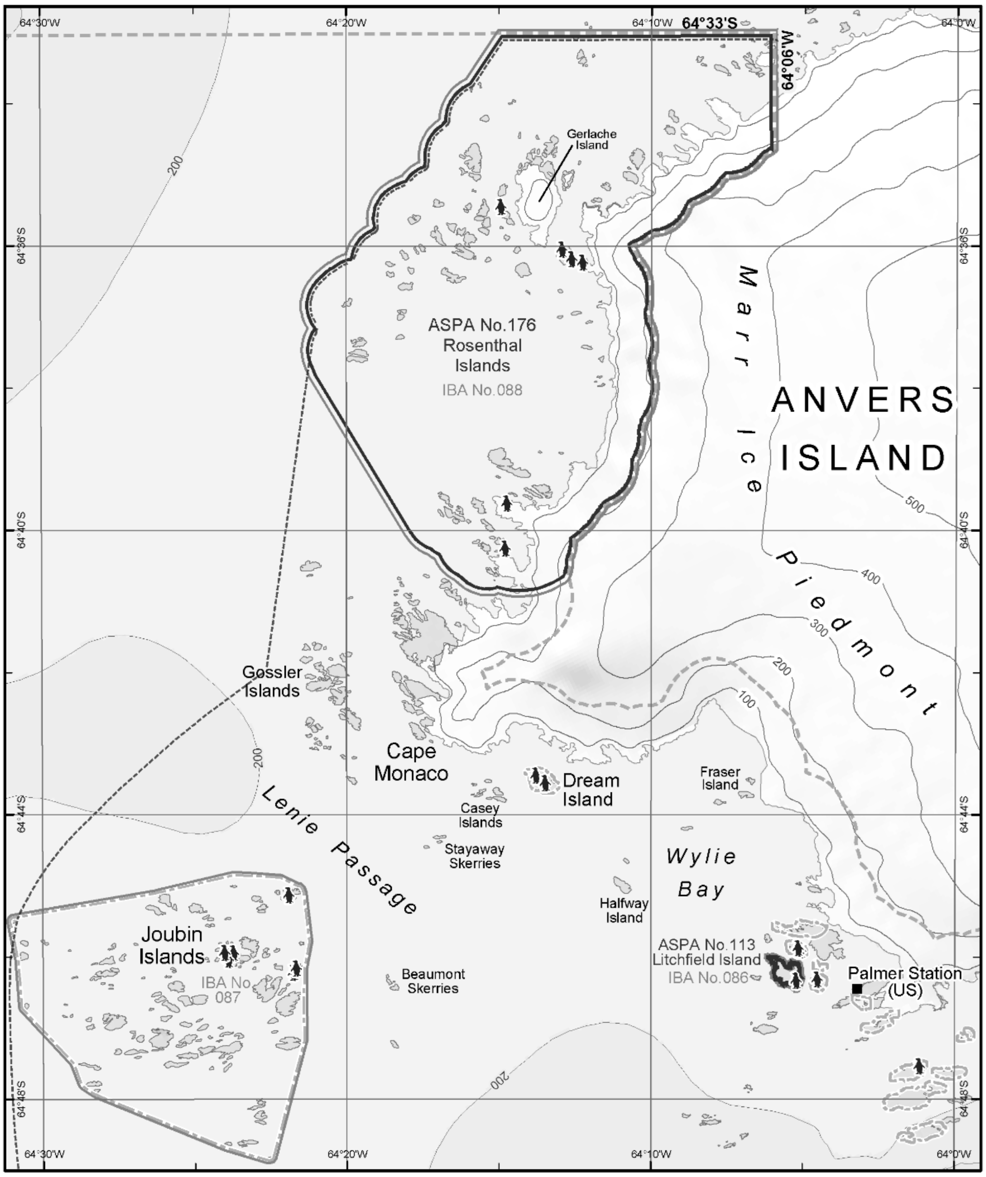
Notes: The number of species recorded within the Area = 83

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

Common name	Scientific name	Status within Area
Birds		
Chinstrap penguin	Pygoscelis antarcticus	Confirmed breeder
Adélie penguin	Pygoscelis adeliae	Confirmed breeder
Gentoo penguin	Pygoscelis papua	Confirmed breeder
Southern Giant petrel	Macronectes giganteus	Confirmed breeder
Imperial shag	Leucocarbo atriceps bransfieldensis	Confirmed breeder
Kelp gull	Larus dominicanus	Confirmed breeder
Wilson's Storm petrel	Oceanites oceanites	Confirmed breeder
Snowy sheathbill	Chionis alba	Confirmed breeder
South Polar skua	Catharacta maccormicki	Confirmed breeder
Brown skua	Catharacta antarctica	Confirmed breeder
Antarctic tern	Sterna vittata	Confirmed breeder
Southern fulmar	Fulmarus glacialoides	Frequent visitor
Antarctic petrel	Thalassoica antarctica	Frequent visitor
Cape petrel	Daption capense	Frequent visitor
Snow petrel	Pagadroma nivea	Frequent visitor
Emperor penguin	Aptenodytes forsteri	Occasional visitor
King penguin	A. patagonicus	Occasional visitor
Macaroni penguin	Eudyptes chrysolophus	Occasional visitor
Rockhopper penguin	Eudyptes chrysocome	Occasional visitor
Magellanic penguin	Spheniscus magellanicus	Occasional visitor
Black-browed albatross	Diomedea melanophris	Occasional visitor
Gray-headed albatross	D. chrystosoma	Occasional visitor
Northern giant petrel	Macronectes halli	Occasional visitor
Black-bellied storm petrel	Fregetta tropica	Occasional visitor
Red phalarope	Phalaropus fulicarius	Occasional visitor
South Georgia pintail	Anas georgica	Occasional visitor
Black-necked swan	Cygnus melancoryphus	Occasional visitor
Sandpiper	(sp. unknown)	Occasional visitor
Cattle egret	Bubulcus ibis	Occasional visitor
Arctic tern	Sterna paradisaea	Occasional visitor
Seals (no data on breeding or numbers available)		
Weddell seal	Leptonychotes weddellii	Frequent visitor
Southern Elephant seal	Mirounga leonina	Frequent visitor
Crabeater seal	Lobodon carcinophagus	Frequent visitor
Leopard seal	Leptonyx hydrurga	Frequent visitor
Antarctic fur seal	Arctocephalus gazella	Frequent visitor
Whales and dolphins (no data on breeding or numbers available)		
Fin whale	Balaenoptera physalus	Observed
Humpback whale	Megaptera novaeangliae	Observed
Sei whale	Balaenoptera borealis	Observed
Southern right whale	Eubalaena australis	Observed
Minke whale	Balaenoptera bonaerensis	Observed
Killer whale	Orcinus orca	Observed
Hourglass dolphin	Lagenorhynchus cruciger	Observed



Map 1: ASMA No.7 - Southwest Anvers Island & Palmer Basin boundary



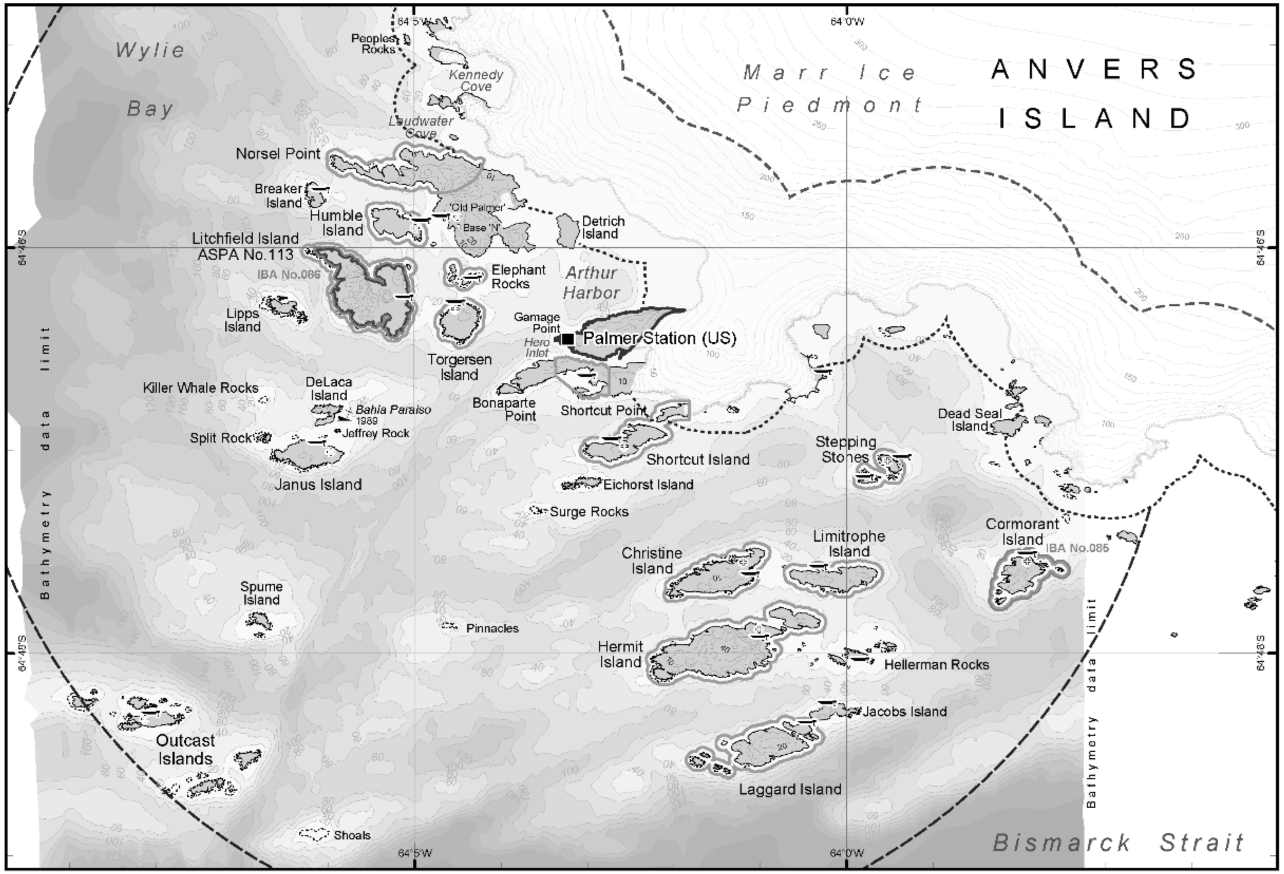
Map 2: ASMA No.7 - Southwest Anvers Island

0 1 2 3 4 5
Kilometers

02 Mar 2022
United States Antarctic Program
Environmental Research & Assessment

Permanent ice
Ice shelf
Ice-free ground
Contours (100 m)
Bathymetry (200 m)
ASMA boundary
ASPA boundary
Restricted Zone
Important Bird Area
Station, Year-Round
Extended boating limit (RHIB)
Penguin colony

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: SCAR ADD v7.2 (2020) (edited)
Contours: SCAR ADD v7.3 (2021) derived from REMA v1.1
Bathymetry: IBCSO v1 (2013) (http://www.ibcso.org)
Protected areas / Zones: ERA (2022); Stations: COMNAP (2021)
Penguin colonies - Polar Oceans Research Group (Aug 2018)



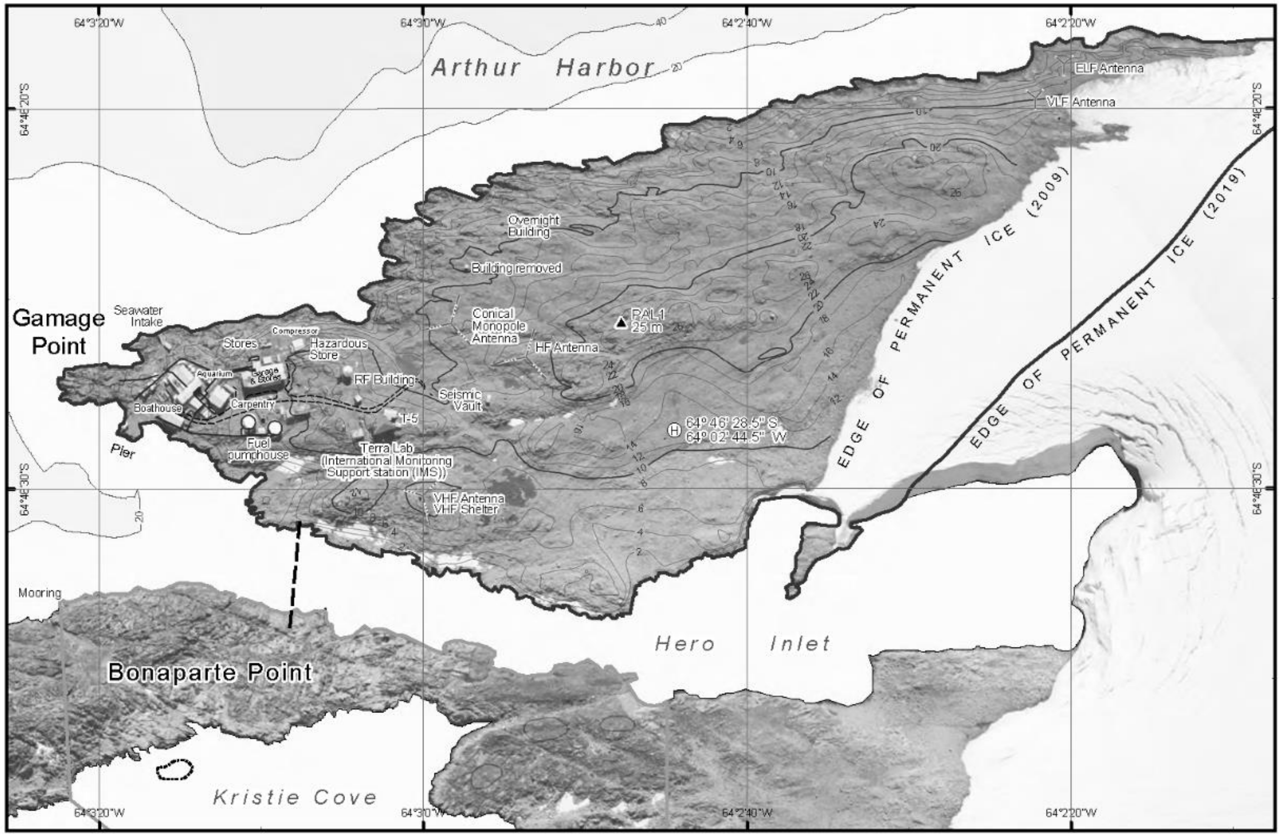
Map 3: ASMA No.7 - Arthur Harbor & Palmer Station access

02 Mar 2022
United States Antarctic Program
Environmental Research & Assessment

Ice coastline (approx.)
Rock coastline
Contour on ice (10 m)
Contour on land (10 m)
Shoal
Bathymetry (20 m)
Ice free ground
Permanent ice
ASMA Boundary
Operations Zone
Restricted Zone
ASPA boundary
Important Bird Area
Local Boating Area
Small boat icecliff safety limit
Small boat landing site
Permanent station
Former station site
Emergency cache
Wreck

0 0.5 1 1.5 2
Kilometers

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Rock coastline & ice free ground digitised from orthorectified aerial imagery (Feb 09). Ice coastline updated to 11 Jan 2018 from GeoEye-1 image (Imagery © 2019 DigitalGlobe, Inc.)
Bathymetric contours derived from Asper & Gallagher PRIMO survey data
Infrastructure ASC (2018). Zones and Protected Areas: ERA (Jan 2022)



Map 4: ASMA No.7 - Palmer Station Operations Zone

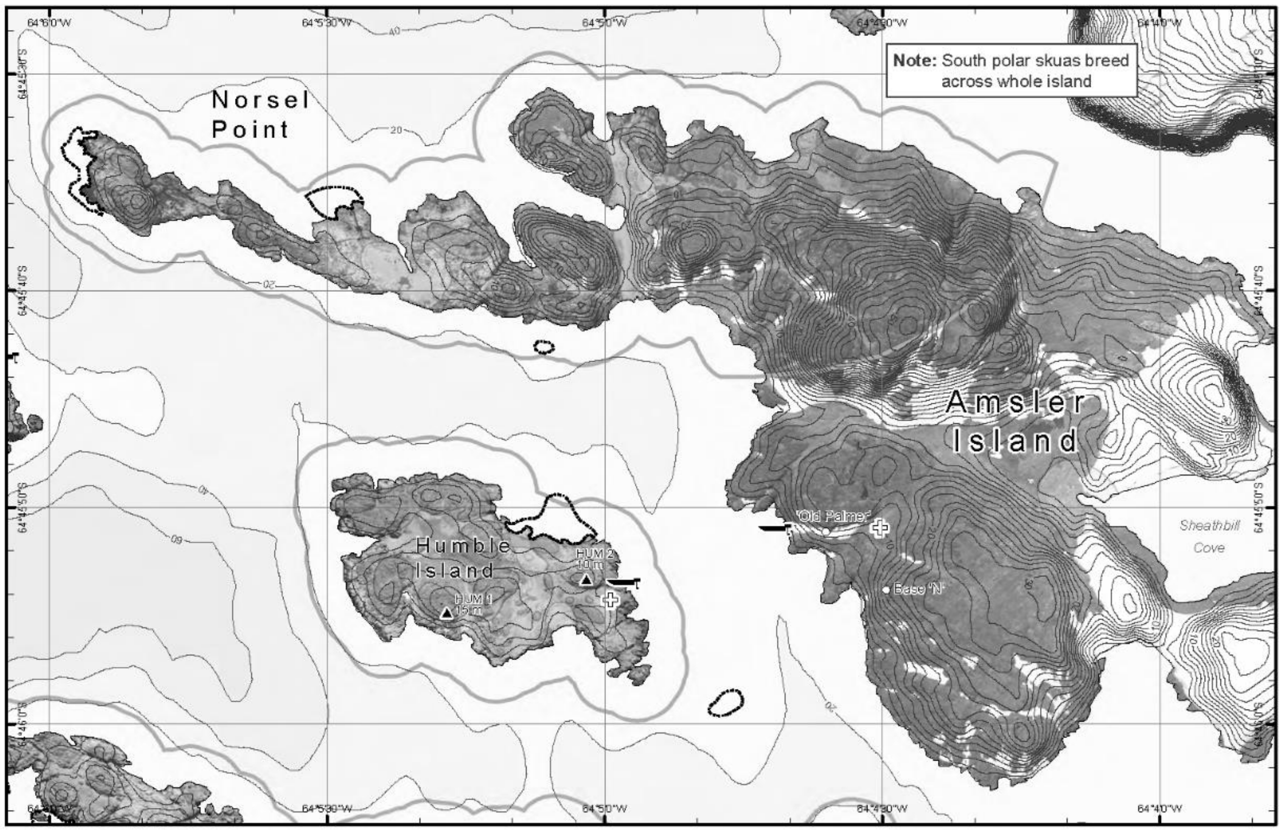
17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Index contour (10 m)
Contour (2 m)
Isobath (20 m)
Vehicle route
Access trolley line
Antenna / tower
Service line
Operations Zone
Restricted Zone
Helicopter landing site
Survey control (monumented)

Breeding birds
Southern Giant petrel
Kelp gull

0 50 100
Meters

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours: derived from orthorectified aerial imagery (Feb 09)
Updated permanent ice edge from GeoEye-1 image (Imagery © 2019 DigitalGlobe, Inc.) 11 Jan 2019.
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2016)
Infrastructure: ASC (2018-19); Survey marker: USGS; Zones: ERA (Jan 2022)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 5: ASMA No. 7 - Norsel Point Restricted Zone

17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

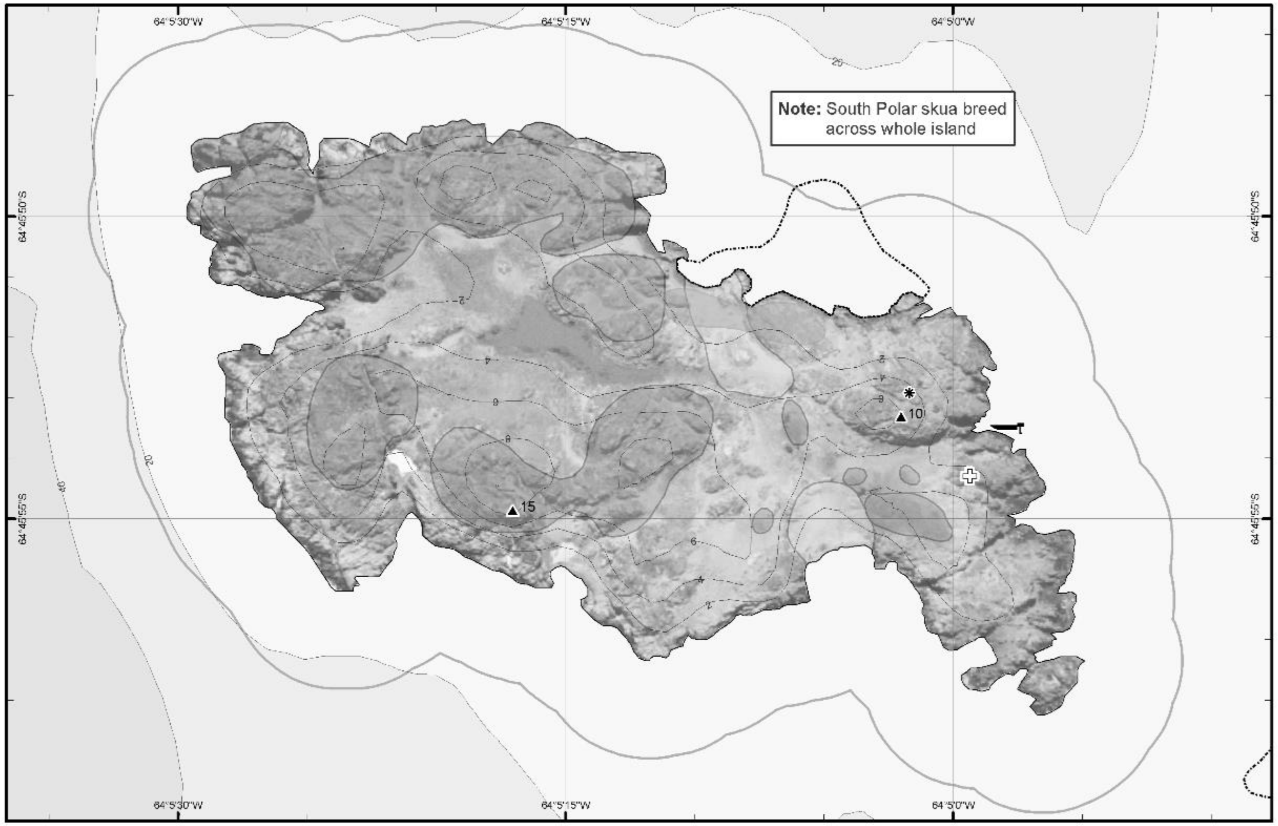
Zones
Restricted Zone

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

Mammals
Elephant seal haul out

0 100 200
Meters

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours: derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2016)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC Survey (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 6: ASMA No.7 - Humble Island Restricted Zone

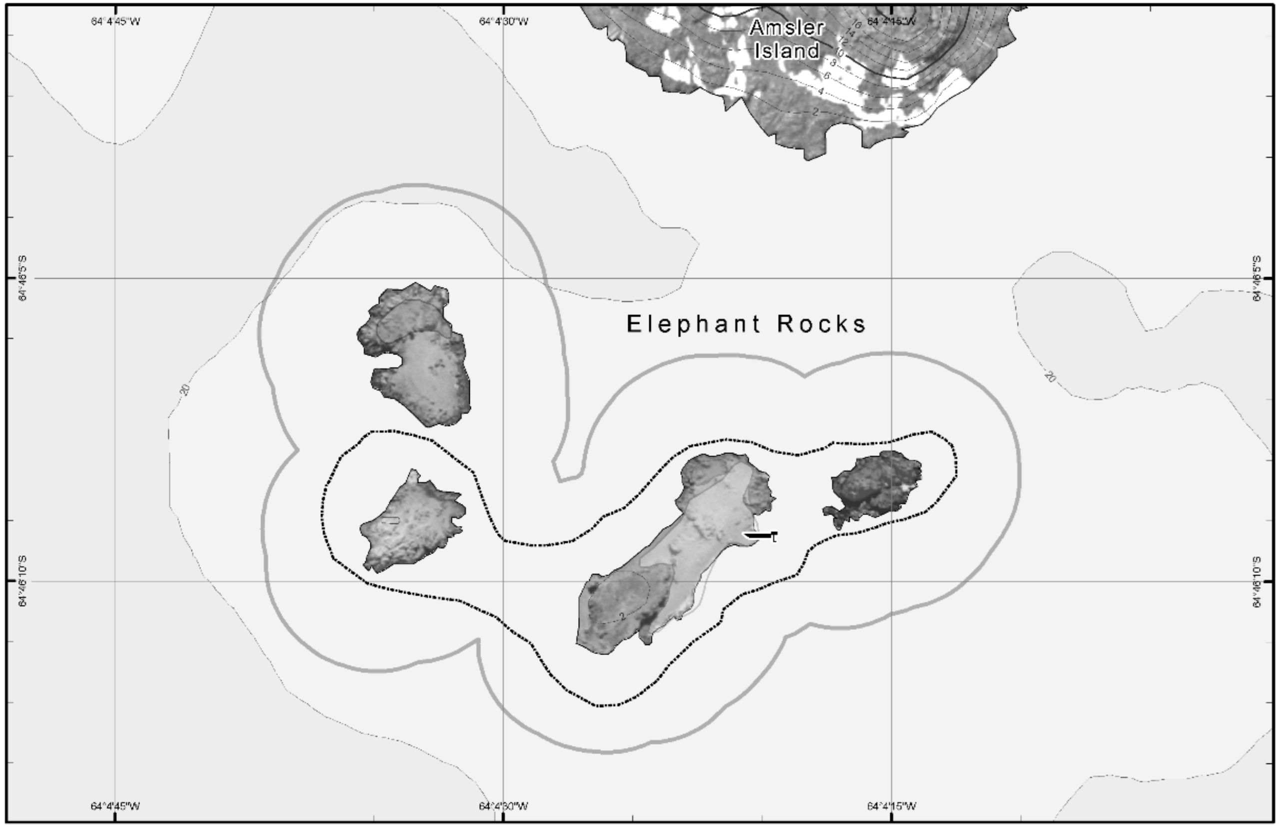
17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

Rock coastline
Shoal
Contour (2 m)
Isobath (20 m)
Restricted Zone
Emergency cache
Small boat landing site
Survey control (monumented)
VHF Antenna

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull

Mammals
Elephant seal haul out

Projection: Lambert Conformal Conic;
Spheroid: WGS84; Horizontal datum: USGS TOR1;
Data sources:
Coastline, shoals, contours: from orthorectified aerial imagery (Feb 09);
Survey marker: USGS; Zones: ERA Jan 2022;
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004);
Wildlife data: Polar Oceans Research Group (Dec 2016);
Infrastructure: updated Polar Oceans Research Group (Mar 2019).



Map 7: ASMA No.7 - Elephant Rocks Restricted Zone

17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

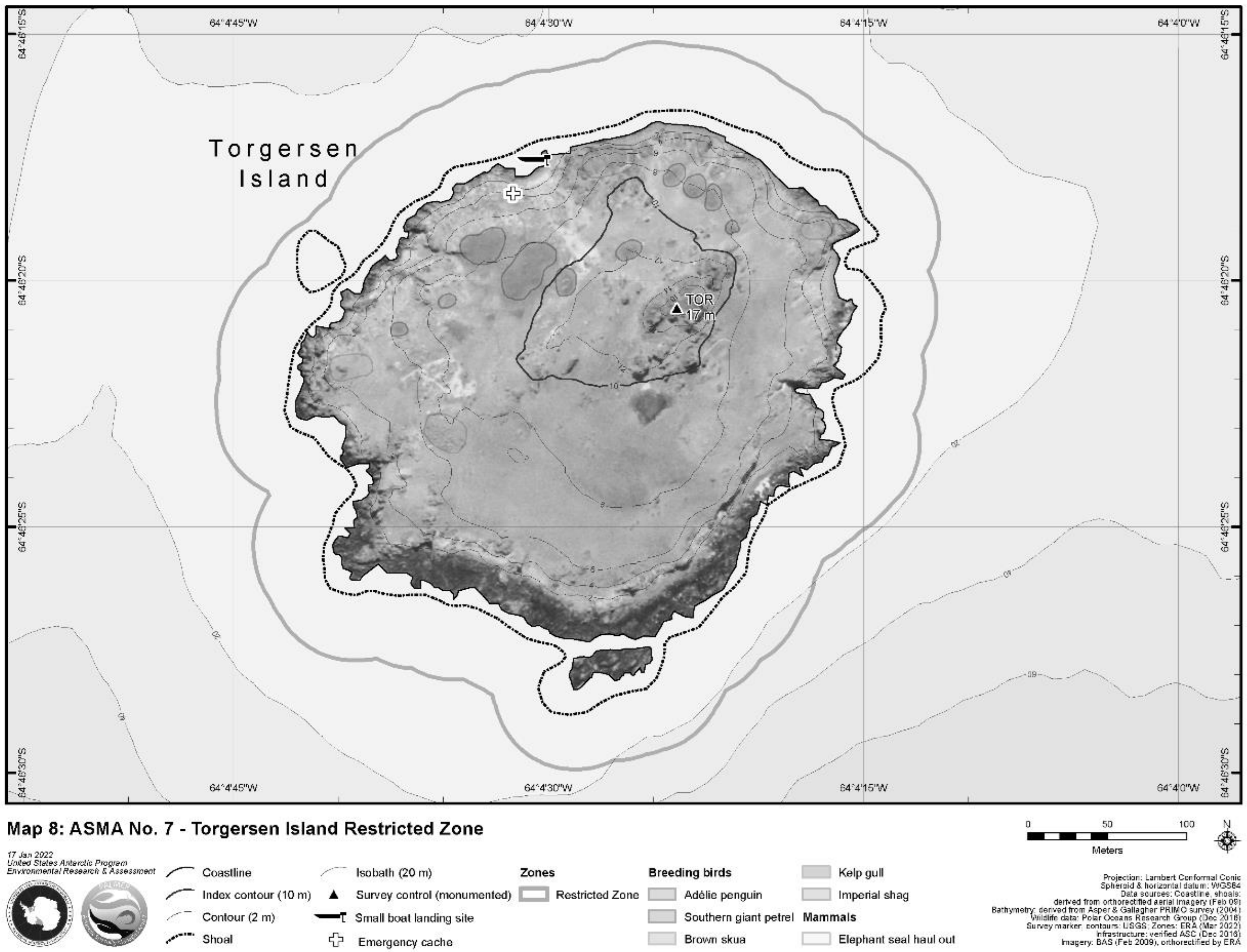
Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

Zones
Restricted Zone

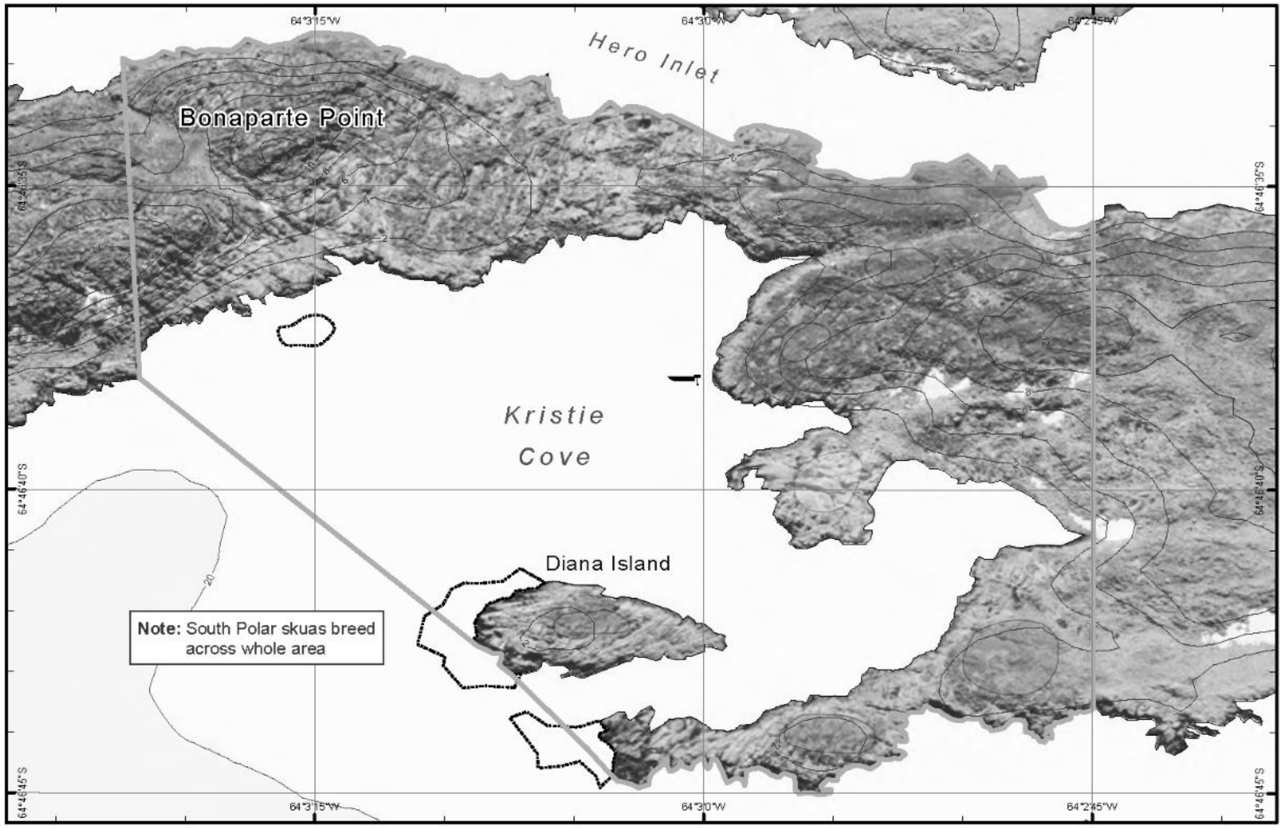
Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

Mammals
Elephant seal haul out

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours: derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2018)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Torgersen Island
TOR
17 m
64°4'45"W
64°4'30"W
64°4'15"W
64°4'0"W
64°46'15"S
64°46'20"S
64°46'25"S
64°46'30"S
Map 8: ASMA No. 7 - Torgersen Island Restricted Zone
17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment
Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache
Zones
Restricted Zone
Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag
Mammals
Elephant seal haul out
0
50
100
Meters
N
Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals: derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2018)
Survey marker, contours: USGS; Zones: ERA (Mar 2022)
Infrastructure: verified ASC (Dec 2018)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 9: ASMA No. 7 - Bonaparte Point & Kristie Cove Restricted Zone

17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

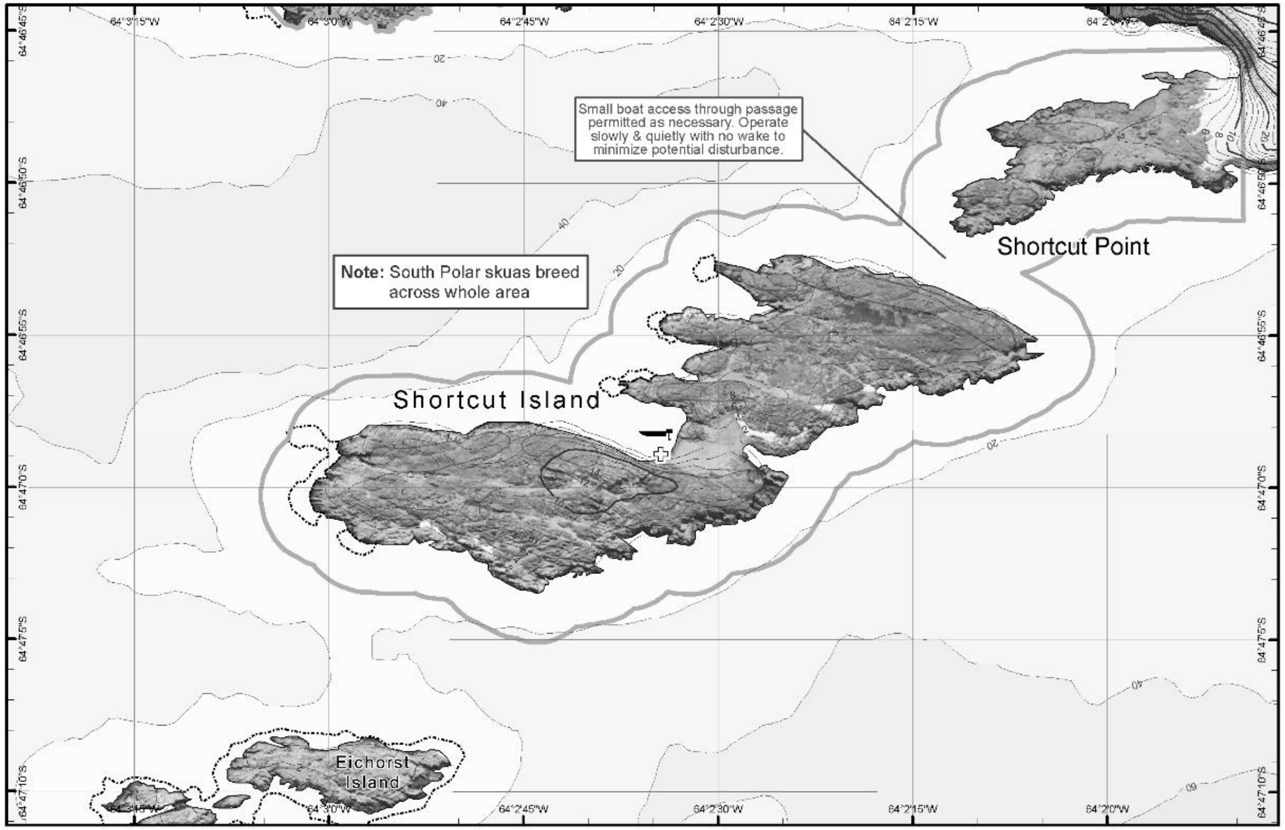
Zones
Restricted Zone

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

Mammals
Elephant seal haul out

0 50 100
Meters
N

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours:
derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2016)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 10: ASMA No.7 - Shortcut Island & Shortcut Point Restricted Zone

17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

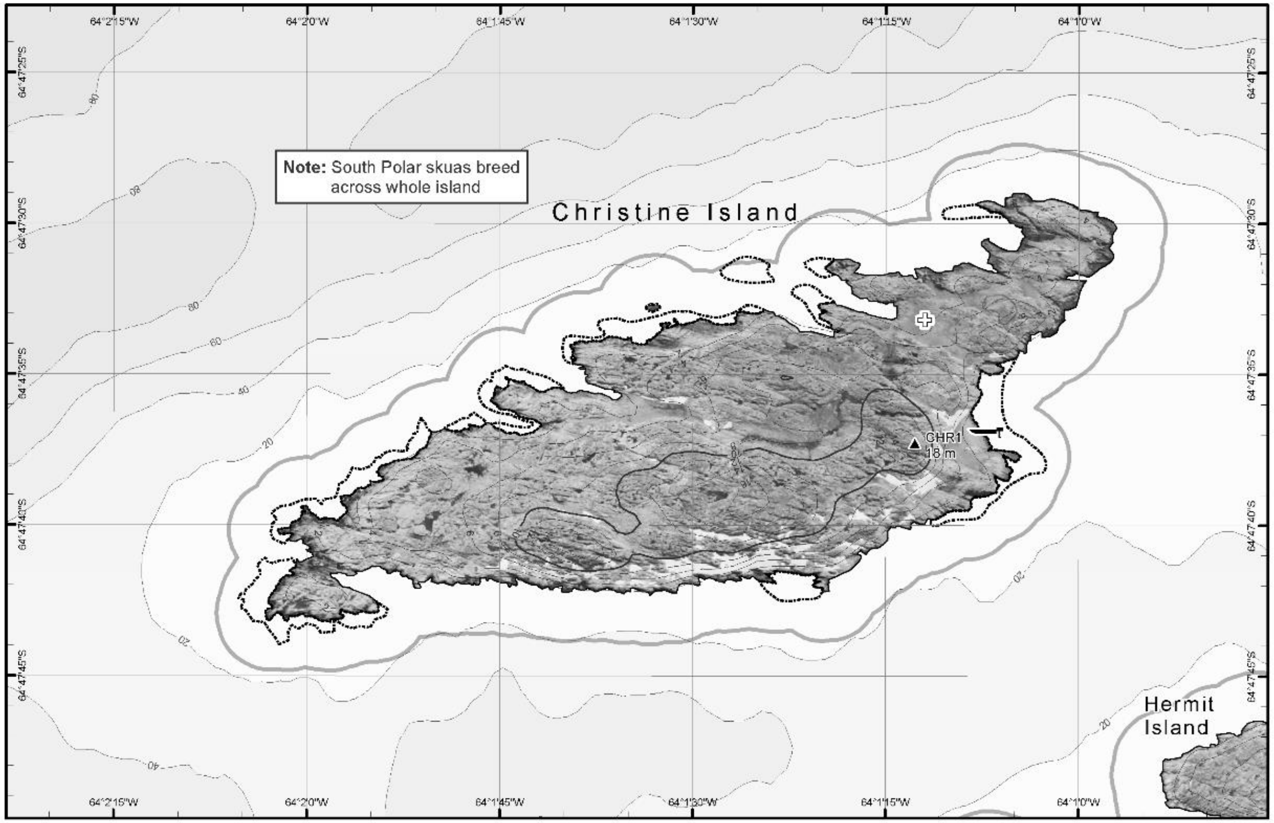
Zones
Restricted Zone

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

Mammals
Elephant seal haul out

0 50 100
Meters

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours: derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2018)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 11: ASMA No.7 - Christine Island Restricted Zone

17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

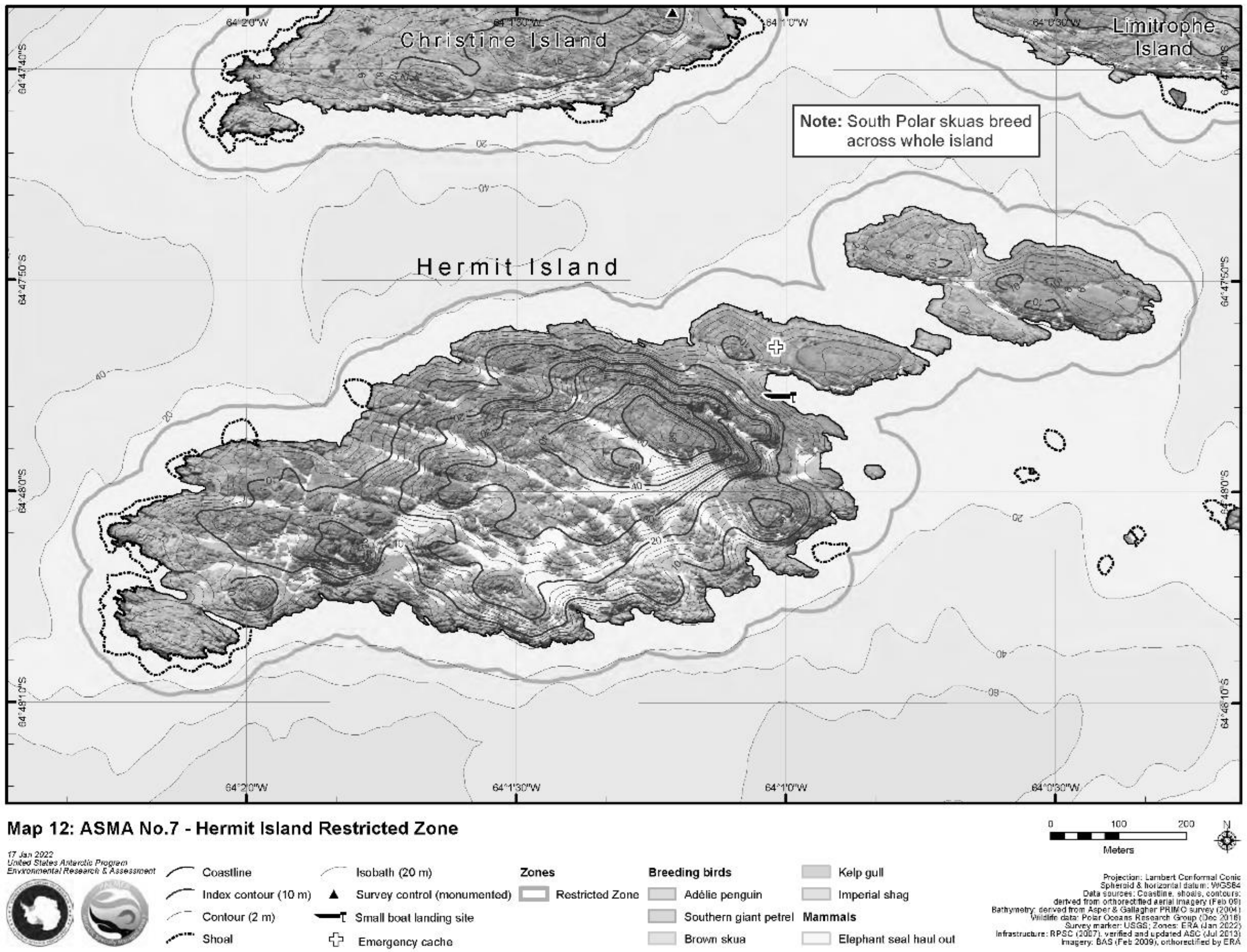
Zones
Restricted Zone

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

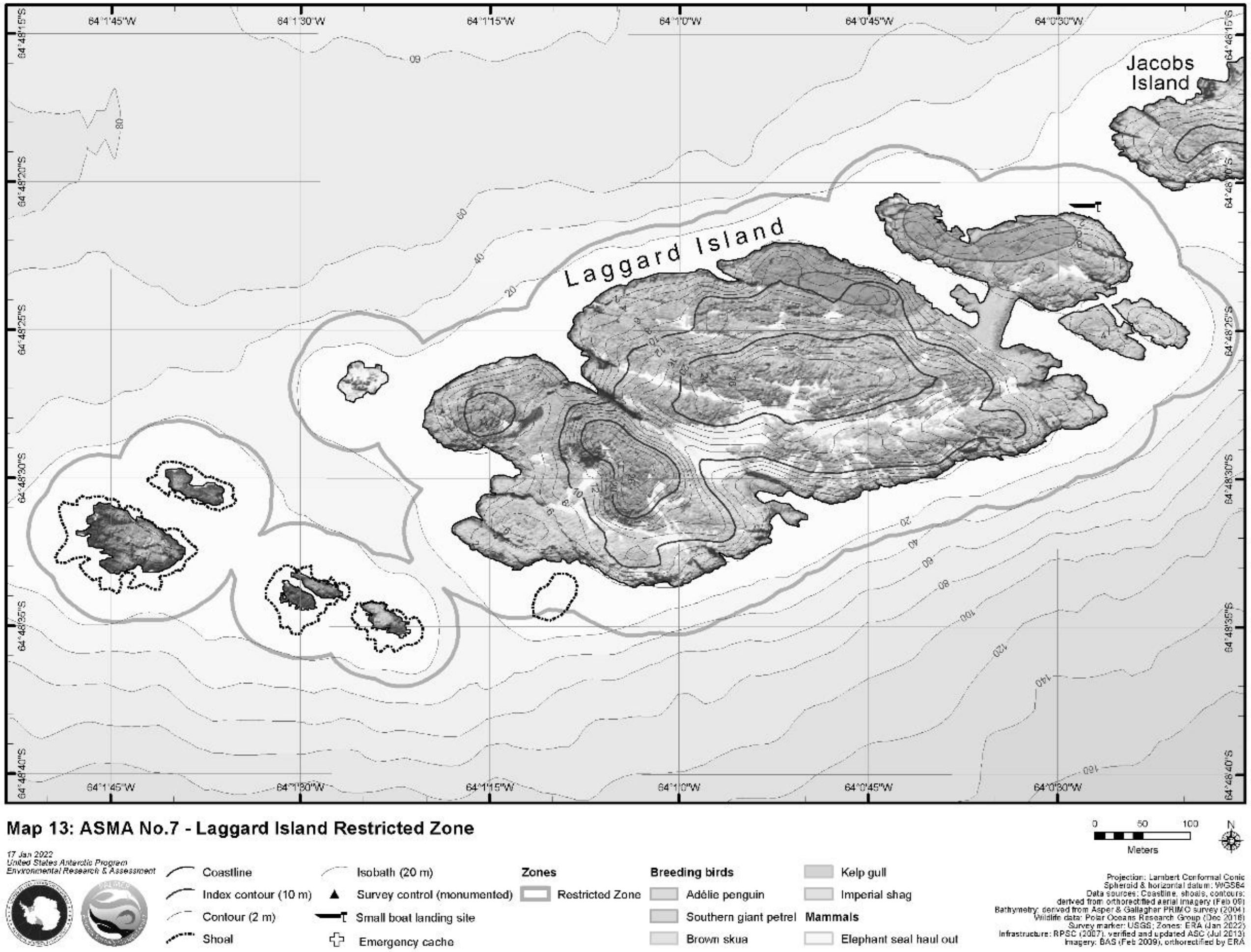
Mammals
Elephant seal haul out

0 50 100
Meters

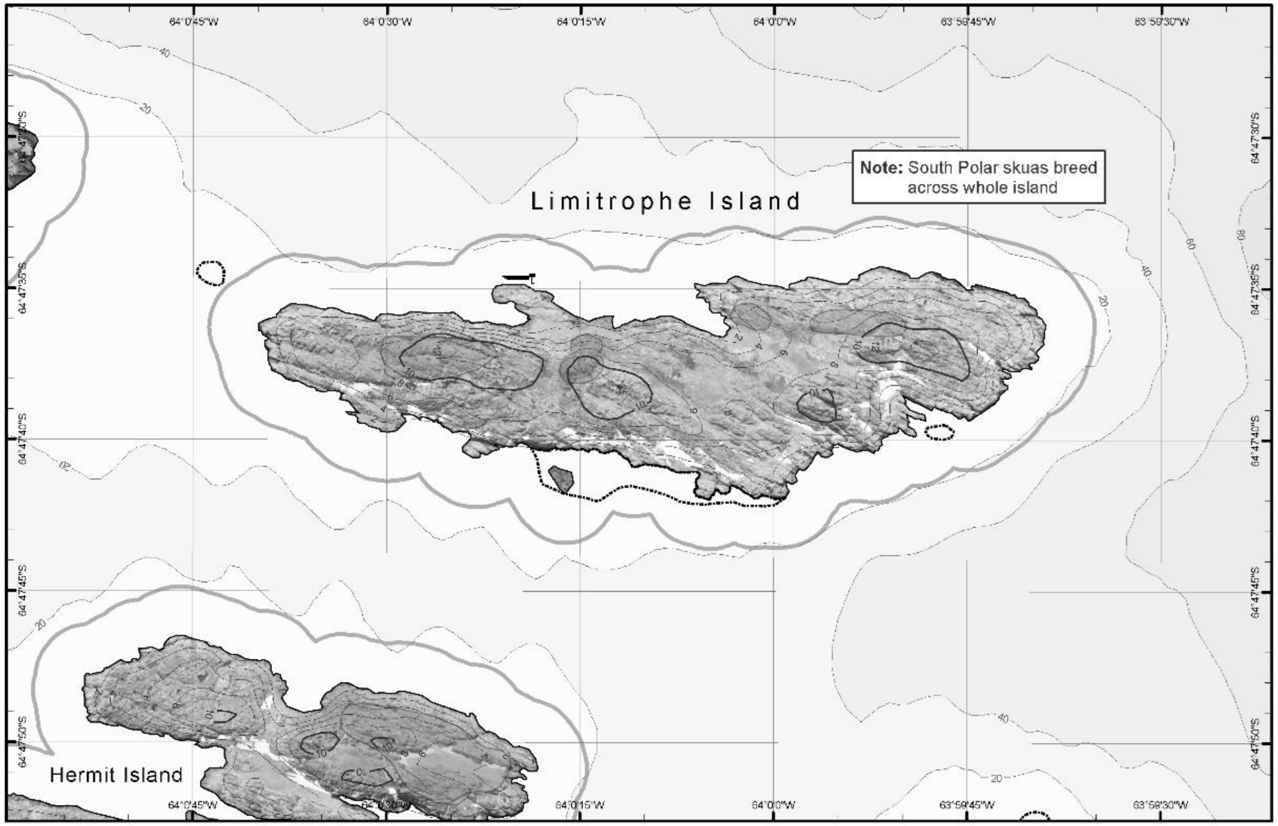
Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours:
derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2018)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 12: ASMA No.7 - Hermit Island Restricted Zone



Map 13: ASMA No.7 - Laggard Island Restricted Zone



Map 14: ASMA No.7 - Limitrophe Island Restricted Zone

17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

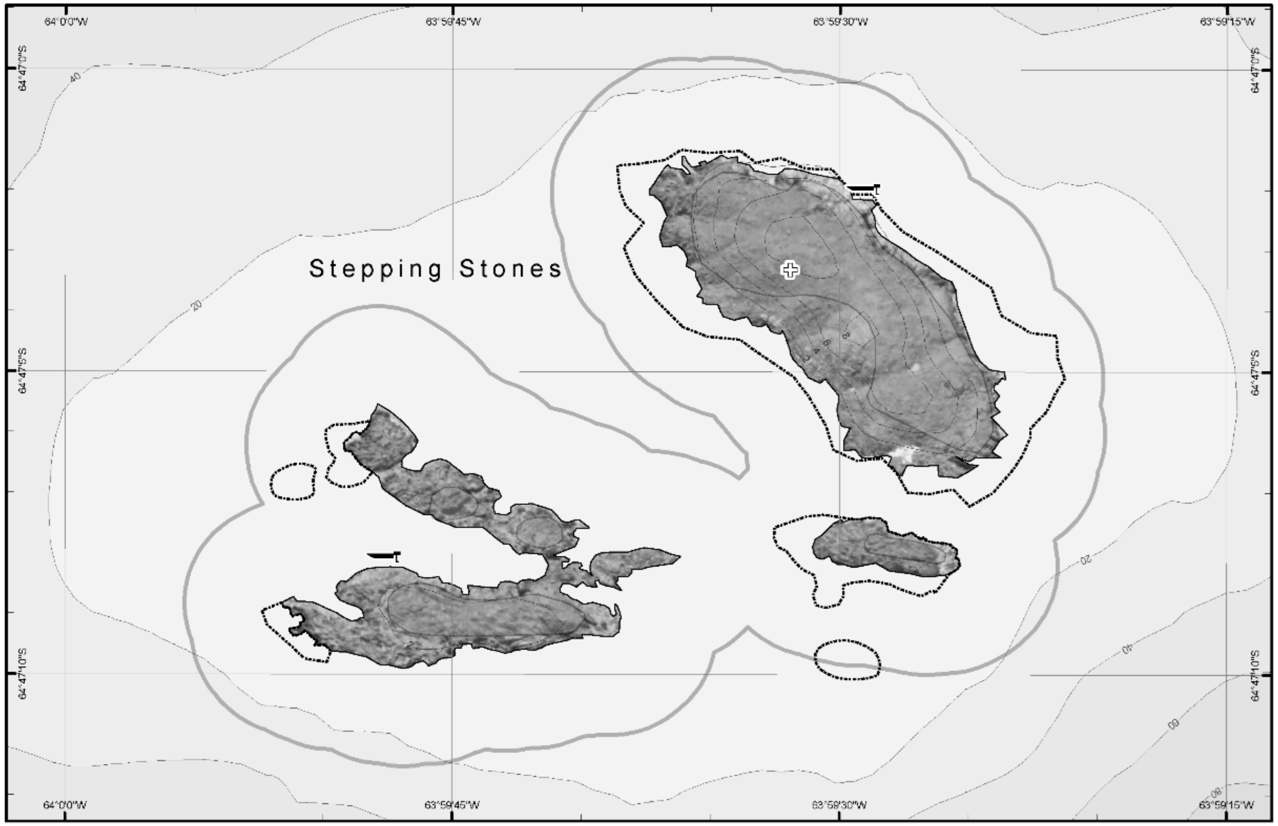
Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

Zones
Restricted Zone

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

Mammals
Elephant seal haul out

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours:
derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2016)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 15: ASMA No. 7 - Stepping Stones Restricted Zone

17 Jan 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

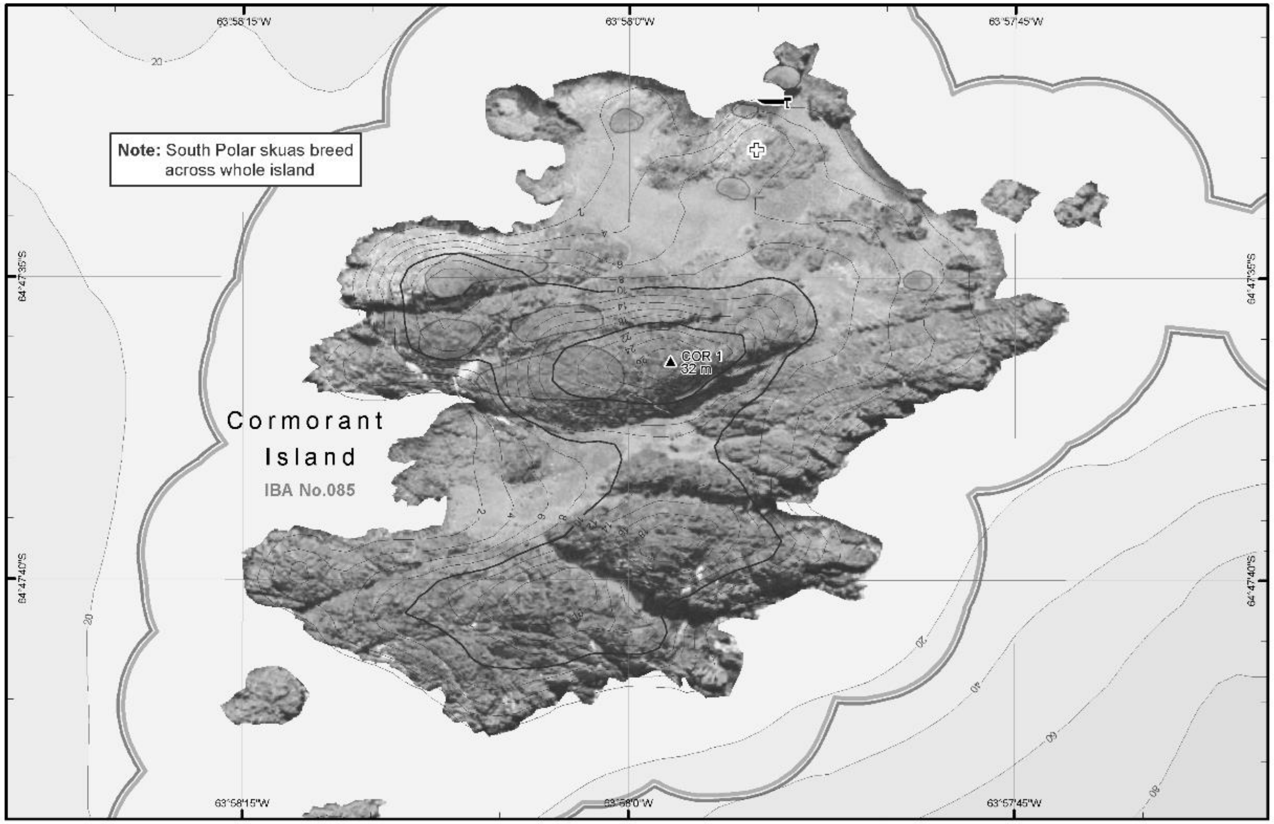
Zones
Restricted Zone

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

Mammals
Elephant seal haul out

0 50 100
Meters
N

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours:
derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2018)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 16: ASMA No.7 - Cormorant Island Restricted Zone

02 Mar 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Index contour (10 m)
Contour (2 m)
Shoal
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

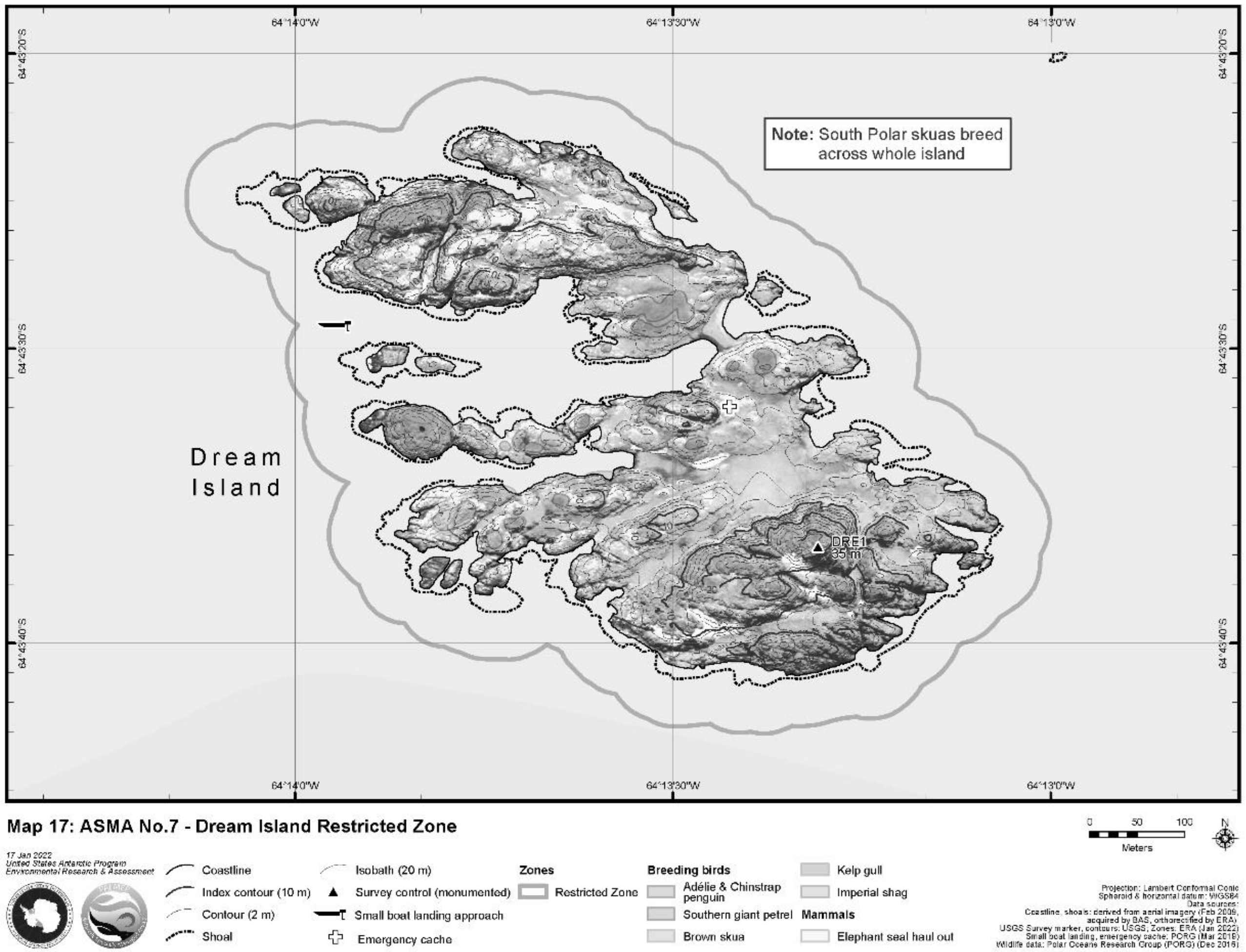
Zones
Restricted Zone
Important Bird Area

Breeding birds
Adélie penguin
Southern giant petrel
Brown skua
Kelp gull
Imperial shag

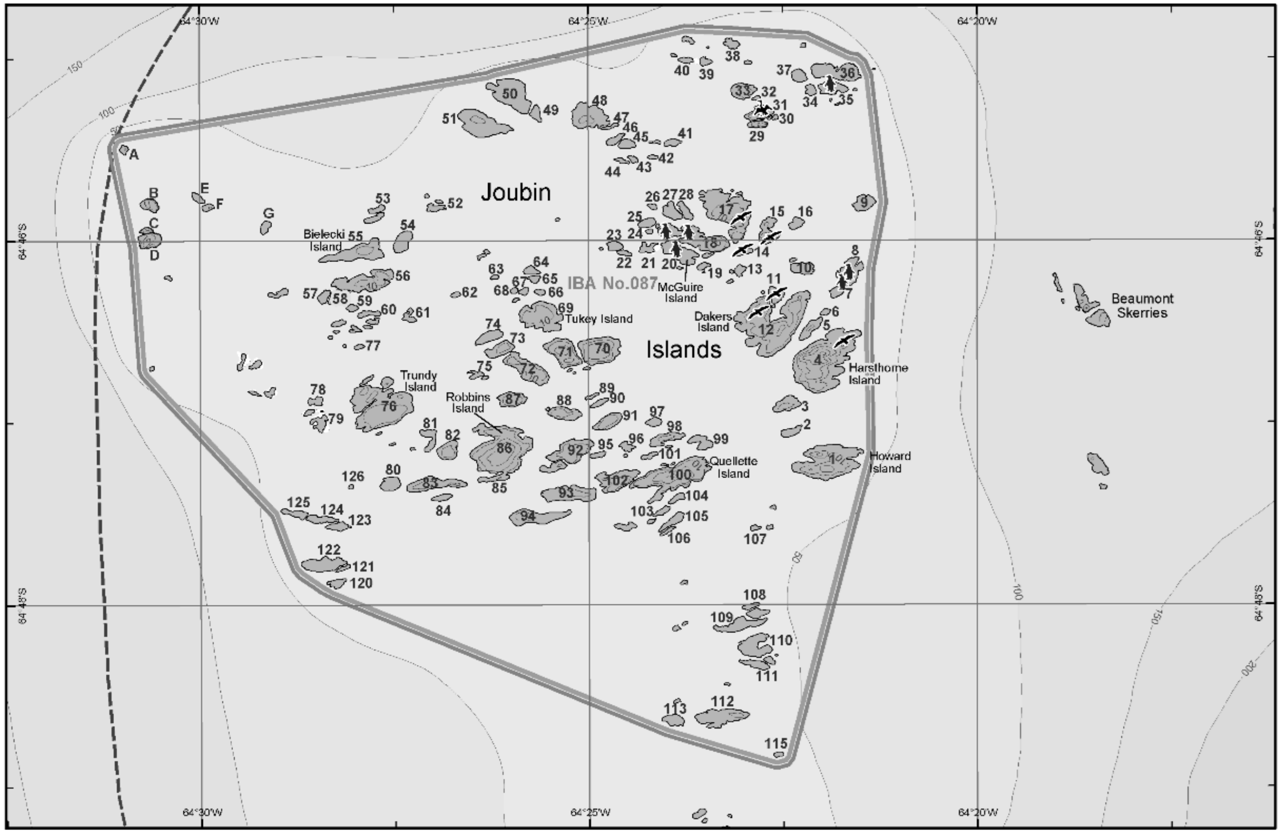
Mammals
Elephant seal haul out

0 50 100
Meters

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline, shoals, contours: derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from Asper & Gallagher PRIMO survey (2004)
Wildlife data: Polar Oceans Research Group (Dec 2016)
Survey marker: USGS; Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
Imagery: BAS (Feb 2009), orthorectified by ERA



Map 17: ASMA No.7 - Dream Island Restricted Zone



Map 18: ASMA No.7 - Joubin Islands Restricted Zone

02 Mar 2022
United States Antarctic Program
Environmental Research & Assessment

Coastline
Contour (10 m)
Isobath (50 m)

Ice free ground
Permanent ice
Restricted Zone
Important Bird Area
Extended Boating Area

Penguin colony
Imperial shag colony
Southern Giant petrel colony

0 1 2
Kilometers

Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: Coastline & ice free ground: derived from satellite imagery by ERA & PGC
Contours: derived from DEM created by PGC
Bathymetry: IBCSO v.1 (2013) (http://www.ibcso.org)
Restricted Zone / IBA: ERA (Mar 2022)
Bird colonies & Island numbering system - Polar Oceans Research Group (2016)

Measure 2 (2022)

Antarctic Specially Protected Area No 109 (Moe Island, South Orkney 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-13 (1966), which designated Moe Island, South Orkney Islands as Specially Protected Area ("SPA") No 13 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a revised description of SPA 13 and a Management Plan for the Area;
- Measure 1 (1995), which annexed a revised description and a revised Management Plan for SPA 13;
- Decision 1 (2002), which renamed and renumbered SPA 13 as ASPA 109;
- Measures 1 (2007), 1 (2012) and 1 (2017), which adopted a revised Management Plan for ASPA 109;

Recalling

- Recommendation IV-13 (1966) was designated as no longer current by Decision 1 (2011);
- Resolution 9 (1995) was designated as no longer current by Resolution 1 (2008);
- Recommendation XVI-6 (1991) did not become effective and was withdrawn by Decision 3 (2017); and
- Measure 1 (1995) did not become effective and was withdrawn by Measure 3 (2012);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 109;

Desiring to replace the existing Management Plan for ASPA 109 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 109 (Moe Island, South Orkney Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 109 annexed to Measure 1 (2017) be revoked.

Management Plan for Antarctic Specially Protected Area No. 109

MOE ISLAND, SOUTH ORKNEY ISLANDS

Introduction

The primary reason for the designation of Moe Island, South Orkney Islands (Latitude 60°44'S, Longitude 045°41'W), as Antarctic Specially Protected Area (ASPA) No. 109 is to protect environmental values, and primarily the terrestrial flora and fauna within the Area.

The Area was originally designated in Recommendation IV-13 (1966, SPA No. 13) after a proposal by the United Kingdom on the grounds that the Area provided a representative sample of the maritime Antarctic ecosystem, that intensive experimental research on the neighbouring Signy Island might alter its ecosystem and that Moe Island should be specially protected as a control area for future comparison.

These grounds are still relevant. Whilst there is no evidence that research activities at Signy Island have significantly altered the ecosystems there, a major change has occurred in the low altitude terrestrial system as a result of the rapidly expanding Antarctic fur seal (Arctocephalus gazella) population. Plant communities on nearby Signy Island have been physically disrupted by trampling by fur seals and nitrogen enrichment from the seals' excreta has resulted in replacement of bryophytes and lichens by the macro-alga Prasiola crispa. Low-lying lakes have been significantly affected by enriched run-off from the surrounding land. So far Moe Island has only been invaded by fur seals to a limited extent and its topography makes it less likely that seals will penetrate to the more sensitive areas inland. Moe Island has been visited on few occasions and has never been the site of occupation for periods of more than a few hours.

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 109 is contained within Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment Domain G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 111, 112, 125, 126, 128, 145, 149, 150, and 152 and ASMAs 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.

ASPA 109 sits within Antarctic Conservation Biogeographic Region (ACBR) 2 South Orkney Islands.

Through Resolution 5 (2015) Parties recognised the usefulness of the list of Antarctic Important Bird Areas (IBAs) in planning and conducting activities in Antarctica. Within the boundary of ASPA 109 is located IBA ANT020 Moe Island, which was identified due to its extensive colonies of chinstrap penguins, cape petrels and Antarctic prions.

The two other ASPAs present within the South Orkney Islands (ASPA 110 Lynch Island and ASPA 111 Southern Powell Island and adjacent islands) were designated primarily to protect terrestrial vegetation and bird communities. Moe Island complements the local network of ASPAs by protecting a representative sample of the maritime Antarctic ecosystem including cryptogam-dominated terrestrial and coastal communities.

1. Description of values to be protected

Following a visit to the ASPA in January 2022, the values specified in the earlier designation were reaffirmed. These values are set out as follows:

- The Area contains exceptional environmental values associated with the biological composition and diversity of a near-pristine example of the maritime Antarctic terrestrial and littoral marine ecosystems.
- Moe Island contains the greatest continuous expanses of Chorisodontium-Polytrichum moss turf found in the Antarctic.

2. Aims and objectives

Management of Moe Island aims to:

- major changes to the structure and composition of the terrestrial vegetation, in particular the moss turf banks;
- prevent unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microorganisms;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- allow visits for management purposes in support of the aims of the management plan;
- minimise the possibility of introduction of pathogens which may cause disease in bird populations within the Area.

3. Management activities

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

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- The Management Plan shall be reviewed at least every five years and updated as required.
- 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.
- A copy of this Management Plan shall be made available at Signy Research Station (UK; 60°42′30″ S, 045°36′30″ W) and Orcadas Station (Argentina; 60°44′15″ S, 044°44′20″ W).
- Where appropriate, National Antarctic Programmes are encouraged to liaise closely to ensure management activities are implemented. In particular, national Antarctic programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area. Also, national Antarctic programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.
- 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.

4. Period of designation

Designated for an indefinite period.

5. Maps

Figure 1. Map of the location of Moe Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 45°W.

Figure 2. Map of Moe Island in greater detail. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 45°W.

6. Description of the Area

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

- *Boundaries and co-ordinates*

The boundary co-ordinates of the Area, starting with the most north-westerly position and moving clockwise, are shown in Table 1.

Number	Latitude	Longitude
1	60°43’40’’ S	045°42’15’’ W
2	60°43’40’’ S	045°40’30’’ W
3	60°43’55’’ S	045°40’10’’ W
4	60°44’40’’ S	045°40’10’’ W
5	60°44’40’’ S	045°42’15’’ W

The Area includes all of Moe Island and unnamed adjacent islands and islets. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within the boundaries, but excludes the marine environment extending greater than 10 m offshore from the low tide water line (Figure 2). Boundary markers have not been installed..

- *General description of the area*

Moe Island, South Orkney Islands, is a small irregularly-shaped island lying 300 m off the south-western extremity of Signy Island, from which it is separated by Fyr Channel. It is about 1.3 km from the northeast to southwest and 1 km from northwest to southeast (1.22 km^2). It should be noted that the position of Moe Island on Admiralty Chart No. 1775 (60°44'S, 45°45'W), does not agree closely with the more accurate coordinates in Figure 2 (60°44'S, 45°41'W).

The island rises precipitously on the north-eastern and south-eastern sides to Snipe Peak (226 m altitude). There is a subsidiary summit above South Point (102 m altitude) and lower hills on each of three promontories on the western side above Corral Point (92 m), Conroy Point (39 m) and Spaull Point (56 m). Small areas of permanent ice remain on the east- and south-facing slopes with late snow lying on the steeply dipping western slopes. There are no permanent streams or pools.

- *Geology*

The rocks are metamorphic quartz mica schists, with occasional biotite and quartz-rich beds. There is a thin bed of undifferentiated amphibolite on the northeastern coast. Much of the island is overlain with glacial drift and scree. Soils are predominantly immature deposits of fine to coarse clays and sands intermixed with gravels, stones and boulders. They are frequently sorted by freeze-thaw action in high or exposed locations into small-scale circles, polygons, stripes and lobes. There are deep accumulations of peat (up to 2 m thick on western slopes), considerable expanses of the surface of which are bare and eroded.

- *Terrestrial biological communities*

The dominant plant communities are Andreaea-Usnea fellfield and banks of Chorisodontium-Polytrichum moss turf (the largest known example of this community type in the Antarctic). Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 0.58 km² (48% of the ASPA area; Figures 3 and 4). These moss banks constitute a major biological value and a reason for the designation of the Area. The cryptogamic flora is diverse. The majority of these moss banks have received little damage from fur seals, and show few visible sign of degradation. However, the exception to this observation is the northern-most banks located around Spaull Point. Here, although still extensive, the moss turf was estimated to have suffered about 50% damage from Antarctic fur seal (Arctocephallus gazella) activity during a survey in January 2006 and still evident during observations in February 2016. Almost certainly fur seals gain access to this plant community via the gentle slope leading inland from the small shingle beach located at the north-eastern corner of Landing Cove.

The mites Gamasellus racovitzai and Stereotydeus villosus and the springtail Cryptopygus antarcticus are common under stones.

- *Vertebrate fauna*

There were five colonies of chinstrap penguins (Pygoscelis antarctica) totalling about 11,000 pairs in 1978-79. A visit in February 1994 noted fewer than 100 pairs on the northern side of Landing Cove and more than a thousand on the southern side. A visit in February 2011 noted c. 75 pairs on the northern side of Landing Cove and c. 750 pairs on the southern side. Approximately 100 breeding pairs were observed on Spaull Point during a visit in January 2006. Numerous other birds breed on the island, notably about 2,000 pairs of cape petrels (Daption capensis) in 14 colonies (1966) and large numbers of Antarctic prions (Pachyptila desolata). Snow Petrels (Pagodroma nivea) were recorded breeding on Moe Island in 1957/58 when the colony comprised 34 breeding pairs (Croxall et al. 1995), and were confirmed breeding during a survey in 2005/06 (R. Fijn pers. comm. 2015, quoted in Harris et al., 2015).

Weddell seals (Leptonychotes weddellii), crabeater seals (Lobodon carcinophaga) and leopard seals (Hydrurga leptonyx) are found in the bays on the west side of the island. Increasing numbers of fur seals (Arctocephalus gazella), mostly juvenile males, come ashore on the north side of Landing Cove and have caused some damage to vegetation in that area. However, it is possible that the nature of the terrain will restrict these animals to this small headland where damage may intensify.

6(ii) Access to the Area

- Where possible, access shall be by small boat. There are no restrictions on landing from the sea. Landings are usually most safely made at the northeast corner of Landing Cove (Lat. 60°43’55” S, Long. 045°41’06” W; Figure 2). If Landing Cove is inaccessible due to the ice conditions, an alternative landing site is at the western-most point of Spaull Point (Lat. 60°43’54” S, Long. 045°41’15” W), directly opposite an offshore rock of 26 m altitude.
- Under exceptional circumstances, necessary for purposes consistent with the objectives of the Management Plan, helicopters may be permitted to land within the Area.
- Helicopters may land only on the col between hill 89 m and the western slope of Snipe Peak (Lat. 60°44’09” S, Long. 045°41’23” W, Figure 2). Landing on vegetation in the col should be avoided to the maximum extent practicable. To avoid overflying bird colonies, approach should preferably be from the south, though an approach from the north is permissible.
- Within the Area the operation of aircraft 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). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit the Area.
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used, all smoke grenades should be retrieved.

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

A marker board is located at the back of the small shingle beach in the northeast corner of Landing Cove, beyond the splash zone on top of a flat rock, to which it is bolted (Lat. 60°43’55” S, Long. 045°41’05” W). During periods of heavy snowfall, the marker board may be buried and difficult to locate.

There is a cairn and the remains of a survey mast, erected in 1965-66, on Spaull Point (Lat. 60°43’49” S, Long. 045°41’05” W). This mast is of interest for lichenometric studies and should not be removed. There are no other structures on Moe Island.

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

ASPA No. 110, Lynch Island, lies about 10 km north-north-east of Moe Island. ASPA No. 111, Southern Powell Island and adjacent islands, is about 41 km to the east (Figure 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 as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

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

- it is issued for a compelling scientific purpose which cannot be served elsewhere; or
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- a report or reports are supplied to the authority or authorities named in the Permit;
- 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

- Land vehicles are prohibited within the Area
- Movement within the Area shall be on foot.
- Pilots, helicopter or boat crew, or other people on helicopters or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- 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, i.e. all movement should be undertaken carefully so as to minimise disturbance to the soil and vegetated surfaces, walking on rocky terrain if practical.
- 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

- Compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area.
- Essential management activities, including monitoring.

7(iv) Installation, modification or 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 a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be 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 of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

7(v) Location of field camps

Camp in the Area is not normally permitted. If camping is essential for reasons of safety, tents should be erected having regard to causing the least damage to vegetation or disturbance to fauna.

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 COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species. 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 and fauna

Taking of or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of or harmful interference with animals is involved, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica (Resolution 4 (2019)) should be used as a minimum standard.

7(viii) The collection or removal of materials not brought into the Area by the Permit holder

Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs.

Other material of human origin likely to compromise the values of the Area which was not brought into the Area by the permit holder or otherwise authorised, may be removed 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 must be notified and approval obtained.

7(ix) Disposal of waste

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

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

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, 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 visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. 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.

8. Supporting documentation

Croxall, J. P., Rootes, D. M. & Price, R. A. 1981. Increases in penguin populations at Signy Island, South Orkney Islands. British Antarctic Survey Bulletin 54, 47-56.

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Morgan, F., Barker, G., Briggs, C., Price, R. and Keys, H. 2007. Environmental

Domains of Antarctica Version 2.0 Final Report, Manaaki Whenua Landcare Research New Zealand Ltd. 89 pp.
Ochyra, R., Bednarek-Ochyra, H. and Smith, R.I.L. The Moss Flora of Antarctica. 2008. Cambridge University Press, Cambridge. 704 pp.
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Peat, H., Clarke, A., and Convey, P. 2007. Diversity and biogeography of the Antarctic flora. Journal of Biogeography, 34, 132-146.
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Smith, R. I. L. 1972. British Antarctic Survey science report 68. British Antarctic Survey, Cambridge, 124 pp.
Smith, R. I. L. 1984. Terrestrial plant biology of the sub-Antarctic and Antarctic. In: Antarctic Ecology, Vol. 1. Editor: R. M. Laws. London, Academic Press.

Figure 1. Map showing the location of Moe Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica.

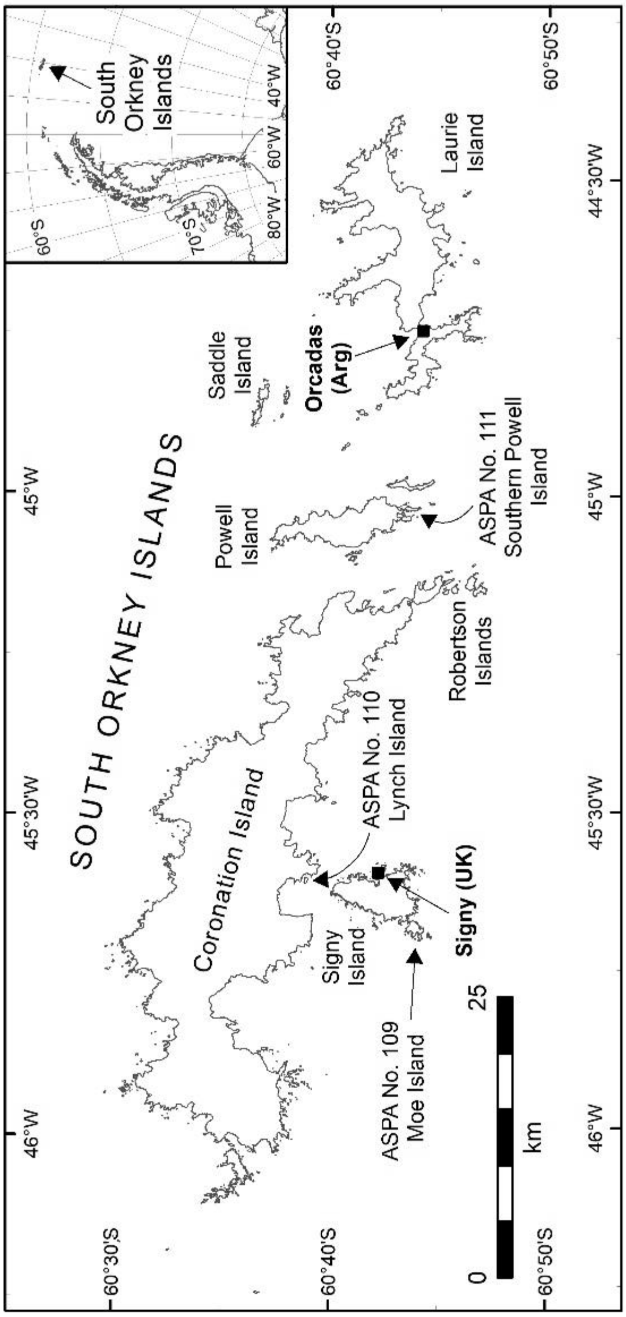

Figure 2. Map of Moe Island in greater detail.

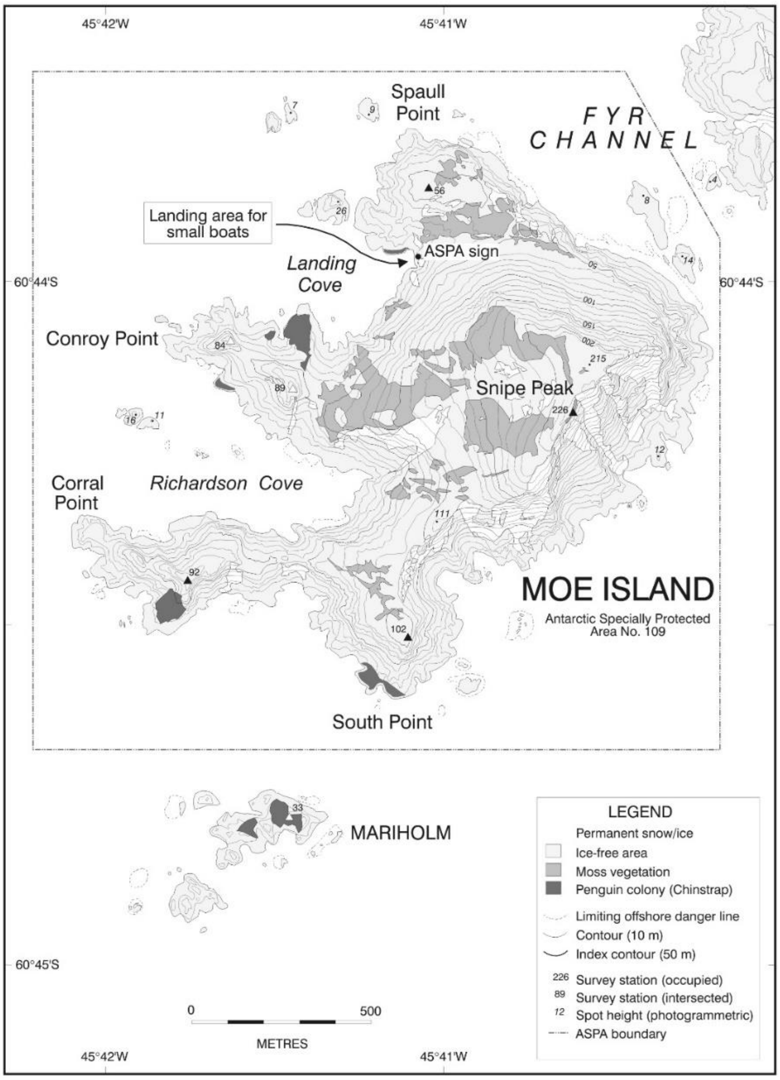

Figure 3. False colour satellite image of ASPA No. 109 Moe Island, South Orkney Islands, which highlights vegetation in red.

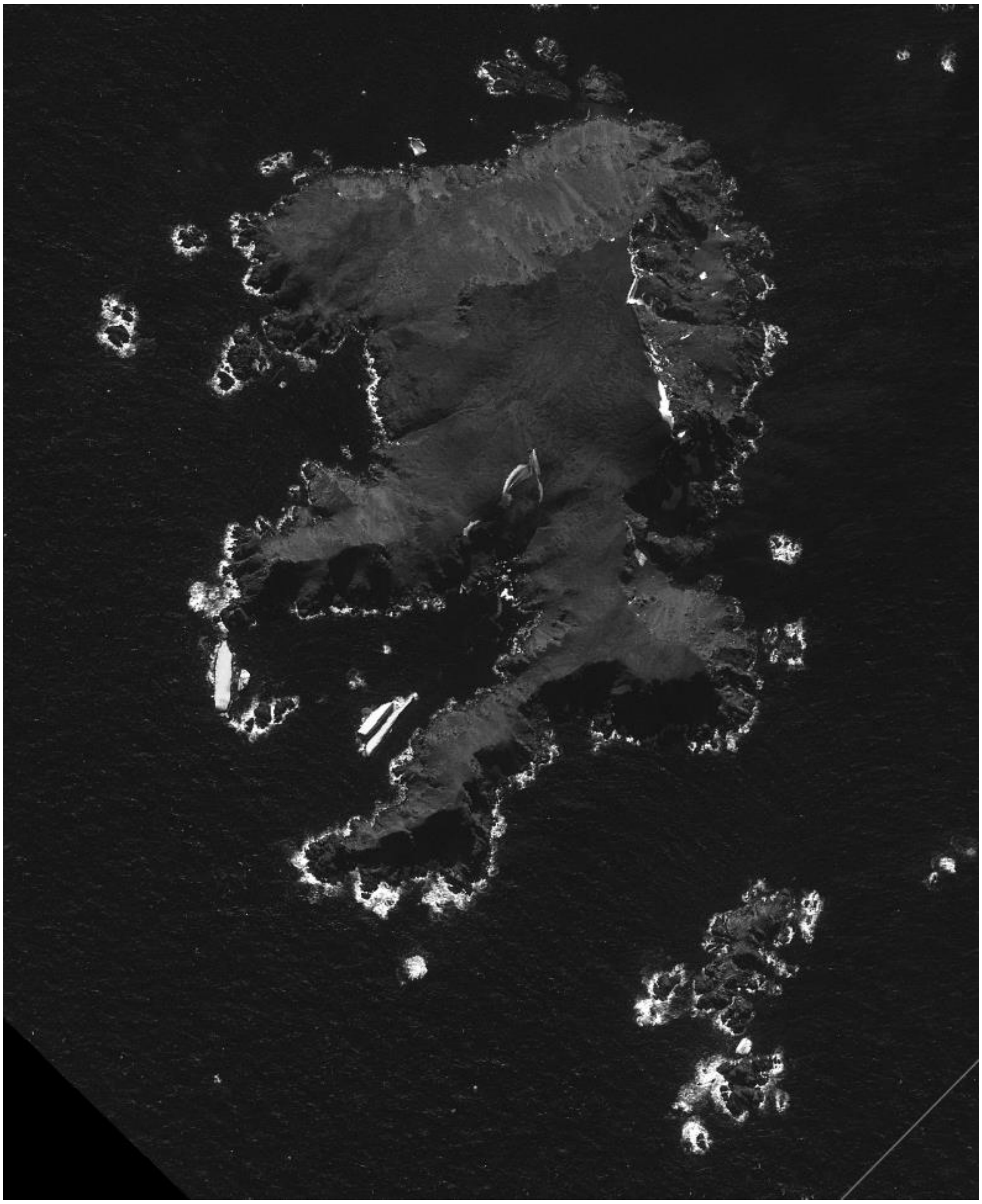

Figure 4. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 109 Moe Island, South Orkney Islands, showing vegetation cover using a colour scale of white → orange → red, with red indicating the highest NDVI values.

Measure 3 (2022)

Antarctic Specially Protected Area No 110 (Lynch Island, South Orkney 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-14 (1966), which designated Lynch Island, South Orkney Islands as Specially Protected Area ("SPA") No 14 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a Management Plan for the Area;
- Measure 1 (2000), which annexed a revised Management Plan for SPA 14;
- Decision 1 (2002), which renamed and renumbered SPA 14 as ASPA 110;
- Measures 2 (2012) and 2 (2017), which adopted a revised Management Plan for ASPA 110;

Recalling that Recommendation XVI-6 (1991) and Measure 1 (2000) did not become effective and were withdrawn by Decision 3 (2017);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 110;

Desiring to replace the existing Management Plan for ASPA 110 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 110 (Lynch Island, South Orkney Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 110 annexed to Measure 2 (2017) be revoked.

Management Plan for Antarctic Specially Protected Area No. 110

LYNCH ISLAND, SOUTH ORKNEY ISLANDS

Introduction

The primary reason for the designation of Lynch Island, South Orkney Islands (Latitude 60°39'10'' S, Longitude 045°36'25'' W; 0.14 km²), as Antarctic Specially Protected Area (ASPA) 110 is to protect environmental values, and primarily the terrestrial flora within the Area.

Lynch Island, Marshal Bay, South Orkney Islands, was originally designated as a Specially Protected Area through Recommendation IV-14 (1966, SPA No. 14) after a proposal by the United Kingdom. It was designated on the grounds that the island "supports one of the most extensive and dense areas of grass (Deschampsia antarctica) known in the Treaty area and that it provides an outstanding example of a rare natural ecological system". These values were amplified and extended by Recommendation XVI-6 (1991) when a management plan for the site was adopted. Lynch Island is 2.4 km from Signy Island, the location of Signy Research Station (UK), and about 200 m from Coronation Island, the largest of the South Orkney Islands. The Area has been afforded special protection for most of the modern era of scientific activity in the region, with entry permits having been issued only for compelling scientific reasons. Thus, the island has not been subjected to frequent visits, scientific research or sampling. Since 1983, the numbers of Antarctic fur seals in the South Orkney Islands as increased significantly, with consequent destruction of accessible areas of vegetation where the seals come ashore. Some vegetated areas on Lynch Island have been damaged, for example, accessible Polytrichum and Chorisodontium moss banks and Deschampsia on the north-eastern and eastern sides of the island have been extensively damaged in some locations. A visit in February 2011 reported fur seals were present over the eastern side of the island [roughly drawing a line between the boat landing site (Lat. 60°39'05" S, Long. 045°36'12" W; Figure 2) and the island's summit (Lat. 60°39'05" S, Long. 045°36'12" W)]. Seals were present to the highest point of the island with about 30 seals on the summit. During a subsequent visit in January 2022, no fur seals were observed. Despite variable levels of fur seal trampling, both the Antarctic hair grass; Deschampsia antarctica and Colobanthus quitensis have thrived over recent years. The area covered by Deschampsia, as reported in February 2011, is more extensive than in the previous report (February 1999). The grass has now increased its abundance and distribution range in an area to the east of the island, extending west to the highest point on the island with good cover to the summit and all over the area around the summit cairn (Figure 3). During a visit in February 1999 it was observed that the most luxuriant areas of grass on the northern and north-western slopes had not yet been affected and this observation was confirmed during a visit in February 2011. Notwithstanding some localised destruction, to date the primary values of the island, as noted above, have not been significantly compromised by either human or seal access to the island.

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). ASPA 110 is not categorised within Morgan et al.; however, ASPA 110 is likely to be contained within Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment Domain G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 109, 111, 112, 125, 126, 128, 145, 149, 150, and 152 and ASMAs 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. ASPA 110 sits within Antarctic Conservation Biogeographic Region (ACBR) 2 South Orkney Islands.

The two other ASPAs present within the South Orkney Islands (ASPA No. 109 Moe Island, and ASPA No. 111 Southern Powell Island and adjacent islands) were designated primarily to protect terrestrial vegetation and bird communities. ASPA No. 110 Lynch Island complements the local network of ASPAs by protecting a representative sample of the maritime Antarctic ecosystem including phanerogam-dominated terrestrial communities.

1. Description of values to be protected

Following a visit to the ASPA in January 2022, the values specified in the earlier designation were reviewed. Values within the Area are set out as follows:

- The Area contains luxuriant swards of Antarctic hair grass Deschampsia antarctica and the only other Antarctic flowering plant, Antarctic pearlwort (Colobanthus quitensis), is also abundant. It is also one of few sites where the grass Deschampsia is known to grow directly on Polytrichum-Chorisodontium moss banks.
- The cryptogamic vegetation is typical of the region; however, several species of moss found on the island (Polytrichastrum alpinum (=Polytrichum alpinum) and Muelleriella crassifolia) are unusually fertile for their southerly location. It is also possibly the only known location in Antarctica where Polytrichastrum alpinum develops sporophytes in profusion annually. Furthermore, Polytrichum strictum (=Polytrichum alpestre) occasionally produces male inflorescences in local abundance, which is a rare occurrence in this species in Antarctica and the rare moss Plagiothecium ovalifolium occurs in moist shaded rock crevices near the shore.
- The shallow loam-like soil associated with the grass swards was contains a rich invertebrate fauna. The population density of the arthropod community

associated with Deschampsia on Lynch Island appears unusually high, with some measurements suggesting it is one of the highest in the world. The site also shows unusual diversity for an Antarctic site. A rare enchytraeid worm was also found in moist moss in rock crevices on the northern side of the island. One arthropod species (Globoppia loxolineata) is near the northernmost limit of its known distribution, and specimens collected from Lynch Island exhibited unusual morphological characteristics compared to specimens collected elsewhere in the South Orkney-Antarctic Peninsula region.

- Chromobacterium bacteria, yeasts and fungi are found in higher densities than on Signy Island, thought to be a result of the lower acidity of the soils associated with Deschampsia and the more favourable microclimate at Lynch Island.
- The shallow gravelly loam-like soil beneath the dense swards of Deschampsia may represent one of the most advanced soil types in the Antarctic.

2. Aims and objectives

Management at Lynch Island aims to:

- avoid major changes to the structure and composition of the terrestrial vegetation;
- prevent unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microorganisms;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- ensure that the flora and fauna are not adversely affected by excessive sampling within the Area;
- allow visits for management purposes in support of the aims of the management plan;
- minimise the possibility of introduction of pathogens which may cause disease in vertebrate populations within the Area.

3. Management activities

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

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.

- The Management Plan shall be reviewed at least every five years and updated as required.
- 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.
- A copy of this Management Plan shall be made available at Signy Research Station (UK; 60°42′30″ S, 045°36′30″ W) and Orcadas Station (Argentina; 60°44′15″ S, 044°44′20″ W).
- Where appropriate, national Antarctic programmes are encouraged to liaise closely to ensure management activities are implemented. In particular, national Antarctic programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area. Also, national Antarctic programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.
- 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.

4. Period of designation

Designated for an indefinite period.

5. Maps and images

Figure 1. Map of the location of Lynch Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 45°W.

Figure 2. ASPA No. 110, Lynch Island, South Orkney Islands, topographic map. Projection: Lambert Conformal Conic. Standard parallels: 1st 60°40’00’’ W; 2nd 63°20’00’’ S. Central Meridian: 045°26’20’’ W. Latitude of Origin: 63°20’00’’ S. Spheriod: WGS84. Datum: Mean Sea Level. Horizontal accuracy of control points: ±1 m.

Figure 3. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 110 Lynch Island, South Orkney Islands, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values.

6. Description of the Area

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

- *Boundaries and co-ordinates*

The Area encompasses all of Lynch Island but excludes all unnamed adjacent islands and islets. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within Lynch Island, but excludes the marine environment extending greater than 10 m offshore from the low tide water line (Map 2). Boundary markers have not been installed because the coast itself is a clearly defined and visually obvious boundary.

- *General description*

Lynch Island (Latitude 60°39'10" S, Longitude 045°36'25" W; area) is a small island situated at the eastern end of Marshall Bay in the South Orkney Islands, about 200 m south of Coronation Island and 2.4 km north of Signy Island (Map 1). The 500 m x 300 m island has low cliffs of up to 20 m in height on the south, east and west sides, dissected by boulder-filled gullies. The northern side has a low cliff below a rock terrace at about 5-8 m altitude, above which moderate slopes rise to a broad plateau at about 40-50 m, with a maximum altitude of 57 m. A beach at the eastern end of the northern coast affords easy access to relatively gentle slopes leading to the central plateau area. The coastal cliffs generally make access to the upper island by other routes difficult, although access is feasible via one or two of the gullies on the eastern and northern sides. Small temporary melt-streams occur on the slopes in summer, but there are no permanent streams or pools, and only a few small late-lying snow patches occur on the southern side of the island. No meteorological data are available for Lynch Island, but conditions are broadly expected to be similar to those experienced at Signy Research Station. However, anecdotal observations suggest that significant microclimatic differences exist on Lynch Island, as the more profuse growth of plant communities would seem to attest. The island is exposed to the south-west and to katabatic and föhn winds descending from Coronation Island to the north. However, in other respects the island is relatively sheltered from regional northerly, easterly and southerly winds by Coronation Island, Cape Hansen and Signy Island respectively. The föhn effect can briefly raise local air temperatures by as much as 10°C at Signy Island. Lynch Island has often been observed to receive sunshine when the surrounding region is shrouded in low cloud. The angle of solar incidence is also relatively high on the northern side of the island because of its general slope and aspect. The above factors may be important reasons for the abundance of the two flowering plants found on the island.

- *Geology*

The bedrock of Lynch Island consists of quartzo-feldspathic and micaceous schists of the Scotia metamorphic complex, but is poorly exposed and equivalent rocks are much better displayed in the Cape Hansen area, to the east on Coronation Island.

- *Pedology*

Three main soil types have been identified on Lynch Island:

- An acidic (pH 3.8 – 4.5) moss peat, formed by the tall turf-forming mosses Chorisodontium aciphyllum and Polytrichum strictum (=Polytrichum alpestre), occurs mainly at the north-eastern end of the island. This peat reaches a depth of about 50 cm and is similar to peat on Signy Island where it reaches a depth of 2 m. Where the peat depth exceeds about 30 cm there is permafrost. In a few places where the substratum is moist, shallow peat of 10-15 cm depth (pH 4.8 - 5.5) has accumulated beneath the carpet-forming mosses Warnstorfia laculosa (=Calliergidium austro-stramineum) and Sanionia uncinata (=Drepanocladus uncinatus).
- A shallow, gravelly loam-like soil resembling tundra brown soil occurs beneath dense swards of the grass Deschampsia antarctica. It is seldom more than about 30 cm in depth (pH 5.0 – 5.8) and probably represents one of the most advanced soil types in the Antarctic.
- A glacial till with material ranging from fine clay (pH 5.2 – 6.0) and sand to gravel and larger stones. This covers the summit plateau and occurs in rock depressions throughout the island, as well as on parts of the rock terrace. On the plateau cryoturbation has in several places sorted the material into patterned features with small stone circles and polygons on level ground and stone stripes on sloping ground. At the north-eastern end of the island, the deposition of limpet shells (Nacella concinna) by gulls (Larus dominicanus) has resulted in a more calcareous mineral soil in rock depressions with a pH of 6.5 - 6.8.

- *Terrestrial flora*

Cryptogamic and phanerogamic vegetation typical of the maritime Antarctic is found over much of the island (Figure 3). Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 35,000 m² (25% of the ASPA area). The most significant aspect of the vegetation is the abundance and reproductive success of the two native Antarctic flowering plants, the Antarctic hair grass (Deschampsia antarctica) and Antarctic pearlwort (Colobanthus quitensis), found especially on the northern slopes (Map 3). Both species flower in profusion and seed viability appears to be much greater than on Signy Island. Lynch Island possesses the largest stands of Deschampsia and the greatest abundance of Colobanthus known in the South Orkney Islands and one of the most extensive anywhere in the Antarctica Treaty area. On the rock terrace and moist slope rising above the northern coast, the grass forms extensive swards of up to 15 × 50 m. These swards range from continuous stands of relatively luxuriant plants on the moister sites and ledges to small, yellowish, more isolated plants on the drier, stonier and more exposed terrain. Colobanthus is generally associated with the grass, but here the plants do not coalesce to form closed patches. This is one of very few sites where Deschampsia is known to grow directly on Polytrichum-Chorisodontium moss banks. Elsewhere on the island, the grass and, to a lesser extent, the pearlwort are frequent associates in other communities, especially stands of denser fellfield vegetation where there is quite high cover afforded by various mosses and lichens (particularly towards the western end of the northern terrace).

Shallow but occasionally extensive (about 50 m^2) banks of Chorisodontium aciphyllum and Polytrichum strictum are frequent at the north-eastern end of the island and, to a lesser extent, on the southern side. These are typical of the moss banks which occur on Signy Island and elsewhere in the northern maritime Antarctic, with several fruticose and crustose lichens growing epiphytically on the moss surface. In small moist depressions, there are carpets of Warnstorfia laculosa and Sanionia uncinata, with some Warnstorfia sarmentosa (=Calliergon sarmentosum) and Cephaloziella varians (= C. exiliflora). On wet soil and rock ledges, Brachythecium austro-salebrosum is common. On the drier, more windswept, stonier soils and rock surfaces – notably in the plateau area – a typical open fellfield community of many bryophyte and lichen taxa form a complex mosaic. The dominant species in this locality are the lichens Usnea antarctica and U. aurantiaco-atra (=U. fasciata) and the moss Andreaea depressinervis; Sphaerophorus globosus and other species of Alectoria, Andreaea, Cladonia, and Stereocaulon are also common, while Himantormia lugubris and Umbilicaria antarctica are infrequent. Crustose lichens are abundant on all rock surfaces. The mosses and macrolichens in this area are loosely attached on thin soils and are easily damaged. Large thalli of Usnea spp. and Umbilicaria antarctica are found on moist sheltered boulders and rock faces, especially on the southern side of the island.

Communities of crustose lichen occur in the cliffs above the high water mark, especially where the rock is influenced by breeding or roosting birds. The distribution of several species forms distinctive zones in relation to inundation by sea spray and exposure to wind. The best developed communities of brightly coloured ornithocoprophilous taxa occur at the western end of the island where Caloplaca spp., Haematomma erythromma, Mastodia tesselata, Physcia caesia, Xanthoria candelaria, X. elegans, and species of Buellia and Verrucaria are frequent. The uncommon halophilous moss Muelleriella crassifolia also occurs within the spray zone around the island.

The only rare moss recorded on Lynch Island is Plagiothecium ovalifolium, found in moist, shaded rock crevices near the shore. However, the island is possibly the only site known in the Maritime Antarctic where the moss Polytrichastrum alpinum develops sporophytes in profusion each year; this occurs among Deschampsia, Colobanthus and cryptogams on the northern side of the island; elsewhere in the Antarctic sporophytes are in some years very rare. Also, Polytrichum strictum produces male inflorescences in local abundance, a rare phenomenon in this species in the Antarctic. While the thalloid liverwort Marchantia berteroana is locally common on Signy Island, Lynch Island is one of very few other localities where it is known in the South Orkney Islands. Several cryptogamic species of very restricted distribution in the Antarctic, but which are locally common on Signy Island and the mainland of Coronation Island only a few hundred metres away, have not been observed at Lynch Island.

- *Terrestrial invertebrates*

The microinvertebrate fauna associated with the rich Deschampsia swards described thus far comprises 13 taxa: three springtails (Cryptopygus antarcticus, Friesea woyciechowskii and Isotoma (Folsomotoma) octooculata (=Parisotoma octooculata), one mesostigmatid mite (Gamasellus racovitzai), two cryptostigmatid mites (Alaskozetes antarcticus and Globoppia loxolineata), and seven prostigmatid mites (Apotriophtydeus sp., Ereynetes macquariensis, Nanorchestes berryi, Stereotydeus villosus, and three species of Eupodes). The number of taxa identified is likely to increase with greater sampling. The community is dominated by the Collembolla, especially Cryptopygus antarcticus (84% of all arthropods extracted), with relatively large numbers of I. octooculata; the principal mite was an undetermined species of Eupodes. Globoppia loxolineata is near the northernmost limit of its known distribution. In general, the population density of the arthropod community of grass stands on Lynch Island appears unusually high, with some measurements suggesting it is one of the highest in the world. It also shows considerable diversity for an Antarctic site, although this observation was based on a small number of sample replicates and further sampling would be required to establish densities with greater reliability: this is difficult to achieve on Lynch Island given the very limited extent of communities available for sampling.

Lynch Island was the first site in the Antarctic where a terrestrial enchytraeid was found (in soil beneath a moss Hennediella antarctica on a rock ledge above the northern shore); only in a few other sites in the South Orkney Islands have these worms been found – although few samples have been gathered and the species has yet to be identified. Of the tardigrade fauna, most of the 16 individuals isolated from a sample of Brachythecium were Hypsibius alpinus and H. pinguis with some H. dujardini, while of 27 isolated from a Prasiola crispa sample, almost all were the latter species with a few that were other species of Hypsibius.

- *Microorganisms*

The mineral and organic soils of Lynch Island have a slightly higher pH than corresponding soils on nearby Signy Island. This higher base and nutrient status, together with the more favourable microclimate, is reflected in larger numbers of bacteria (including Chromobacterium), yeasts and fungi than occur in comparable soils on Signy Island. Bacterial numbers in the Polytrichum peat on Lynch Island are about eight times, and in the Warnstorfia peat about six times, greater than in corresponding Signy Island peats; yeasts and fungi are similarly much more abundant. Soil associated with the two flowering plants yielded several nematophagous fungi: in Deschampsia soil Acrostalagmus goniodes, Cephalosporium balanoides and Dactylaria gracilis; in Colobanthus soil, Cephalosporium balanoides, Dactylaria gracilis, Dactylella stenobrocha and Harposporium anguillulae were found. The basidiomycete fungi Galerina antarctica and G. longinqua occur on moist moss.

- *Vertebrates*

The island has no penguin colonies or substantial breeding colonies of other birds. Groups of chinstrap (Pygoscelis antarctica), Adélie (P. adeliae) and gentoo (P. papua) penguins and, sometimes, blue-eyed cormorants (Phalacrocorax atriceps) often congregate at the north-eastern and the western ends of the island. Several pairs of brown skuas (Catharacta lonnbergii) and at least two pairs of kelp gulls (Larus dominicanus) were observed in the early 1980s to nest at the north-eastern corner. A small colony of Antarctic terns (Sterna vittata) may also occur in this vicinity, although in February 1994 breeding was not observed. Cape petrels (Daption capense) and snow petrels (Pagodroma nivea) breed on the higher cliffs at the eastern end and along the north-western coast of the island. A few pairs of snow petrels and Wilson's storm petrels (Oceanites oceanicus) nest on ledges and beneath boulders on the south side of the island.

Weddell seals (Leptonychotes weddellii), crabeater seals (Lobodon carcinophgus),occasional leopard seals (Hydrurga leptonyx), and small groups of southern elephant seals (Mirounga leonina) are regularly seen on the coast and on ice floes in the vicinity; none have been known to breed on Lynch Island. Since the early 1980s increasing numbers of Antarctic fur seals (Arctocephalus gazella), virtually all being immature non-breeding males, have been observed on Lynch Island, some gaining access up the more gentle north-eastern slopes to vegetated areas, where they have caused local, but severe, damage to Polytrichum-Chorisodontium moss banks and other communities.

Seal access to the island is principally from a beach on the northeast coast. Once seals have gained access, there are no further substantial geographical impediments to their more extensive travel over the island. Groups of seals have been observed near the summit. Destruction of swards of Deschampsia was first reported in 1988. During earlier inspections of the island, it was observed that the most luxuriant areas of Deschampsia and Colobanthus on the northern and north-western slopes had not yet been affected. Accessible areas of vegetation in the eastern and north-eastern sides of the island, particularly Polytrichum and Chorisodontium moss banks, had been severely damaged by Antarctic fur seals. In some eastern and north-eastern areas that have been heavily impacted by fur seals, Deschampsia and Colobanthus have either been damaged or have died, but at less impacted locations at higher altitudes, these plants continue to grow and may be increasing their abundance and extending their distribution range on the island (see Map 3). During the most recent inspection, no fur seals were observed on the island.

6(ii) Access to the Area

- Where possible, access shall be by small boat. Landings from the sea should be at the beach on the eastern end of the northern coast of the island (Lat. 60°39’05” S, Long. 045°36’12” W; Map 2), unless specifically authorised by

Permit to land elsewhere, or when landing at this location is impractical because of adverse conditions.

- Under exceptional circumstances, necessary for purposes consistent with the objectives of the Management Plan, helicopters may be permitted to land within the Area.
- Landing of helicopters within the Area shall be at the designated location on the rock platform (8 m) on the north-western end of the island (Lat. 60°39’04.5” S, Long. 045°36’12” W; Map 2).
- Within the Area the operation of aircraft 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). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit.
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used, all smoke grenades should be retrieved.

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

There are no structures present in the Area apart from several cairns marking sites used for topographical survey. The island’s summit cairn is located at Lat. 60°39’05” S, Long. 045°36’12” W. A sign notifying the protected status of Lynch Island was erected on a prominent rock outcrop above the recommended landing beach in February 1994, but this was destroyed by strong winds.

Signy Research Station (UK) is 6.4 km south at Factory Cove, Borge Bay, on Signy Island.

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

The nearest protected areas to Lynch Island are Moe Island (ASPA No. 109), which is about 10 km SSW, and Southern Powell Island and adjacent islands (ASPA No. 111), which is about 35 km to the east (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 as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

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

- it is issued for a compelling scientific purpose which cannot be served elsewhere; or
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- a report or reports are supplied to the authority or authorities named in the Permit;
- 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

- Land vehicles are prohibited within the Area.
- Movement within the Area shall be on foot.
- Pilots, helicopter or boat crew, or other people on helicopters or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- 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, i.e. all movement should be undertaken carefully so as to minimise disturbance to the soil and vegetated surfaces, walking on rocky terrain if practical.
- 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

- Compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area.
- Essential management activities, including monitoring.

7(iv) Installation, modification or 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 a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be 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 (see Section 7(vi)), and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

7(v) Location of field camps

Camping should be avoided within the Area. However, when absolutely necessary for purposes specified in the Permit, camping is allowed at the designated site at the north-western end of the island (Lat. 60°39’04” S, Long. 045°36’37” W; Map 2).

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)).

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, or harmful interference with, native flora or fauna

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica (Resolution 4 (2019)) should be used as a minimum standard.

7(viii) The collection or removal of materials not brought into the Area by the Permit holder

Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs.

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.

Other material of human origin likely to compromise the values of the Area which was not brought into the Area by the permit holder or otherwise authorised, may be removed 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 must be notified and approval obtained.

7(ix) Disposal of waste

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

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, to erect or maintain signboards, 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 visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. 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.

8. Supporting documentation

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Figure 1. Map showing the location of Lynch Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica.

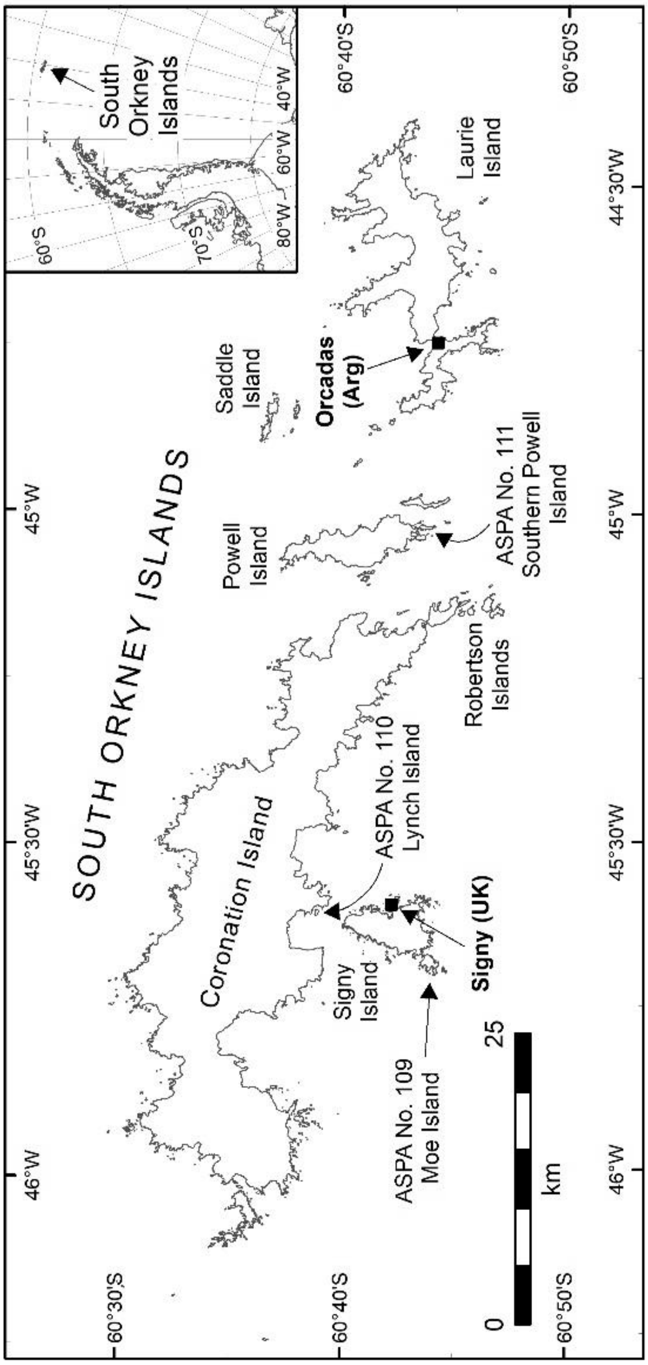


Figure 2. ASPA No. 110, Lynch Island, South Orkney Islands, topographic map.

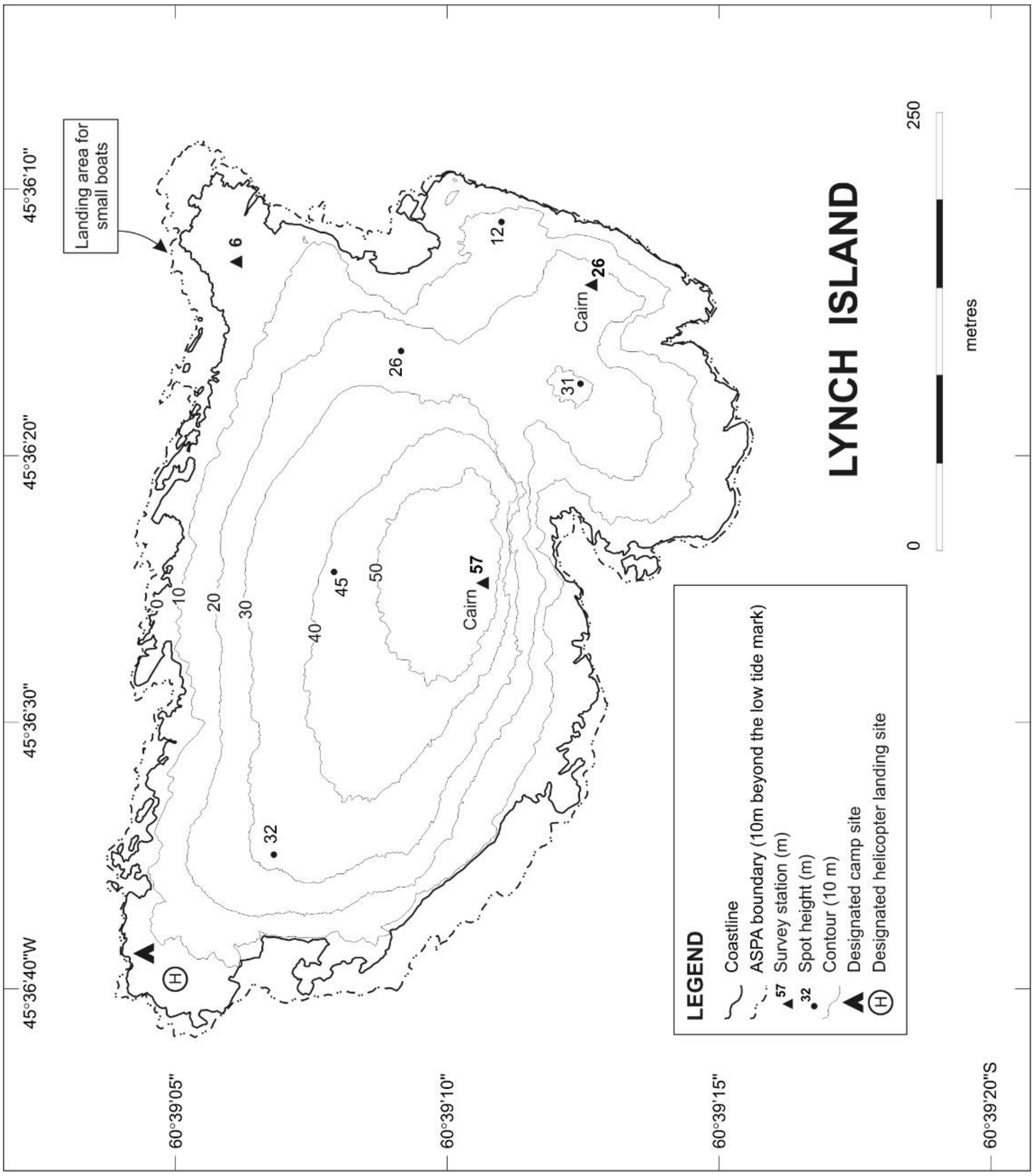
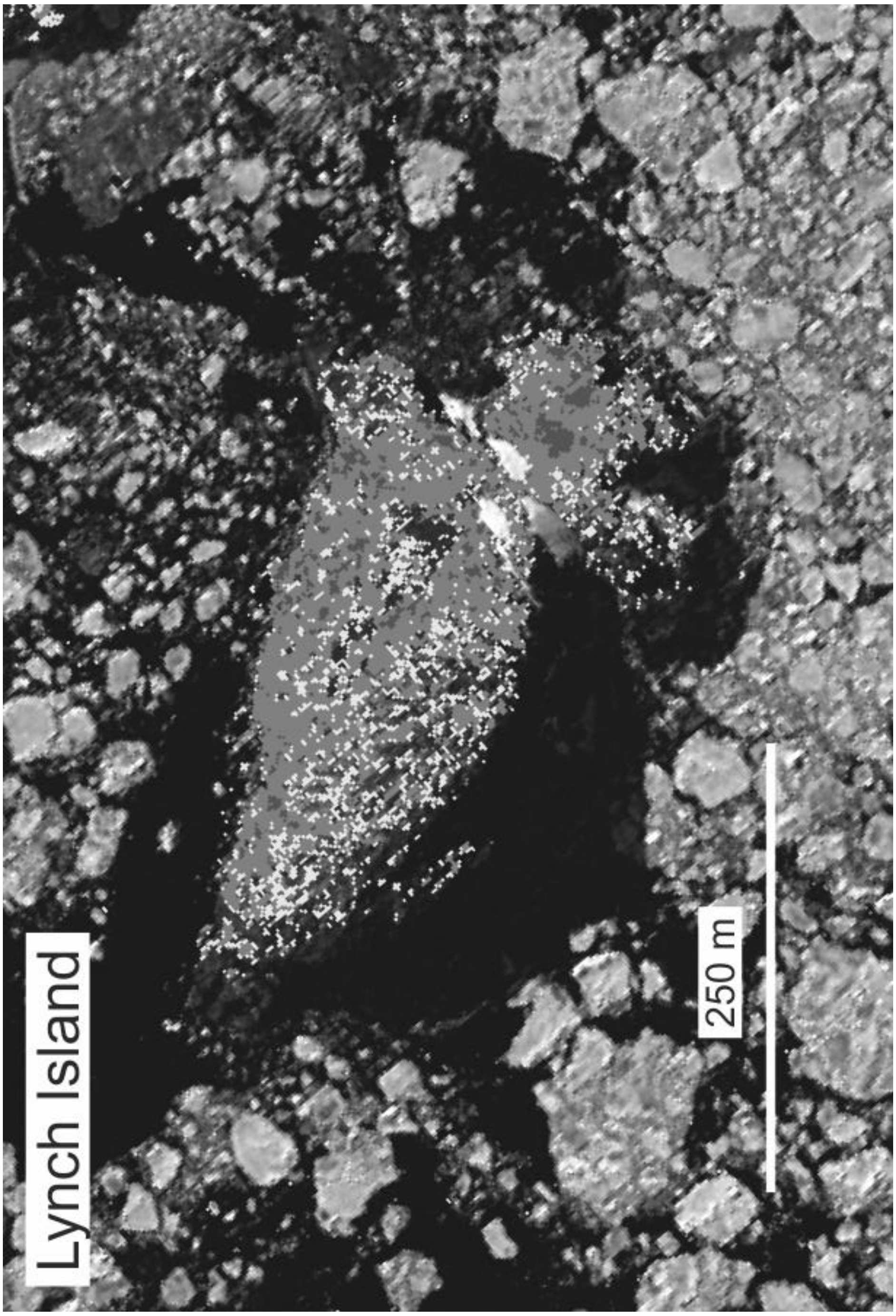


Figure 3. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 110 Lynch Island, South Orkney Islands, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values



Measure 4 (2022)

Antarctic Specially Protected Area No 111 (Southern Powell Island and adjacent islands, South Orkney 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-15 (1966), which designated Southern Powell Island and adjacent islands, South Orkney Islands as Specially Protected Area ("SPA") No 15 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a Management Plan for SPA 15;
- Measure 1 (1995), which annexed a modified description and a revised Management Plan for SPA 15;
- Decision 1 (2002), which renamed and renumbered SPA 15 as ASPA 111;
- Measures 3 (2012) and 3 (2017), which adopted a revised Management Plan for ASPA 111;

Recalling that Recommendation XVI-6 (1991) did not become effective and was withdrawn by Decision 3 (2017) and Measure 1 (1995) did not become effective and was withdrawn by Measure 3 (2012);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 111;

Desiring to replace the existing Management Plan for ASPA 111 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 111 (Southern Powell Island and adjacent islands, South Orkney Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 111 annexed to Measure 3 (2017) be revoked.

Management Plan for Antarctic Specially Protected Area No. 111

SOUTHERN POWELL ISLAND AND ADJACENT ISLANDS, SOUTH ORKNEY ISLANDS

Introduction

The primary reason for the designation of Southern Powell Island and Adjacent Islands, South Orkney Islands (Lat. 62°57'S, Long. 60°38'W) as an Antarctic Specially Protected Area (ASPA) is to protect environmental values, predominantly the breeding bird and seal populations, and to a lesser extent, the terrestrial vegetation within the Area.

The Area was originally designated in Recommendation IV-15 (1966, SPA No. 15) after a proposal by the United Kingdom on the grounds that southern Powell Island and the adjacent islands support substantial vegetation and a considerable bird and mammal fauna. The Area was representative of the natural ecology of the South Orkney Islands, and was rendered more important by the presence of a small colony of Antarctic fur seals (Arctocephalus gazella).

The Area is also recognised as having scientific value. It is now well established that climate change is affecting the Southern Ocean, and that the region around the Antarctic Peninsula, Scotia Sea and South Orkney Islands is showing some of the most evident impacts of climate change. Air temperatures and ocean temperatures have increased, some ice shelves have collapsed and seasonal sea ice is now much reduced. This has important consequences for biological communities with some of the most obvious consequences of environment change have been reported for pygoscelid penguins. In particular, Adélie penguins, a species of the pack ice, are now though to be declining at most localities along the Peninsula and at the South Orkney Islands. Chinstrap penguins, a species of the more open ocean, are now also thought to be in decline. Consequently, understanding penguin foraging behaviour in an attempt to relate it to their preferred foraging habitat is particularly important. Understanding how pygoscelid penguins utilise the ocean around them is critical if we are to adequately protect their breeding colonies, including in highly biodiverse protected areas such as southern Powell Island.

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 111 is contained within Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment Domain G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 109, 112, 125, 126, 128, 140, 145, 149, 150, and 152 and ASMAs 1 and 4. Environment Domain A is also present (Antarctic Peninsula northern geologic). Other protected areas containing Environment Domain A include ASPAs 128, 151 and ASMA 1.

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. ASPA 111 sits within Antarctic Conservation Biogeographic Region (ACBR) 2 South Orkney Islands.

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 ANT015 Southern Powell Island and adjacent islands has the same boundary as ASPA 111, and was identified due to its extensive colonies of chinstrap penguins, Adélie penguins, gentoo penguins, blue-eyed cormorants and southern giant petrels.

The two other ASPAs present within the South Orkney Islands (ASPA 109 Moe Island and ASPA 110 Lynch Island) were designated primarily to protect terrestrial vegetation. Therefore, ASPA 111 Southern Powell Island and adjacent islands complements the local network of ASPAs by protecting primarily breeding bird and seal populations, but also terrestrial vegetation.

1. Description of values to be protected

Following a visit to the ASPA in January 2022, the values specified in the original designation were reaffirmed and expanded. These values are set out as follows:

- The breeding avifauna within the Area is diverse, including up to four species of penguin [chinstrap (Pygoscelis antarctica), gentoo (P. papua), Adélie (P. adeliae) and macaroni penguins (Eudyptes chrysolophus)], Wilson's storm petrels (Oceanites oceanicus), cape petrels (Daption capense), Dominican gulls (Larus dominicanus), southern giant petrels (Macronectes giganteus), black-bellied storm petrels (Fregetta tropica), blue-eyed cormorants (Phalacrocorax atriceps), brown skuas (Catharacta loennbergi), sheathbills (Chionis alba), snow petrels (Pagodroma nivea) and possibly Antarctic prions (Pachyptila desolata).
- The longest known breeding site of fur seals in the Antarctic, since their near extermination in the nineteenth century, is found within the Area.
- A diverse flora, typical of the region, including moss banks with underlying peat, moss carpet in wet areas, snow algae and the nitrophilous macroalga Prasiola crispa associated with the penguin colonies, is found within the Area.
- The Area has scientific value as a location for the collection of telemetry data in order to explore penguin foraging behaviour. This information will

contribute to the development of habitat models that will describe the relationship between penguin foraging behaviour and seasonal sea ice extent.

2. Aims and objectives

Management of southern Powell Island and adjacent islands aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microorganisms;
- minimise the possibility of introduction of pathogens which may cause disease in bird populations within the Area;
- preserve the natural ecosystem of the Area as a reference area for future comparative studies and for monitoring floristic and ecological change, colonisation processes and community development;
- allow visits for management purposes in support of the aims of the management plan;
- allow for the gathering of data on the population status of the resident penguins and seals on a regular basis and in a sustainable manner.

3. Management activities

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- The Management Plan shall be reviewed at least every five years and updated as required.
- 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.
- A copy of this Management Plan shall be made available at Signy Research Station (UK; 60°42′30″ S, 045°36′30″ W) and Orcadas Station (Argentina; 60°44′15″ S, 044°44′20″ W).
- Where appropriate, national Antarctic programmes are encouraged to liaise closely to ensure management activities are implemented. In particular, national Antarctic programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area. Also,

national Antarctic programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.

- 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.

4. Period of designation

ASPA 111 is designated for an indefinite period.

5. Maps

Map 1. The location of southern Powell Island and adjacent island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 45°W.

Map 2 shows the Area in greater detail.

6. Description of the Area

6(i) Geographical coordinates and natural features

- *Boundaries and co-ordinates*

The corner co-ordinates of the Area are shown in Table 1.

Corner	**Latitude**	**Longitude**
northwest	60°42’35’’ S	45°04’00’’ W
northeast	60°42’35’’ S	44°58’00’’ W
southwest	60°45’30’’ S	45°04’00’’ W
southeast	60°45’30’’ S	44°58’00’’ W

The Area includes all of Powell Island south of the southern summit of John Peaks (415 m altitude), together with the whole of Fredriksen Island, Michelsen Island (a tidal peninsula at the southern tip of Powell Island), Christoffersen Island, Grey Island and unnamed adjacent islands. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within the boundaries, but excludes the marine environment extending greater than 10 m offshore from the low tide water line. All but the Crutchley Ice Piedmont of southern Powell Island are ice-free in summer, though there are patches of semi-permanent or late-lying snow in places.

- *Geology*

The rocks of southern Powell Island, Michelsen Island and Christoffersen Island are conglomerates of Cretaceous-Jurassic age. The two promontories to the west of John Peaks are Carboniferous greywacke-shales. There are boulders containing plant fossils in the glacial deposits around Falkland Harbour. Much of central and southern Fredriksen Island is composed of sandstone and dark phyllitic shales. The north-east and probably most of the north of this island is highly sheared conglomerate with laminated mudstone. The Area has a thick mantle of glacial till, strongly influenced by seabird guano.

- *Biological communities*

Michelsen Island has little land vegetation, although on the rocks there are extensive communities of lichens dominated by nitrophilous crustose species. These are also widespread on Fredriksen Island and elsewhere on bird-influenced cliffs and rocks near the shore. The most diverse vegetation on Powell Island occurs on the two promontories and associated scree west of Falkland Harbour. Here, and on Christoffersen Island and the northern part of Fredriksen Island, moss banks with underlying peat occur. Wet areas support stands of moss carpet. There are extensive areas of the nitrophilous macroalga Prasiola crispa associated with the penguin colonies in the area. Snow algae are prominent on the ice piedmont and snow patches in late summer. Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 0.8 km^2 (c. 3% of the ASPA area).

No information is available on the arthropod fauna, but this is probably very similar to that at Signy Island. The springtails Cryptopygus antarcticus and Parisotoma octoculata and the mites Alaskozetes antarcticus, Stereotydeus villosus and Gamasellus racovitzai occur in great numbers beneath stones.

There are few observations on marine invertebrates and biota in the Area, but this is likely to be very similar to the well-researched Signy Island area. The relatively enclosed Falkland-Ellefsen Harbour area and the bay on the east side of the peninsula are highly influenced by glacial run-off from the ice piedmont.

Large numbers of penguins and petrels breed throughout the Area. There are many thousand pairs of chinstrap penguins (Pygoscelis antarctica), mostly on Fredriksen Island. Similarly large numbers of Adélie penguins (P. adeliae) occur principally on the southern Powell-Michelsen Island area. Here there are also several thousand pairs of gentoo penguins (P. papua) and a very few scattered pairs of macaroni penguins (Eudyptes chrysolophus) breeding among the gentoos (for more information see Harris et al., 2015).

Other breeding birds include southern giant petrels (Macronectes giganteus), cape petrels (Daption capensis), snow petrels (Pagodroma nivea), Wilson’s storm petrels (Oceanites oceanicus), blue-eyed shags (Phalacrocorax atriceps), Dominican gulls

(Larus dominicanus), brown skuas (Catharacia lonnbergi), sheathbills (Chionis alba), and possibly Antarctic prions (Pachyptila desolata) and blackbellied storm petrels (Fregetta tropica).

Michelsen Island is the longest known breeding site in the Antarctic of fur seals since their near extermination in the nineteenth century. The number of pups born annually has increased slowly but fairly steadily from 11 in 1956 to about 60 in 1989. Thirty-four live pups were recorded in January 1994. However, numbers have declined, with only four pups recorded during the 2013-14 and 2015-16 breeding seasons. Nevertheless, many transient non-breeding males and juveniles visit the Area during the summer. Other seals are frequent on the beaches, mainly elephant seals (Mirounga leonina) and Weddell seals (Leptopychotes weddelli). Leopard seals (Hydrurga leptonyx) and crabeater seals (Lobodon carcinophagus) are occasionally seen on ice floes.

6(ii) Access to the Area

- Access shall be by small boat.
- There are no special restrictions on boat landings from the sea, or that apply to the sea routes used to move to and from the Area. Due to the large extent of accessible coast around the Area, landing is possible at many locations. Nevertheless, if possible, landing of cargo and scientific equipment should be close to the recommended field camp at 60°43’20’’S, 045°01’32’’W.
- Under exceptional circumstances necessary for purposes consistent with the objectives of the Management Plan helicopters may be permitted to land at the designated landing site located beside the recommended field camp at 60°43’20’’S, 045°01’32’’W. Helicopters shall not land elsewhere within the Area.
- To prevent disturbance of breeding avifauna, helicopters landings are prohibited within the Area between the period 1 November to 15 February.
- Within the Area the operation of aircraft 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). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit.
- Overflying helicopters should avoid sites where there are concentrations of birds (e.g. southern Powell-Michelsen Island area or Fredriksen Island).
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used all smoke grenades should be retrieved.

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

Marker boards denoting the Area’s protected status are positioned in the following locations:

- Christoffersen Island: on a small promontory on the north-eastern shore of the island at the entrance to Falkland Harbour. The board is located at the back of the beach just below a small Adélie penguin rookery (60°43’36’’S, 045°02’08’’W).
- Fredriksen Island: at the northern end of the pebble boulder beach on the western side of the island, below a small chinstrap penguin rookery. The board is at the back of the beach on top of a small rock outcrop (60°44’06’’S, 044°59’25’’W).

Other structures in the area include a marker posts on top of a small rock outcrop at the back of the shingle beach on the east side of the southern promontory of Powell Island (60°43’20’’S, 045°01’40’’W) and various mooring chains, posts and rings associated with the use of Ellefsen and Falkland Harbours by floating whale factories in the 1910s that are located on the shore.

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

ASPA No. 109, Moe Island, and ASPA No. 110, Lynch Island, are located approximately 35 km west of the Area (see Map 1).

6(v) Restricted 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 as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

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

- it is issued for a compelling scientific purpose which cannot be served elsewhere;
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit must be carried within the Area;
- permits shall be issued for a stated period;
- a report or reports are supplied to the authority or authorities named in the Permit;

- 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

- Land vehicles are prohibited in the Area.
- No pedestrian routes are designated within the Area, but persons on foot should avoid walking on vegetated areas or disturbing wildlife wherever possible.
- To reduce disturbance of bird species, anchoring within Falkland Harbour and Ellefsen Harbour is strongly discouraged, except in an emergency.
- Pilots, air and boat crew, or other people on aircraft or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- 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 include:

- compelling scientific research which cannot be undertaken elsewhere;
- essential management activities, including monitoring.

7(iv) Installation, modification or 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 a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be 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 (see Section 7(vi)), and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

7(v) Location of field camps

In order to minimise the area of ground within the ASPA impacted by camping activities, tents should be erected at the designated field campsite, located at 60°43’20’’S, 045°01’32’’W. When necessary for purposes specified in the Permit, temporary camping beyond the designated field campsite is allowed within the Area. Camps should be located on non-vegetated sites, such as on the drier parts of the raised beaches, or on thick (>0.5 m) snow-cover when practicable, and should avoid concentrations of breeding birds or mammals.

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 COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species. 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 or harmful interference with native flora and fauna

Taking of or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of 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 (Resolution 4 (2019)).

7(viii) Collection and removal of materials not brought into the Area by the Permit holder

Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs.

Other material of human origin likely to compromise the values of the Area which was not brought into the Area by the permit holder or otherwise authorised, may be removed 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 must be notified and approval obtained.

7(ix) Disposal of waste

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

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

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, 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 visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. 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.

8. Supporting documentation

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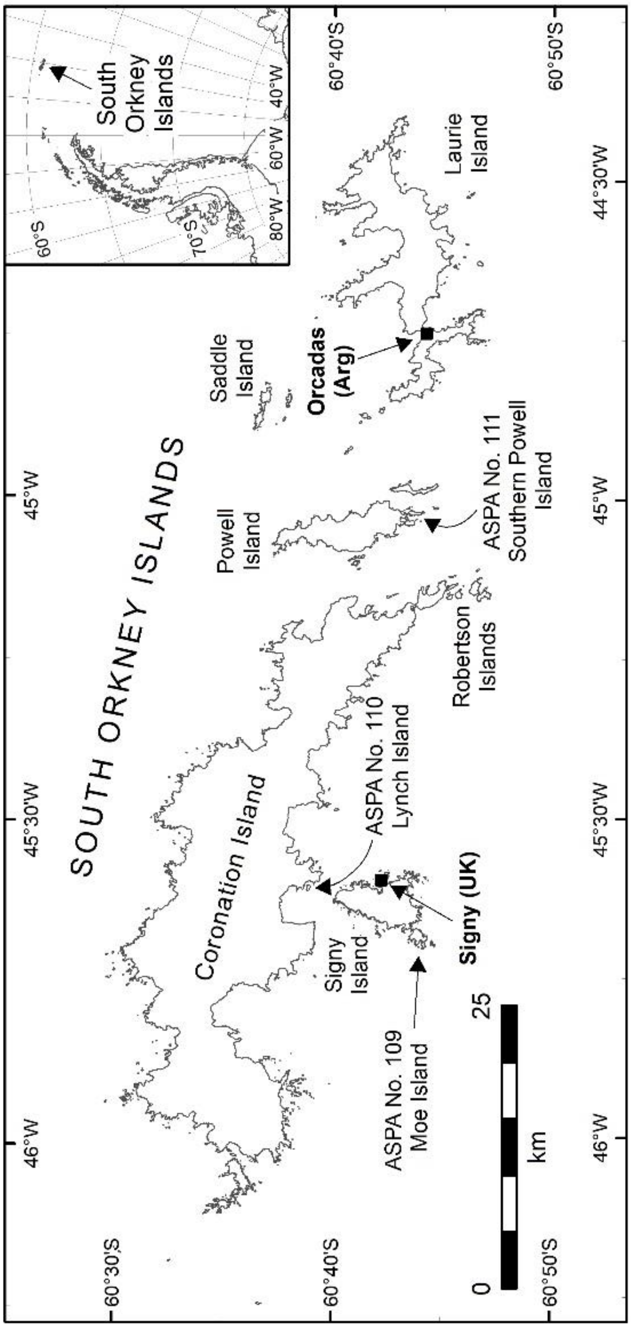
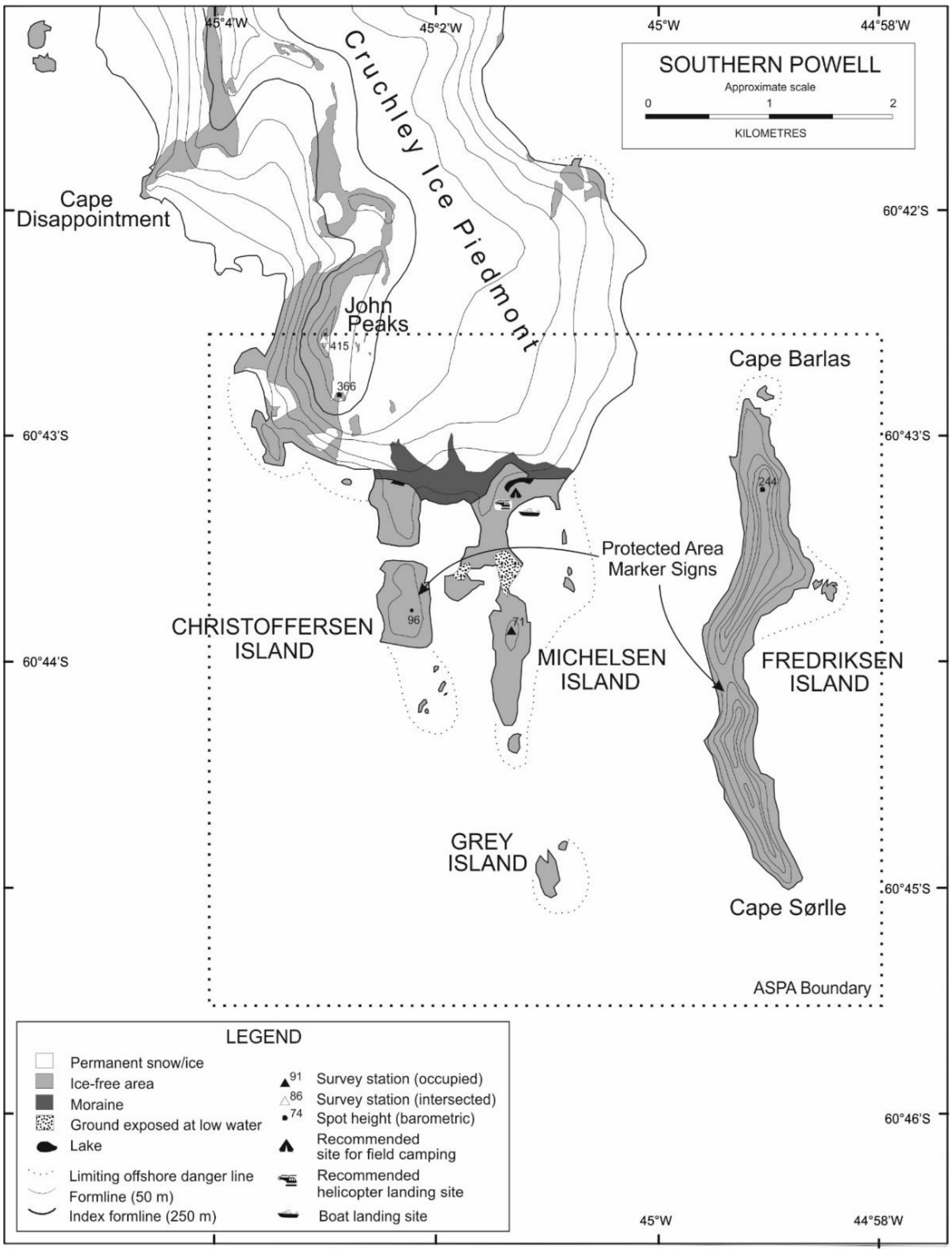
Thomson, M. R. A. 1981. Late Mesozoic stratigraphy and invertebrate palaeontology of the South Orkney Islands. British Antarctic Survey Bulletin, No. 54, 65-83.

Map 1. The location of Southern Powell Island and adjacent island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica.



Map 2. Southern Powell Island and adjacent islands Antarctic Specially Protected Area No. 111.



Measure 5 (2022)

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

The Representatives,

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

Recalling

- Recommendation VIII-1 (1975), which designated Litchfield Island, Arthur Harbor, Palmer Archipelago as Specially Protected Area ("SPA") No 17 and annexed a map for the Area;
- Decision 1 (2002), which renamed and renumbered SPA 17 as ASPA 113;
- Measure 2 (2004), which adopted a Management Plan for ASPA 113;
- Measure 1 (2008), which designated Southwest Anvers Island and Palmer Basin as Antarctic Specially Managed Area No 7, within which ASPA 113 is located;
- Measures 4 (2009) and 1 (2014), which adopted a revised Management Plan for ASPA 113;

Recalling that Recommendation VIII-1 (1975) was designated as no longer effective by Measure 4 (2009);

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

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

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

That:

1. the revised Management Plan for Antarctic Specially Protected Area No 113 (Litchfield Island, Arthur Harbor, Anvers Island, Palmer Archipelago), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 113 annexed to Measure 1 (2014) be revoked.

Management Plan for Antarctic Specially Protected Area No. 113

LITCHFIELD ISLAND, ARTHUR HARBOR ANVERS ISLAND, PALMER ARCHIPELAGO

Introduction

Litchfield Island lies within Arthur Harbor, SW Anvers Island, at 64°46' S, 64°06' W. Approximate area: 0.34 km^2. Designation on the grounds that Litchfield Island, together with its littoral zone, possesses an unusually high collection of marine and terrestrial life, is unique amongst the neighboring islands as a breeding place for six species of native birds and provides an outstanding example of the natural ecological system of the Antarctic Peninsula area. In addition, Litchfield Island possesses rich growths of vegetation and has the most varied topography and the greatest diversity of terrestrial habitats of the islands in Arthur Harbor.

The Area was originally designated as Specially Protected Area (SPA) No. 17 through Recommendation VIII-1 (1975) after a proposal by the United States of America. The site was renamed and renumbered as Antarctic Specially Protected Area (ASPA) No. 113 by Decision 1 (2002). The original Management Plan was adopted through Measure 2 (2004) and revised through Measure 4 (2009) and through Measure 1 (2014).

The Area is situated within Environment E – Antarctic Peninsula, Alexander and other islands based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) and within Region 3 – Northwest Antarctic Peninsula based on the Antarctic Conservation Biogeographic Regions (Resolution 3 (2017)). Litchfield Island lies within Antarctic Specially Managed Area No.7 Southwest Anvers Island and Palmer Basin (adopted through Measure 11 (2019)). The Area has been identified as Antarctic Important Bird Area (IBA) No. 86.

1. Description of values to be protected

Litchfield Island (Latitude 64°46' S, Longitude 64°06' W, 0.34 km^2), Arthur Harbor, Anvers Island, Antarctic Peninsula was originally designated on the grounds that “Litchfield Island, together with its littoral, possesses an unusually high collection of marine and terrestrial life, is unique amongst the neighboring islands as a breeding place for six species of native birds and provides an outstanding example of the natural ecological system of the Antarctic Peninsula area”.

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

In 1964 Litchfield Island supported one of the most extensive moss carpets known in the Antarctic Peninsula region, dominated by Warnstorfia laculosa which was then considered near its southern limit (Corner 1964a). W. laculosa is now known to occur at a number of sites further south, including Green Island (ASPA No. 108, in the Berthelot Islands) and Avian Island (ASPA No. 118, in Marguerite Bay). Accordingly, the value originally cited that this species is near its southern limit at Litchfield Island is no longer valid. Nevertheless, at the time Litchfield Island represented one of the best examples of maritime Antarctic vegetation off the western coast of Graham Land. Furthermore, several banks of Chorisodontium aciphyllum and Polytrichum strictum of up to 1.2 m in depth were described in 1982, which were considered to be some of the best examples of their kind in the Antarctic Peninsula area (Fenton and Lewis Smith 1982). In February 2001 it was observed that these values have been severely compromised by the impact of Antarctic fur seals (Arctocephalus gazella), which have damaged and destroyed large areas of vegetation on the lower accessible slopes of the island by trampling and nutrient enrichment. Southern elephant seals (Mirounga leonina) have also had a severe, although more localized, impact. Some areas previously richly carpeted by mosses have been completely destroyed, while others have suffered moderate-to-severe damage. Slopes of Deschampsia antarctica are more resilient and have persisted even where fur seals have been numerous, although here signs of damage are also obvious. However, on the steeper and higher parts of the island, and other areas that are inaccessible to seals, the vegetation remains undamaged. Furthermore, observations suggest that a recent local decline in Antarctic fur seal numbers has led to the recovery of previously damaged vegetation on Litchfield Island (Fraser and Patterson-Fraser pers. comms. 2014). While the vegetation is less extensive and some of the moss carpets have been compromised, the remaining vegetation continues to be of value and an important reason for special protection of the island. Litchfield Island also has the most varied topography and the greatest diversity of terrestrial habitats of the islands in Arthur Harbor.

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

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

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

2. Aims and objectives

Management of Litchfield 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 and physical environment in the Area provided it is for compelling reasons which cannot be served elsewhere and that will not compromise the values for which the Area is protected;
- Allow visits for educational and outreach purposes (such as documentary reporting (visual, audio or written) or the production of educational resources or services) provided such activities are for compelling reasons that cannot be served elsewhere and will not compromise the values for which the Area is protected;
- Minimize the possibility of introduction of non-native species (e.g. plants, animals and microbes) to the Area;
- Minimise 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, and copies of this management plan, including maps of the Area, shall be made available at Palmer Station (United States);
- Copies of this management plan shall be made available to all vessels and aircraft visiting the Area and/or operating in the vicinity of Palmer Station,

and all personnel (national program staff, field expeditions, tourist expedition leaders, pilots and ship captains) operating in the vicinity of, accessing or flying over the Area, shall be informed by their national program, tour operator or appropriate national authority 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 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 (at least 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.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No. 113 Litchfield Island – Arthur Harbor, Anvers Island, showing the location of nearby stations (Palmer Station, US; Yelcho Station, Chile; Port Lockroy Historic Site and Monument No. 61, UK), the boundary of Antarctic Specially Managed Area No. 7 Southwest Anvers Island and Palmer Basin, and the location of nearby protected areas. Projection: Lambert Conformal Conic; Central Meridian: 64° 00' W; Standard parallels: 64° 40' S, 65° 00' S; Latitude of Origin: 66° 00' S; Spheroid and horizontal datum: WGS84; Contour interval: Land – 250 m, Marine – 200 m. Data sources: coastline & topography SCAR Antarctic Digital Database v4.1 (2005); Bathymetry: IBCSO v.1 (2013); Protected areas: ERA (2021); Stations: COMNAP (2020). Inset: the location of Anvers Island and the Palmer Archipelago in relation to the Antarctic Peninsula.

Map 2: ASPA No. 113Litchfield Island: Topography and selected wildlife.
Projection: Lambert Conformal Conic; Central Meridian: 64°06'W; Standard parallels: 64° 46'S, 64° 48'S; Latitude of Origin: 65° 00'S; Spheroid and horizontal datum: WGS84; Vertical datum: mean sea level; Contour interval: Land – 5 m; Marine – 20 m; Coastline, topography, vegetation & southern elephant seal wallow derived from orthophoto (Feb 2009, ERA 2014) with a horizontal accuracy of ~ ± 2 m and a vertical accuracy of ~± 3 m; Bathymetry derived from Asper & Gallagher PRIMO survey (2004); Skuas: W. Fraser (2001-09); Former penguin colony: USGS Orthophoto (1998); Survey mark: USGS; Campsite, boat landing site: RPSC; Protected area and zones: ERA (2020).

6. Description of the Area

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

- *Overview*

Litchfield Island (64°46'15" S, 64°05'40" W, 0.34 km²) is situated in Arthur Harbor approximately 1500 m west of Palmer Station (US), Gamage Point, Anvers Island, in the region west of the Antarctic Peninsula known as the Palmer Archipelago (Map 1). Litchfield Island is one of the largest islands in Arthur Harbor, measuring approximately 1000 m northwest to southeast and 700 m from northeast to southwest. Litchfield Island has the most varied topography and the greatest diversity of terrestrial habitats of the islands in Arthur Harbor (Bonner and Lewis Smith 1985). Several hills rise to between 30-40 m, with the maximum elevation of 48 m being in the central western part of the island (Map 2). Rocky outcrops are common both on these slopes and on the coast. The island is predominantly ice-free in summer, apart from small snow patches occurring mainly on the southern slopes and in valleys. Cliffs of up to 10 m form the northeastern and southeastern coasts, with pebble beaches found in bays in the north and south.

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

- *Climate*

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

Longer-term data available for Palmer Station show regional temperatures to be relatively mild because of local oceanographic conditions and because of the frequent and persistent cloud cover in the Arthur Harbor region (Lowry 1975). Yearly air temperature averages recorded at Palmer Station during the period 1974 to 2012 show a distinct warming trend but also demonstrate significant inter-annual variability (Figure 1). Between 2010-17 the mean annual temperature at Palmer Station was –1.8° C, with an average monthly air temperature in August of –5.94° C, and in January 1.72° C. The maximum temperature recorded between 1974 to 2018 was 11.6° C in March 2010, whilst the minimum was –26° C in August 1995. Previous studies have identified August as the coldest month and January as the warmest (Baker 1996). Storms at Palmer Station are frequent, with precipitation in the form of snow and rain giving an annual average snowfall depth of 344 cm and approximately 636 mm water equivalent. Winds are persistent but generally light to moderate in strength, prevailing from the northeast.

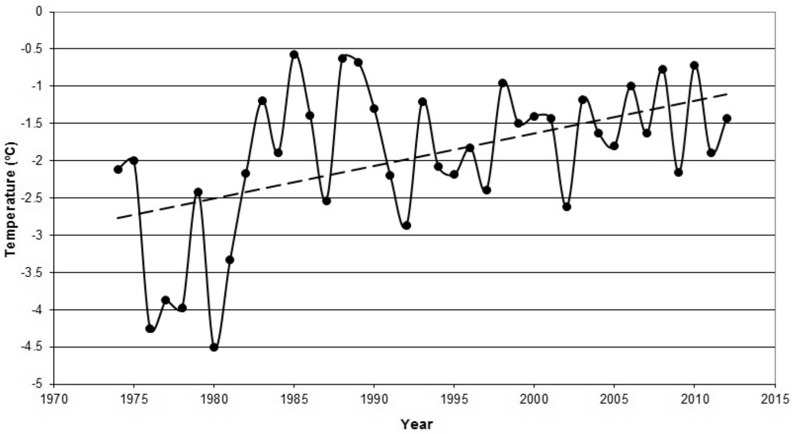


Figure 1. Mean annual surface air temperature at Palmer Station 1974 – 2012. Data source: Palmer LTER (http://oceaninformatics.ucsd.edu/datazoo/data/pallter/datasets?action=summary&id=189).

- *Geology, geomorphology and soils*

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

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

- *Freshwater habitat*

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

- *Vegetation*

The plant communities at Litchfield Island were surveyed in detail in 1964 (Corner 1964a). At that time, vegetation on Litchfield Island was well-developed and comprised several distinct communities with a diverse flora (Lewis Smith and Corner 1973; Lewis Smith 1982). Both species of Antarctic vascular plant, Antarctic hairgrass (Deschampsia antarctica) and Antarctic pearlwort (Colobanthus quitensis) were present on Litchfield Island (Corner 1964a; Greene and Holtom 1971; Lewis Smith and Corner 1973). Corner (1964a) noted that D. antarctica was common along the northern and northwestern coast of the island, with more localized patches growing further inland on ledges with deposits of mineral material and forms closed swards (Greene and Holtom 1971; Lewis Smith 1982). C. quitensis was present in two localities: a patch on the northeastern coast measuring approximately 9x2 m and a series of about six cushions scattered over a steep, flushed cliff above the northwestern coast. Commonly associated with the two vascular plants was a moss carpet assemblage comprising Bryum pseudotriquetrum, Sanionia uncinata, Syntrichia princeps and Warnstorfia laculosa (Corner 1964a). Factors controlling the distribution of C. quitensis and D. antarctica area include the availability of suitable substrate and air temperature (Komarkova et al. 1985). In conjunction with recent warming, existing populations of C. quitensis have expanded and new colonies have been established within the Arthur Harbor area, although this has not been studied specifically at Litchfield Island (Grobe et al. 1997; Lewis Smith 1994).

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

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

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

Other species recorded as present within the Area are: the hepatic Lophozia excisa; the lichens Buellia spp., Caloplaca spp., Cetraria aculeata, Coelopogon epiphorellus, Lecanora spp., Lecidia spp., Lecidella spp., Lepraria sp., Mastodia tessellata, Ochrolechia frigida, Parmelia saxatilis, Physcia caesia, Rhizocarpon geographicum, Rhizocarpon sp., Stereocaulon glabrum, Umbilicaria decussata, Xanthoria candelaria and X. elegans; and the mosses Andreaea gainii var. gainii, Bartramia patens, Dicranoweisia grimmiacea, Pohlia cruda, Polytrichastrum alpinum, Sarconeurum glaciale and Schistidium antarctici (BAS Plant Database 2009).

Previously, increasing populations of Antarctic fur seals (Arctocephalus gazella) have caused significant damage to the moss banks and carpets at lower elevations (Lewis Smith 1996; Harris 2001). However, observations suggest previously damaged vegetation is recovering at some sites following a recent decline in fur seal populations on Litchfield Island, although recent increases in southern elephant seals (Mirounga leonina) hauling out on the island has resulted in severe damage in their wallow locality (Map 2) and on access routes (Fraser and Patterson-Fraser, pers comms. 2014). South polar skuas (Catharacta maccormicki) nest in the moss banks and cause some local damage.

- *Invertebrates, bacteria and fungi*

The invertebrate fauna of Litchfield Island has not been studied in detail. Observations made in 1966 recorded the presence of large populations of invertebrates, particularly in areas colonised by plants, including Cyrtolaelaps, Protereunetes, Stereotydeus, Rhagidia, Tydeus, Alaskozetes and Opisa, in addition to Cryptopygus, Parisotoma and Belgica. Larvae of Belgica were numerous under grass and moss, numbering approximately 10,000 per m^2. Large numbers of Nanorchestes and some Cryptopygus were observed on the green algae Pandorina. The intertidal mite Rhombognathus gressitti was observed, although very scarce, on a rocky beach and mudflat of the island (Gressitt 1967). The tardigrades Macrobiotus furciger, Hypsibius alpinus and H. pinguis have been observed in moss patches, predominantly on north-facing slopes (Jennings 1976).

- *Breeding birds*

Six bird species breed on Litchfield Island, making it one of the most diverse avifauna breeding habitats within the Arthur Harbor region. A small Adélie penguin (Pygoscelis adeliae) colony was previously situated on the eastern side of the island and has been censused regularly since 1971 (Table 1, Map 2). Following the substantial decline in the numbers of breeding pairs over a 30-year period, Adélie penguins are presently extinct on Litchfield Island (Fraser pers. comm. 2014). Population decline has been attributed to changes in both sea ice distribution and snow accumulation (McClintock et al. 2008). Adélie penguins are sensitive to changes in sea ice concentration, which has an influence on penguin access to feeding areas and on the abundance of Antarctic krill, which is their primary prey (Fraser and Hofmann 2003; Ducklow et al. 2007). The recent substantial extension of ice-free conditions within the Palmer LTER study area occurred concurrently with an 80 percent decrease in krill abundance along the northern half of the western Antarctic Peninsula and as a result may have significantly reduced the food supply of Adélie penguins inhabiting Litchfield Island (Fraser and Hofmann 2003; Forcada et al. 2008). In recent years, spring blizzards in the Arthur Harbor area have become more frequent and more intense, which coupled with widespread precipitation increases, is thought to have substantially increased mortality rates of Adélie chicks and eggs (McClintock et al. 2008; Patterson et al. 2003). The Litchfield Island colony receives the most snowfall of the seven penguin colonies studied in the Palmer area and has shown the most rapid decline, strongly implicating increased snowfall as a contributing factor in Adélie penguin losses (Fraser, in Stokstad 2007).

Table 1. Numbers of breeding Adélie penguins (Pygoscelis adeliae) on Litchfield Island 1971-2020

Year	BP	Count Type 1	Source	Year	BP	Count Type1	Source	Year	BP	Count Type 1	Source
1971-72	890	N3	2	1986-87	577	N1	3	2000-01	274	N1	3
1972-73				1987-88	430	N1	3	2001-02	166	N1	3
1973-74				1988-89				2002-03	143	N1	3
1974-75	1000	N4	2	1989-90	606	N1	3	2003-04	52		4
1975-76	884	N1	3	1990-91	448	N1	3	2004-05	33		4
1977-78	650	N1	2	1991-92	497	N1	3	2005-06	15		4
1978-79	519	N1	2	1992-93	496	N1	3	2006-07	4		4
1979-80	564	N1	2	1993-94	485	N1	3	2007-08	0		4
1980-81	650	N1	2	1994-95	425	N1	3	2008-09	0		4
1981-82				1995-96	410	N1	3	2009-10	0		5
1982-83				1996-97	346	N1	3	2010-11	0		5
1983-84	635	N1	2	1997-98	365	N1	3	2011-12	0		5
1984-85	549	N1	2	1998-99	338	N1	3	2012-13	0		5

1985-86	586	N1	2	1999-2000	322	N1	3	2013-20	0		6

BP = Breeding pairs, N = Nest, C = Chick, A = Adults; 1 = < ± 5%, 2 = ± 5-10%, 3 = ± 10-15%, 4 = ± 25-50% (classification after Woehler, 1993)

1. Parmelee and Parmelee, 1987 (N1 and December counts are shown where several counts were made in one season).
2. W.R. Fraser data supplied February 2003, based on multiple published and unpublished sources.
3. W.R. Fraser data supplied January 2009.
4. W.R. Fraser data supplied February 2014.
5. W.R. Fraser pers. comm. 2020.

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

Table 2. Numbers of breeding southern giant petrels (Macronectes giganteus) on Litchfield Island 1993-2012 (nest counts accurate < ± 5%).

Year	Breeding pairs	Year	Breeding pairs	Year	Breeding pairs
1993-94	26	2000-01	39	2007-08	45
1994-95	32	2001-02	46	2008-09	57
1995-96	37	2002-03	42	2009-10	52
1996-97	36	2003-04	47	2010-11	60
1997-98	20	2004-05	48	2011-12	54

1998-99	44	2005-06	43	2012-13	54
1999-2000	41	2006-07	50		

Source: Unpublished data supplied by W.R. Fraser, February 2003, January 2009, February 2014.

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

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

Antarctic Important Bird Area (IBA) No. 86, Litchfield Island, was identified because the South polar skua (Catharacta maccormicki) colony contains ≥1% of the global South polar skua population (Harris et al. 2015). The IBA has the same boundary as the ASPA (Map 2).

- *Marine mammals*

Antarctic fur seals (Arctocephalus gazella) started to appear in Arthur Harbor in the mid-1970s and are now common on Litchfield Island from around February each year. Regular censuses conducted in February and March over the period 1988-2003 recorded on average 160 and 340 animals on the island in these months respectively (Fraser pers. comm. 2003), with a peak of 874 on 19 March 1994 (Fraser pers. comm. 2014). In recent years, however, Antarctic fur seal numbers have decreased within the Arthur Harbor area (Siniff et al. 2008). Population decline has been tentatively attributed to reduced Antarctic krill availability within the area, which represents a key component of the diet of Antarctic fur seals, particularly during pupping (Clarke et al. 2007; Siniff et al. 2008). Diminished Antarctic krill abundance is thought to be a result of reduced sea ice extent and persistence within the Arthur Harbor area (Fraser and Hoffman 2003; Atkinson et al. 2004).

Southern elephant seals (Mirounga leonina) haul out on accessible beaches from October to June, numbering on average 43 animals throughout these months since 1988 (Fraser pers. comm. 2003), with numbers remaining relatively stable or perhaps increasing slightly (Fraser and Patterson-Fraser, pers. comms. 2014). A group of a dozen or more is found on the northeastern side of the island, having moved in recent years from the low-lying valley to more elevated ground ~150 m northwest of the former haul-out site (Map 2). A few Weddell seals (Leptonychotes weddellii) occasionally haul out on beaches. Long term census data (1974–2005) indicate that elephant seal populations within the Arthur Harbor area have recently expanded, as larger ice-free areas have become available for breeding. In contrast, data indicate that Weddell seal numbers have declined as a consequence of reduced fast-ice extent, which is necessary for breeding (Siniff et al. 2008). Both crabeater seals (Lobodon carcinophagus) and leopard seals (Hydrurga leptonyx) may also commonly be seen on ice floes near Litchfield Island. Minke whales (Balaenoptera acutorostrata) have been sighted in the Arthur Harbor area during both the austral summer (Dec-Feb) and autumn (Mar-May) (Scheidat et al. 2008).

- *Littoral and benthic communities*

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

- *Human activities and impact*

In January 1989 the vessel Bahia Paraiso ran aground 750 m south of Litchfield Island, releasing more than 600,000 liters (150,000 gallons) of petroleum into the surrounding environment (Kennicutt 1990; Penhale et al. 1997). The intertidal communities were most affected, and hydrocarbon contaminants were found in both sediments and inter- and sub-tidal limpets (Nacella concinna), with an estimated mortality of up to 50% (Kennicutt et al. 1992a&b; Kennicutt and Sweet 1992; Penhale et al. 1997). However, numbers recovered soon after the spill (Kennicutt 1992a&b). Levels of petroleum contaminants found in intertidal sample sites on Litchfield Island were among some of the highest recorded (Kennicutt et al. 1992b; Kennicutt and Sweet 1992). It was estimated that 80% of Adélie penguins nesting in the vicinity of the spill were exposed to hydrocarbon pollution, and exposed colonies were estimated to have lost an additional 16% of their numbers in that season as a direct result (Penhale et al. 1997). However, few dead adult birds were observed. Samples collected in April 2002 detected hydrocarbons within the waters surrounding the Bahia Paraiso wreck, suggesting some leakage of Antarctic gas oil (Janiot et al. 2003) and fuel occasionally reaches beach areas on south-western Anvers Island (Fraser pers. comm. 2009). However, hydrocarbons were not found within sediment or biota samples collected in 2002 and high sea energy within the area is thought to significantly limit the impact of fuel leaks on local biota and the persistence of contaminants on beaches. In addition, marine debris, including fishing hooks, lines and floats are occasionally observed on Litchfield Island.

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

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

An old and disintegrated cache originating from British operations in the 1950-60s was cleaned up and removed from the summit of Litchfield Island and from the Area in the summer of 2016/17.

6(ii) Access to the Area

The Area may be accessed over sea ice or by sea. Particular routes have not been designated for access to the Area, although the preferred small boat landing site is located in a small cove on the eastern coast of the island (Map 2). Overflight and aircraft landing 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

With the exception of a cairn on the summit of the island, there are no structures present within the Area. A permanent survey marker, consisting of a 5/8" stainless steel threaded rod, was installed on Litchfield Island by the USGS on 9 February 1999. The marker is located near the summit of the island at 64°46'13.97"S, 64°05'38.85"W at an elevation of 48 m, about 8 m west of the cairn (Map 2). The marker is set in bedrock and marked by a red plastic survey cap. A survival cache is located near the crest of a small hill overlooking the former Adélie penguin colony, approximately 100 m south of the small boat landing site.

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

Litchfield Island lies within Antarctic Specially Managed Area (ASMA) No.7 Southwest Anvers Island and Palmer Basin (Map 1). The nearest Antarctic Specially Protected Areas (ASPAs) to Litchfield Island are: Biscoe Point (ASPA No. 139) which is 15 km east of the Area, Rosenthal Islands (ASPA No. 176) which is ~15 km to the northwest, and South Bay (ASPA No. 146), which is approximately 27 km to the southeast at Doumer Island (Inset, Map 1).

6(v) Special zones within the Area

A Restricted Zone surrounding the Area is defined by the Management Plan for Antarctic Specially Managed Area No. 7 as a buffer extending 50 m from the shore into the adjacent marine area (Map 2). The Restricted Zone lies outside of the boundary of the Area, and does not require a permit for entry. However, small boat traffic and / or cruising within the 50 m marine buffer should be avoided to minimize potential disturbance to wildlife 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 scientific reasons that cannot be served elsewhere, and in particular for research on the terrestrial ecosystem or fauna in the Area, 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 and scientific values of the Area;
- it is issued for compelling educational or outreach reasons 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 when in the Area.

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

Access to the Area shall be by small boat, or over sea ice by vehicle or on foot. Vehicles are prohibited and all movement within the Area shall be on foot. 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.

- *Foot access and movement within the Area*

Persons on foot should at all times avoid disturbance to birds and seals, and damage to vegetation. Boat crew, or other people in boats or vehicles, are prohibited from moving on foot beyond the immediate vicinity of the landing site unless specifically authorised by permit.

Pedestrians should maintain the following minimum approach distances from wildlife, unless it is necessary to approach closer for purposes allowed for by the permit:

- Southern giant petrels (Macronectes giganteus) – 50 m
- Antarctic fur seals (for personal safety) – 15 m
- other birds and seals – 5 m.

Visitors should move carefully so as to minimize disturbance to flora, fauna, and soils, and should walk on snow or rocky terrain if practical, but taking care not to damage lichens. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

- *Small boat access*

The recommended landing site for small boats is on the beach in the small cove mid-way along the eastern coast of the island (Map 2). Access by small boat at other locations around the coast is allowed, provided this is consistent with the purposes for which a permit has been granted.

- *Aircraft access and overflight*

Landings by piloted aircraft within the Area are prohibited and landings within 930 m (~1/2 nautical mile) of the Area should be avoided wherever possible. Overflight of piloted aircraft below 610 m (~2000 ft) Above Ground Level is prohibited except when operationally necessary for scientific purposes.

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 ecosystem values of the Area or the value of the Area as a reference site, and which cannot be served elsewhere.
- Activities with compelling educational and / or outreach purposes purposes (such as documentary reporting (e.g. visual, audio or written) or the production of educational resources or services) that are for compelling reasons that cannot be served elsewhere. Educational and / or outreach activities do not include tourism.
- Essential management activities, including monitoring and inspection.

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

- No structures are to be erected within the Area except as specified in a permit and, with the exception of permanent survey markers and the existing cairn at the summit of the island, permanent structures or installations are prohibited.
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator, 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 or 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.
- 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 be avoided within the Area. However, when necessary for essential purposes specified in the permit, temporary camping is allowed at the designated site on the terrace above the former penguin colony. The campsite is located at the foot of a small hill (~35 m), on its eastern side, approximately 100 m south-west of the small boat landing beach (Map 2). Camping on surfaces with significant vegetation cover is prohibited.

7(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 sampling equipment 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 e.g. backpacks, carry-bags, tents, walking poles, tripods etc.) shall be thoroughly cleaned at Palmer Station 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));
- Poultry and all poultry products are prohibited from the 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 of 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.

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 or essential logistic 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 are strongly encouraged to consult with established programs working within the Area, such as those of the US, 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 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 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, or anything removed, or anything released and not removed, that were not included in the authorized permit.

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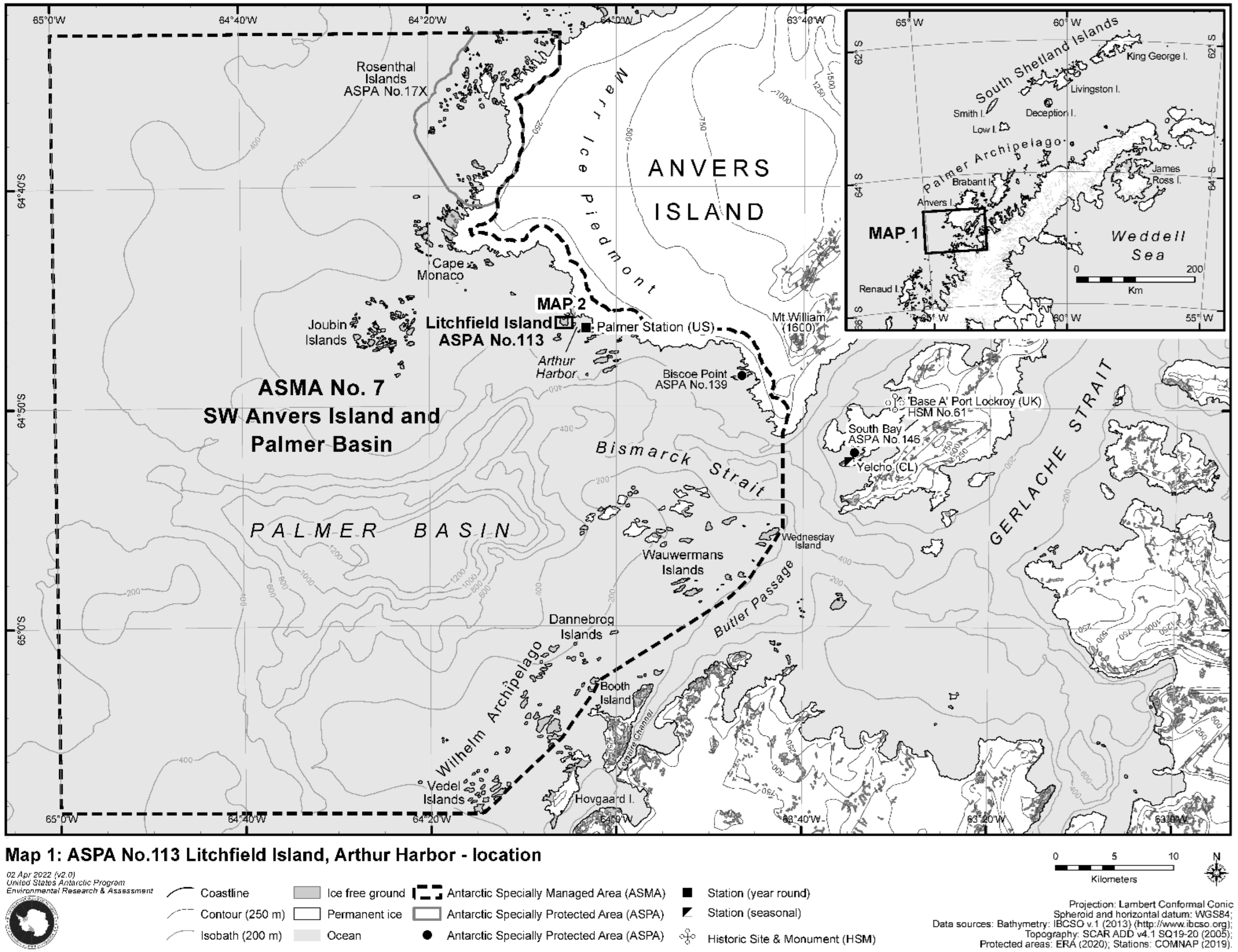
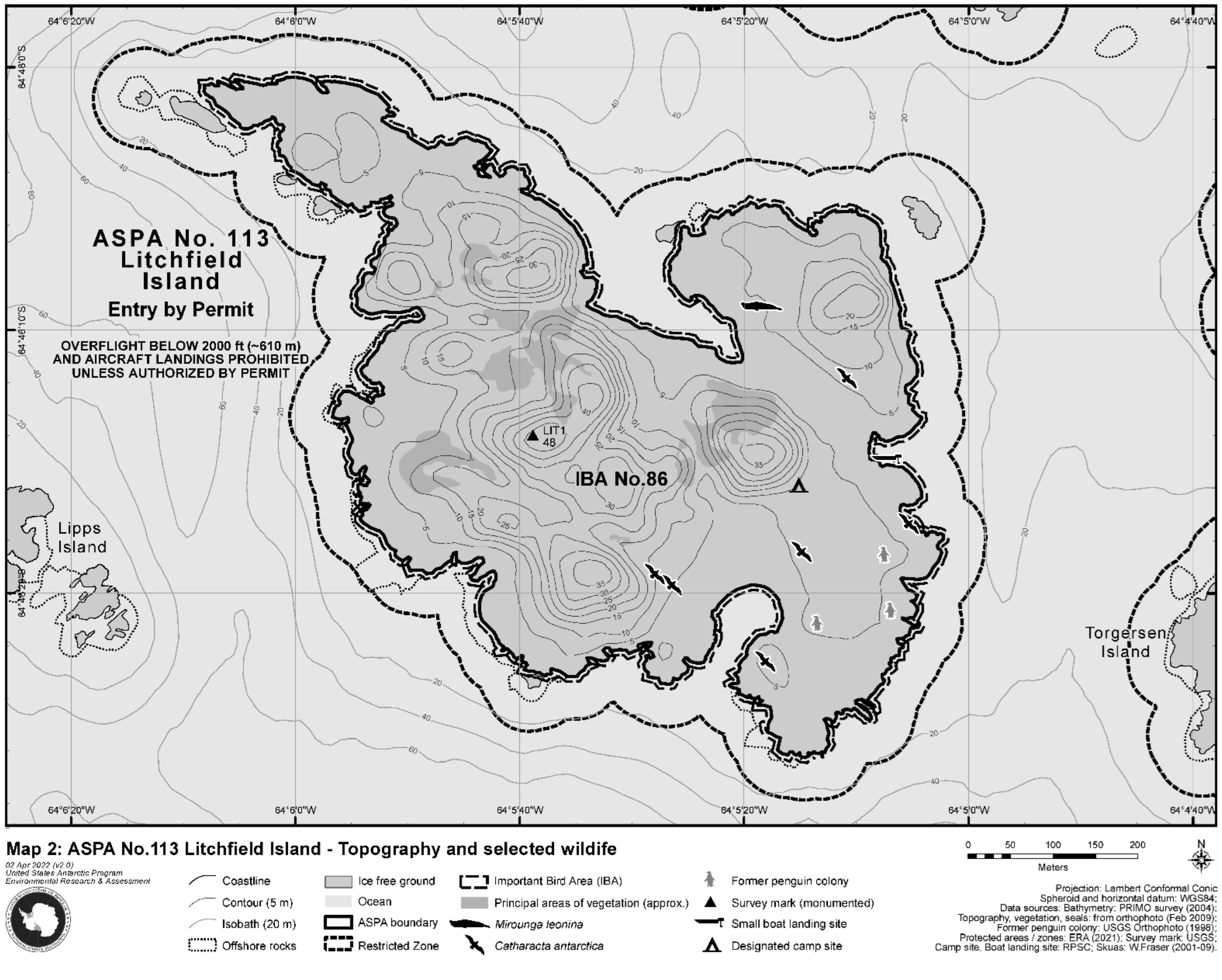


Map 1: ASPA No.113 Litchfield Island, Arthur Harbor - location



Map 2: ASPA No.113 Litchfield Island - Topography and selected wildlife

Measure 6 (2022)

Antarctic Specially Protected Area No 115 (Lagotellerie Island, Marguerite Bay, Graham 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-11 (1985), which designated Lagotellerie Island, Marguerite Bay, Graham Land as Specially Protected Area ("SPA") No 19 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a Management Plan for the Area;
- Measure 1 (2000), which annexed a revised Management Plan for SPA 19;
- Decision 1 (2002), which renamed and renumbered SPA 19 as ASPA 115;
- Measures 5 (2012) and 4 (2017), which adopted a revised Management Plan for ASPA 115;

Recalling that Recommendation XVI-6 (1991) and Measure 1 (2000) did not become effective and were withdrawn by Decision 3 (2017);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 115;

Desiring to replace the existing Management Plan for ASPA 115 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 115 (Lagotellerie Island, Marguerite Bay, Graham Land), which is annexed to this Measure, be approved; and
2. Management Plan for Antarctic Specially Protected Area No 115 annexed to Measure 4 (2017) be revoked.

Management Plan for Antarctic Specially Protected Area No. 115

LAGOTELLERIE ISLAND, MARGUERITE BAY, GRAHAM LAND

Introduction

The primary reason for the designation of Lagotellerie Island, Marguerite Bay, Graham Land (Latitude 67°53'20" S, Longitude 67°25'30" W; area 1.58 km²) as an Antarctic Specially Protected Area (ASPA) is to protect environmental values, and primarily the terrestrial flora and fauna but also the avifauna within the Area.

Lagotellerie Island is approximately 2 km by 1.3 km, oriented generally in an east-west direction. The Area is 11 km south of Porquois Pas Island and 3.25 km west of the south end of Horseshoe Island. Lagotellerie Island was first mapped by Jean-Baptiste Charcot during the Deuxième Expédition Antarctiques Française in 1908-10. There are no records of further visits until the 1940s, when the island was visited occasionally by American, Argentine and British field parties from nearby scientific stations. The island has not been the subject of any major scientific investigations and is thus largely undisturbed by human activities.

Lagotellerie Island was originally designated as a Specially Protected Area through Recommendation XIII-II (1985, SPA No. 19) after a proposal by the United Kingdom. It was designated on the grounds that the island contains a rich and diverse flora and fauna typical of the southern Antarctic Peninsula region. These values were reiterated in Recommendation XVI-6 (1991) when a management plan for the site was adopted, and are largely reaffirmed again in the present management plan.

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 115 is contained within Environment Domain B (Antarctic Peninsula mid-northern latitudes geologic). Other protected areas containing Domain B include ASPAs 108, 134, 140 and 153 and ASMAs 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. ASPA 115 Lagotellerie Island sits within ACBR 3 Northwest Antarctic Peninsula (Terauds et al., 2012). 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 ANT098 Lagotellerie Island has the same boundary as ASPA 115, and was identified due to the presence of a large colony of blue-eyed cormorants.

The three other ASPAs are present within the Marguerite Bay area (ASPA 107 Emperor Island, Dion Islands, ASPA 117 Avian Island and ASPA 129 Rothera Point). ASPA 107 Emperor Island and ASPA 117 Avian Island were designated to protect predominantly the avifauna of the area, while ASPA 129 Rothera Point was designated to monitor the impact of the nearby station on an Antarctic fellfield ecosystem. Therefore, Lagotellerie Island complements the local network of ASPAs by primarily protecting terrestrial biological communities.

1. Description of values to be protected

Following a visit to the ASPA in January 2022, the values specified in the earlier designation were reaffirmed. These values are set out as follows:

- Lagotellerie Island contains a relatively diverse flora typical of the southern Antarctic Peninsula region. Of particular interest is the abundance of the only two Antarctic flowering plants Deschampsia antarctica and Colobanthus quitensis which form stands up to 10 m^2. These are amongst the largest stands known south of the South Shetland Islands, being only 90 km north of their southern limit. Both species flower profusely and the seeds have a greater viability than those produced in the South Orkney or South Shetland Islands.
- Numerous mosses and lichens form well-developed communities on the island. A few of the mosses are fertile, which is a rare phenomenon in most Antarctic localities.
- The island is notable for the occurrence of Deschampsia antarctica at the highest recorded altitude south of 56° S, with scattered small plants observed at heights of up to 275 m. The island therefore has a particular future scientific value for study of the influence of altitudinal gradient on biological viability for plant species represented at this site.
- The invertebrate fauna is rich and the island is one of the southernmost sites for the apterous midge Belgica antarctica.
- The shallow loamy soil developed beneath the vegetation and its associated invertebrate fauna and microbiota are probably unique at this latitude.
- There is a colony of 7482 breeding pairs of Adélie penguins (Pygoscelis adeliae) (counted January 2013) and one of the farthest south colonies of c. 250 blue-eyed cormorants (Phalacrocorax atriceps) at the south-east corner of the island. Numerous pairs of brown and south polar skuas (Catharacta lonnbergii and C. maccormicki) breed on the island.
- The values associated with the penguin and skua colonies are now considered to be their ecological interrelationship with the other biological features of exceptional value noted above.
- Fossiliferous strata present at the eastern end of the island are of particular geological value, as such formations are not commonly exposed in the Antarctic Peninsula Volcanic Group.
- The island has not been subject to frequent visits, scientific research or sampling and therefore may be regarded as one of the most pristine highly vegetated areas in the region.

2. Aims and objectives

Management at Lagotellerie Island aims to:

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

3. Management activities

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

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- The Management Plan shall be reviewed at least every five years and updated as required.
- 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.
- A copy of this Management Plan shall be made available at Rothera Research Station (UK; Latitude 67°34' S, Longitude 68°07' W) General San Martín Station (Argentina; Latitude 68°08' S, Longitude 67°06' W) and the Turkish Antarctic Research Station (TARS; Latitude 67°49' S, Longitude 67°14' 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.

4. Period of designation

The ASPA is designated for an indefinite period.

5. Maps

Figure 1. Lagotellerie Island Antarctic Specially Protected Area No. 115, Marguerite Bay, location map, showing the location of General San Martín Station (Arg.), the station Teniente Luis Carvajal (Chile), Adelaide Island, Rothera Research Station (UK) and nearby ASPA 129 at Rothera Point, also on Adelaide Island, and the location of the other protected areas in the region [Emperor Island, Dion Islands (ASPA 107) and Avian Island (ASPA 117)]. 'Base Y' (UK) (Historic Monument No. 63) on Horseshoe Island is shown. Inset: the location of Lagotellerie Island along the Antarctic Peninsula.

Figure 2. Lagotellerie Island (ASPA 115) topographic map. Map specifications: Projection: Lambert Conformal Conic. Standard parallels: 1st 63° 20' 00" S; 2nd 76° 40' 00"S. Central Meridian: 65° 00' 00" W. Latitude of Origin: 70° 00' 00" S. Spheroid: WGS84. Datum: Mean Sea Level. Vertical contour interval 20 m. Horizontal and vertical accuracy expected to be better than ±5 m.

Figure 3. Lagotellerie Island (ASPA 115) geological sketch map.

Figure 4. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 115 Lagotellerie Island, Marguerite Bay, Graham Land, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values

6. Description of the Area

6(i) Geographical coordinates and natural features

- *Boundaries and co-ordinates*

The corner co-ordinates of the Area are shown in Table 1.

Corner	Latitude	Longitude
northwest	67°52’30’’ S	67°27’00’’ W
northeast	67°2’30’’ S	67°22’00’’ W
southwest	67°54’00’’ S	67°27’00’’ W
southeast	67°54’00’’ S	67°22’00’’ W

The Area includes all of Lagotellerie Island and unnamed adjacent islands and islets. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within the boundaries, but excludes the marine environment extending greater than 10 m offshore from the low tide water line (Map 2). Boundary markers have not been installed because the coast itself is a clearly defined and visually obvious boundary.

Lagotellerie Island is steep-sided and rocky, with about 13% permanent ice cover, most of which is on the southern slopes. The island rises to twin peaks of 268 m and 288 m separated by a broad saddle at around 200 m, with precipitous cliffs up to this height on the south, west and east sides. The upper northern slopes also have steep cliffs, intersected by gullies, screes and traversed by broad rock terraces. The lower northern slopes are more gentle, particularly on the eastern half of the island, with a broad rocky terrace at an elevation of about 15 m which is formed of frost-shattered raised beach debris.

- *Geology*

The bulk of Lagotellerie Island is formed of quartz diorite of unknown age, cut by pink, coarse-grained granodiorite and numerous basic and felsic dykes (Map 3). At the eastern end of the island the plutonic rocks are in fault contact with folded, mildly hornfelsed volcanic rocks of Jurassic–Cretaceous age. These consist of agglomerates, andesitic lavas and tuffs of the Antarctic Peninsula Volcanic Group, with plant remains – probably Jurassic – present in shaly beds interbedded with tuff. Such fossiliferous strata are not commonly exposed in the Antarctic Peninsula Volcanic Group, and are therefore of particular geological importance.

Locally extensive areas of coarse sand and gravel derived from weathered quartz-diorite occur on slopes, ledges, gullies and depressions; the most extensive accumulations are on the saddle between the two summits where the soil is sorted into well-developed stone polygons, circles and stripes. On the broad rock terraces closed stands of moss and grass have developed a relatively rich loamy earth up to 25 cm in depth. Glacial erratics are common on the island.

- *Terrestrial biological communities*

The island has a relatively diverse flora and luxuriant development of plant communities, representative of the southern maritime Antarctic region. Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 0.06 km² (c. 3.7% of the ASPA area). The rich terrestrial biology of Lagotellerie Island was first noted by Herwil Bryant, biologist at East Base (US, on Stonington Island; now Historic Monument No. 55), during a visit in 1940-41 when he observed growths of moss, the Antarctic hair grass Deschampsia antarctica, and "a small flowering plant" (almost certainly the Antarctic pearlwort Colobanthus quitensis), in a small gully – believed to be that found at the north-eastern end of the island – which he considered of such unusual richness for the region that he unofficially referred to it as "Shangri-la Valley". He did not describe the less luxuriant but more extensive communities of Deschampsia antarctica and Colobanthus quitensis found on the higher north-facing slopes of the island. These slopes and terraces also provide favourable microclimatic conditions for growth, with a relatively long snow-free growing season, and support an abundance of Deschampsia antarctica and Colobanthus quitensis, the grass forming closed swards of up to 10 m² on some of the terraces. These are among the largest stands of these plants known south of the South Shetland Islands. Both species flower abundantly and the seeds have a greater viability than those produced in the South Orkney or South Shetland Islands, yet they are close to the southern limit of their range. Lagotellerie Island, however, is notable for the growth of Deschampsia antarctica at the highest altitude recorded south of 56° S, with scattered small plants observed at heights of up to 275 m. Colobanthus quitensis has been observed growing up to 120 m on the island.

Lagotellerie Island also has a rich cryptogamic flora, with small stands of well-developed communities containing several mosses and lichens which are rare at this latitude (notably the mosses Platydictya jungermannioides and Polytrichastrum alpinum, and lichens Caloplaca isidioclada, Fuscoparmelia gerlachei and Usnea trachycarpa). The number of bryophyte species thus far identified include 20 mosses and two liverworts (Barbilophozia hatcheri and Cephaloziella varians), and there are at least 60 lichen species. A comprehensive floristic survey of the island has not yet been undertaken, and numerous species, especially of crustose lichens, remain to be accurately determined.

Vegetation is best developed on a series of rock terraces at around 30-50 m a.s.l. on the northern side of the island. Here, both Deschampsia and Colobanthus are abundant, and closed grass swards form stands of several square metres. Associated with these, especially on the moister terraces, are usually the mosses Brachythecium austro-salebrosum, Bryum spp., Pohlia nutans, Polytrichastrum alpinum and Sanionia uncinata, and liverworts Barbilophozia hatcheri and Cephaloziella varians. Many of these grass swards are used as nest sites by skuas.

In drier habitats, especially on scree and rock faces, there are locally dense stands dominated by the macrolichens Usnea sphacelata and U. subantarctica, with Pseudephebe minuscula, Umbilicaria decussata, and a large number of crustose taxa. Several lichens are associated with the grass and moss communities (e.g. Cladonia spp., Leproloma spp., Leptogium puberulum, Ochrolechia frigida, Psoroma spp.). Near the penguin and cormorant colonies several colourful nitrophilous lichens are abundant (e.g. Buellia spp., Caloplaca spp., Fuscoparmelia gerlachei, Xanthoria spp.).

Numerous lichens (notably Caloplaca isidioclada, Pseudephebe minuscula, Usnea sphacelata, Umbilicaria decussata and many crustose taxa) and a few mosses (notably Grimmia refelxidens) occur close to the summit of the island, as do scattered individual plants of Deschampsia. Few bryophytes produce sporophytes at far southern latitudes, but several mosses are fertile on Lagotellerie Island (e.g. Andreaea regularis, Bartramia patens, Bryum amblyodon, B. pseudotriquetrum, Grimmia reflexidens, Hennediella heimii, Pohlia nutans, Schistidium antarctici, Syntrichia princeps).

Specific studies of the invertebrate fauna have not been conducted on Lagotellerie Island. However, at least six species of arthropod have been recorded: Alaskozetes antarcticus, Gamasellus racovitzai, Globoppia loxolineata (Acari), Cryptopygus antarcticus, Friesea grisea (Collembola), and Belgica antarctica (Diptera, Chironomidae). Several species of nematophagous fungi have been isolated from the soils associated with mosses and Deschampsia on Lagotellerie Island (Cephalosporium balanoides, Dactylaria gracilis, Dactylella ellipsospora), species widely distributed in similar habitats throughout the Antarctic and also commonly found in temperate soils.

Bryant reported several small pools present on the island in the early 1940s, which presumably are the same as, or close to, those observed more recently on the extensive flat low-lying ground on the northern side of the island. He recorded the pools contained many phyllopod crustaceans identified as Branchinecta granulosa. Rocks in one of the pools were coated in a bright green filamentous alga, on which the mites Alaskozetes antarcticus were observed. A. antarcticus was also common under pebbles on the pool floor. Other microorganisms of the trochelminth type were observed living in the algae, with a pink rotifer identified as Philodina gregaria being especially numerous. Small tufts of a grey-green alga were observed on large pebbles close to the pool bottom. The algae have not been described in more detail, although the presence of Prasiola crispa has been noted. More recent observations in the early 1980s suggested there were no permanent freshwater bodies on the island, but temporary runnels in summer were found, with some brackish pools in rock depressions near the northern coast. Inspection visit January 1989 and February 2011 noted the presence of several small melt pools of around 5-10 m², some with fringing wet moss carpets, and suggested these were probably the habitat of Belgica antarctica.

- *Vertebrate fauna*

A small Adélie penguin (Pygoscelis adeliae) colony occupies the eastern promontory of the island (Map 2). Numbers have varied from a low of perhaps 350-400 pairs based on an estimate made in December 1936 to a high of 2402 pairs recorded in an accurate nest count in November 1955. A count of the colony made on 19 February 2011 noted approximately 1850 adult and juvenile birds (accurate to within 10%). An accurate count in Jan 2013 recorded 7482 breeding pairs, while a rough estimate in January 2022 counted 12-13,000 adults and c. 6,000 chicks. The colony was regularly used as a source of eggs for personnel stationed at the nearby British Base Y on Horseshoe Island between 1955-60. It was reported that some 800 eggs were taken during 1955. The number of breeding pairs dropped to around 1000 in 1959 and 1960. Adélie penguin colonies are known to exhibit high interannual change in numbers as a result of a variety of natural factors, and in March 1981 it was observed that all of the approximately 1000 chicks in the colony had died. A chick count made in February 1983 suggested the colony consisted of approximately 1700 pairs, which is considered accurate to within 15-25%.

A small colony of blue-eyed cormorants (Phalacrocorax atriceps) has been observed on the eastern promontory of the island, which is one of the most southerly breeding sites reported for the species. Some 200 immature birds were observed close to the island, within view of the colony, on 16 January 1956. The colony was reported to consist of 10 nests on 17 February 1983. The colony was not seen in the January 1989 inspection on Lagotellerie Island; however, in February 2011, c. 250 adults and chicks were observed and with many nest containing two large chicks, and a similar number were recorded in January 2022.

Brown and south polar skuas (Catharacta loenbergi and C. maccormicki) are also present, with 12 nests reported in 1956, when it was noted that many of the chicks were definitely south polar skua (C. maccormicki). It was estimated in 1958 that five pairs nested around the penguin colony and that both species occurred. A group of 59 non-breeding birds of both species was recorded on 12 January 1989 mid-way along the northern side of the island. Two Wilson's storm petrel (Oceanites oceanicus) nests were recorded on 14 January 1956. A kelp gull (Larus dominicanus) nest, with eggs, was recorded in the 'Shangri-La Valley' by Bryant in December 1940 (for more information on bird life in the Area see Harris et al., 2015).

The inspection visit in January 1989 reported 12 Weddell seals (Leptonychotes weddellii) hauled out on a small shingle beach at the base of a rocky spit on the north coast, but no other seals were seen. In contrast, the inspection visit of February 2011 noted c. 200 fur seals on northern side of the island and within the Adélie penguins colony (particular to the south of the colony above the pebble beaches). Twenty Weddell seals were also observed.

- *Human impact*

The most significant environmental impact at Lagotellerie Island appears to have been from the practice of egg harvesting to feed personnel at bases operating nearby in the period 1955-60. The inspection visit of January 2022 reported there was no evidence of any recent physical or biological change on the island and it was concluded that the Area was continuing to serve the purpose for which it was designated.

6(ii) Access to the Area

- Access to the Area shall be by boat. Access from the sea should be to the northern coast of the island (Map 2), unless specifically authorised by Permit to land elsewhere or when landing along this coast is impractical because of adverse conditions. The coastline is generally rocky and recommended landing sites are located on the north coast at Lat. 67°52’57’’ Long. 067°24’03’’ and Lat. 67°53’04’’ Long. 067°23’30’’ (see Map 2).
- Access to the Area is not permitted 100 m either side of the gulley on the northeast coast at Lat. 67°53’10’’ Long. 067°23’13’’ (i.e. the coast below the valley unofficially referred to as "Shangri-la Valley" by Bryant; see Map 2). The valley inland of this coastline contains the richest vegetation growth on the island, and to reduce trampling impacts, non-essential activity within this area is discouraged (Map 2). These restrictions apply equally to persons wishing to access the Area via sea ice in the winter.

- Under exceptional circumstances necessary for purposes consistent with the objectives of the Management Plan helicopters may be permitted to land at the designated landing site located beside the recommended field camp on the broad rock/permanent snow platform about half-way along the northwest coast at about 15 m altitude, and 200 m inland from the sea (Lat. 67°53’04’’ Long. 067°23’43’’). Helicopters shall not land elsewhere within the Area unless specifically authorized by Permit.
- Within the Area the operation of aircraft 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). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit.
- Overflight of the eastern end of the island over the penguin/cormorant colony is prohibited below 610 m (2000 feet) (Map 2).
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used all smoke grenades should be retrieved.

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

A cairn and the remains of a mast erected for survey purposes in the 1960s are present on the summit of the island. During the inspection visit in February 2011, some of the cabling and the remains of black survey flag associated with the mast were removed. The five 8-10 m long bamboo posts, from which the original mast was constructed, were collected together and secured along with six metal stakes near the eastern summit of the island (288 m). In February 2017 all of the bamboo posts and metal stakes were removed.

A cairn (c. 1 m high) is present on the north coast of the island (Lat. 67°53’16’’ Long. 067°22’51’’) and a 30 cm high pile of stones containing a short wooden post with a 2.5 cm diameter metal disc at one end inscribed with the number ‘10’ is present on cliffs west of the penguin colony (Lat. 67°53’17’’ Long. 067°22’46’’). No other structures are known to exist on the island.

Two year-round scientific research stations operate in the vicinity: General San Martín (Argentina; Lat. 68°08' S, Long. 67°06' W) which is 29.5 km south-southeast, and Rothera Research Station (UK; Lat. 67°34' S, Long. 68°07' W) which is 46 km to the northwest. A summer-only station, Teniente Luis Carvajal (Lat. 67°46' S, Long. 68°55' W), has been operated by Chile at the southern end of Adelaide Island since 1985 and the Turkish Antarctic Research Station has constructed on nearby Horseshoe (Lat. 67°49' S, Long. 67°14' W).

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

The nearest protected areas to Lagotellerie Island are Emperor Island, Dion Islands (ASPA 107) about 55 km west, Avian Island (ASPA 117) 65 km west, Leonie Islands and south-east Adelaide Island (ASPA 177) 45 km to the northwest and Rothera

Point (ASPA 129) 46 km to the northwest (Map 1). Several Historic Sites and Monuments are located in the vicinity: 'Base Y' (UK) on Horseshoe Island (HSM No. 63); 'Base E' (UK) (HSM No. 64) and buildings and artefacts at and near East Base (US) (HSM No. 55), both on Stonington Island; and installations of San Martín Station (Argentina) at Barry Island (HSM No. 26).

6(v) Special zone 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 as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

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

- it is issued for a compelling scientific purpose which cannot be served elsewhere;
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit must be carried within the Area;
- permits shall be issued for a stated period;
- a report or reports are supplied to the authority or authorities named in the Permit;
- 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 over the Area

- Vehicles are prohibited within the Area
- Movement within the Area shall be on foot.
- Pilots, helicopter or boat crew, or other people on helicopters or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- 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, i.e. all movement should be undertaken

carefully so as to minimise disturbance to the soil and vegetated surfaces, walking on rocky terrain if practical.

- 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).

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

- Scientific research that will not jeopardise the ecosystem or scientific values of the Area and which cannot be served elsewhere;
- Essential management activities, including monitoring.

7(iv) Installation, modification or 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 a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be 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 of the Area (see Section 7(vi)). Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

7(v) Location of field camps

When necessary for purposes specified in the Permit, temporary camping is allowed at the designated site on the broad rock/permanent snow platform about half-way along the northwest coast at about 15 m altitude, and 200 m inland from the sea (Lat. 67°53'04'' Long. 067°23'43''; Map 2).

7(vi) Restrictions on materials and organisms which can 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 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 or harmful interference with native flora or fauna

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica (Resolution 4 (2019)) should be used as a minimum standard.

To prevent human disturbance of the breeding cormorant colony and in particular the premature fledging of juvenile cormorants, visitors shall not approach within 10 m of the cormorant colony on the eastern tip of the island between 15 October and 28 February, unless authorised by Permit for specific scientific or management purposes.

7(viii) Collection and removal of materials not brought into the Area by the Permit holder

Collection or removal of anything not brought into the Area by the Permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs. Permits shall not be granted in instances where it is proposed to take, remove or damage such quantities of soil, native flora or fauna that their distribution or abundance on Lagotellerie Island 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, may be removed unless the impact of removal is likely to be greater than leaving the material in situ: if this is the case the appropriate authority should be notified.

7(ix) Disposal of waste

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

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

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, 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 visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. 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.

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Figure 1. Lagotellerie Island Antarctic Specially Protected Area No. 115, Marguerite Bay, location map, showing the location of General San Martín Station (Arg.), the station Teniente Luis Carvajal (Chile), Adelaide Island, Rothera Research Station (UK) and nearby ASPA 129 at Rothera Point, also on Adelaide Island. The map also show the location of the Turkish Antarctic Research Station (TARS) on Horseshoe Island and the location of the other protected areas in the region [Emperor Island, Dion Islands (ASPA 107) and Avian Island (ASPA 117)]. 'Base Y' (UK) (Historic Monument No. 63) on Horseshoe Island is shown. Inset: the location of Lagotellerie Island along the Antarctic Peninsula.

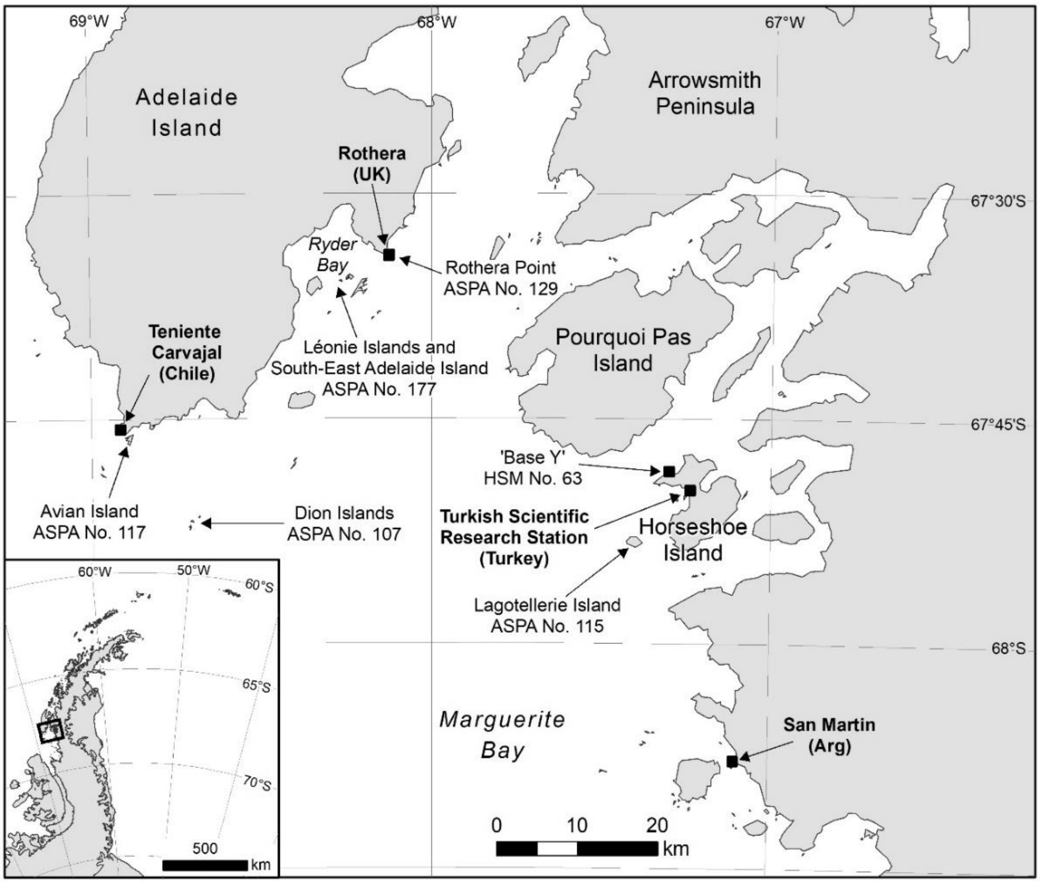


Figure 2. Lagotellerie Island (ASPA 115) topographic map.

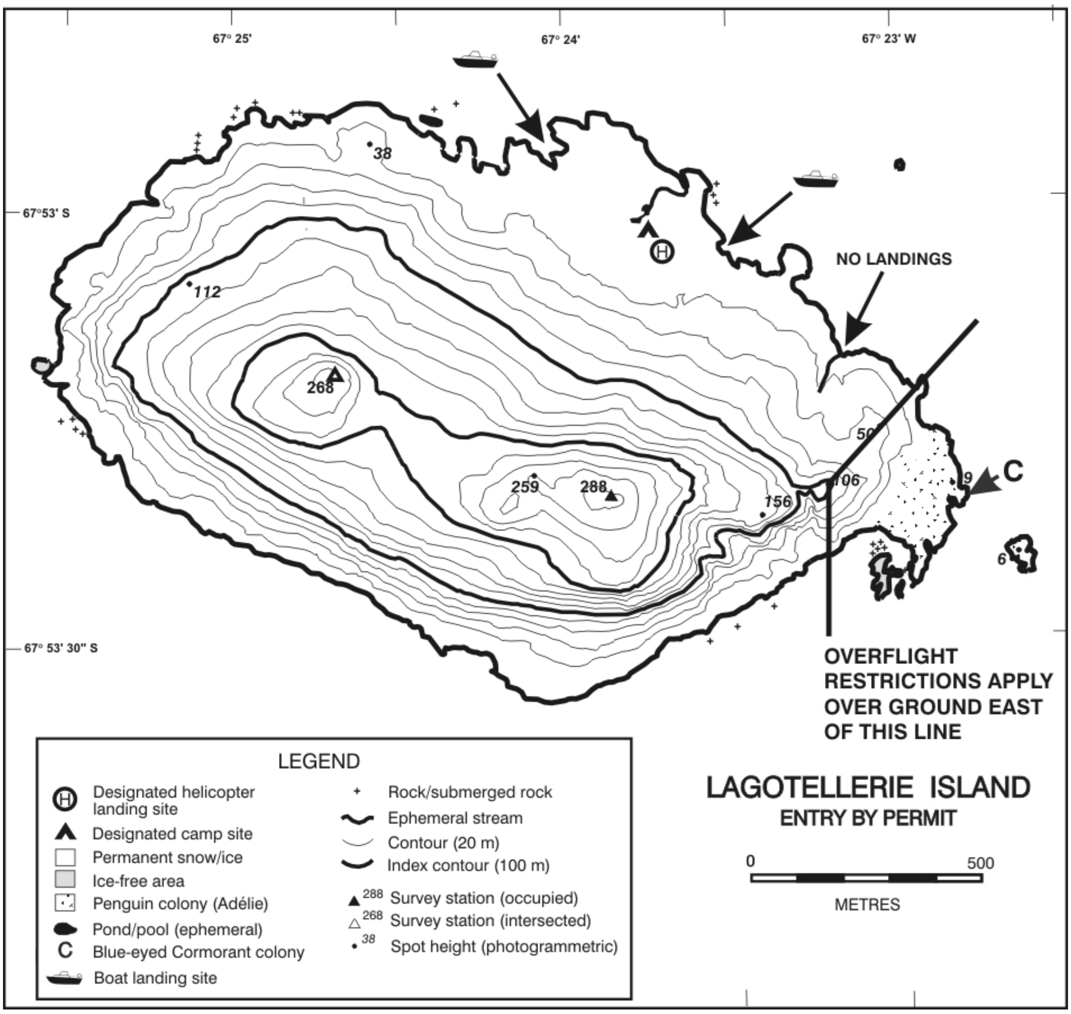


Figure 3. Lagotellerie Island (ASPA 115) geological sketch map.

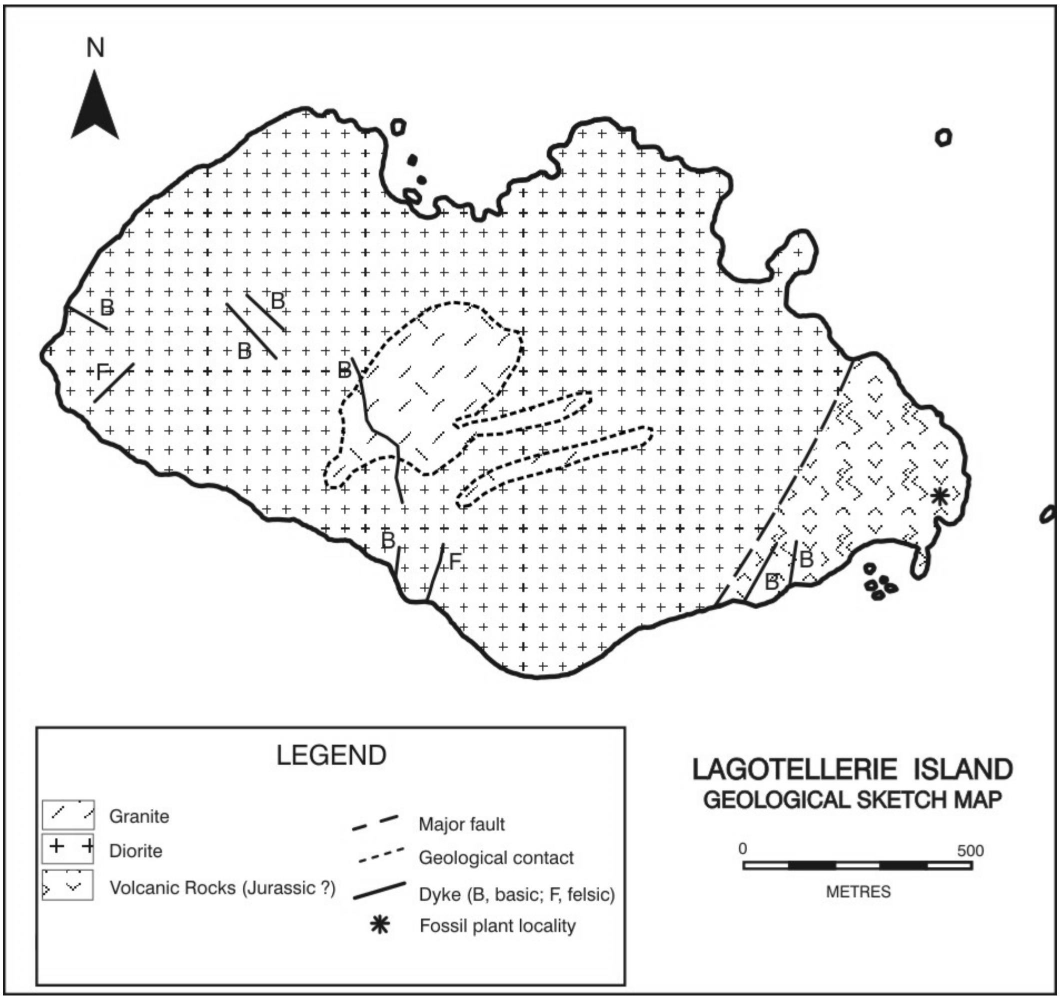
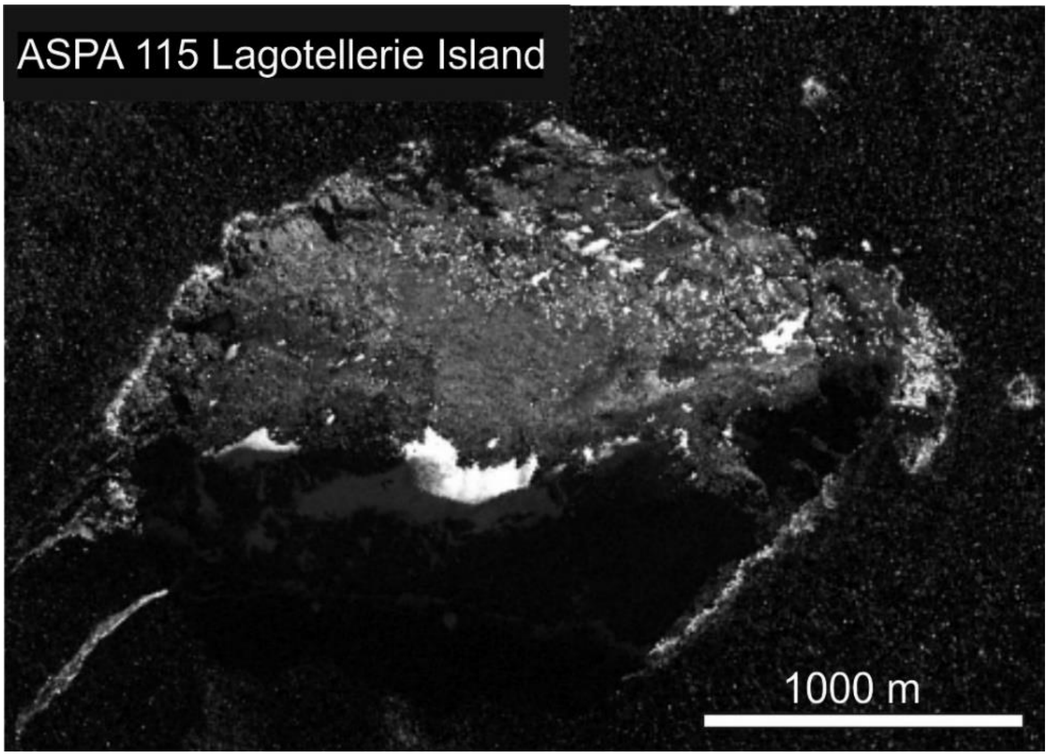


Figure 4. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 115 Lagotellerie Island, Marguerite Bay, Graham Land, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values



Measure 7 (2022)

Antarctic Specially Protected Area No 119 (Davis Valley and Forlidas Pond, Dufek Massif, Pensacola Mountains): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XVI-9 (1991), which designated Forlidas Pond and Davis Valley Ponds as Specially Protected Area ("SPA") No 23 and annexed a Management Plan for the Area;
- Decision 1 (2002), which renamed and renumbered SPA 23 as ASPA 119;
- Measures 2 (2005), 6 (2010) and 7 (2015), which adopted a revised Management Plan for ASPA 119;

Recalling that Recommendation XVI-9 (1991) has not become effective and was withdrawn by Measure 6 (2010);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 119;

Desiring to replace the existing Management Plan for ASPA 119 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 119 (Davis Valley and Forlidas Pond, Dufek Massif, Pensacola Mountains), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 119 annexed to Measure 7 (2015) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 119

DAVIS VALLEY AND FORLIDAS POND, DUFEK MASSIF, PENSACOLA MOUNTAINS

Introduction

Davis Valley and Forlidas Pond Antarctic Specially Protected Area (ASPA) is situated within the Dufek Massif, Pensacola Mountains at 82° 29' 21" S 51° 4' 53" W. Approximate area: 55.8 km². The primary reason for the designation of the Area is that it contains some of the most southerly freshwater ponds with autotrophic microbial life known to exist in Antarctica, which represent unique examples of near-pristine freshwater ecosystems and their catchments. The geomorphology of the Area represents a unique scientific resource for the reconstruction of previous glacial and climatic events. As a consequence of its extreme remoteness and inaccessibility, the Area has experienced very little human activity and with the total number of visitors estimated to be less than 50 people. As a result, the Area has outstanding potential as a scientific reference site. Furthermore, the Area possesses outstanding wilderness and aesthetic values. The Area is one of the most southerly 'dry valley' systems in Antarctica and, as of March 2020, is the most southerly Antarctic Specially Protected Area (ASPA) in Antarctica. The Area was originally proposed by the United States of America and adopted through Recommendation XVI-9 (1991, SPA No. 23). It included Forlidas Pond (82°27' 28" S 51° 16' 48"W) and several ponds along the northern ice margin of the Davis Valley. The boundaries of the Area were extended to include the entire ice-free region centered on the Davis Valley through Measure 2 (2005). Newly available imagery in 2013 allowed the boundaries of the Area to be adjusted to follow the margins of ice-free ground. A revised Management Plan was adopted through Measure 7 (2015).

The Area lies within 'Environment O – West Antarctic Ice Sheet' and 'Environment R – Transantarctic Mountains', as defined in the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)), and is the only protected area designated within Environment R. Under the Antarctic Conservation Biogeographic Regions classification (Resolution 3 (2017)) the Area lies within ACBR10 – Transantarctic Mountains, and is also the only protected area designated within this bioregion.

1. Description of values to be protected

Forlidas Pond (82° 27' 28" S 51° 16' 48" W) and several ponds along the northern ice margin of the Davis Valley (82° 27' 30" S 51° 05' W), in the Dufek Massif, Pensacola Mountains, were originally designated as a Specially Protected Area through Recommendation XVI-9 (1991, SPA No. 23) after a proposal by the United States of America. The Area was designated on the grounds that it "contains some of the most southerly freshwater ponds known in Antarctica containing plant life" which "should be protected as examples of unique near-pristine freshwater ecosystems and their catchments". The original Area comprised two sections approximately 500 metres apart with a combined total area of around 6 km². It included Forlidas Pond and the meltwater ponds along the ice margin at the northern limit of the Davis Valley. The site has been rarely visited and until recently there has been little information available on the ecosystems within the Area.

This Management Plan reaffirms the original reason for designation of the Area, recognizing the ponds and their associated plant life as pristine examples of a southerly freshwater habitat. The values identified for special protection and the boundaries of the Area were expanded as described below following a field visit made in December 2003 (Hodgson and Convey 2004).

The Davis Valley and the adjacent ice-free valleys is one of the most southerly ‘dry valley’ systems in Antarctica and, as of March 2015, is the most southerly Antarctic Specially Protected Area in Antarctica. While occupying an area of only 53 km², which is less than 1% of the area of the McMurdo Dry Valleys, the Area nevertheless contains the largest ice-free valley system found south of 80°S in the 90°W-0°-90°E half of Antarctica. Moreover, it is the only area known in this part of Antarctica where the geomorphology preserves such a detailed record of past glacial history. Some ice-free areas around the Weddell Sea region have scattered erratics and sometimes moraines, but the assemblage of drift limits, moraines, and abundant quartz-bearing erratics in the Davis Valley and associated valleys is very unusual. The location of the Dufek Massif close to the junction between the western and the eastern Antarctic ice sheets also makes this site particularly valuable for the collection of data that can be used to constrain parameters such as the past thickness and dynamics of this sector of the Antarctic ice sheet. Such data are potentially extremely valuable for understanding the response of the Antarctic ice sheet to climate change. The Area therefore has exceptional and unique scientific value for the interpretation of past glacial events and climate in this part of Antarctica and it is important that this value is maintained.

The terrestrial ecology of the Area is impoverished but is also highly unusual, with lake and meltwater stream environments and their associated biota being rare this far south in Antarctica. As such, they provide unique opportunities for the scientific study of biological communities near the extreme limit of the occurrence of these environments. Vegetation appears to be limited to cyanobacterial mats and a very sparse occurrence of small crustose lichens. The cyanobacterial mat growth in the terrestrial locations is surprisingly extensive, and represents the best examples of this community type known this far south. The cyanobacterial community appears to survive in at least three distinct environments:

- in the permanent water bodies;
- in exposed terrestrial locations, particularly at the boundaries of sorted polygons; and
- in a series of former or seasonally dry pond beds on ice-free ground in the Davis Valley.

No arthropods or nematodes have thus far been detected in samples taken from within the Area, and the invertebrate fauna in the Area is unusually sparse. This characteristic distinguishes the Area from more northerly ice-free valley systems such as those at the Ablation Valley – Ganymede Heights (ASPA No. 147), Alexander Island, or at the McMurdo Dry Valleys (ASMA No. 2), where such communities are present. Rotifers and tardigrades have been extracted from samples taken within the Area, with the greatest numbers occurring within the former pond beds in the Davis Valley, although their diversity and abundance is also extremely limited compared with more northerly Antarctic sites (Hodgson and Convey 2004). Further analyses of the samples obtained and identification of all taxa present are published (Hodgson et al. 2010; Fernandez-Carazo et al. 2011; Peeters et al. 2011, 2012)) and are an important contribution to the understanding of biogeographical relationships between the different regions of Antarctica.

The Area is extremely isolated and difficult to access, and as a result has been visited by only a small number of people. Reports indicate that small field parties visited the Area in December 1957, in the 1965-66 and 1973-74 austral summer seasons, in December 1978 and in December 2003. The total number of people having visited probably numbers less than 50, with visits generally limited to a period of a few weeks or days. No structures or installations have been built within the Area, and as far as is known all equipment brought into the Area has subsequently been removed. While Hodgson and Convey (2004) reported evidence of a very limited number of human footprints and several old soil pit excavations, the Area has been exposed to few opportunities for direct human impact. The Area is believed to be one of the most pristine ice-free valley systems in Antarctica, and is therefore considered to possess outstanding potential as a reference area for microbiological studies, and it is important that these values receive long-term protection.

The site possesses outstanding wilderness and aesthetic values. The dry and weathered brown valleys of the Area are surrounded by extensive ice-fields, the margins of which fringe the valleys with dry based glacial ice of a deep blue hue. This abrupt and dramatic blue-ice margin stands in stark contrast to the stony and barren ice-free landscape of the valleys, and aesthetically is extremely striking in appearance. One of the original explorers of this area in 1957 recalled “the excitement we felt at being the first people to view and enter this magnificently scenic, pristine area.” (Behrendt 1998: 354). Further examples of descriptions of the Area by visitors are: “[the blue ice] was towering over us ~ 150 feet – a large wave of blue. It was like being in a tidal wave that was held in suspension as we walked under it…” (Reynolds, field notes, 1978), and “I still cannot find adequate superlatives to describe the features, whether large or small, biologic or physical… [Of the] many settings that stretch the imagination…in my experience none match the northern side of the Dufek Massif, with Davis Valley as its crown jewel.” (Reynolds, pers. comm. 2000); “the most unusual [landscape] I have ever seen on any of the seven continents.” (Boyer, pers. comm. 2000); “Probably the single most remarkable environment I've been, either in Antarctica or elsewhere” (Convey, pers. comm. 2004). Burt (2004) described the region simply as “inspiringly awesome”.

The boundaries of the Area include the entire ice-free region centered on the Davis Valley, including the adjacent valleys and Forlidas Pond. In general, the margins of the surrounding ice sheets form the new boundary of the Area, providing special protection of the region as an integrated ice-free unit that closely approximates the valley catchments. The full catchments of the surrounding glaciers that flow into these valleys extend considerable distances from the ice-free area and do not possess many of the values related to the purpose of special protection, and are therefore excluded from the Area.

2. Aims and objectives

Management at Davis Valley and Forlidas Pond 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 ecosystem as an area largely undisturbed by human activities;
- preserve the almost pristine ecosystem for its potential 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;
- 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:

- 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 necessary.
- National programs shall ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and aeronautical charts;
- 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.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: Davis Valley and Forlidas Pond, ASPA No. 119, Dufek Massif, Pensacola Mountains: Location Map.
Map Specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 82°S; 2nd 83°S; Central Meridian: 51°W; Latitude of Origin: 81°S; Spheroid: WGS84. Inset: the location of the Pensacola Mountains and Map 1 in Antarctica.

Map 2: Davis Valley and Forlidas Pond, ASPA No. 119: Topographic map and protected area boundary.
Map Specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 82°S; 2nd 83°S; Central Meridian: 51°W; Latitude of Origin: 81°S; Spheroid: WGS84; Vertical datum: WGS84. EGM96 MSL height differential –21 m. Contour interval 25 m. Topographic data generated by digital orthophoto and photogrammetric techniques from USGS aerial photography (TMA400, TMA908, TMA909 (1958) and TMA1498 (1964)) by the Mapping and Geographic Information Centre, British Antarctic Survey (Cziferszky et al. 2004). Accuracy estimates: horizontal: ±1 m; vertical: ±2 m, declining towards the south away from available ground control points. The surrounding ice fields and ice-free area beyond orthophoto coverage are mapped from WorldView 1 satellite imagery (05 Nov 2013) (© Digital Globe, courtesy NGA Commercial Imagery Program) with elevation data generated from a DEM produced by the Polar Geospatial Center (PGC) in 2014.

6. Description of the Area

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

- *Overview*

Davis Valley (82° 28' 30" S 51° 05' W) and Forlidas Pond (82° 27' 28" S 51° 16' 48" W) are situated in the north-eastern Dufek Massif, Pensacola Mountains, part of the Transantarctic Mountain range (Map 1). The Dufek Massif is situated approximately mid-way between the Support Force Glacier and the Foundation Ice Stream, two of the major glaciers draining northwards from the Polar Plateau into the Ronne and Filchner Ice Shelves. Approximately 60 km to the southeast is the Forrestal Range (also part of the Pensacola Mountains), which is separated from the Dufek Massif by the Sallee Snowfield. The Ford Ice Piedmont separates the Dufek Massif from the Ronne and Filchner Ice Shelves, about 50 km to the northwest and 70 km to the northeast respectively.

The Davis Valley is approximately five kilometers wide and seven kilometers long, with its northern extent defined by the blue ice lobes that form part of the southern margin of the Ford Ice Piedmont (Map 2). It is bounded in the northeast by Wujek Ridge and Mount Pavlovskogo (1074 m) and southeast by Mount Beljakova (1240 m), flanked on the outer side by a glacier draining north from the Sallee Snowfield to the Ford Ice Piedmont. The western extent of the Davis Valley is defined by Clemons Spur, Angels Peak (964 m) and Forlidas Ridge. The Edge Glacier extends approximately 4 km into the Davis Valley from the Sallee Snowfield. The southern Davis Valley is dominated by Mount Beljakova (1240 m), on the northwestern margin of the Sallee Snowfield. Several smaller valleys exist in the west of the Area, adjacent to the prominent Preslik Spur and Forlidas Ridge. Almost 75% of the region enclosed by the large surrounding ice fields is ice-free, comprising 39 km² of ice-free ground in total, with the remainder of the area covered by the Edge Glacier, other permanent bodies of snow / ice and several small ponds.

Forlidas Pond is landlocked and occupies a small unnamed dry valley separated from the Davis Valley by a tributary ridge extending north from Forlidas Ridge. Other pro-glacial lakes and ponds occur within the Area at various locations along the blue ice margin of the Ford Ice Piedmont, at the terminus of the Edge Glacier, and along the ice margin west of Forlidas Ridge and Clemons Spur.

- *Boundary*

The Area comprises all of the Davis Valley and the immediately adjacent ice-free valleys, including several of the valley glaciers within these catchments (Map 2). The boundary predominantly follows the margins of the surrounding ice fields of the Ford Ice Piedmont and Sallee Snowfield, which enclose the ice-free area that is considered to be of outstanding value. The northern boundary extends parallel to and 500 metres north from the southern margin of the Ford Ice Piedmont in the Davis Valley and in the adjacent valley containing Forlidas Pond, extending from 51°24'02"W, 82°26'23.4"S in the northwest to 50°52'10"W, 82°26'45.5"S in the northeast. This provides a buffer of protection around the freshwater bodies of value along the northern glacier margin. The eastern boundary follows the ice margin along Wujek Ridge from the Ford Ice Piedmont to Mount Pavlovskogo. The southeastern boundary extends from Mount Pavlovskogo across the Sallee Snowfield and the upper slopes of the Edge Glacier, following areas of outcrop where they exist to Mount Beljakova. The southern and western boundaries of the Area follow the margins of the permanent ice, with the southernmost extent being at 51°17'00"W, 82°33'20"S. The boundary encompasses a total area of 55.8 km².

Boundary markers have not been installed in the Area because of its remoteness, the limited opportunities for visits and the practical difficulties of maintenance. Moreover, the margins of the permanent ice fields are generally sharply defined and form a visually obvious boundary around most of the Area.

- *Meteorology*

Several estimates of mean annual surface air temperature have been made in the Dufek Massif region from measurements taken in ice bores or crevasses at around 10 metres depth. A measurement of –24.96°C was obtained 32 km due north of Forlidas Pond on the Ford Ice Piedmont in December 1957 (Pit 12, Map 1) (Aughenbaugh et al. 1958). Another estimate of -9°C was made in December 1978 in the Enchanted Valley 26 km to the south (Map 1), measured in a crevasse at 8 metres depth (Boyer pers. comm. 2000).

Detailed meteorological data for the Area itself are limited to records collected over two weeks in 2003. Hodgson and Convey (2004) measured temperature and relative humidity over snow and rock surfaces at their sampling sites within the Area from 3-15 December 2003, with data recorded at 30-minute intervals, though sensors were not shielded with a Stevenson screen. Temperatures over snow ranged from a maximum of +12.8°C to a minimum of –14.5°C, with an average over the period of –0.56°C. Temperatures over rock ranged from a maximum of +16.0°C to a minimum of –8.6°C, with an average over the period of +0.93°C (data over rock were only recorded from 3-11 December 2003). Relative humidity recorded over snow ranged from a maximum of 80.4% to a minimum of 10.8%, with an average over the period of 42.6%. Over rock surfaces (from 3-11 December 2003), relative humidity ranged from a maximum of 80.9% to a minimum of 5.6%, with an average over the period of 38.7%.

Directly measured data on wind speeds and directions within the Area are not available, but models suggest near surface winds are predominantly from the west-north-west with mean winter velocities of c. 10 ms-1 (van Lipzig et al. 2004). While the older exposed ice-free areas above the glacial drift limit possess many features related to long-term wind erosion, there is some evidence to suggest that wind speeds within the locality are currently not especially high. For example, ice and snow surfaces were observed as largely free of wind-blown debris, and terrestrial cyanobacterial mats exist in-tact in exposed locations in the bottom of dry valleys (Hodgson and Convey 2004). No precipitation data are available, although the bare ice and rock surfaces and low average relative humidity recorded by Hodgson and Convey (2004) attest to a dry environment of low precipitation. This is consistent with a Type 2 dominated ablation area where sublimation-driven ablation occurs at the foot of the steep topographic barriers, with individual glacier valleys serving as gates for air drainage from the plateau to the Ronne-Filchner Ice Shelf. Strongest sublimation rates occur on these localized glaciers in the Transantarctic Mountains, where widespread blue ice areas are present (van den Broeke et al. 2006).

- *Geology, geomorphology and soils*

The Dufek Massif is characterized by layered bands of cumulate rock belonging to the Dufek intrusion, thought to be one of the largest layered gabbro intrusions in the world (Behrendt et al. 1974; 1980; Ferris et al. 1998). This is exposed in the Davis Valley as the light- to medium-gray, medium-grained Aughenbaugh gabbro, which is the lowest exposed part of the Middle Jurassic Dufek intrusion (Ford et al. 1978).

The Davis Valley primarily consists of minimally weathered talus and glacial till of both local and exotic origin. In particular there appears to be an abundance of erratics of Dover Sandstone, one of several metasedimentary layers disrupted by the Dufek intrusion. An extensive glacial geomorphological record is evident. Features include overlapping valley-glacier moraines, ice sheet moraines, lake shoreline, lateral glacial channels, ice eroded surfaces, well-developed patterned ground and erratics. Boyer (1979) identified at least three major glacial and two major interglacial events, while Hodgson et al. (2012) maps geomorphological features derived from up to seven glacial stages. From oldest to youngest, these stages were: alpine glaciation of the escarpment edge; over-riding warm-based glaciation; glacier advance to an upper limit (760 m); two ice-sheet advances to closely parallel limits in the valleys; advance of the plateau outlet glacier (Edge Glacier) to merge with the ice sheet; and finally an advance and retreat of the main ice sheet margin. Attempts to provide age constraints for some of these glacial events have been carried out using paired cosmogenic 10Be-26Al exposure ages on erratic boulders, composed of Dover Sandstone. These suggest that some parts of the valley have been exposed for >1.0-1.8 Ma and experienced only a minor ice sheet advance at the Last Glacial Maximum, consistent with an emerging dataset from around the Weddell Sea rim that implies only rather modest ice thickening at this time.

Soils are not well-developed in the Area and generally lack a significant organic component. Parker et al. (1982) collected a soil that was light brown in color, resulting from gravel weathering predominantly to muscovite. The soil comprised sand (81%) with silt (14%) and clay (5%), a composition different from other sites in the Pensacola Mountains where the clay proportions of six samples ranges from 0.4% to 1.6%. The soil sample from the Davis Valley had a pH of 6.4 (Parker et al. 1982).

- *Lakes, ponds and streams*

Forlidas Pond is a perennially frozen, shallow, round landlocked pond that was ~100 metres in diameter in 1957 (Behrendt 1998). In December 2003 the lake was measured by Hodgson and Convey (2004) as 90.3 metres in diameter from shoreline to shoreline on a transect azimuth of 306° (magnetic). At this time it was frozen almost completely to its base, with a thin layer of hypersaline slush at the lake bottom, and a freshwater meltwater moat that was partly ice free and partly covered by 10-15 cm of ice (Hodgson and Convey 2004). Depth was measured at 1.83 m and the thickness of the ice between 1.63 and 1.83 metres. The conductivity and temperature in the brine layer was 142.02 mS cm^{-1} and -7.67°C respectively, compared with 2.22 mS cm^{-1} and 0.7°C in the freshwater moat (Hodgson et al. 2010). The salinity of the bottom-water in Forlidas Pond is thus around four times greater than seawater. This concentration of salts is the result of the pond being the remnant of a much larger lake, which evaporated from about 2200 years ago and can be identified by a series of lake terraces and a high shoreline 17.7 m above the present water level (Hodgson et al. 2012).

Hodgson and Convey (2004) also report a small remnant pro-glacial pond near the margin of the Ford Ice Piedmont, 900 metres north of Forlidas Pond. Two pro-glacial meltwater ponds also occur to the west of Forlidas Ridge and a series of similar pro-glacial meltwater ponds also occur along the blue-ice margin of the northern Davis Valley, located at 51° 05.5' W, 82° 27.5' S and 51° 07' W, 82° 27.55' S. The pro-glacial lake at the terminus of the Edge Glacier is the largest within the Area. This is permanently frozen to the bottom apart from at the eastern margins where seasonal meltwater has been observed.

Dry stream channels and water erosion features are evident within the ice-free area, although only the small glacial melt streams on the eastern margin of the Edge Glacier have thus far been reported as flowing in December (Hodgson and Convey 2004). The apparent lack of melt streams may be because all visits to date have been made in the month of December, possibly before streams become more active. The presence of lake moats, the positive temperatures recorded by Hodgson and Convey (2004), as well as the biological and the geomorphological evidence, as well observations of footprints into formerly moist ground (Convey pers. comm. 2015) suggest that it is probable that at least some streams become active later in the season from melting snow, although perhaps not on an annual basis.

- *Biology*

Visible biota is dominated by cyanobacterial mats, found both in lakes and in patches on the surface of ice-free ground, and a very sparse occurrence of small crustose lichens. Neuburg et al. (1959) observed yellow and black lichens growing sparsely in sheltered places in the Davis Valley, while Hodgson and Convey (2004) observed several lichen forms growing deep within the crevices of boulders. These have been identified as Lecidea cancrioformis Dodge & Baker (Hodgson et al. 2010, and see Appendix 1: Table A1 for a list of taxa identified in the Area). The British Antarctic Survey Plant Database also reports Blastenia succinea Dodge & Baker and Xanthoria elegans (Link.) Th. Fr. in samples from elsewhere in the Dufek Massif, although these have not been independently verified. Previous anecdotal reports of the possible occurrence of mosses within the Area could not be substantiated by Hodgson and Convey (2004), and it is probable that the rich cyanobacterial mat growth was earlier mistaken for bryophytes by non-specialists. The cyanobacterial community is the most abundant biota and is present in at least three distinct environments:

(1) In the permanent water bodies; particularly in the moat of Forlidas Pond, at the bottom and littoral zones of the Davis Valley Ponds, and in the seasonally wetted perimeter of Edge Lake. These habitats are extensively covered by red-brown cyanobacterial mats. These are actively photosynthesizing, as evidenced by gas bubbles trapped against the lower ice surfaces, and bubbles incorporated into the ice. Because perennially ice covered lakes have elevated concentrations of dissolved O^2 gas, the microbial mats growing on the bottom can become buoyant and start to float off the bottom as ‘lift-off’ mats, or become incorporated into the base of the lake ice when it makes contact with the bed. In Forlidas Pond and the Davis Valley Ponds lift off mats frozen into the base of the lake ice eventually migrate up through the ice profile. In the Davis Valley, this appears to take place over several years with each summer marked by the development of a 2-3 cm melt-cavity formed by the upward progression of the clump thorough the lake ice due to preferential heating of its upper surface. These clumps eventually break out at the surface and are dispersed by wind onto the shoreline, or further afield. Cyanobacteria were also present in the hypersaline brine of Forlidas Pond as single cells and as small flakes. A strain corresponding to the morphology of Leptolyngbya antarctica was isolated from the saline slush of TM1 (Fernandez-Carazo et al. 2011).

(2) In exposed terrestrial locations, particularly at the edge of larger rocks and within the boundary crevices of frost sorted polygons. These are generally very foliose in form, mid brown in colour, and best developed at the edge of larger rocks with depths of at least 10-15 cm. Nearly all clumps were completely dry on discovery, although those near to melting snow were damp and some had lower thalli that were often deep green in colour. Particularly good examples of this growth form were found in the mid valley floor of Forlidas Valley and in Davis Valley (near a large snow gully where it meets the second major terrace above Edge Lake).

(3) In a series of dry pond beds in the Davis Valley, two of up to 50 m diameter, which have extensive areas of almost continuous cyanobacterial mat on the former pond floors. These pond beds and gullies occupy depressions and therefore may accumulate snow in winter, permitting the cyanobacteria to take advantage of the wet and protected environment within the snow patches.

The growth form also occurs in many of the adjacent small gullies between polygons or other cryoturbation features, which often have the appearance of temporary drainage features.

Analyses of the cyanobacterial molecular diversity from four samples collected in and around Forlidas Pond show a depleted diversity, with only 2 - 5 Operational Taxonomic Units (OTUs) per sample (Hodgson et al. 2010). This is likely a product of geographical isolation combined with multiple environmental stressors such as salinity and seasonal desiccation, and UV radiation. Some of the cyanobacteria, for example from the brine of Forlidas Pond, are related to sequences from other hypersaline Antarctic lakes, whilst others are found almost exclusively in glacial regions. The six cyanobacterial OTUs described from the Dufek Massif are all distributed in more than one location within the continent and are found outside Antarctica.

The invertebrate fauna within the area is equally impoverished, with both the diversity and abundance of organisms being extremely limited compared with lower latitude and coastal Antarctic sites. No nematodes or arthropods have been found, but there are three species of tardigrade present from two Classes: Echiniscus (cf) pseudowendti Dastych, 1984 (Heterotardigrada), Acutuncus antarcticus (Richters 1904) and Diphascon sanae Dastych, Ryan and Watkins, 1990 (Eutardigrada), and a few unidentified bdelloid rotifers (Hodgson et al. 2010). Acutuncus antarcticus is an Antarctic species that occurs in semi-permanent damp / wet habitats throughout the Antarctic continent and sub-Antarctic islands, but has not been reported from any of the close neighbour continents. Echiniscus (cf) pseudowendti and Diphascon sanae found in samples from Forlidas Pond are also endemic to the Antarctic, with restricted distributions.

The most productive sites for these organisms were not the aquatic environments of the permanent lakes, but the former pond beds in the Davis Valley, showing these areas to be biologically productive, which necessitates a source of liquid water. In December 2003 very little snow was evident on the valley floor, prompting Hodgson and Convey (2004) to reason that the source of moisture may be from a considerable increase in melt later in the season flowing off the local ice sheet in the upper valley, or from local ice-cored moraines. Although this process was not occurring during their visit, footprints and shallow soil survey pits remaining from one of the previous parties (i.e. 25-46 years old) indicated that some ground was moist or waterlogged at the time of the earlier visit. Seasonal inundation by liquid water would explain the extensiveness and integrity of this cyanobacterial community, and its apparent resilience to the potential ravages of polar winds, as well as the relative abundance of invertebrates extracted from samples taken from within these areas.

Viable yeast species have been recorded in the soil, along with the algae Oscillatoria sp., Trebouxia sp. and Heterococcus sp. (Parker et al. 1982). Chasmoendolithic microorganisms have been recorded in rocks in the Dufek Massif (Friedmann 1977), although Hodgson and Convey (2004) found no evidence of their presence within the Area and noted that rock types most favorable for the occurrence of endolithic organisms are not widespread.

Avifauna is sparse: in December 2003 a single snow petrel (Pagadroma nivea) was noted flying around one of the peaks above Davis Valley.

- *Human activities and impact*

There have been few visits to the Area and human impacts are believed to be minimal (Table A2 Appendix 1). Because of its remoteness and the infrequency of visits, it is one of the few ice-free areas of Antarctica where the compiled record of past human activity at the site is almost complete. The almost pristine condition of the environment contributes to the extremely high value of the Area and is an important reason for its special protection.

The key characteristics of visits recorded to the Area are summarized in Table A2 (Appendix 1), which should be updated as required (see Section 7(x)). Past camps have generally been on the ice sheet outside of the Area. Previous parties removed all wastes from the Area, with the possible exception of small quantities of human wastes. In 2003 all wastes including all human wastes were removed, both from within the Area and from the party's adjacent campsite on the Ford Ice Piedmont (Map 2). Hodgson and Convey (2004) noted that in December 2003 the evidence of previous visits was limited to a number of footprints and several shallow soil excavations in the Davis Valley.

6(ii) Access to the Area

Access to the Area may be made only on foot. Access to the icefields surrounding the Area may be made by aircraft or via overland routes. Access to the Area should be made as close as practicable to the intended study site, in order to minimize the amount of the Area that needs to be crossed. Due to the surrounding terrain and crevasse patterns, the most practical access routes into the Area are from the Ford Ice Piedmont to the north of the Area. Overflight and aircraft landing 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

No structures, installations or caches are known to exist within the Area.

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

There are no other protected areas nearby, with the nearest being Ablation Valley – Ganymede Heights (ASPA No. 147), Alexander Island, which is approximately 1300 km to the north-west.

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 compelling scientific or educational 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, scientific and aesthetic and wilderness values of the Area, in particular its pristine value and its potential as a largely undisturbed biological 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

- Piloted aircraft landings are prohibited within the Area and overflight of the Area at less than 100 metres above ground level is prohibited.
- Vehicles are prohibited within the Area.
- Access into and movement within the Area shall be on foot.
- No special restrictions apply to the means of access, or air or land routes used, to move to and from the icefields surrounding the boundaries of the Area.
- Access into the Area should be at a practicable point close to sites of study in order to minimize the amount of the Area that needs to be traversed. The terrain and crevassing generally makes such access most practical from the Ford Ice Piedmont to the north of the Area.

- Pedestrian routes should avoid lakes, ponds, former pond beds, stream beds, areas of damp ground and areas of soft sediments or sedimentary features. Care should be exercised to avoid damage to any areas of cyanobacterial mat growth, in particular to the extensive areas found in relict pond beds in Davis Valley (see Map 2).
- 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.
- 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 scientific, ecological or aesthetic and wilderness values of the Area, or its pristine value and potential as a reference site, and which cannot be served elsewhere.
- Essential management activities, including monitoring and inspection.
- Activities with educational aims that are undertaken for compelling reasons which cannot be served elsewhere. Activities may include documentary reporting (photographic, audio or written) or the production of educational resources or services. Educational activities shall not compromise the values for which the Area is protected, in particular its value as a near-pristine reference site. Educational aims do not include tourism.

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 are prohibited.
- All scientific equipment installed in the Area must be approved by permit.
- Should equipment be intended to remain within the Area for a duration of more than one season it shall clearly be 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 the physical, ecological, scientific or aesthetic and wilderness values of the Area;
- Removal of structures, equipment or markers for which the permit has expired shall be a condition of the permit. It shall be the responsibility of the authority which granted the permit to ensure that this condition is included in the permit, and, in the event that the permit holder does not meet this obligation, it shall be that authority's responsibility to ensure removal.

7(v) Location of field camps

- Camping within the Area is prohibited.
- Suitable camp sites have been proven to the north and west of the Area on the Ford Ice Piedmont (Map 2), and also in the Enchanted Valley (Map 1).

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 sampling equipment 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 andtripods 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 be sterilized before use within the Area. Sterilization should be by an acceptable method, such as by washing in 70% ethanol solution in water.
- Herbicides and pesticides are prohibited from 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 minimizes the risk of their accidental introduction into the environment;
- All materials introduced shall be present only for a finite period stated in the permit and shall be removed at or before the conclusion 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 or 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 to 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. 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. Individuals or groups shall carry appropriate containers for human waste and gray water so that they may be safely transported and 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;
- 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, to be

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

- The appropriate authority should be notified of any activities / measures 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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Appendix 1: Table A1. Biological sampling program in the Davis and Forlidas Valleys: groups of taxa identified and the methods used (Hodgson et al., 2010).

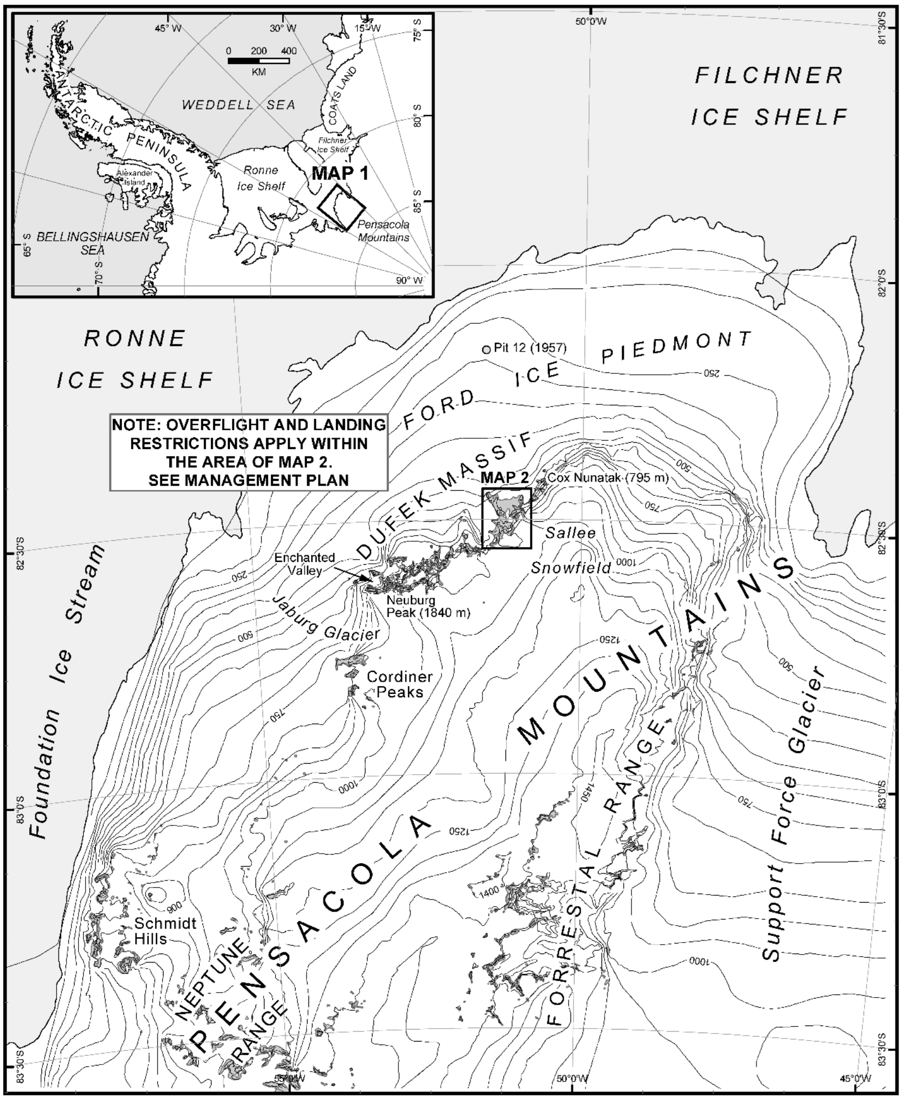
Description	Method	No. samples	No. taxa	Taxa
Bryophyta	Observational survey	0	0	n/a
Lichens	Observational survey	1	1	Lecidea cancriformis Dodge & Baker
Bacillariophyceae / Diatoms	Survey under light microscope	2	1	Pinnularia microstauron (Ehr.) Cl.††
Cyanobacteria	Clone library, DGGE + band sequencing, isolation of strains+ sequencing (microscopy)	3	6	Sample TM1: 16ST63, 16ST14 Sample TM2: 16ST63, 16ST14, 16ST44, 16ST49, 16ST80 Sample TM3: 16ST44, 16ST49, 16ST80, 16ST07
Chlorophyta /Green algae	DGGE + band sequencing	2	1	Urospora sp.
Rhizaria/ Cercozoa	DGGE + band sequencing	2	2	Heteromitidae, Paulinella sp.
Bacteria	DGGE + band sequencing	2	32	Cyanobacteria: Nostocales, Oscillatoriales, Chroococcales, Gloeobacteriales** Bacteroidetes: Sphingobacteriales, Flavobacteriales Firmicutes: Clostridiales Gammaproteobacteria: Pseudomonadales, Psychrobacter
Bacteria	Isolation of strains + sequencing	1	330 isolates	Firmicutes 33%, Bacteroidetes 23%, Alphaproteobacteria 25%, Actinobacteria 9%, Betaproteobacteria. 8%, Gammaproteobacteria 1.5%, Deinococci 0.3%
Arthropods	Tullenberg	50	0	n/a
Invertebrates	Baermann extractions	130	3	See Tardigrades (below)
Tardigrades	Light microscope (Molecular†)	14 20	3 1	Echiniscus (cf) pseudowendti Dastych, 1984 (Heterotardigrada), Acutuncus antarcticus (Richters, 1904) Diphascon sanae Dastych, Ryan and Watkins, 1990 (Eutardigrada)
Rotifers	Tullenberg and light microscope	130	present	Bdelloid rotifers
Soil bacteria and algae	Cultured (Parker et al., 1982)*	1	3	Cyanobacteria: Oscillatoria sp. Algae: Trebouxia sp., Heterocous sp. (viable yeasts present)
Avifauna	Observation	n/a	1	Snow petrel (Pagadroma nivea)

*previously published, ** tentative identification based on about 100 bases, †analyses carried out on morphologically congruent samples from the Shackleton Range, †† not considered as evidence of an extant community

Appendix 1: Table A2. Known visits to the Davis Valley and adjacent ice-free valleys within and near the Area.

Party	No. pers	Org	Purpose	Dates	Duration (days)	Locations visited	Camp	Transport
Aughenbaugh, Behrendt, Neuburg, Thiel, Walker	5	IGY (US)	Geology Geophysics	Dec 1957	?	FIP,DV,FP, FR	FIP west of FR	Sno-Cat traverse to FIP, then on foot
Ford, Schmidt, Nelson, Boyd, Rambo (?)	5	USGS	Geology	Dec 1965 – Jan 1966	?	?	Base camp in Neptune Range	Numerous helicopter landings in Dufek Massif
Ford & team	?	USGS	Geology	Summer 1973-74	?	?	?	?
Ford, Carlson, Czamanske, Nutt, England, Nelson	6	USGS	Geology	30 Nov – 30 Dec 1976 (expedition dates)	?	?	Base camp close to Walker Peak (southwest Dufek Massif)	Numerous helicopter landings in Dufek Massif. Motor toboggans and ski traverses used on ground.
Russian team led by Shuljatin, O. G. Accompanied by Ford (and Grue?) from the USA and Paech from Germany.	11	Soviet Antarctic Expedition (22)	Geology Geophysics	Summer 1976-77	49 (total expedition)	Dufek Massif and other locations in the Pensacola Mountains	Field camps on Mount Provender, Read Mountains and Mount Skidmore. Druznaja Station used as base camp.	Helicopter landings, snowmobile 'Buran', thence on foot
Russian team led by Kamenev, E. N.	6	Soviet Antarctic Expedition (23)	Geology Geophysics	06 Feb – 17 Feb 1978	11	Dufek Massif	Field camp in Schmidt Hills. Druznaja Station used as base camp.	Airplane, snowmobile 'Buran', thence on foot
Boyer, Reynolds	2	USGS	Geology	12 Dec 1978	2	FIP, DV	EV	Toboggan from EV to ice margin, thence on foot
Ford, Boyer, Reynolds Carl?	4	USGS	Geology	14 Dec 1978	4	FIP, DV, FR, AP	EV	Toboggan from EV to ice margin, thence on foot
Hodgson, Convey, Burt	3	BAS (UK)	Biology, Limnology, Glacial geomorphology	3-15 Dec 2003	13	FIP, DV, FP, FR, AP	FIP 1.9km north of FP	Twin Otter to FIP, thence on foot.
TOTALS	~30		~40??			(numbers approximate owing to incomplete data)		

Key: FIP – Ford Ice Piedmont; DV – Davis Valley; FP – Forlidas Pond; FR– Forlidas Ridge; AP – Angels Peak; CS – Clemons Spur; PS – Preslik Spur; MB– Mt Beljakova; MP–Mt Pavlovskogo; EV–Enchanted Valley.



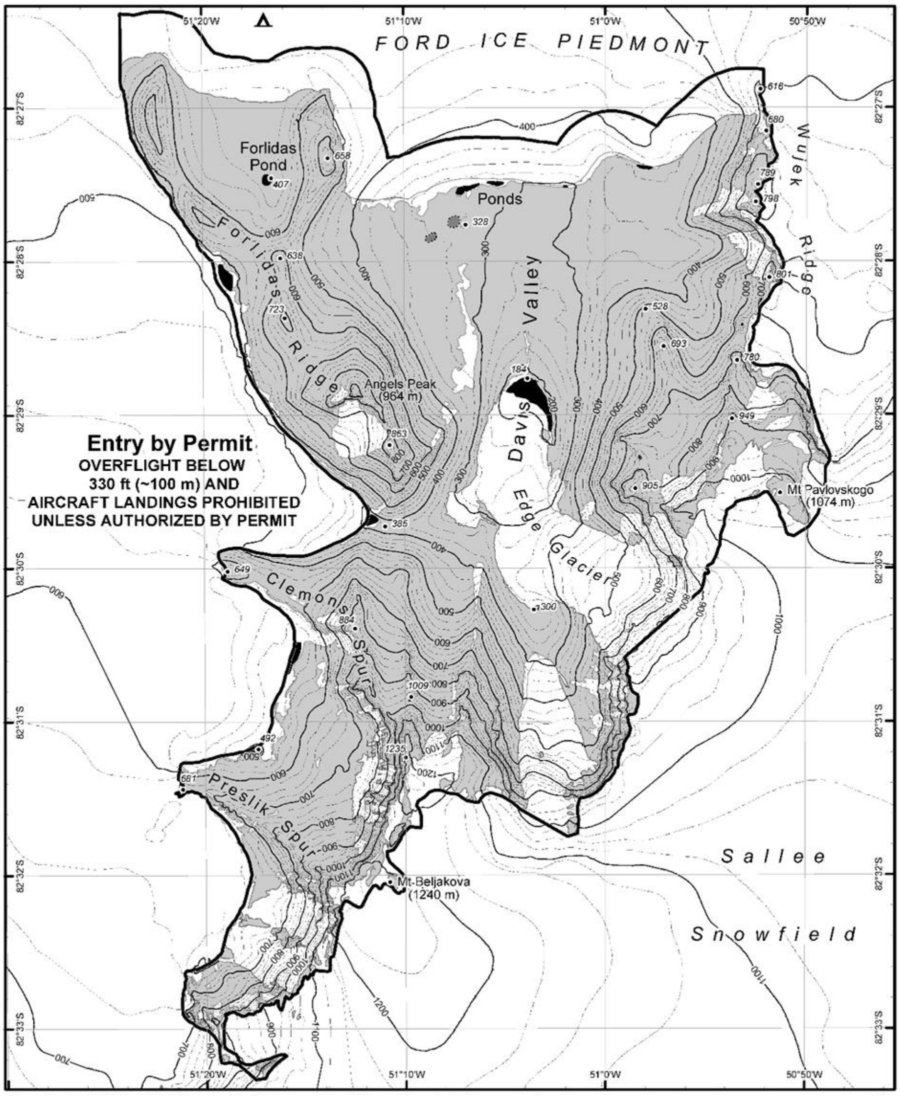
Map 1: ASPA No.119 Davis Valley and Forlidas Pond - Location

02 Apr 2022 (v2.0)
United States Antarctic Program
Environmental Research & Assessment

0 10 20 30 40
Kilometers

Permanent ice
Ice shelf
Ice free ground
Coastline
Contour (50 m)
Ice bore

Projection: Lambert Conformal Conic
Spheroid and horizontal datum: WGS84
Data sources: Coast & topography: SCAR ADD (v6, 2012).



Map 2: ASPA No.119 Davis Valley and Forlidas Pond - Topography

02 Apr 2022 (v2.0)
United States Antarctic Program
Environmental Research & Assessment

- Spot elevation
- Index contour (100 m)
- Contour (25 m)
- Permanent ice
- Ice free ground
- ASPA boundary
- Lake
- Relict pond bed
- Proven campsite

0 1 2
Kilometers

Projection: Lambert Conformal Conic
Spheroid and horizontal datum: WGS84
Data sources: Topographic data supplied by the MAGIC, BAS.
Derived from USGS aerial photography (1956, 1964), satellite imagery (2002) and field observations (Hodgson and Convey).
Updated by ERA using WorldView imagery and DEM provided by PGC.

Measure 8 (2022)

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) and 3 (2016), which adopted a revised Management Plan 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 3 (2016) 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 km². 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*

Hut 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 km^2 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 7.1°C (30 Dec 2001) and the minimum was -49.8°C (21 July 2004). During this period, December was the warmest month, with mean monthly air temperatures of -5.1°C, and August was the coolest month, averaging – 28.8°C (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 PM10 (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 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 generally be on foot.
- 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.

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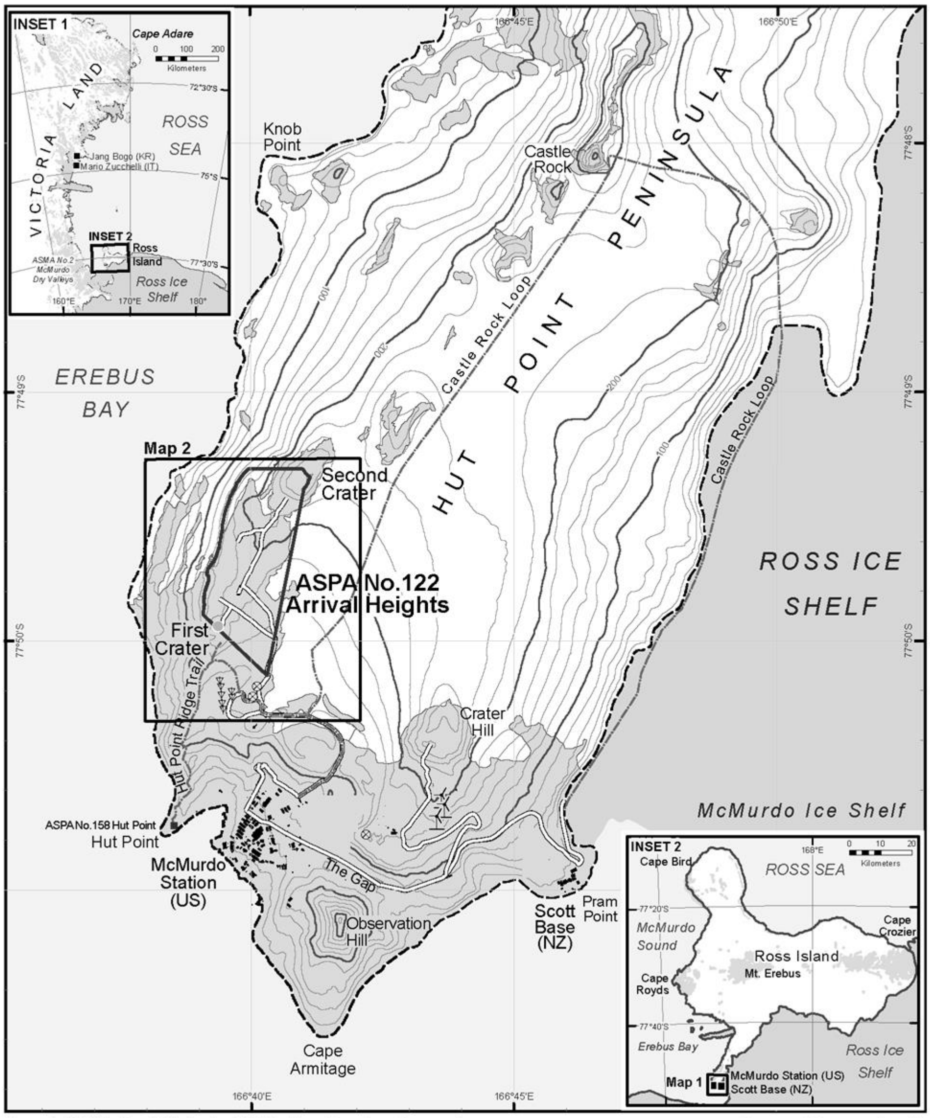


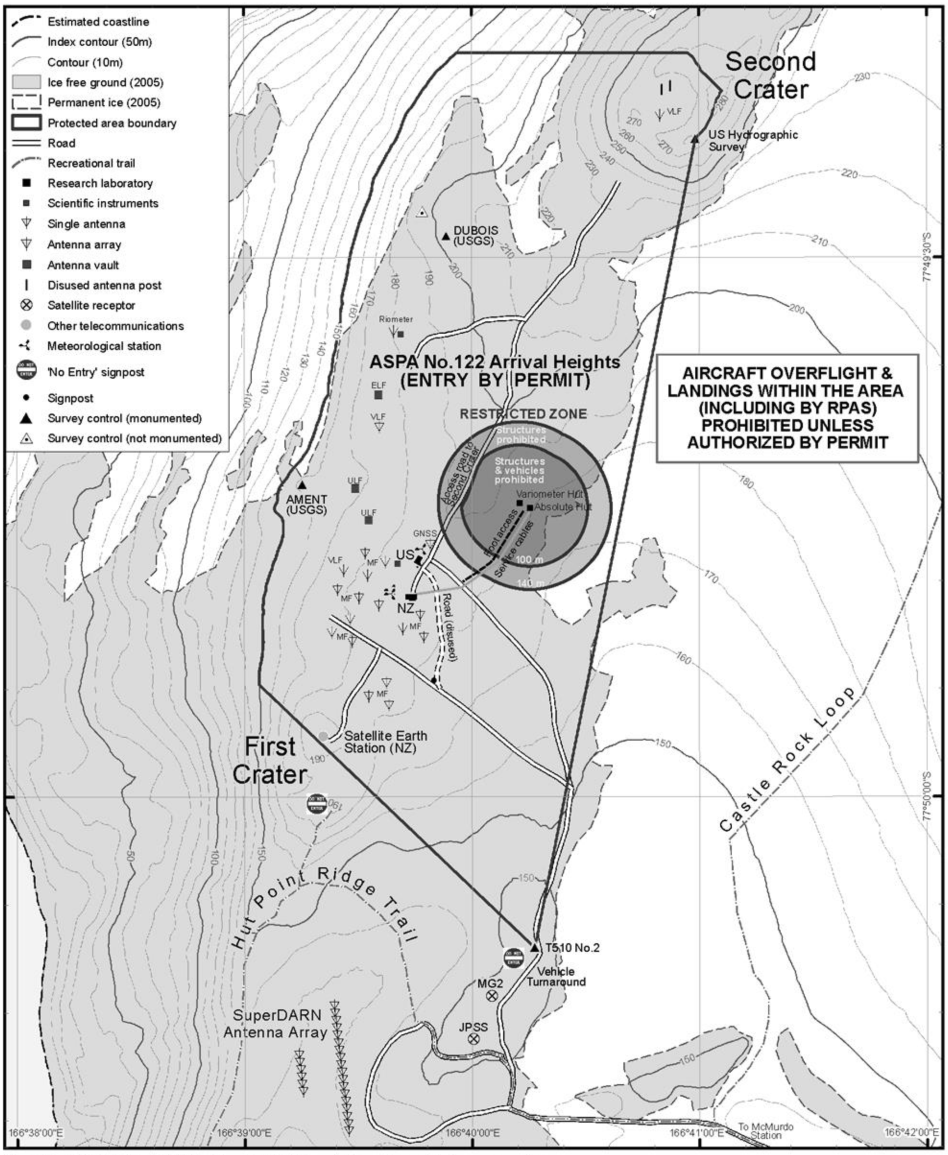
Map 1: ASPA No.122 Arrival Heights - Regional overview

21 Mar 2022 (v1)
United States Antarctic Program
Environmental Research & Assessment

Estimated coastline
Index contour (100m)
Contour (20m)
Ice free ground (2005)
Permanent ice (2005)
Ice shelf
Protected area boundary
Road
Recreational trail
Buildings
SuperDARN antenna array
Satellite receiver
Satellite Earth Station
Wind turbine

0 0.5 1
Kilometers

Projection: Lambert Conic Conformal
Spheroid and horizontal datum: WGS84
Data sources: Contours: Derived from 2m DEM, contour interval 20m; Buildings: RPSC survey (Feb 09); Features: Derived from USAP (Feb 2009) & ERA (Nov 2009) field surveys; Recreational trails: PGC field survey 2009; Permanent ice: Digitised from Quickbird orthophoto (15 Oct 05); ASPA boundary: Management Plan (2022).



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

22 Mar 2022 (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 9 (2022)

Antarctic Specially Protected Area No 124 (Cape Crozier, 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 IV-6 (1966), which designated Cape Crozier, Ross Island as Specially Protected Area (“SPA”) No 6 and annexed a map for the Area;
- Recommendation VIII-2 (1975), which terminated Recommendation IV-6 (1966);
- Recommendation VIII-4 (1975), which designated Cape Crozier, Ross Island as Site of Special Scientific Interest (“SSSI”) No 4 and annexed a Management Plan for the Site;
- Recommendations X-6 (1979), XII-5 (1983), XIII-7 (1985) and XVI-7 (1991) and Measure 3 (2001), which extended the expiry date for SSSI 4;
- Decision 1 (2002), which renamed and renumbered SSSI 4 as ASPA 124;
- Measures 1 (2002), 7 (2008) and 3 (2014), which adopted a revised Management Plan for ASPA 124;

Recalling that Recommendations VIII-2 (1975), X-6 (1979), XII-5 (1983), XIII-7 (1985) and XVI-7 (1991) were designated as no longer current by Decision 1 (2011);

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

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 124;

Desiring to replace the existing Management Plan for ASPA 124 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 124 (Cape Crozier, Ross Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 124 annexed to Measure 3 (2014) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 124

CAPE CROZIER, ROSS ISLAND

Introduction

The Cape Crozier Antarctic Specially Protected Area (ASPA) is located at the eastern extremity of Ross Island, Ross Sea. Approximate area and coordinates: ~70 km² (centered at 77° 28' 54" S, 169° 19' 53" E), of which ~43 km² (61%) is marine (including ice shelf) and ~27 km² is terrestrial (39%). The primary reasons for designation of the Area are its diverse avian and mammalian fauna, locally rich vegetation and historic values. The emperor penguin (Aptenodytes forsteri) colony at Cape Crozier is one of the most southerly known, and it also has a long study record. The Adélie penguin colony is one of the largest known. The Area is also one of the most southerly recorded locations of snow algae. The Area provides representation of relatively undisturbed terrestrial and aquatic habitats on Ross Island, including of mosses, lichens, algae, invertebrate and microbial communities.

The Area was originally designated as Specially Protected Area (SPA) No.6 through Recommendation IV-6 (1966) after a proposal by the United States of America on the grounds that the region supports a rich bird and mammal fauna as well as microfauna and microflora, and that the ecosystem depends on a substantial mixing of marine and terrestrial elements of outstanding scientific interest. With adoption of the Site of Special Scientific Interest (SSSI) category of protection in 1972, Cape Crozier’s designation as an SPA was terminated by Recommendation VIII-2 (1975) and the site was re-designated as SSSI No. 4 by Recommendation VIII-4 (1975). The reason for designation of SSSI No. 4 was to protect long-term studies of the population dynamics and social behavior of emperor (Aptenodytes forsteri) and Adélie (Pygoscelis adeliae) penguin colonies in the region. Information gathered since designation of SSSI No. 4 supported the inclusion of skua populations and vegetation assemblages as important values to be protected at Cape Crozier. The SSSI was extended through Recommendation X-6 (1979), Recommendation XII-5 (1983), Recommendation XIII-7 (1985), Recommendation XVI-7 (1991), and Measure 3 (2001). The site was renamed and renumbered as Antarctic Specially Protected Area (ASPA) No. 124 by Decision 1 (2002)a. In Measure 1 (2002) the boundaries were extended south to include Igloo Spur and to protect the range of vegetation assemblages representative of the Cape Crozier region. In Measure 7 (2008) the western boundary of the Area was modified to follow a simple line of longitude because visitors found the previous boundary hard to follow. This boundary was simplified in 2016 to follow a line directly between the summits of Bomb Peak and Post Office Hill, and to exclude the Cape Crozier hut from the Area (Measure 3 (2014)).

The Area comprises environments within two of the domains defined in the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)): ‘Environment P – Ross and Ronne-Filchner ice shelves’ and ‘Environment S - McMurdo - South Victoria Land geologic’. Under the Antarctic Conservation

Biogeographic Regions classification the Area lies within 'ACBR9 – South Victoria Land' (Resolution 3 (2017)).

1. Description of values to be protected

The emperor penguin colony at Cape Crozier was first recorded by members of the British National Antarctic Expedition in 1902. The colony is one of the most southerly known and has the longest record of study on an emperor penguin population. The colony breeds on fast ice that forms between large cracks which develop in the Ross Ice Shelf where it abuts Cape Crozier. The positions of these cracks shift with movement of the ice shelf, and the colony itself is known to move around different parts of the cracks during the breeding season. The boundaries of the Area have been designed to include fast-ice areas consistently occupied by breeding birds.

Cape Crozier has a large Adélie penguin (Pygoscelis adeliae) population averaging around 150,000 breeding pairs, with just over 270,000 pairs in 2012, comprising ~14% of the estimated global population and making it one of the largest Adélie colonies in Antarctica. The colony is divided into two main groups 1 km apart known as East and West Colonies (Maps 1 and 2). The first observations of Adélie penguins apparently nesting on sea ice were made at Cape Crozier in November 2018, and this underscores the importance of the habitat associated with persistent sea ice that forms in the large cracks in the Ross Ice Shelf for various species, including emperor and Adélie penguins and Weddell seals. The first circovirus to be discovered in penguins, which was also a new species and given the name PenCV, was recorded at Cape Crozier in 2018/19. In addition, well-preserved ancient Adélie penguin remains found within the Area have particular scientific value for genetic studies. Associated with the penguin colonies is a large south polar skua (Catharacta maccormicki) colony, estimated at over 1000 breeding pairs which represents ~18% of the upper estimate of the global breeding population for this species.

Weddell seals (Leptonychotes weddellii) breed within the Area, while leopard seals (Leptonyx hydrurga) are frequent visitors and crabeater seals (Lobodon carcinophagus) are commonly seen at sea and on ice floes. Killer whales (Orcinus orca) are also frequently seen close off shore within the Area. While the mammal species recorded at Cape Crozier are neither unique to the Area nor known to be outstanding in this context, they form an integral and representative part of the local ecosystem.

There are moss, algae and lichen assemblages in the Area. Expanses of snow algae at Cape Crozier cover an area of more than 4 ha adjacent to the skua and penguin colonies. Growths as extensive as those at Cape Crozier have been noted only once before in the Continental Antarctic Zone, on the Wilkes Land Coast, and Cape Crozier has one of the most southerly records of snow algae. Lichens are also abundant, with large areas of bright orange crustose lichens on rocks and stones on the slopes above the Adélie colony, and rich growths of foliose and fruticose lichens in the vicinity of Wilson’s Stone Igloo. Two lichen species (Caloplaca erecta and C. soropelta) observed within the Area have not previously been recorded in Antarctica. The Area therefore has value by providing representation of relatively extensive and pristine terrestrial and aquatic habitats on Ross Island that host a variety of moss, lichen, algal and microbial communities and an associated invertebrate fauna.

A message post from Scott’s National Antarctic Expedition (1901-04) is situated in West Colony (77° 27' 16.7" S, 169° 14' 37.5" E) and was designated as Historic Site and Monument (HSM) No.69 through Measure 4 (1995). Wilson’s Stone Igloo (77° 31' 51" S, 169° 17' 56" E), designated as HSM No.21 through Recommendation VII-9 (1972), is situated in the south of the Area. The rock shelter was constructed in July 1911 by members of the 1910-1913 British Antarctic Expedition during their winter journey to Cape Crozier to collect emperor penguin eggs.

The high scientific, ecological and historic values of this area along with its vulnerability to disturbance through trampling, sampling, pollution or alien introduction, are such that this Area requires long-term special protection.

2. Aims and objectives

Management at Cape Crozier 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 of the Area, in particular on the avifauna, marine fauna and terrestrial ecology, provided it will not compromise the values for which the Area is protected;
- Allow other scientific research, scientific support activities and visits for educational and outreach purposes (such as documentary reporting (visual, audio or written) or the production of educational resources or services) provided that such activities are for compelling reasons that cannot be served elsewhere and will not compromise the values for which the Area is protected;
- Minimize the possibility of introduction of non-native species (e.g. plants, animals and microbes) to the Area;
- Minimize the possibility of introduction of pathogens that may cause disease in faunal populations within the Area;
- Allow visits to the historic sites under strict control by permit;
- Take into account the potential historic and heritage values of any artifacts before their removal and/or disposal, while allowing for appropriate clean-up and remediation if required;
- Allow visits for management purposes in support of the aims of the management plan.

3. Management activities

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

- Durable wind direction indicators should be erected close to the primary designated helicopter landing site whenever it is anticipated there will be a number of landings at the site 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 primary and secondary designated helicopter landing sites adjacent to the field hut;
- A notice 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 research hut facility at Cape Crozier;
- 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 structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer necessary;
- National Antarctic programs operating in the Area should maintain a record of all new markers, signs and structures erected within the Area;
- Personnel (national program staff, field expeditions, and pilots) in the vicinity of, accessing or flying over the Area shall be specifically instructed by their national program or appropriate national authority to observe the provisions and contents of the Management Plan;
- The Area shall be visited as necessary (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 for the purpose of ensuring that the above provisions are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No.124 Cape Crozier - location and topography.
Projection: Lambert conformal conic; Standard parallels: 1st 77° 27' S; 2nd 77° 32' S; Central meridian: 169° 15' E; Latitude of Origin: 77° S; Spheroid and horizontal datum: WGS84.

Data sources:

Coastline, contours and bird data supplied by Gateway Antarctica; ASPA boundary: ERA (Feb 2014); Facilities: RPSC GPS survey (25 Dec 2007); Ice free ground: Quickbird (09 Oct 2011); Ice shelf front 1993 estimated from orthorectified aerial imagery (DoSLI / USGS SN7848) and for 2002, 2007 and 2011 from Quickbird (© Digital Globe). Emperor penguin colony: from Sentinel-2 imagery (2021; Australian Antarctic Division (AAD) pers. comm. 2022).

Inset 1: Ross Sea region, showing location of Inset 2.

Inset 2 Ross Island region, showing the location of Map 1 and McMurdo Station (US) and Scott Base (NZ).

Map 2: ASPA No. 124 Cape Crozier - access, facilities and wildlife.
Map specifications are the same as for Map 1. Emperor penguin colony: 2007 and 2011 from Quickbird (© Digital Globe).

6. Description of the Area

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

- *Overview*

Cape Crozier (77° 30' 30" S, 169° 21' 30" E) is at the eastern extremity of Ross Island, where an ice-free area comprises the lower eastern slopes of Mount Terror (Map 1). The designated Area is situated in the vicinity of Post Office Hill (407 m), Bomb Peak (740 m) and The Knoll (360 m), extending to encompass Gamble, Topping and Kyle Cones. Igloo Spur and the adjacent marine environment and an area of the Ross Ice Shelf where large cracks form as the shelf pushes against the land. The water in these cracks is generally covered by fast-ice, which is occupied annually by breeding emperor penguins.

- *Boundaries and coordinates*

The marine northern boundary of the Area extends 6.5 km along the 77° 26' 00" S line of latitude from 169° 12' 00" E to 169° 28' 00" E. The western boundary extends 1.68 km south from the northern boundary to the coast, thence south for a further 800 m to the edge of icefree ground before ascending to the summit of a low hill (~ 300 m) above and east of the field hut (Map 1). The boundary thence proceeds directly to the summit of Post Office Hill (407 m) at 77° 27' 55" S, 169° 12' 40" E. The boundary thence follows a straight line southward direct to a point close to the summit of Bomb Peak (740 m) at 77° 31' 02" S, 169° 11' 30" E. The boundary extends down the SE ridge of Bomb Peak to Igloo Spur at 77° 32' 00" S, 169° 20' 00" E, from where it extends due east along latitude 77° 32' 00" S to the east boundary at 169° 28' 00" E.

- *Climate*

The nearest Automatic Weather Station (AWS) to Cape Crozier is Laurie II, situated on the Ross Ice Shelf 35 km east of Cape Crozier. Air temperatures recorded at Laurie II between 2009-13 showed December as the warmest month over this period, with a mean temperature of -5.8 °C, and August as the coolest with a mean temperature of -33.1 °C (http://uwamrc.ssec.wisc.edu/ 06 Mar 2014). The minimum air temperature recorded at Laurie II during this period was -56.5 °C in July 2010, whilst the maximum was 5.9 °C in December 2011. The average wind speed over the period was ~ 6.3 m/s with the winds predominantly coming from the south to southwest. Conditions at Cape Crozier are likely to differ as a result of the local geography; for example, nearby Mount Terror probably influences local airflow and katabatic winds to affect the local climate, and Broady (1989) observed that prevailing winds in the ice-free region near Cape Crozier tend to be from the southeast.

- *Geology, geomorphology and soils*

The ice-free ground at Cape Crozier is of volcanic origin, with numerous small cones and craters evident among gentle slopes of scoria and fine-grained basalt lava. Phonolite cones at Post Office Hill and The Knoll are 1.4 million years old, while other volcanic rocks in the area are less than 1 million years old (Cole et al. 1971; Wright & Kyle 1999). Several of these hills, including Post Office Hill, shelter the penguin colonies from southwesterly winds. On the surface are many volcanic bombs and other evidence of small-scale volcanic explosions. To the south of the Area coastal cliffs adjacent to the ice shelf are up to 150 m high. The cliff faces show bedded lava and brown palagonitic tuffs with several lenticular patches of columnar basalt towards the base. Large erratics of continental origin transported by the Ross Ice Shelf can be found on the northern side of Cape Crozier.

- *Breeding birds*

The emperor penguin (Aptenodytes forsteri) colony at Cape Crozier was discovered in October 1902 by R.S. Skelton, a member of Scott’s Discovery Expedition. The presence of the colony depends on fast-ice locked within cracks in the Ross Ice Shelf where it abuts Cape Crozier. The size of the colony is limited by the area and condition of the fast ice, which also affects the availability of breeding sites sheltered from the strong katabatic winds that descend from Mount Terror. The location of the colony varies from year to year (Map 2) and the colony moves within a breeding season, beginning the season near to shore and moving further offshore as fledging approaches. The breeding population has fluctuated widely since the turn of the century, for example with 400 adults recorded in 1902, 100 in 1911, and 1,300 in 1969. The number of chicks fledged and the fledging success of the colony has also been variable (Table 1). The mean number of chicks fledged at Cape Crozier is 769 over the years for which data are available (Table 1).

Table 1. Cape Crozier emperor penguin live chick counts 1983–2018 and adults 2007-12.

Year	Chicks	Year	Chicks	Year	Chicks	Year	Adults
1983	78	1996	859	2004	475	2007	537
1986	?	1997	821	2005	0	2008	623
1989	?	1998	1108	2006	339 (b)	2009	303 (c)
1990	324	1999	798	2015	1737	2010	856
1992	374	2000	1201	2016	1759	2011	870
1993	?	2001	0	2017	1743	2012	1189
1994	645	2002	247	2018	1911		
1995	623	2003	333 (a)				

Sources: chick counts Barber-Meyer, Kooyman & Ponganis 2008; Schmidt & Ballard 2020. Adult counts: Kooyman pers. comm. 2014. All counts made between October-December of the stated year.

a) All chicks not counted due to rugged ice conditions and thus one chick assumed per adult counted.

b) G. Kooyman, pers. comm., Nov. 2007.

c) Estimate from 2009 satellite imagery (Fretwell et al. 2012).

In 2000, a section of the Ross Ice Shelf calved to form an iceberg 295 km long and 40 km wide. A fragmented section of this iceberg, known as B15A, together with another iceberg (C16) lodged near Ross Island in 2001. These icebergs had a major effect on sea ice distribution and primary production, and impeded the arrival of emperor penguins. In 2001 and several subsequent years, icebergs C16 and B15A affected the breeding success and colony locations of emperor and Adélie penguins by blocking access to foraging areas and destroying nesting habitat. In 2005, the emperor colony remained well below its pre-2000 size, with no sign of breeding (Kooyman et al. 2007). However, in 2006 the emperor colony had returned to its pre-iceberg location and 339 chicks were produced (G. Kooyman, pers. comm., Nov. 2007; Table 1), and in recent years the number of adults has returned to levels similar to those last observed in the 1996-2000 period. Emperor chick counts since 2015 all exceeded 1325, which was the previous highest number (recorded in 1960). However, a significant loss of emperor chicks occurred in 2018 when the fast ice broke up unusually early, highlighting the vulnerability of the species to changes induced by a warming climate (Schmidt & Ballard 2020).

A comprehensive population study of Adélie penguins occurred at Cape Crozier from 1961/62 through the 1981/82 austral summers, with 2000 to 5000 chicks banded yearly. There are two Adélie penguin (Pygoscelis adeliae) colonies at Cape Crozier, known as East and West Colonies. These are about 1 km apart, separated by a 45-m high ridge and a sloping ice field across which the birds do not travel. A coastline of 1.6 km with three beaches separated by rock outcrops provides penguins with access to West Colony. By contrast, East Colony has one 50-m wide rocky beach and 550 m of sea cliffs. The population of the two colonies has increased substantially over the last 50 years, numbering 65,000 breeding pairs in 1958, 102,500 in 1966 and 177,083 in 1987. Numbers fell to 136,249 in 1989 and 106,184 in 1994. In 2000, the number of breeding pairs was estimated to be 118,772 (based on a projection from counts of selected subcolonies) (Ainley et al. 2004). The combined mean population of the East and West Colonies at Cape Crozier over a 28-year period was 153,632, and in 2012 there were 270,340 breeding pairs representing ~14% of the global population (Lynch & LaRue 2014), making it one of the largest Adélie penguin colonies in Antarctica (Lyver et al. 2014). The presence of the B15A and C16 icebergs from 2001 to 2005 in the foraging area had a significant effect on the Adélie penguin colony at Cape Crozier (Arrigo et al. 2002; Ballard et al. 2010; Dugger et al. 2010).

A subcolony of 426 Adélie penguins was observed on the fast ice ~3 km from the main Cape Crozier colony over a one month period in November 2018, displaying behavior associated with nesting (LaRue et al. 2019). This is the first time Adélie penguins have been observed using sea ice as a possible breeding habitat separate from regularly occupied terrain to form an apparent breeding 'subcolony' over a prolonged period, making this discovery unique to Cape Crozier and in Antarctica. La Rue et al. (2019) put forward several hypotheses to explain the observation:

- Juvenile birds 'practicing' nesting and forming a 'critical mass', despite the unsuitable habitat;
- Individuals becoming disoriented on the way to the main colony in a dynamic landscape;
- Nesting overflow from Cape Crozier, a colony that has been growing rapidly since 2010;
- A fluke incident with limited, if any, implications for the life history of the species.

The 'subcolony' was absent from high resolution satellite imagery the following year (C. Harris pers. comm. Aug 2020; Worldview 3, 23 December 2019 © Digital Globe), when the 2018 'breeding' site was open water. While perhaps a rare and transitory event, the presence of the 'subcolony' in 2018 is further evidence for the importance of the sea ice habitat close to Cape Crozier, which persists longer in the ice shelf 'canyons' than in the open sea. Numerous Adélie penguins congregate in this area, and the feature also provides habitat for breeding emperor penguins and Weddell seals.

A novel circovirus (named PenCV) was identified in Adélie penguins at Cape Crozier in 2018/19, which is the first report of a circovirus in a penguin species (Morandini et al. 2019). The virus is associated with, and may be the cause, of feather loss in penguin chicks.

Over 1000 pairs of south polar skuas (Catharacta maccormicki) breed on ice-free ground surrounding the Adélie penguin colony, with ~1099 breeding pairs in the 2011/12 summer season and 1347 in 2012/13 (Wilson et al. 2016). A demographic study of this colony began in 1961/62 and was continued until 1996/97. Chinstrap penguins (Pygoscelis antarcticus), Wilson's storm petrels (Oceanites oceanicus), snow petrels (Pagadroma nivea), Antarctic petrels (Thalassoica antarctica), southern fulmars (Fulmaris glacialoides), southern giant petrels (Macronectes giganteus), kelp gulls (Larus dominicanus), and south polar skuas from more northerly breeding sites, have been recorded as visitors to Cape Crozier.

Antarctic Important Bird Area (IBA) No. 187, Cape Crozier was identified because the Adélie penguin colony contained ~14% of the estimated global Adélie penguin population in 2012/13 (Lynch & LaRue 2014; Harris et al. 2015) and because the south polar skua colony comprised almost 18% of the upper estimate of the global population for this species in 2012/13 (Harris et al. 2015). The south polar skua colony is the largest documented in Antarctica. In addition, the emperor penguin is listed as Near Threatened on the IUCN Red List. The Area therefore more than meets the thresholds of criteria for IBA designation (Harris et al. 2015). The IBA has the same boundary as the ASPA (Map 1).

- *Breeding mammals*

Weddell seals (Leptonychotes weddellii) breed within the Area, with approximately 20 pups being recorded in recent years. Approximately 60 seals, presumed to be Weddells, were evident in satellite imagery on 23 December 2019, hauled out near cracks in the sea ice persisting in the ice shelf 'canyons' (C. Harris pers. comm. Aug 2020; Worldview 3 image © Digital Globe). Leopard seals (Leptonyx hydrurga) frequent the Area, with approximately 12 individuals recognized as regular visitors, while crabeater seals (Lobodon carcinophagus) are commonly seen at sea and on ice floes in the vicinity. Other mammals frequently observed within the Area include killer whales (Orcinus orca), of which several distinct types have been recognized. Regular killer whale observations were carried out at Cape Crozier between 2002-09 (Ainley et al. 2009), with the finding that sightings of killer whales of ecotype-C (also referred to as 'Ross Sea killer whales') appear to have been decreasing at Cape Crozier contemporaneously with an increase in Ross Sea commercial fishing, in particular for Antarctic toothfish (Dissostichus mawsoni). 'Ross Sea killer whales' appear to feed principally on fish, including Antarctic toothfish, so the authors suggest that changes to the foraging patterns of these whales in this region could be linked to decreased prey availability as a result of the fishery.

- *Terrestrial biology – aquatic and non-aquatic habitats*

Algae can be found throughout the Area on large patches of snow and on soils and stones, often below the soil surface layer. Large areas of green snow algae, covering more than 4 ha, can be found in the north of the Area in snowfields around the periphery of the Adélie penguin colony and skua nesting areas (Broady 1989). Particularly large patches have been reported in the snow-filled valley between the two coastal hills at the northern end of the Adélie penguin colony, with green-tinted snow over at least one hectare. However, the extent of snow algae is not always obvious, with the green color often not revealed until a surface crust of white ice is broken away. Snow algae samples are dominated by a species of Chlamydomonas, and associated with occasional Ulothrix-like filaments and diatoms. Growth requires percolating meltwater during summer and nutrients derived from the bird colonies.

Prasiola crispa grows in slow water flows in the vicinity of the penguin colonies and ribbon-like growths of P. calophylla are found where water percolates over stones on the tallus slopes. Numerous small ponds are found throughout the Area, from small pools of ~1 m in diameter to a lake of ~150 m in diameter situated immediately south of The Knoll. The four ponds in the penguin colonies contain abundant phytoplankton populations of Chlamydomonas cf. snowiae, while ponds elsewhere support growths of red-brown to dark blue-green benthic mats dominated by Oscillatoriaceae. Occasional epilithic algae (dominated by Gloeocapsa, Nostoc and Scytonema) are found as blackish crusts coating rock surfaces where meltwater percolates.

Mosses are sparse and scattered in their distribution with most occurrences being of one or a small number of isolated cushions no larger than 10 cm in diameter. Richer growths than this occur up to 0.5 km NE of the hut on north and NW facing slopes and on slopes immediately above the coastal cliffs about 1 km south of the penguin colonies. The moss species occurring at Cape Crozier have yet to be identified.

Encrusting orange lichens are present in shallow hollows, on rock outcrops, boulders and encrusting bryophytes on the slopes above the penguin colonies. Also present adjacent to Wilson's Stone Igloo is the fruticose lichen Usnea and the foliose lichen Umbilicaria, both duller in color but structurally more complex. Green algal crusts are found throughout the Area. A survey conducted in 2010 near the Adélie colony identified 14 lichen species, of which two (Caloplaca erecta and C. soropelta) had not previously been recorded in Antarctica, and one (Lecania nylanderiana) had not previously been recorded in Victoria Land (Smylka et al. 2011). Caloplaca soropelta had not previously been recorded in the Southern Hemisphere, and is known as an Arctic species. The 11 other species, previously known in Antarctica, are Buellia darbishirei, B. pallida, Caloplaca citrina C. saxicola, C. schofieldii, Lecanora expectans, L. mons-nivis, Lecidella siplei, Physcia dubia, Rhizoplaca melanophthalma, and Rinodina sp.

- *Human activities and impact*

Cape Crozier is relatively isolated and difficult to access, and the number of visitors to the Area each year is generally low, with only 30 permits for entry being issued by NZ and the US over the period 2009-14. Access is generally made by helicopter, and the designated landing site near the Cape Crozier hut requires careful approach to avoid inadvertent overflight of the Adélie penguin colony (Map 2). Pilots are briefed in advance to avoid the colonies when flying at low elevations.

Some materials such as nails, screws and hinges remain at the site of the old 'Jamesway' hut which has now been removed (Map 2). Vehicle tracks apparently made in the early 1970s remain evident in soils along the bench below Kyle, Topping and Gamble Cones (Ainley pers. comm. 2014).

6(ii) Access to the Area

The Area may be accessed by traversing over land or sea ice, by sea or by air. Particular routes have not been designated for access to the Area. Overflight and aircraft landing 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

The Cape Crozier hut (US) (77° 27' 41" S, 169° 11' 13" E) is situated on the NW side of a low peak ~ 675 m NW of Post Office Hill (Maps 1 and 2). A radio communications antenna is installed above the hut on a seasonal basis (Map 2). An observation hide installed during the period 1960–80 was located at the foot of the north side of Post Office Hill although no longer exists. An old 'Jamesway' hut was built on a small terrace approximately 1 km NE of the present hut (Map 2), although this was destroyed by fire and, with the exception of some small items such as nails etc., the hut debris has since been removed.

The historic Discovery's Message Post, designated as HSM No.69 through Measure 4 (1995), was erected on 22 January 1902, and is situated in the West Colony on the NE coast of the Area (77° 27' 16.7" S, 169° 14' 37.5" E). The post was used by the 1901–04 British National Antarctic Expedition to provide information to the expedition's relief ships. An historic rock hut known as Wilson's Stone Igloo (HSM No.21) (77° 31' 51" S, 169° 17' 56" E) is located on Igloo Spur (Map 1).

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

The nearest protected areas to Cape Crozier are on Ross Island: Lewis Bay (ASPA No.156), the site of the 1979 DC-10 passenger aircraft crash is the closest and 45 km west; Tramway Ridge (ASPA No.130) near the summit of Mt. Erebus is 55 km west; Discovery Hut on the Hut Point Peninsula (ASPA No.158 and HSM No.18); Arrival Heights (ASPA No.122) is 70 km to the SW adjacent to McMurdo Station; Cape Royds (ASPA No.121), Backdoor Bay (ASPA No.157 and HSM No.15) and Cape Evans (ASPA No.155) are 75 km west; and New College Valley (ASPA No.116) are 75 km NW at Cape Bird.

6(v) Special zones within the Area

There are no zones designated 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, and in particular for research on the avifauna, marine or terrestrial ecosystems in the Area, or 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 the continued protection of the environmental, scientific and historic values of the Area;
- Approach distances to fauna must be respected, except when scientific needs may require otherwise and this is specified in the relevant permits;
- Visitors shall not enter Wilson's Stone Igloo (HSM No.21) or in any other way disturb this structure or the Discovery's Message Post (HSM No.69) unless specifically authorized to do so by the permit;
- 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 the Area shall be by helicopter, by boat or on foot. Vehicles are prohibited on land within the Area.

\- *Foot access and movement within the Area*

Movement on land within the Area shall be on foot. All people in aircraft, boats, or vehicles are prohibited from moving on foot beyond the immediate vicinity of their landing or access site unless specifically authorised by permit. Pedestrians should maintain a minimum approach distance of 5 m from wildlife, unless it is necessary to approach closer for purposes allowed for by the permit.

Visitors should move carefully so as to minimize disturbance to flora, fauna, soils, and water bodies. Pedestrians should walk on snow or rocky terrain if practical, but take care not to damage lichens. Particular care should be exercised when walking on rocky terrain in the vicinity of Wilson's Stone Igloo (HSM No.21) (77° 31' 51" S, 169° 17' 56" E) on Igloo Spur (Map 1), where fragile lichens are present on rocks. Wilson's Stone Igloo is itself fragile, and visitors should not enter or in any other way disturb the structure unless specifically authorized to do so by permit.

Pedestrians should walk around the penguin colonies and should not enter sub-groups of nesting penguins unless required for research or management purposes. Care should be taken to avoid trampling nests when moving through skua territories. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

- *Ship or small boat access*

Restrictions on ship and / or small boat operations apply during the period from 01 April through to 01 January inclusive, when ships and / or small boats shall operate within the Area according to strict observance of the following conditions:

- Ships and / or small boats are prohibited from the Area, including entering sea ice within the Area, unless authorized by permit for purposes allowed for by this Management Plan;
- There are no special restrictions on where access can be gained to the Area by small boat, although small boat landings should avoid areas where penguins are accessing the sea unless this is necessary for purposes for which the permit was granted.

- *Aircraft access and overflight*

Aircraft may operate and land within the Area according to strict observance of the following conditions:

- Aircraft landings within the Area are prohibited unless authorized by permit for purposes allowed for by the Management Plan;
- Overflight of the Area by piloted aircraft below 2000 ft (~610 m) Above Ground Level is prohibited, except in accordance with a permit issued by an appropriate national authority;
- Pilots should ensure aircraft maintain a horizontal separation distance of at least 2000 ft (~610 m) from the edges of the penguin colonies (Maps 1 & 2) when accessing the designated landing sites, or otherwise operating within the Area. Pilots should be aware that congregations of penguins commonly occur on sea ice adjacent to the coast, and associated with the ice shelf ‘canyons’;
- Aircraft landings on sea ice within ½ nautical mile (~930 m) of the emperor colony are prohibited. Pilots should note that the emperor colony may shift from year to year, and move throughout the breeding season, and may be several kilometers from the nominal position shown in Map 1, and the colony may also comprise a number of smaller units within the Area;
- The primary helicopter landing site preferred for most access to the Area is located at 77° 27.64' S, 169° 11.19' E (elevation 240 m). This landing site is below and 150 m northwest of the Cape Crozier (US) field hut, and outside of the Area approximately 430 m west of the western ASPA boundary (Map 2). The site is marked by a circle of bright orange painted rocks. An alternative, secondary, landing site may be used when necessary, located at 77° 27.72' S, 169° 11.28' E. The landing site is 150 m above the hut and approximately 450 m west of the ASPA boundary;
- A third designated helicopter landing site is located above and 350 m northwest of Wilson’s Stone Igloo at 77° 31.75' S, 169° 17.19' E (Map 1) in an area of relatively flat terrain;
- To minimize the risks of inadvertent overflight of bird colonies, helicopter pilots accessing the Area for the first time should be accompanied by another

pilot with previous experience of flying into the Area or be briefed in advance by those with that experience;

- 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

Activities that may be conducted within the Area include:

- Scientific research that will not jeopardize the values of the Area;
- Activities with educational and / or outreach purposes (such as documentary reporting (e.g. visual, audio or written) or the production of educational resources or services) that are for compelling reasons that cannot be served elsewhere. Activities for educational and / or outreach purposes do not include tourism;
- Activities with the aim of documenting, preserving or protecting historic resources within the Area;
- Essential management activities, including monitoring and inspection.

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

- No structures are to be erected within the Area except as specified in a permit and, with the exception of permanent survey markers and signs, permanent structures or installations are prohibited;
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator, 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 or 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 Adélie penguin and skua breeding season (01 Oct – 31 Mar);
- 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 outside of the Area should be within a 100 m radius of the field hut (77° 27' 39" S, 169° 11' 14" E). When necessary for essential purposes specified in the Permit, camping is permitted within the Area to facilitate access to sites inaccessible from the hut. Such camping should preferably be at sites that have been previously used, are not vegetated or occupied by breeding birds, and should be on snow or ice-covered ground if available. Researchers should consult with the appropriate national authority to obtain up-to-date information on any sites where camping may be preferred.

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:

- 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 markers brought into the Area are clean. To the maximum extent practicable, clothing, footwear and other equipment used or brought into the Area (including e.g. backpacks, carry-bags, tents, walking poles, tripods and other 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));
- Poultry and all poultry products are prohibited from the Area;
- 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, chemicals and other materials are not to be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted. 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 introduced shall be for a stated period only, 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 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) 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. This includes biological samples, rock specimens, soil and historical items.

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 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.

Unless specifically authorized by permit, visitors are prohibited from interfering with or attempting restoration of Wilson's Stone Igloo in any way, or from handling, taking or damaging any artifacts. Evidence of recent changes, damage or new artifacts observed should be notified to the appropriate national authority. Relocation or removal of artifacts for the purposes of preservation, protection, or to re-establish historical accuracy is allowable by permit.

7(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 or essential logistic 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 are strongly encouraged to consult with established programs working within the Area, such as those of the United States and New Zealand, 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 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 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, or anything removed, or anything released and not removed, that were not included in the authorized permit.

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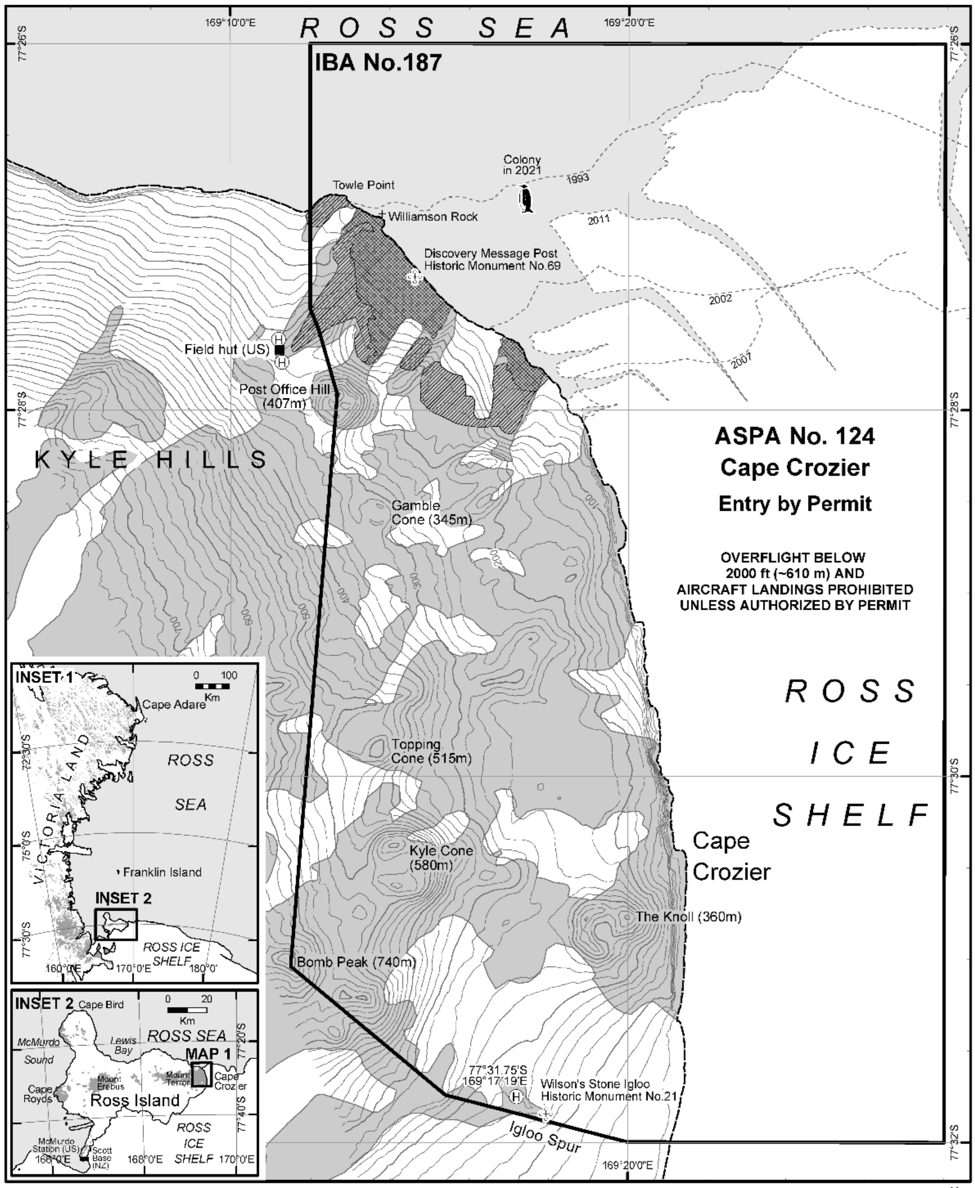


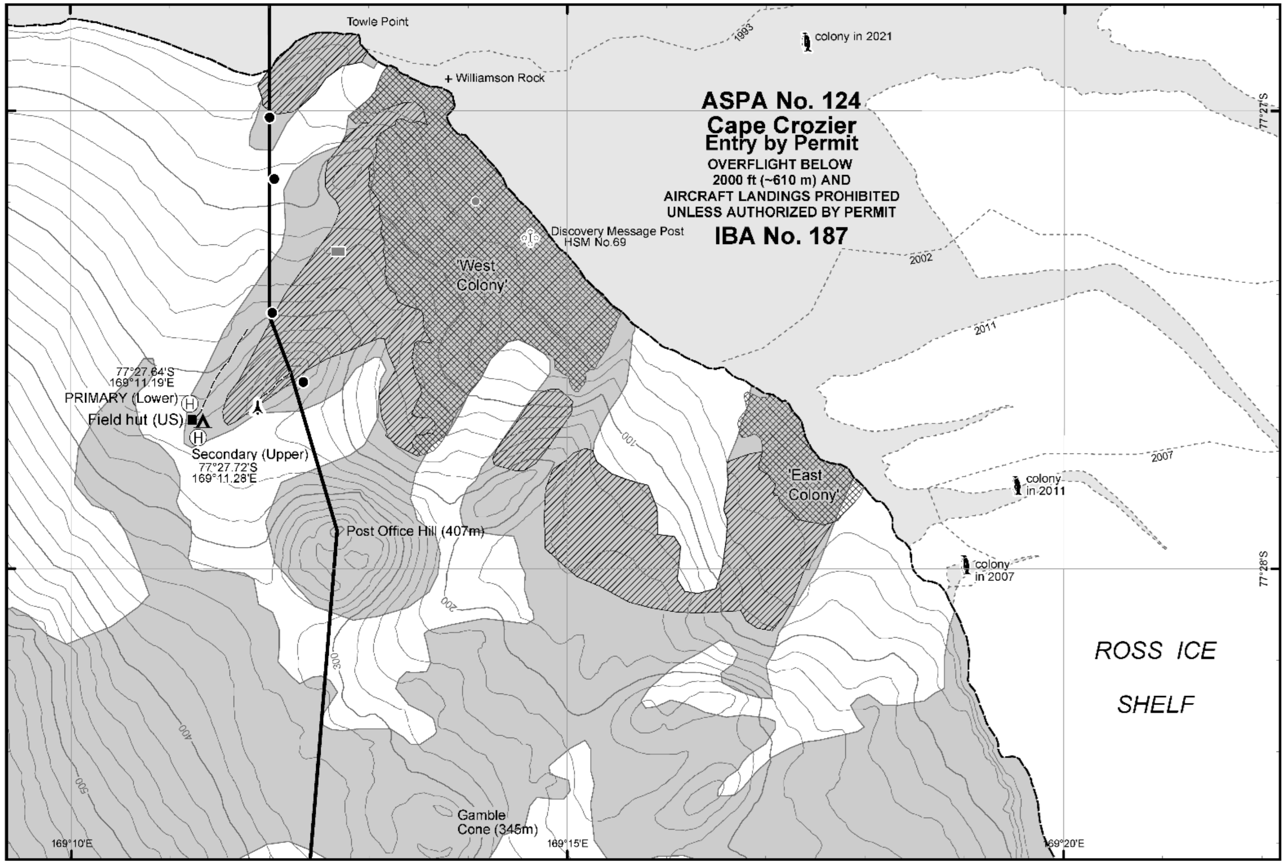
Map 1: ASPA No.124 Cape Crozier - Location & topography

03 May 2022 v3.0
United States Antarctic Program
Environmental Research & Assessment

Coastline (approx)
Index contour (100 m)
Contour (20 m)
Ice free ground
Permanent ice
Ocean
Ice shelf edge
Antarctic Specially Protected Area (ASPA) boundary
Historic Site & Monument
Field hut
Helicopter landing site
Skua nesting area
Adélie penguin colony
Emperor penguin colony

0 0.5 1 1.5 2
Kilometers

Projection: Lambert Conic Conformal,
Spheroid and horizontal datum: WGS 84
Data sources: ASPA boundary: ERA (Aug 2020);
Coastline, contours and bird data: Gateway Antarctica;
Facilities: RPSC GPS survey (25 Dec 2007); Ice shelf,
icefree ground: Quickbird © 09 Oct 2011 Digital Globe.
Emperor colony location: Sentinel-2 2021 (AAD 2022).



Map 2: ASPA No.124 Cape Crozier - access, facilities and wildlife

03 May 2022 v3.0
United States Antarctic Program
Environmental Research & Assessment

Coastline (approx)
Index contour (100 m)
Contour (20 m)
Ice free ground
Permanent ice
Ocean
Ice shelf edge
ASPA boundary
Historic Site & Monument
Path
Skua nesting area
Adélie penguin colony
Emperor penguin colony
Helicopter landing site
Field hut
Designated camp site
Radio antenna (seasonal)
Signpost
Former 'Jamesway' site
Former weigh station

Projection: Lambert Conic Conformal.
Spheroid and horizontal datum: WGS84;
Data sources: Coastline, contours and bird data: Gateway Antarctica;
ASPA boundary: ERA (Feb 2014); Facilities: RPSC GPS survey (25 Dec 2007);
Ice shelf, ice free ground: from Quickbird © 09 Oct 2011 Digital Globe;
Emperor penguin colony: Quickbird 2007, 2011; Sentinel-2 2021 (AAD 2022).
Historical ice shelf from imagery: orthophoto 1993; Quickbird 2002/2007.

Measure 10 (2022)

Antarctic Specially Protected Area No 126 (Byers Peninsula, 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-10 (1966), which designated Byers Peninsula, Livingston Island, South Shetland Islands as Specially Protected Area ("SPA") No 10;
- Recommendation VIII-2 (1975), which terminated SPA 10, and Recommendation VIII- 4 (1975), which redesignated the Area as Site of Special Scientific Interest ("SSSI") No 6 and annexed the first Management Plan for the Site;
- Recommendations X-6 (1979), XII-5 (1983), XIII-7 (1985) and Measure 3 (2001), which extended the expiry date of SSSI 6;
- Recommendation XVI-5 (1991), which adopted a revised Management Plan for SSSI 6;
- Decision 1 (2002), which renamed and renumbered SSSI 6 as ASPA 126;
- Measures 1 (2002), 4 (2011) and 4 (2016), which adopted a revised Management Plan for ASPA 126;

Recalling that Recommendation XVI-5 (1991) and Measure 3 (2001) had not become effective and were withdrawn by Measure 4 (2011);

Recalling that Recommendations VIII-2 (1975), X-6 (1979), XII-5 (1983), XIII-7 (1985) and XVI-5 (1991) 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 126;

Desiring to replace the existing Management Plan for ASPA 126 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 126 (Byers Peninsula, Livingston Island, South Shetland Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 126 annexed to Measure 4 (2016) be revoked.

Management Plan for Antarctic Specially Protected Area No. 126

BYERS PENINSULA, LIVINGSTON ISLAND, SOUTH SHETLAND ISLANDS

Introduction

The primary reason for the designation of Byers Peninsula (latitude 62°34'35" S, longitude 61°13'07" W), Livingston Island, South Shetland Islands, as an Antarctic Specially Protected Area (ASPA) is to protect the terrestrial and lacustrine habitats within the Area.

Byers Peninsula was originally designated as Specially Protected Area (SPA) No. 10 through Recommendation IV-10 in 1966. This area included the ice-free ground west of the western margin of the permanent ice sheet on Livingston Island, below Rotch Dome, as well as Window Island about 500 m off the northwest coast and five small ice-free areas on the south coast immediately to the east of Byers Peninsula. 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), small colonies of Antarctic fur seals (Arctocephalus gazella), and the outstanding scientific values associated with such a large variety of plants and animals within a relatively small area.

Designation as an SPA was terminated through Recommendation VIII-2 and redesignation as a Site of Special Scientific Interest (SSSI) was made through Recommendation VIII-4 (1975, SSSI No. 6). The new designation as an SSSI more specifically sought to protect four smaller ice-free sites on the peninsula of Jurassic and Cretaceous sedimentary and fossiliferous strata, considered of outstanding scientific value for study of the former link between Antarctica and other southern continents. Following a proposal by Chile and the United Kingdom, the SSSI was subsequently extended through Recommendation XVI-5 (1991) to include boundaries similar to those of the original SPA: i.e., the entire ice-free ground of Byers Peninsula west of the margin of the permanent Livingston Island ice sheet, including the littoral zone, but excluding Window Island and the five southern coastal sites originally included, as well as excluding all offshore islets and rocks. Recommendation XVI-5 noted that in addition to the special geological value, the Area was also of considerable biological and archaeological importance.

While the particular status of designation and boundaries have changed from time to time, Byers Peninsula has in effect been under special protection for most of the modern era of scientific activity in the region. Recent activities within the Area have been almost exclusively for scientific research (Benayas et al. (2013) provide a review of all science conducted in the area that was published between 1957 and 2012). Most visits and sampling within the Area, since original designation in 1966, have been subject to Permit conditions, and some areas (e.g., Ray Promontory) have been rarely visited. During the International Polar Year, Byers Peninsula was established as an 'International Antarctic Reference Site for Terrestrial, Freshwater and Coastal Ecosystems' (Quesada et al., 2009, 2013). During this period baseline data relating to terrestrial, limnetic and coastal ecosystems were established, including permafrost characteristics, geomorphology, vegetation extent, limnetic diversity and functioning, marine mammal and bird diversity, microbiology, and coastal marine invertebrate diversity (López-Bueno et al., 2009; Moura et al., 2012; Barbosa et al., 2013; De Pablos et al., 2013; Emslie et al., 2013; Gil-Delgado et al., 2013; Kopalova and van de Vijvier, 2013; Lyons et al., 2013; Nakai et al., 2013; Pla-Rabes et al., 2013; Rico et al., 2013; Rochera et al., 2013a; Rochera et al., 2013b; Toro et al., 2013; Velazquez et al., 2013; Velazquez et al., 2016; Vera et al., 2013; Villaescusa et al., 2013). The archaeological values of Byers Peninsula have been described as unique in possessing the greatest concentration of historical sites in Antarctica, namely the remains of refuges, together with contemporary artefacts and shipwrecks of early nineteenth century sealing expeditions (see Map 2).

Byers Peninsula makes a substantial contribution to the Antarctic protected areas system as it (a) contains a particularly wide diversity of species, (b) is distinct from other areas due to its numerous and diverse lakes, freshwater ponds and streams, (c) is of great ecological importance and represents the most significant limnological site in the region, (d) contains one of the highest concentrations of historical remains associated with 19th Century sealers' activities in Antarctica, (e) is vulnerable to human interference, in particular, due to the oligotrophic nature of the lakes which are highly sensitive to pollution and (f) is of great scientific interest across a range of disciplines. While some of these quality criteria are represented in other ASPAs in the region, Byers Peninsula is unique in possessing a high number of different criteria within one area. While Byers Peninsula is protected primarily for its outstanding environmental values (specifically its biological diversity and terrestrial and lake ecosystems) the Area contains a combination of other values including scientific (i.e. for terrestrial biology, limnology, ornithology, palaeolimnology, geomorphology and geology), historic (artefacts and refuge remains of early sealers), wilderness (e.g. Ray Promontory) and on-going scientific values that may benefit from the Area's protection.

The ice-free ground of Byers Peninsula is surrounded on three sides by ocean and the Rotch Dome glacier to the east. The Area has been designated to protect values found within the ice-free ground on Byers Peninsula. To fulfil this objective a portion of Rotch Dome has been included within the ASPA to ensure newly exposed ice-free ground, (resulting from any retreat of Rotch Dome), will be within the boundaries of the ASPA. In addition, the northwestern Rotch Dome including adjacent de-glaciated ground and Ray Promontory have been designated as restricted zones to allow microbiological studies that required higher quarantine standards than considered necessary within the rest of the Area. The Area (84.7 km^2) is considered to be of sufficient size to provide adequate protection of the values described below.

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, Byers Peninsula is predominantly Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 109, 111, 112, 114, 125, 128, 140, 145, 149, 150, and 152 and ASMAs 1 and 4. The permanent ice of Rotch Dome comes under Environment Domain E. Other protected areas containing Domain E include ASPAs 113, 114, 117, 126, 128, 129, 133, 134, 139, 147, 149, 152 and ASMAs 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 paragraph 2 of Article 3 of Annex V to the Environmental Protocol'. ASPA 126 sits within Antarctic Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula. In Resolution 5 (2015) the ATCM recognised the significance of the Important Bird Areas (IBAs) of Antarctica. The boundary of ASPA 126 also marks the extent of Important Bird Area ANT054 Byers Peninsula, Livingston Island. The IBA qualifies on the basis of the Antarctic tern (Sterna vittate) and kelp gull (Larus dominicanus) colonies although may other bird species, including southern giant petrels (Macronectes giganteus) are present.

1. Description of values to be protected

The Management Plan attached to Measure 1 (2002) noted values considered important as reasons for special protection of the Area. The values recorded in the original Management Plans are reaffirmed. These values are set out as follows:

- With over 60 lakes, numerous freshwater pools and a great variety of often extensive streams, it is the most significant limnological site in the South Shetland Islands – and perhaps the Antarctica Peninsula region – and also one which has not been subjected to significant levels of human disturbance.
- The described terrestrial flora and fauna is of exceptional diversity, with one of the broadest representations of species known in the maritime Antarctic. For example, sparse but diverse flora of calcicolous and calcifuge plants and cyanobacteria are associated with the lavas and basalts, respectively, and several rare cryptogams and the two native vascular plants (Deschampsia antarctica and Colobanthus quitensis) occur at several sites. The abundance of vegetation is also exceptional with c. 8.1 km^2 of green vegetation contained within the Area, representing over half of the green vegetation protected with all terrestrial ASPAs.
- Parochlus steinenii (the only native winged insect in Antarctica) is of limited distribution in the South Shetland Islands. The only other native dipteral, the wingless midge Belgica antarctica, has a widespread but sporadic distribution on the Antarctic Peninsula. Both species are abundant at several of the lakes, streams and pools on Byers Peninsula.
- Unusually extensive cyanobacterial mats dominated by Leptolyngbya spp., Phormidium spp., and other species, particularly on the upper levels of the central Byers Peninsula plateau, are the best examples so far described in the maritime Antarctic.

- The breeding avifauna within the Area is diverse, including two species of penguin [chinstrap (Pygoscelis antarctica) and gentoo (P. papua)], Antarctic tern (Sterna vittate), Wilson's storm petrels (Oceanites oceanicus), cape petrels (Daption capense), kelp gulls (Larus dominicanus), southern giant petrels (Macronectes giganteus), black-bellied storm petrels (Fregetta tropica), blue-eyed cormorants (Phalacrocorax atriceps), brown skuas (Catharacta loennbergi), and sheathbills (Chionis alba).
- The lakes and their sediments constitute one of the most important archives for study of the Holocene palaeoenvironment in the Antarctic Peninsula region, as well as for establishing a regional Holocene tephrachronology.
- Well-preserved sub-fossil whale bones are present in raised beaches, which are important for radiocarbon and other heavy isotope dating of beach deposits.
- The ice-free sites on the peninsula with exposed Jurassic and Cretaceous sedimentary and fossiliferous strata, are considered of outstanding scientific value for study of the former link between Antarctica and other southern continents.
- The area contains one of the highest concentrations of historic sites and artifacts associated with the activities of sealers in the early 19th Century, and is of outstanding value with regard to our knowledge of the earliest activities of humans in Antarctica.
- The area has remained largely unaffected by human disturbance, compared to other extensive ice-free areas in the local vicinity, and is thought to be free of non-native plants.

2. Aims and objectives

Management at Byers Peninsula aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance;
- allow scientific research on the terrestrial and lacustrine ecosystems, marine mammals, avifauna, coastal ecosystems and geology;
- allow other scientific research within the Area provided it is for compelling reasons which cannot be served elsewhere;
- allow archaeological research and measures for artefact protection, while protecting historic artefacts present within the Area from unnecessary destruction, disturbance, or removal;
- 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 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:

- A map showing the location of the Area and stating the special restrictions that apply, shall be displayed prominently at Base Juan Carlos I (Spain) and St. Kliment Ohridski Station (Bulgaria) on Hurd Peninsula, where copies of this management plan shall be made available.
- Markers, signs, fences or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition.
- Visits shall be made as necessary to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.

Byers Peninsula has been described as extremely sensitive to trampling impact (Tejedo et al., 2009; Pertierra et al., 2013a). The Area was designated as an ASPA to protect a diverse range of values present within the Area. As a result, it attracts scientists (representing a diverse range of disciplines) and archaeologists from a number of Treaty nations. The high number of people present in the Area at peak times (mid-summer) means there is potential for the environmental values of the area to be negatively impacted upon by human activities, for example by potentially increasing (i) the size and number of camping location, (ii) the trampling of vegetation, (iii) the disturbance of native wildlife (iv) the generation of waste and (v) the need for fuel storage. Consequently, when making plans for field work within the Area, Parties are strongly encouraged to liaise with other nations likely to be operating in the Area that season and co-ordinate activities to keep environmental impacts, including cumulative impacts, to an absolute minimum (e.g., fewer than c. 12 people in the International Field Camp at any one time).

All Parties are strongly encouraged to use the established International Field Camp (located on South Beaches, 62°39'49.7" S, 61°05'59.8' W), to reduce the creation of new camping sites that would increase levels of human impacts within the Area. Two melon huts are found within the camp (one set up for scientific research, the other for domestic activities; both huts are managed by Spain). The melon huts are available to all Treaty Parties, should they wish to use them. Parties should liaise with Spain to co-ordinate access to the melon huts. Pertierra et al. (2013b) provides information concerning the challenges and environmental impacts resulting from the running of the camp.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: Byers Peninsula ASPA No. 126 in relation to the South Shetland Islands, showing the location of Base Juan Carlos I (Spain) and St. Kliment Ohridski Station (Bulgaria), and showing the location of protected areas within 75 km of the Area. Inset: the location of Livingston Island along the Antarctica Peninsula.

Map 2: Byers Peninsula ASPA No. 126 topographic map. Map specifications: Projection UTM Zone 20S; Spheroid: WGS 1984; Datum: Mean Sea Level. Horizontal accuracy of control: ±0.05 m. Vertical contour interval 50 m.

6. Description of the Area

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

- *Boundaries*

The Area encompasses:

- Byers Peninsula and all ice-free ground and ice sheet west of longitude 60°53’45’’ W, including Clark Nunatak and Rowe Point;
- the near-shore marine environment extending 10 m offshore from the low tide water line; and
- Demon Island and Sprite Island, adjacent to the southern shoreline of Devils Point, but excluding all other offshore islets, including Rugged Island, and rocks (Map 2).

The linear eastern boundary follows longitude 60°53’45’’ W to ensure newly exposed ice-free ground resulting from the retreat of Rotch Dome, which may contain scientifically useful opportunities and new habitats for colonization studies, will be within the boundaries of the ASPA.

No boundary markers are in place.

- *General description*

Byers Peninsula (between latitudes 62°34'35" and 62°40'35" S and longitudes 60°53’45’’ and 61°13'07" W, 84.7 km²) is situated at the west end of Livingston Island, the second-largest of the South Shetland Islands (Map 1). The ice-free area on the peninsula has a central west-east extent of about 9 km and a NW-SE extent of 18.2 km, and is the largest ice-free area in the South Shetland Islands. The peninsula is generally of low, gently rolling relief, although there are a number of prominent hills ranging in altitude between 80 – 265 m (Map 2). The interior is dominated by a series of extensive platforms at altitudes of up to 105 m, interrupted by isolated volcanic plugs such as Chester Cone (188 m) and Negro Hill (143 m) (Thomson and López-Martínez 1996). There is an abundance of rounded, flat landforms resulting from marine, glacial and periglacial erosional processes. The most rugged terrain occurs on Ray Promontory, a ridge forming the northwest-trending axis of the roughly ‘Y’-shaped peninsula. Precipitous cliffs surround the coastline at the northern end of Ray Promontory with Start Hill (265 m) at the NW extremity being the highest point on the peninsula.

The coast of Byers Peninsula has a total length of 71 km (Map 2). Although of generally low relief, the coast is irregular and often rugged, with numerous headlands, cliffs, offshore islets, rocks and shoals. Byers Peninsula is also notable for its broad beaches, prominent features on all three coasts (Robbery Beaches in the north, President Beaches in the west, and South Beaches). The South Beaches are the most extensive; extending 12 km along the coast and up to almost 0.9 km in width, these are the largest in the South Shetland Islands (Thomson and López-Martínez 1996). For a detailed description of the geology and biology of the Area see Annex 1.

6(ii) Access to the Area

- Access shall be by helicopter or small boat.
- There are no special restrictions on boat landings from the sea, or that apply to the sea routes used to move to and from the Area. Due to the large extent of accessible beach around the Area, landing is possible at many locations. Nevertheless, if possible, landing of cargo and scientific equipment should be close to the International Field Camp located at Southern Beaches (62°39'49.7" S, 61°05'59.8' W; see 6(iii) for further details). Personnel operating vessels to deliver cargo and/or personnel to the ASPA must not leave the landing area unless in accordance with a permit issued by an appropriate national authority.
- A designated helicopter landing site is located at 62°39'36.4" S, 61°05'48.5' W, to the east of the International Field Camp.
- Under exceptional circumstances necessary for purposes consistent with the objectives of the Management Plan, helicopters may land elsewhere within the Area, although landings should, where practicable, be made on ridge and raised beach crests.
- No helicopter lands shall be made within the restricted zones [see section 6(v)].
- Helicopters should avoid sites where there are concentrations of birds (e.g., Devils Point, Lair Point and Robbery Beaches) or well-developed vegetation (e.g., large stands of mosses near President and South Beaches).
- To avoid disturbance of wildlife, aircraft should avoid landing within an over-flight restriction zone extending ¼ nautical mile (c. 460 m) inland from the coast during the period 1 October – 30 April inclusive (see Map 2). The only exception to this is the designated helicopter landing site at 62°39'36.4" S, 61°05'48.5'W.
- Within the over-flight restriction zone the operation of aircraft 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). In particular, aircraft should maintain a vertical height of 2000 ft (~ 610 m) AGL and cross the coastline at right angles where possible. When conditions require aircraft to fly at lower elevations than

recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit the coastal zone.

- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used all smoke grenades should be retrieved.

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

An International Field Camp is located at South Beaches, at 62°39'49.7" S, 61°05'59.8' W. It is comprised of two fibreglass 'melon huts'. It is maintained by Spain and is available for use by all Parties. Parties aiming to use the melon huts should communicate their intentions to the Spanish Polar Committee well in advance. The locations of 19th Century sealers remains, including refuges and caves used for shelter are given in Smith and Simpson (1987) (see Map 2). Several cairns marking sites used for topographical survey are also present within the Area, predominantly on high points.

The nearest scientific research stations are 30 km east at Hurd Peninsula, Livingston Island [Base Juan Carlos I (Spain) and St Kliment Ohridski (Bulgaria)].

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

The nearest protected areas to Byers Peninsula are: Cape Shirreff (ASPA No. 149) which lies about 20 km to the northeast, Deception Island (ASMA No. 4), Port Foster and other parts of Deception Island (ASPAs No. 140, 145) which are approximately 40 km SSE, and 'Chile Bay' (Discovery Bay) (ASPA No. 144), which is about 70 km to the east at Greenwich Island (Map 1).

6(v) Restricted and managed zones within the Area

Some zones on Byers Peninsula are thought to have been visited only very rarely, or never. 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:

- 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. If accessing the restricted zones by boat, protective clothing shall be put on immediately upon landing.
- 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 equipment used or brought into the restricted zones shall have been thoroughly cleaned and sterilized at the originating Antarctic station or ship. 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 permitted to enter the restricted areas, but shall adhere to the quarantine measures detailed above.
- Camping within the restricted zones is not permitted.
- Helicopter landings within the restricted zones are not permitted.
- If access to the restricted zones is required for research or for emergency reasons, a detailed record of where visitation occurred (preferably using GPS technology) and the specific activities, should be submitted to the appropriate national authority and included in the Exchange of Information Annual Report, preferably through the Electronic Information Exchange System (EIES).

The restricted zones are:

- North-western Rotch Dome and adjacent deglaciated ground. The restricted zone includes all land and ice sheet within an area bordered to the east by longitude 60°53'45"W, to the west by longitude 60°58'48" W, to the south by latitude 62°38'30"S, and the northern boundary follows the coastline (see Map 2).
- Ray Promontory. The restricted zone includes all land and permanent ice northwest of a straight line crossing the Promontory from 62°37’S, 61°08’W (marked by a small coastal lake) to 62°36’S, 61°06’W. Within the Ray Promontory restricted zone, access to archaeological remains located on the coast is permitted without the need for quarantine precautions required elsewhere within the restricted zone. Access to inland areas beyond the coastal archaeological remains is not permitted without quarantine measures, detailed in this section, in place. Preferably, access to the archaeological remains shall be from the sea using small boats. Access to the archaeological remains on foot is also permitted without the need for the additional quarantine measures, by following the coastline from the unrestricted area of the Byers Peninsula ASPA to the southeast. Access to the archaeological remains shall be solely for archaeological investigations, authorised by the appropriate national authority.

7. Terms and conditions for entry permits

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

7(i) General permit conditions

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

- it is issued only for scientific study of the ecosystem, geology, palaeontology or archaeology of the Area, or for compelling scientific reasons that cannot be served elsewhere; or
- it is issued for essential management purposes consistent with management plan objectives such as inspection, maintenance or review;
- the actions permitted will not jeopardise the ecological, geological, historical or scientific values of the Area;
- the sampling proposed will not take, remove or damage such quantities of soil, rock, native flora or fauna that their distribution or abundance on Byers Peninsula would be significantly affected;
- cumulative impacts of geological sampling are taken into consideration in any EIA, as substantial collections have been made at some palaeontological sites with significant negative impacts upon the Area's scientific values.
- 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 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; 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

- Land vehicles are prohibited within the Area.
- Movement within the Area shall be on foot unless under exceptional circumstances when helicopter may be used.
- All movement shall be undertaken carefully so as to minimise disturbance to archaeological remains, animals, soils, geomorphological features and vegetated surfaces, walking on rocky terrain or ridges if practical to avoid damage to sensitive plants, patterned ground 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. Where possible, existing tracks should be used to transit the area (Map 2). If no track exists, care should be taken to avoid creation of new tracks. Research has shown that vegetation on Byers Peninsula can recover if fewer than 200 transits are made over it in a single season (Tejedo et al., 2009). Pedestrian routes over vegetated ground should therefore be chosen depending on the forecasted number of transits (i.e., number of people x transits per day x number of days). When the number of transits on the same track is expected to be less than 200 in the same season, the track should be clearly identified and transits always made along the

track. When the number is expected to be larger than 200 in a season, then the route should not be fixed along a single track, but transits should be done across a wide belt (i.e. multiple tracks, each with fewer than 200 transits), to diffuse the impact and allow quicker recovery of trampled vegetation.

- Conditions for use of helicopters within the Area are described in section 6(ii)
- 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).
- Pilots, air and boat crew, or other people on aircraft or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- Restrictions on access and movement within the restricted zones are described in section 6(v).

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

- Compelling scientific research which cannot be undertaken elsewhere and that will not jeopardise the ecosystem or values of the Area or interfere with existing scientific studies.
- Archaeological research.
- Essential management activities, including monitoring.

7(iv) Installation, modification or 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 a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be 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 of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

7(v) Location of field camps

In order to minimise the area of ground within the ASPA impacted by camping activities, camps should be within the immediate vicinity of the International Field Camp (62°39'49.7" S, 61°05'59.8" W). When necessary for purposes specified in the Permit, temporary camping beyond the International Field Camp is allowed within the Area. Camps should be located on non-vegetated sites, such as on the drier parts of the raised beaches, or on thick (> 0.5 m) snow-cover when practicable, and should avoid concentrations of breeding birds or mammals. Camping within 50 m of any sealers' refuge or shelter is prohibited. Previously used campsites should be re-used where practical, unless the guidance above suggests that they were inappropriately located. Camping within the restricted zones is not permitted. Due to the high winds often experienced in the area, great care should be taken to ensure all camping and scientific equipment is adequately secured.

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

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 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 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 (Resolution 5 (2018)). In view of the presence of breeding bird colonies on Byers Peninsula, 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 or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of or harmful interference with animals is involved, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica (Resolution 4 (2019)) should be used as a minimum standard.

7(viii) The collection or removal of materials not brought into the Area by the Permit holder

Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific, archaeological or management needs.

Unless specifically authorized by permit, visitors to the Area are prohibited from interfering with or from handling, taking or damaging any historic anthropogenic material meeting the criteria in Resolution 5 (2001). Similarly, relocation or removal of artefacts for the purposes of preservation, protection or to re-establish historical accuracy is allowable only by permit. The appropriate national authority shall be informed of the location and nature of any newly identified anthropogenic materials.

Other material of human origin likely to compromise the values of the Area which was not brought into the Area by the permit holder or otherwise authorised, may be removed 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 must be notified and approval obtained.

7(ix) Disposal of waste

As a minimum standard all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes, including all solid human waste, shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea as the near-shore reefs will prevent dispersal, but shall be removed from the Area. No human waste shall be disposed of inland as the oligotrophic characteristics of the lakes and other water-bodies on the plateau can be compromised by even a small quantity of human waste, including urine.

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

Permits may be granted to enter the Area to:

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

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)).

Any specific sites of long-term monitoring shall be appropriately marked on site and on maps of the Area. A GPS position should be obtained for lodgement with the Antarctic Data Directory System through the appropriate national authority.

To help maintain the ecological and scientific values of the Area, visitors shall take special precautions against introductions. Of particular concern are microbial, animal or vegetation introductions sourced from soils from other Antarctic sites, including stations, or from regions outside Antarctica. To the maximum extent practicable, visitors shall ensure that footwear, clothing and any equipment – particularly camping and sampling equipment – is thoroughly cleaned before entering the Area. Poultry products and other introduced avian products, which may be a vector of avian diseases, shall not be released into the Area. Visitors accessing the ASPA by helicopter should ensure it is free of seeds, soil and propagules before entering the area. The transfer of species between lakes from outside and within the ASPA presents a substantial threat to these chemically and biologically unique waterbodies. Therefore, every precaution shall be taken to prevent cross-contamination of lakes including the cleaning of sampling equipment between use in different waterbodies.

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 as an Appendix in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas available from the website of the Secretariat of the Antarctic Treaty (www.ats.aq)]. 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.

8. Supporting documentation

For a list of publication resulting from scientific investigations on Byers Peninsula, see Benayas et al. (2013).

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Annex 1

Supporting information

Byers Peninsula has supported scientific investigations for many years and many of the resulting publications up until 2013 are listed in Banayas et al. (2013); however, but numerous new articles have been published since then.

- *Climate*

No extended meteorological records are available for Byers Peninsula before 2001, but the climate is expected to be similar to that at Base Juan Carlos I, Hurd Peninsula (recorded since 1988). Conditions there indicate a mean annual temperature of below -2.8 °C, with temperatures less than 0 °C for at least several months each winter and a relatively high precipitation rate estimated at about 800 mm yr^{-1}, much of which falls as rain in summer (Ellis-Evans 1996; Bañón et al., 2013). The peninsula is snow-covered for much of the year, but is usually mostly snow-free by the end of the summer. The peninsula is exposed to weather from the Drake Passage in the north and northwest, the directions from which winds prevail, and Bransfield Strait to the south. The climate is polar maritime, with a permanently high relative humidity (about 90%), cloud covered skies for most of the time, frequent fogs and regular precipitation events. Mean temperature in summer is 1.1 ° C, but occasionally can be higher than 5 °C. Exceptionally summer temperature has reached 9 °C. Minimum average temperature in summer is close to 0 °C. In winter, temperatures can be lower than -26 °C, although the average value is -6 °C and maximum temperatures in winter can be close to 0 °C. Mean radiation in summer is 14,000 KJ m^{-2}, reaching 30,000 KJ m^{-2} on sunny days close to the solstice. Winds are high and average speed is 24 km h^{-1}, with frequent storms with winds over 140 Km h^{-1}. The predominant winds are from SW and NE.

- *Geology*

The bedrock of Byers Peninsula is composed of Upper Jurassic to Lower Cretaceous marine sedimentary, volcanic and volcaniclastic rocks, intruded by igneous bodies (see Smellie et al., 1980; Crame et al., 1993, Hathway and Lomas 1998). The rocks represent part of a Mesozoic-Cenozoic magmatic arc complex which is exposed throughout the whole of the Antarctic Peninsula region, although most extensively on the Byers Peninsula (Hathway and Lomas 1998). The elevated interior region of the eastern half of the peninsula – surrounded to the north and south by Holocene beach deposits – is dominated by Lower Cretaceous non-marine tuffs, volcanic breccias, conglomerates, sandstones and minor mudstones, with intrusions in several places by volcanic plugs and sills. The western half of the peninsula, and extending NW half-way along Ray Promontory, is predominantly Upper Jurassic-Lower Cretaceous marine mudstones, with sandstones and conglomerates, with frequent intrusions of volcanic sills, plugs and other igneous bodies. The NW half of Ray Promontory comprises mainly volcanic breccias of the same age. Mudstones, sandstones, conglomerates and pyroclastic rocks are the most common lithologies found on the peninsula. Expanses of Holocene beach gravels and alluvium are found in coastal areas, particularly on South Beaches and the eastern half of Robbery Beaches, with less-extensive deposits on President Beaches.

The Area is of high geological value because "the sedimentary and igneous rocks exposed at Byers Peninsula constitute the most complete record of the Jurassic-Early Cretaceous period in the northern part of the Pacific flank of the magmatic arc complex, and they have proved a key succession for the study of marine molluscan faunas (e.g. Crame 1984, 1995, Crame and Kelly 1995) and non-marine floras (e.g. Hernandez and Azcárte 1971, Philippe et al., 1995)" (Hathway and Lomas 1998).

- *Geomorphology and soils*

Much of the terrain consists of lithosols, essentially a layer of shattered rock, with permafrost widespread below an active layer of 30-70 cm depth (Thom 1978, Ellis-Evans 1996, Serrano et al., 1996). Stone fields (consisting of silty fines with dispersed boulders and surficial clasts), gelifluction lobes, polygonal ground (both in flooded and dry areas), stone stripes and circles and other periglacial landforms dominate the surface morphology of the upper platforms where bedrock outcrop is absent (Serrano et al., 1996). Debris and mud-flows are observed in several localities. Beneath some of the moss and grass communities there is a 10-20 cm deep layer of organic matter although, because vegetation is sparse over most of Byers Peninsula, there are no deep accumulations of peat (Bonner and Smith 1985; Moura et al., 2012; Otero et al., 2013). Ornithogenic soils are present especially in the Devils Point vicinity and on a number of knolls along President Beaches (Ellis-Evans 1996).

Parts of the interior of the peninsula have been shaped by coastal processes with a series of raised beaches ranging from 3 to 54 m in altitude, some of which are over 1 km wide. A radiocarbon date for the highest beach deposits suggests that Byers Peninsula was largely free of permanent ice by 9700 yr B.P., while the lowest beach deposits are dated at 300 yr B.P. (John and Sugden 1971, Sugden and John 1973). Lake sediment analyses, however, are contradictory; some suggest a recent general deglaciation of central Byers Peninsula of around 4000-5000 yr B.P. (Björck et al., 1991a, b), but others provide a deglaciation age about 8000-9000 yr B.P. (Toro et al., 2013). More recent work has suggested that the onset of the deglaciation started during the Early Holocene in the western fringe of the Byers Peninsula (ca. 8.3 thousand calibrated years before present (cal. ky BP)) (Oliva et al., 2016). Glacial retreat gradually exposed the highest parts of the Cerro Negro nunatak in the SE corner of Byers Peninsula, creating a nunatak (c. 7.5 ky BP). During the Mid-Holocene the retreat of the Rotch Dome glacier cleared the central part of the Byers plateau of ice, with this area being ice-free at least 5.9 cal. ky BP. Deglaciation of the current ice-free easternmost part of the Byers Peninsula occurred before 1.8 cal. ky BP (Oliva et al., 2016). In several places sub-fossil whalebones are embedded in the raised beaches, occasionally as almost entire skeletons. Radiocarbon dates of skeletal material from about 10 m a.s.l. on South Beaches suggest an age of between 2000 and 2400 yr B.P. (Hansom 1979). Pre-Holocene surfaces of Byers Peninsula exhibit clear evidence of a glacial landscape, despite the gentle landforms. Today only three small residual glaciers (comprising less than 0.5

km²) remain on Ray Promontory. The pre-existing glacially modified landforms, have been subsequently overprinted by fluvial and periglacial processes (Martinez de Pison et al., 1996).

- *Streams and lakes*

Byers Peninsula is perhaps the most significant limnological site in the South Shetland Islands/Antarctic Peninsula region, with over 60 lakes, numerous freshwater pools (differentiated from lakes in that they freeze to the bottom in winter) and a dense and varied stream network. The gentle terrain favours water retention and waterlogged soils are common in the summer. The water capacity of the thin soils is limited, however, and many of the channels are frequently dry, with flow often intermittent except during periods of substantial snow melt, rain or where they drain glaciers (Lopez-Martinez et al., 1996). Most of the streams drain seasonal snowfields and are often no more than 5-10 cm in depth (Ellis-Evans 1996) although snow accumulation in some narrow gorges can reach over 2 m height, and result in ice dams blocking the lake outlet. The larger streams are up to 4.5 km in length, up to 20 m in width and 30-50 cm in depth in the lower reaches during periods of flow. Streams that drain to the west often have sizeable gorges (Lopez-Martinez et al., 1996) and gullies up to 30 m in depth have been cut into the uppermost, and largest, of the raised marine platforms (Ellis-Evans 1996). Above the Holocene raised beaches the valleys are gentle, with widths of up to several hundred metres.

Lakes are especially abundant on the higher platforms (i.e. at the heads of basins) and on the Holocene raised beaches near the coast. Midge Lake is the largest at 587 x 112 m, and deepest with a maximum depth of 9.0 m. The inland lakes are all nutrient-poor and highly transparent, with extensive sediments in deeper water overlain by a dense aquatic moss carpet [Drepanocladus longifolius (=D. aduncus)]. In some lakes, such as Chester Cone Lake about 500 m to the south of Midge Lake, or Limnopolar lake, stands of aquatic moss are found growing at one to several metres in depth and cover most of the lake bottom, which is the habitat for Parochlus larvae (Bonner and Smith 1985). Large masses of this moss are sometimes washed up along parts of the shoreline. The lakes are generally frozen to a depth of 1.0 - 1.5 m for 9 - 11 months of the year and overlain by snow (Rochera et al., 2010), although surfaces of some of the higher lakes remain frozen year-round (Ellis-Evans 1996, Lopez-Martinez et al., 1996). On the upper levels of the central plateau many small, shallow, slow-flowing streams flow between lakes and drain onto large flat areas of saturated lithosol covered with thick cyanobacterial mats of Phormidium spp., Microcoleus spp. and Leptolyngbya spp. These mats are more extensive than in any other maritime Antarctic site thus far described and reflect the unique geomorphology and relatively high annual precipitation of the Area. With spring melt there is considerable flush through most lakes, but outflow from many lakes may cease late in the season as seasonal snowmelt decreases (Rochera et al., 2010). Most lakes contain some crustaceans such as the copepods Boeckella poppei and the fairy shrimp Branchinecta gainii. Some of the streams also contain substantial growths of cyanobacterial and green filamentous algae, along with diatoms and copepods (Kopalova and van de Vijver 2013). A number of relatively saline lakes of lagoonal origin occur close to the shore, particularly on President Beaches. Where these are used as southern elephant seal (Mirounga leonina) wallows these lakes have been highly organically enriched. Those coastal shallow lakes and pools located behind the first raised beach often have abundant algal mats and crustaceans, including the copepods B. poppei and Parabroteas sorsi, and occasionally the fairy shrimp Br. gainii. Some of these water bodies have high biological diversity, with newly described species of diatoms (van der Vijver et al., 2009), oligochaete (Rodriguez and Rico, 2009) and ciliate protozoa (Petz et al., 2008).

- *Vegetation*

Although much of Byers Peninsula lacks abundant vegetation, especially inland (see Lindsay 1971), the use of satellite technology shows the areas does contain 8.1 km² of green vegetation (e.g. vascular plants, algae and some moss species), which represents over 50% of the green vegetation protected within all the terrestrial ASPAs (Hughes et al., 2015). The often sparse communities contain a diverse flora, with at least 56 lichen species, 29 mosses, 5 hepatics and 2 phanerogams having been identified as present within the Area (Vera et al., 2013). Numerous unidentified lichens and mosses have also been collected. This suggests the Area contains one of the most diverse representations of terrestrial flora known in the maritime Antarctic. A number of the species are rare in this part of the maritime Antarctic. For example, of the bryophytes, Anthelia juratzkana, Brachythecium austroglareosum, Chorisodontium aciphyllum, Ditrichum hyalinum, Herzogobryum teres, Hypnum revolutum, Notoligotrichum trichodon, Pachyglossa dissitifolia, Platydictya jungermannioides, Sanionia cf. plicata, Schistidium occultum, Syntrichia filaris and Syntrichia saxicola are considered rare. For A. juratzkana, D. hyalinum, N. trichodon and S. plicata, their furthest-south record is on Byers Peninsula. Of the lichen flora, Himantormia lugubris, Ochrolechia parella, Peltigera didactyla and Pleopsidium chlorophanum are considered rare.

Vegetation development is much greater on the south coast than on the north. Commonly found on the higher, drier raised beaches in the south is an open community dominated by abundant Polytrichastrum alpinum (=Polytrichum alpinum), Polytrichum piliferum (=Polytrichum antarcticum), P. juniperinum, Ceratodon purpureus, and the moss Pohlia nutans and several crustose lichens are frequent. Some large stands of mosses occur near President and South Beaches, where extensive snowdrifts often accumulate at the base of slopes rising behind the raised beaches, providing an ample source of melt water in the summer. These moss stands are dominated mainly by Sanionia uncinata (=Drepanocladus uncinatus), which locally forms continuous carpets of several hectares. The vegetation composition is more diverse than on the higher, drier areas. Inland, wet valley floors have stands of Brachythecium austro-salebrosum, Campylium polygamum, Sanionia uncinata, Warnstorfia laculosa (=Calliergidium austro-stramineum), and W. sarmentosa (=Calliergon sarmentosum). In contrast, moss carpets are almost non-existent within 250 m of the northern coast, replaced by scant growth of Sanionia in hollows between raised beaches of up to 12 m in altitude. Lichens, principally of the genera Acarospora, Buellia, Caloplaca, Verrucaria and Xanthoria, are present on the lower (2-5 m) raised beach crests, with Sphaerophorus, Stereocaulon and Usnea becoming the more dominant lichens with increasing altitude (Lindsay 1971).

On better drained ash slopes Bryum spp., Dicranoweisia spp., Ditrichum spp., Pohlia spp., Schistidium spp., and Tortula spp. are common as isolated cushions and turves with various liverworts, lichens (notably the pink Placopsis contortuplicata and black foliose Leptogium puberulum), and the cyanobacterium Nostoc commune. P. contortuplicata occurs in inland and upland habitats lacking in nitrogen, and is typical of substrata with some degree of disturbance such as solifluction; it is often the only plant to colonise the small rock fragments of stone stripes and frost-heave polygons (Lindsay 1971). It is usually found growing alone, though rarely with species of Andreaea and Usnea. N. commune covers extensive saturated areas on level or gently sloping, gravelly boulder clay from altitudes of between 60-150 m, forming discrete rosettes of about 5 cm in diameter 10-20 cm apart (Lindsay 1971). Scattered, almost spherical, cushions of Andreaea, Dicranoweisia, and Ditrichum are found on the driest soils. In wet, bird- and seal-influenced areas the green foliose alga Prasiola crispa is sometimes abundant.

Rock surfaces on Byers Peninsula are mostly friable, but locally colonised by lichens, especially near the coast. Volcanic plugs are composed of harder, more stable rock and are densely covered by lichens and occasional mosses. Usnea Plug is remarkable for its luxuriant growth of Himantormia lugubris and Usnea aurantiaco-atra (=U. fasciata). More generally, H. lugubris and U. aurantiaco-atra are the dominant lichen species on inland exposed montane surfaces, growing with the moss Andreaea gainii over much of the exposed rock with up to 80% cover of the substratum (Lindsay 1971). In sheltered pockets harbouring small accumulations of mineral soil, the liverworts Barbilophozia hatcheri and Cephaloziella varians (= C. exiliflora) are often found, but more frequently intermixed with cushions of Bryum, Ceratodon, Dicranoweisia, Pohlia, Sanionia, Schistidium, and Tortula. Sanionia and Warnstorfia form small stands, possibly correlated with the absence of large snow patches and associated melt streams. Polytrichastrum alpinum forms small inconspicuous cushions in hollows, but it may merge with Andreaea gainii cushions in favourable situations (Lindsay 1971).

Crustose lichens are mainly species of Buellia, Lecanora, Lecedella, Lecidea, Placopsis and Rhizocarpon growing on rock, with species of Cladonia and Stereocaulon growing on mosses, particularly Andreaea (Lindsay 1971). On the south coast moss carpets are commonly colonised by epiphytic lichens, such as Leptogium puberulum, Peltigera rufescens, Psoroma spp., together with Coclocaulon aculeata and C. epiphorella. On sea cliffs Caloplaca and Verrucaria spp. dominate on lower surfaces exposed to salt spray up to about 5 m, with nitrophilous species, such as Caloplaca regalis, Haematomma erythromma,and Xanthoria elegans often dominant at higher altitudes where seabirds are frequently nesting. Elsewhere on dry cliff surfaces a Ramalina terebrata - crustose lichen community is common. A variety of ornithocoprophilous lichens, such as Catillaria corymbosa, Lecania brialmontii, and species of Buellia, Haematomma, Lecanora, and Physcia occur on rocks near concentrations of breeding birds, along with the foliose lichens Mastodia tessellata, Xanthoria elegans and X. candelaria which are usually dominant on dry boulders.

Antarctic hairgrass (Deschampsia antarctica) is common in several localities, mainly on the south coast, and occasionally forms closed swards (e.g. at Sealer Hill); Antarctic pearlwort (Colobanthus quitensis) is sometimes associated. Both plants are quite abundant in southern gullies with a steep north-facing slope, forming large, occasionally pure stands with thick carpets of Brachythecium and Sanionia, although they are rarely found above 50 m in altitude (Lindsay 1971). An open community of predominantly Deschampsia and Polytrichum piliferum extends for several kilometres on the sandy, dry, flat raised beaches on South Beaches. A unusual growth-form of the grass, forming isolated mounds 25 cm high and up to 2 m across, occurs on the beach near Sealer Hill. Deschampsia has been reported at only one locality on the north coast (Lair Point), where it forms small stunted tufts (Lindsay 1971).

- *Invertebrates*

The invertebrate fauna on Byers Peninsula thus far described comprises (Usher and Edwards 1986, Richard et al., 1994, Block and Stary 1996, Convey et al., 1996, Rodriguez and Rico, 2008): six Collembola (Cryptopygus antarcticus, Cryptopygus badasa, Friesea grisea, Friesea woyciechowskii, Isotoma (Folsomotoma) octooculata (=Parisotoma octooculata) and Tullbergia mixta; one mesostigmatid mite (Gamasellus racovitzai), five cryptostigmatid mites (Alaskozetes antarcticus, Edwardzetes dentifer, Globoppia loxolineata (=Oppia loxolineata), Halozetes belgicae and Magellozetes antarcticus); nine prostigmatid mites (Bakerdania antarcticus, Ereynetes macquariensis, Eupodes minutus, Eupodes parvus grahamensis, Nanorchestes berryi, Nanorchestes nivalis, Pretriophtydeus tilbrooki, Rhagidia gerlachei, Rhagidia leechi, and Stereotydeus villosus); two Dipterans (Belgica antarctica and Parochlus steinenii), and two oligochaetes (Lumbricillus healyae and Lumbricillus sp.), one copepod (Boeckella poppei), one crustacean (Branchinecta gainii) and one cladoceran (Macrothrix ciliate).

Larvae of the wingless midge Belgica antarctica occur in limited numbers in moist moss, especially carpets of Sanionia, although it is of very restricted distribution on Byers Peninsula (found especially near Cerro Negro) and may be near its northern geographical limit. The winged midge Parochlus steinenii and its larvae inhabit the margins of inland lakes and pools, notably Midge Lake and another near Usnea Plug, and are also found amongst the stones of many stream beds (Bonner and Smith 1985, Richard et al., 1994, Ellis-Evans pers. comm., 1999, Rico et al., 2013). During warm calm weather, swarms of adults may be seen above lake margins.

The diversity of the arthropod community described at Byers Peninsula is greater than at any other documented Antarctic site (Convey et al., 1996). Various studies (Usher and Edwards 1986, Richard et al., 1994, Convey et al., 1996) have demonstrated that the arthropod population composition on Byers Peninsula varies significantly with habitat over a small area. Tullbergia mixta has been observed in relatively large numbers; it appears to be limited in Antarctic distribution to the South

Shetland Islands (Usher and Edwards 1986). Locally, the greatest diversity is likely to be observed in communities dominated by moss cushions such as Andreaea spp. (Usher and Edwards 1986). Further sampling is required to establish populations and diversities with greater reliability. While further sampling at other sites may yet reveal the communities described at Byers Peninsula to be typical of similar habitats in the region, available data on the microfauna confirm the biological importance of the Area.

- *Microorganisms*

An analysis of soil samples collected from Byers Peninsula yielded several nematophagous fungi: in soil colonised by Deschampsia were found Acrostalagmus goniodes, A. obovatus, Cephalosporium balanoides and Dactylaria gracilis, while in Colobanthus-dominated soil was found Cephalosporium balanoides and Dactylella gephyropaga (Gray and Smith 1984). The basidiomycete Omphalina antarctica is often abundant on moist stands of the moss Sanionia uncinata (Bonner and Smith 1985). Thirty seven nematode taxa have been recorded, with samples showing great variation in richness and abundance making Byers Peninsula a nematode biodiversity hotspot (Nielsen et al., 2011).

Some of the water bodies have high microbial biodiversity (Velazquez et al., 2010; Villaescusa et al., 2010) including the largest viral genetic diversity found in Antarctic lakes (López-Bueno et al., 2009)

- *Breeding birds*

The avifauna of Byers Peninsula is diverse, although breeding colonies are generally not large. Two species of penguin, the chinstrap (Pygoscelis antarctica) and the gentoo (P. papua), breed in the Area.

Adélie penguins (P. adeliae) have not been observed to breed on Byers Peninsula or its offshore islets. In the South Shetlands Islands, Adélie penguins only breeds on King George Island where the populations are declining (Carlini et al. 2009).

The principal chinstrap penguin colony is at Devils Point, where a rough estimate of about 3000 pairs was made in 1987; a more accurate count made in 1965 indicated about 5300 pairs in four discrete colonies, of which almost 95% were nesting on Demon Island, 100 m to the south of Devils Point (Croxall and Kirkwood 1979; Woehler 1993). Two colonies of about 25 chinstrap penguin pairs surrounded by a colony of gentoo penguins can be found on the President Beaches close to Devils Point (Barbosa et al., 2013). Small chinstrap penguin colonies have been reported on the northern coast, e.g. on Robbery Beaches (50 pairs in 1958; Woehler 1993), but no breeding pairs were reported there in a 1987 survey. In other locations, Lair Point contained 156 pairs in 1966, declining to 25 pairs in 1987 (Woehler 1993). In a recent visit to the area (January 2009) 20 pairs were counted (Barbosa pers.com).

Gentoo penguins breed at several colonies on Devils Point, with approximately 750 pairs recorded in 1965 (Croxall and Kirkwood 1979, Woehler 1993). Currently three colonies of about 3000 pairs in total can be found (Barbosa pers.com). On the northern coast, a rookery of three colonies with 900 pairs in total is located in Robbery Beaches (Woehler 1993). In a visit to Lair Point in January 2009, about 1200 pairs were counted. Woehler (1993) gives no data on gentoo penguins at this location.

Recent estimations of population size for some species of flying birds were obtained from a survey conducted in December 2008 and January 2009 (Gil-Delgado et al., 2010). The Antarctic tern (Sterna vittata) population was estimated at 1873 breeding pairs. Two hundred and thirty eight pairs of southern giant petrels (Macronectes giganticus) and 15 pairs of brown skua (Catharacta lonnbergi) nest locally. A detailed survey of other breeding birds was conducted in 1965 (White 1965). The most populous breeding species recorded then, with approximately 1760 pairs, was the Antarctic tern (Sterna vittata), followed by 1315 pairs of Wilson's storm petrels (Oceanites oceanicus), approximately 570 pairs of cape petrels (Daption capense), 449 pairs of kelp gulls (Larus dominicanus), 216 pairs of southern giant petrels, 95 pairs of black-bellied storm petrels (Fregetta tropica), 47 pairs of blue-eyed cormorants (Phalacrocorax atriceps) (including those on nearshore islets), 39 pairs of brown skuas, and 3 pairs of sheathbills (Chionis alba). In addition, prions (Pachytilla sp.) and snow petrels (Pagodroma nivea) have been seen on the peninsula but their breeding presence has not been confirmed. The census of burrowing and scree-nesting birds is considered an underestimate (White pers. comm. 1999). The majority of the birds nest in close proximity to the coast, principally in the west and south.

Recently some vagrant waders, probably white-rumped sandpipers (Calidris fuscicollis) have been seen frequently foraging in some streams in the southern beaches (Quesada pers. comm. 2009).

- *Breeding mammals*

Large groups of southern elephant seals (Mirounga leonina) breed on the Byers Peninsula coast, with a total of over 2500 individuals reported on South Beaches (Torres et al., 1981), which is one of the largest populations of this species recorded in the South Shetland Islands. A estimation made in 2008-2009 showed a population ranging from 4700 to 6300 individuals (Gil-Delgado et al., 2013). Large numbers haul out in wallows and along beaches in summer. Weddell (Leptonychotes weddellii), crabeater (Lobodon carcinophagous) and leopard (Hydrurga leptonyx) seals may be seen around the shorelines. Antarctic fur seals (Arctocephalus gazella) were once very abundant on Byers Peninsula (see below), but have not substantially recolonised the Area in high numbers in spite of the recent rapid population expansion in other parts of the maritime Antarctic.

- *Historical features*

Following discovery of the South Shetland Islands in 1819, intensive sealing at Byers Peninsula between 1820 and 1824 exterminated almost all local Antarctic fur seals and southern elephant seals, though sealing was revived periodically through the rest of the century. American and British sealers built dry-stone refuges and occupied caves around the shores of the Byers Peninsula, which constitute the greatest concentration of early 19th Century sealers' refuges and associated relics in the Antarctic and these are vulnerable to disturbance and/or removal. Archaeological survey and excavations over the last 30 years have documented these sites and provided a rich history of the lives and activities of the sealers (Stehberg 2003; Zarankin and Senatore 2005, 2007; Lewis-Smith and Simpson 1987).

Sealers' camps consist of stone enclosures shown to have been used for habitation, and other structures of various shapes the functions of which remain unknown. In all cases, structures were built with local stone with whale ribs and jaw bones used as roof supports for canvas or seal skin roofing. The shelters were built against rock outcrops or within caves to provide shelter from the weather. Whale vertebrae commonly served as seating. The use of foreign materials was restricted to old sails (in the case of roofs) and wood (in the case of some roof beams). Some wood pieces show working or copper mails, indicating their being obtained from the remains of wrecked ships or boats. The number, shape, and size of the structures varied. Most sites had only one or two enclosures, but others included multiple structures. Buildings were square, rectangular, or round. In general, none of these structures exceeded 15 square meters; walls were approximately 1.2 meters high. Material remains found in the camps were primarily made of wood and bone, with some textile, metal, ceramic, and glass objects. The distribution of artefacts makes it possible to distinguish cooking, sleeping and work areas within the shelters, and work functions in some of the annexes.

In the shelters lived in by the sealers, material remains include iron pots, stoneware jugs, and wine/spirit bottles, suggesting the shared consumption of food in which the members of a gang ate or drank from the same containers. Faunal assemblages provide information on sealers' diet. In general, food was obtained from local resources—mainly from the seals and elephant seals the men had to kill to get oil and skins. Only a small proportion of the remains corresponded to foreign resources brought from the vessels—for instance, salted meat and pork (Muñoz 2000; Cruz 2016, 2018).

Clothing remains—including textiles and leather shoes—are also found in the shelters. Some of these articles showed signs of intense repair and recycling, such as stitched rips and patches. Sealers' clothes were not fit for the purpose of their work and the life in the severe environment of the South Shetland Islands. However, people did the best they could to retain these articles in use (Salerno 2007, 2011; Radicchi 2015). Evidence of leisure activities, including clay pipes and gaming pieces and boards (made of salvaged wood and leather), and carved whale and seal teeth, suggest pastimes during rest periods, bad weather, and when seals were not available.

Table 1 provides the location and description of the known sealing sites, to enable researchers to identify them and avoid their disturbance.

Table 1. Sealing sites on the Byers Peninsula

Unofficial name	Coordinates	Description
Lima Lima 1 Cave	62° 36' 55.62"S 61° 02' 13.08"W	Cave at the base of a small rocky hill, fronting the sea. Northern Beaches. Cave 3.5 m high, 22 m deep, and 6 m wide. Excavated in 1994-95 (Zarankin & Senatore 2007: 90-91, 124-129, 174-175, Muñoz 2000), and again in 2018-19 by Andres Zarankin.
Lair Point 1	62° 36' 54.78"S 61° 02' 06.3"W	Stone hut and annex built against a rock stack. Northern Beaches (Zarankin & Senatore, 2007: 93).
Robbery Beach 1	62° 37' 19.02"S 61° 01' 56.58"W	Stone structure between rock stacks. Northern Beaches. (Zarankin & Senatore, 2007: 91-92).
Cutler 1	62° 37' 38.34"S 60° 59' 54.18"W	Stone shelter against a rock stack, Northern Beaches. Dug by British naturalists in the 1950-80s period (Lewis-Smith & Simpson 1987: 61-65) (Zarankin & Senatore, 2007: 94-94).
Cutler 2	62° 37' 38.34"S 60° 59' 54.18"W	Stone structure against a rock stack. Northern Beaches (Zarankin & Senatore, 2007: 96).
Cutler 1 Tryworks	63° 37' 36.24S, 60° 59' 56.4"W	Two concreted oil and stone circles c. 43 cm internal, 75 cm external diameter, 1.8m apart, bases for try pots. Flat area 1.3 m sq, 6 m west of pot sites, possible work area. On beach berm at western end of beach 100 m NE of Cutler 1 shelter site. Located 2017.
Negro Hill 1- 4	62° 39' 43.08"S 61° 00' 11.82"W	Four stone-walled structures against a rock stack, Southern Beaches. excavated in 1999. It had been occupied at two different times during the 19th century, the only multiple-occupation as yet documented (Zarankin & Senatore, 2007: 68-70).
South Beaches 1	62° 39' 40.02"S 60° 58' 34.56"W	Stone wall linking a low rock ridge adjacent to a beach lagoon, Southern Beaches. Excavated between 1995 and 1997 (Zarankin & Senatore, 2007: 66-67)
South Beaches (new)	62° 39' 41.52"S, 61° 04' 11.34"W	Rectangular stone structure, 2.3-3 m long and 2 m wide, on the back of the front beach berm, 40 m from shore, half-way between Negro Hill and Sealers Hill. Located 2014.

Stackpole 1	62° 39' 54.42"S 60° 57' 10.26"W	A low line of stones on open beach 60m from Stackpole Stack, Eastern end of Southern Beaches (Zarankin & Senatore, 2007: 63-64).
Stackpole 2	62° 39' 55.86"S 60° 56' 31.74"W	Stones and whale bones on open beach terrace, Eastern end of Southern Beaches. Interpreted by Pearson (2018) as boat camp site. (Zarankin & Senatore, 2007: 65-66).
Point X-1	62° 40' 16.62"S 60° 55' 44.88"W	Three stone walls against a rock stack in beach boulders close to the sea and a lagoon separating it from other Punta X sites. Eastern end of Southern Beaches. Excavated 2012 (Zarankin & Senatore, 2007: 59).
Point X-2	62° 40' 15.00"S 60° 55' 27.54"W	Stone walled structure with whale jaw against a big sea stack . Eastern end of Southern Beaches. Excavated 2012 (Zarankin & Senatore, 2007: 60-61).
Point X-3	62° 40' 16.32"S 60° 55' 25.02"W	Stone walled structure with whale ribs against a rock stack. Eastern end of Southern beaches. Excavated 2012 (Zarankin & Senatore, 2007: 62-63).
Victor Rocks 1	62° 40' 29.04"S 61° 05' 42"W	Three stone walls 2.1 x 1.8 m against a very large rock stack. Whale ribs and vertebra seats. Western end of Southern Beaches (Zarankin & Senatore, 2007: 71- 72). Recorded by biologist Martin White 1965/66.
Victor Rocks 2	62° 40' 29.46"S 61° 05' 48.3W	Large stone structure of 5.4 x 2.4 m with an annex of 2.1 x 1.5 m. Walls to 1.3 m high. Among rock stacks. Western end of Southern Beaches (Zarankin & Senatore, 2007: 72-73) Recorded by biologist Martin White 1965/66.
Victor Rocks 3	62° 40' 29.28"S 61° 06' 2.58"W	2.5 m long double line of stones with whale skull bone at the end. Western end of Southern beaches (Zarankin & Senatore, 2007: 74). Interpreted by Pearson (2018) as possible boat campsite.
Sealer Cave 1	62° 40' 26.94"S 61° 06' 47.58"W	Stone-walled structure and an annex against a rock stack. Western end of Southern beaches. Excavated by Zarankin 2017 (Zarankin & Senatore, 2007: 75-76).
Sealer Cave 2	62° 40' 21.42"S 61° 06' 52.08"W	A structure made up of a series of curved walls of stone forming a roughly circular space. Between two rock stacks (Zarankin & Senatore, 2007: 76-77).

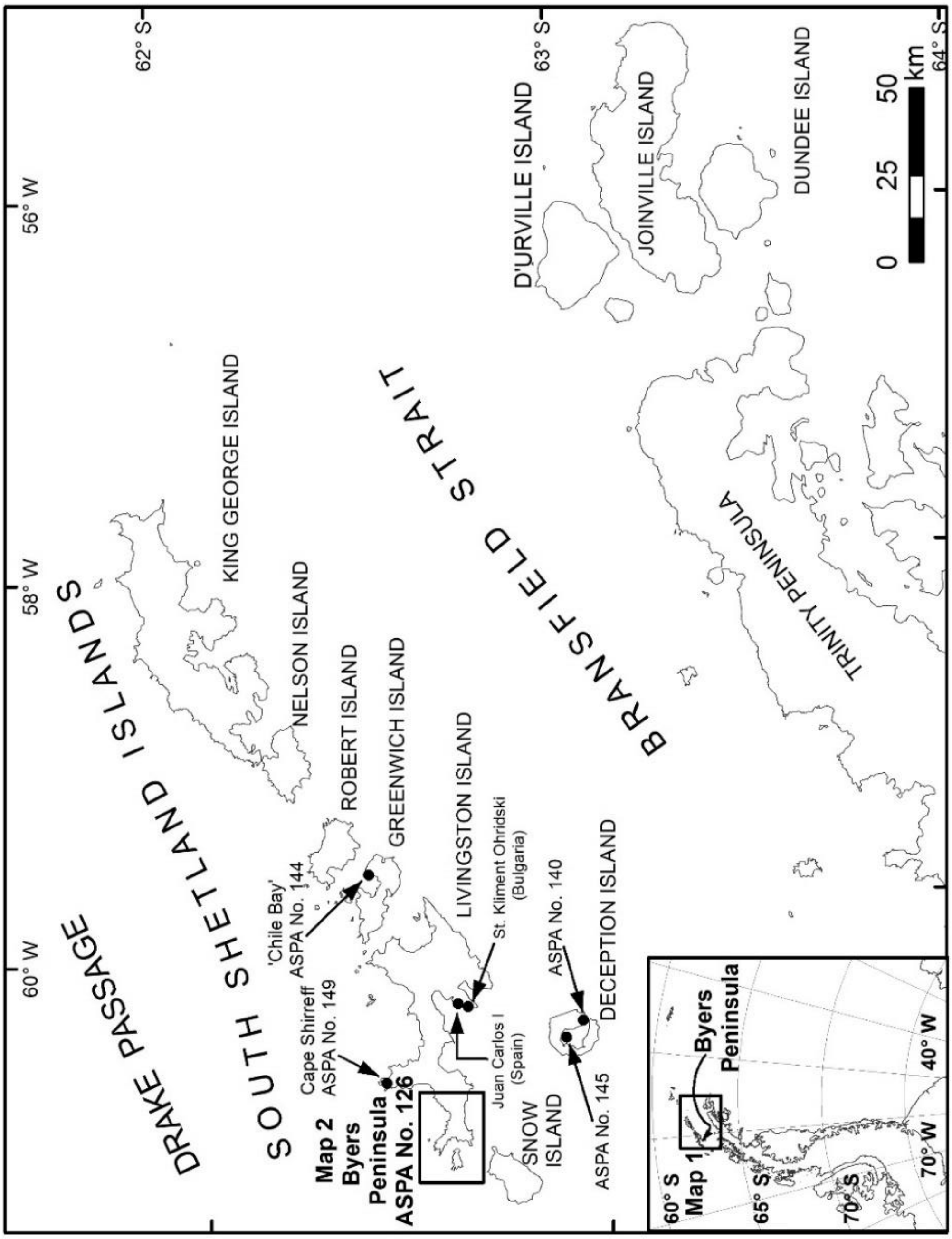
Sealer Cave 3	62° 40' 23.08"S 61° 06' 12.02"W	Stone-walled structure and an annex containing a whale jaw bone. On small 3 m high outcrops east of Sealers Hill on Western end of Southern Beaches. Excavated 1995, 2010 (Zarankin & Senatore, 2007: 78-79; Zarankin et al., 2011: 20-25; Moreno, 2000; Villagran & Schaefer, 2011).
Sealer Cave 4	62° 40' 20.4"S 61° 06' 17.16"W	Two stone-walled enclosures, one on each side of an isolated low rock outcrop. Western end of Southern beaches. Excavated 2010. (Zarankin & Senatore, 2007: 79-80; (Villagran & Schaefer, 2011).
Sealer Cave	62° 40' 27.52"S 61° 06' 47.10"W	Lewis Smith and Simpson reported cave in the 1950s with a stone wall across the rear of the cave, with timbers and seal bones on the floor. Not now visible. Western end of Southern beaches. (Lewis-Smith & Simpson 1987: 60; Zarankin & Senatore, 2007: 80-81).
Long Rocks	62° 40' 26"S 61° 08' 32.4"W	An area of 1.2 x 3 m with a high density of artefacts (leather shoes, fragments of wood, glass), between rock stack and parallel rock outcrop. (Zarankin & Senatore, 2007: 82-83).
Devil Point 1	62° 40' 18.66"S 61° 10' 42"W	Stone wall hut contains whale jaw bone suggesting roof support. Against sloping rock outcrop. Devils Point (Zarankin & Senatore, 2007: 81-82).
Devil Point 2	62° 39' 49.08"S 61° 09' 32.7"W	Located at the northern edge of a penguin rookery on the slope of a hill sheltered by a vertical stack. Devils Point. Reported in the 1950s, recorded by biologist Martin White 1965/66 as: 'Small hut 8' x 7' hut constructed on sledge runners and planking; charcoal & clinker from a cast iron stove; oil soaked into floor material'. In 2007 only the remains of a sledge were located and excavated, with no other evidence of occupation (Zarankin & Senatore, 2007: 84-85; Pearson et al., 2008; Stehberg et al., 2009).
Punta Varadero	62° 36' 29.8"S 61° 04' 51.84"W	Three stone walls enclosing an area of 2.4 x 2.1 m. The hut contains four whale ribs suggesting roof supports. The annex behind contains one whale rib. Between a rock stack and 1.5 m high rocks. Northern Beaches. Exacavated 2011 (Zarankin & Senatore, 2007: 85-86).
Pencas 1	62° 36' 26.1"S 61° 06' 5.34"W	Three stone walls against rock stack, 15 m away from an elephant seal colony. West of Punta Varadero, Northern Beaches. Excavated 1995

		(Zarankin & Senatore, 2007: 87). Recorded by biologist Martin White 1965/66.
Pencas 2	62° 36’ 24.84”S 61° 06’ 14.52”W	Small rock shelter formed between two large sloping rocks. Northern Beaches. (Zarankin & Senatore, 2007: 88). Recorded by biologist Martin White 1965/66.
Pencas 3	62° 36’ 10.62”S 61° 06’ 20.34”W	Straight stone walls enclose a roughly square space. It contains whale vertebra “seats”. 6 x 4 m. Placed on an open stone terrace on a small peninsula. East of a large berm-enclosed lake. Northern Beaches. Excavated 2012 (Zarankin & Senatore, 2007: 89).

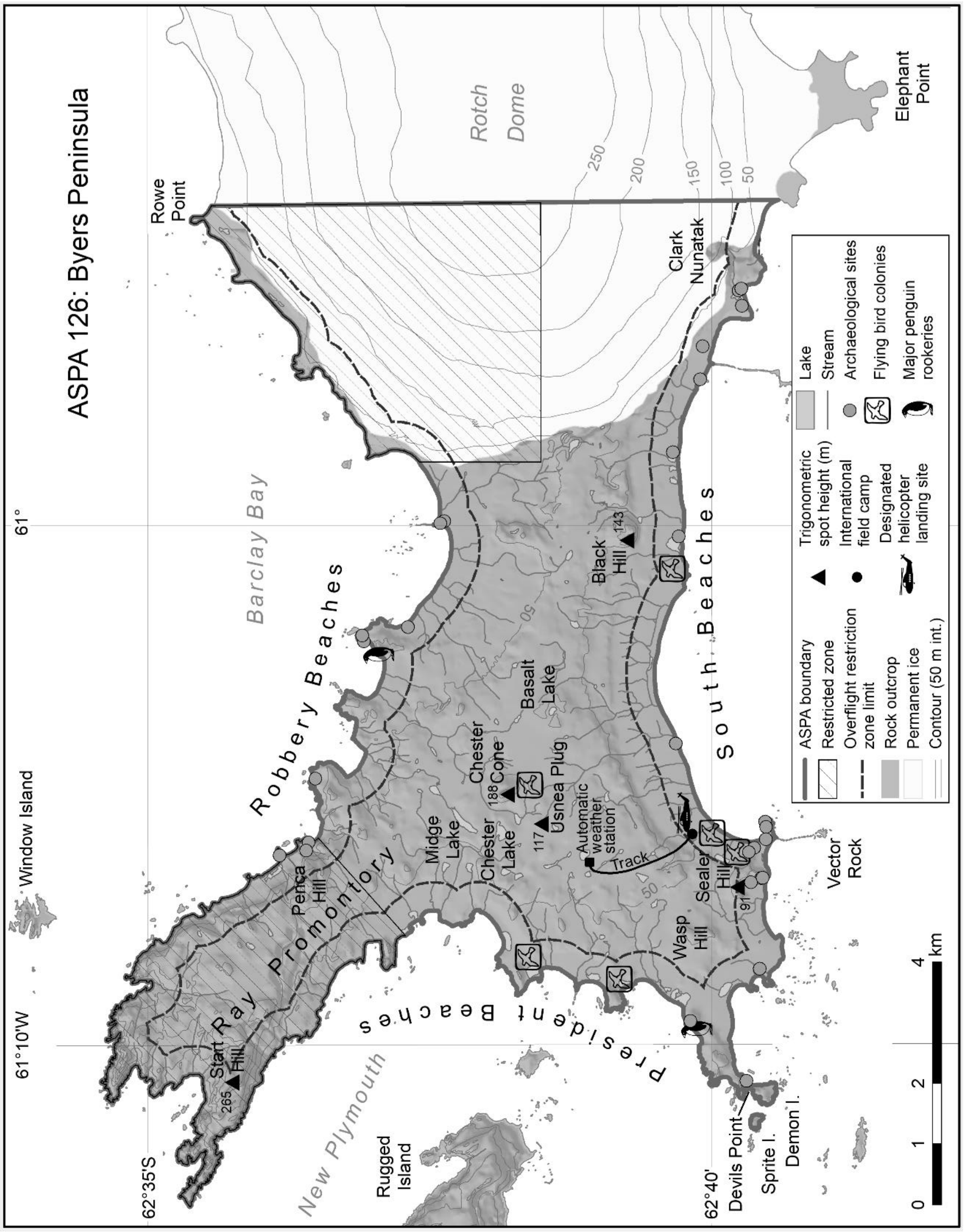
- *Human activities/impacts*

The modern era of human activity at Byers Peninsula has been largely confined to science. The impacts of these activities have not been fully described, but are believed to be minor and limited to items such as campsites, trampling (Tejedo et al., 2012; Pertierra et al., 2013a), markers of various kinds, sea-borne litter washed onto beaches (e.g., from fishing vessels) and from human wastes and scientific sampling. More recently the impacts of the field activities originating from the International Field Camp (62°39'49.7" S, 61°05'59.8" W) between 2001-2010 were quantified (Pertierra et al., 2013b). Several wooden stake markers and a plastic fishing float were observed in the southwest of the Area in a brief visit made in February 2001 (Harris 2001). In summer 2009-2010, a beach litter survey was undertaken (L. R. Pertierra pers. comm. 2011). The highest proportion of litter on beaches (averaged over beach length) was found in Robbery Beach (64%) followed by President Beach (28%) and beaches to the southwest of the Area (8%). This is likely to be related to their exposure to the Drake Passage (Torres and Jorquera, 1994). The majority of the litter found on the three beaches was wood (78% by number of items) and plastic (19%) whereas metal, glass and cloth were found more rarely (less than 1%). Several pieces of timber were found, some of them quite large (several meters in length). The plastic items were highly diverse, with bottles, ropes and tape the most numerous items. Floats and glass bottles were also found on the beaches. Further research to quantify beach plastic was undertaken by Almela and Gonzalez (2020) while González-Pleiter et al. (2020) reported finding microplastics in a stream at the Southern Beach.

Map 1. Byers Peninsula, ASPA No. 126, Livingston Island, South Shetland Islands, location map. Insert: location of Byers Peninsula on the Antarctic Peninsula.



Map 2. ASPA 126: Byers Peninsula topographic map.



Measure 11 (2022)

Antarctic Specially Protected Area No 127 (Haswell 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 Haswell Island as Site of Special Scientific Interest (“SSSI”) No 7 and annexed a Management Plan for the Site;
- Recommendations X-6 (1979), XII-5 (1983), XIII-7 (1985), XVI-7 (1987) and Measure 3 (2001), which extended the expiry date of SSSI 7;
- Decision 1 (2002), which renamed and renumbered SSSI 7 as ASPA 127;
- Measure 4 (2005), which extended the expiry date of the Management Plan for ASPA 127;
- Measures 1 (2006), 5 (2011) and 5 (2016), which adopted a revised Management Plan for ASPA 127;

Recalling that Recommendations VIII-4 (1975), X-6 (1979), XII-5 (1983), XIII-7 (1985) and XVI-7 (1987) 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 127;

Desiring to replace the existing Management Plan for ASPA 127 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 127 (Haswell Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 127 annexed to Measure 5 (2016) be revoked.

Management Plan for Antarctic Specially Protected Area No. 127

"HASWELL ISLAND" (HASWELL ISLAND AND THE ADJACENT FAST ICE FIELD WITH A COLONY OF EMPEROR PENGUINS)

Introduction

Haswell Island was discovered in 1912 by the Australian Antarctic expedition of D. Mawson. It was named in honour of the biologist, Professor W.A. Haswell, who assisted the expedition. This is the largest island of the homonymic group of islands forming an archipelago with the height of up to 93 meters and the area of 0.82 square kilometres, which is located 2.5km from the Russian station Mirny operating since 1956.

The Area includes Haswell Island, its intertidal zone, and the adjacent section of the fast ice, if available. It was originally proposed by the Soviet Union as Site of Special Scientific Interest (SSSI) No 7. Adopted at the VIII ATCM (Oslo, 1975) based on Recommendation VIII-4. Renamed ASPA No. 127 based on Decision 1 (2002). ASPA (Area) Management Plan was revised based on Measure 1 (2006), Measure 5 (2011), and Measure 5 (2016).

1. Description of values in need of protection

The Area was described by biologists of the first Soviet Antarctic expeditions, was studied in detail in the 1970s, and continues to be studied today.

To the east and south-east of Haswell Island there is a large colony of emperor penguins Aptenodytes forsteri residing on the fast ice. Haswell Island itself is a unique breeding site for almost all species of poultry breeding in East Antarctica (the Antarctic petrel Talassoica antarctica, the Southern fulmar Fulmarus glacioloides, the pintado petrel Daption capense, the snow petrel Pagodroma nivea, the Wilson's petrel Oceanites oceanicus, the south polar skua Catharacta maccormicki, the Lonnberg's skua Catharacta antarctica lonnbergi, and the Adelie penguin Pygoscelis adeliae).

Five species of pinnipeds occur in the Area, including the protected Ross seal Ommatophoca rossii.

The proximity of the oldest Russian research wintering station Mirny is of interest for comparative analysis and monitoring of the long-term impact of the station's activity on the environment.

A general view of the location of the Haswell Islands (excluding Vkhodnoy Island), Mirny station and logistical activity sites is shown on Map 1.

The boundaries of ASPA No. 127 cover Haswell Island (66°31'S, 93°00'E) of 0.82 sq km and an adjacent area of fast ice (if any) of the Davis Sea of about 5 sq km, the location of the emperor penguin colony (see Map 2). It is one of the few emperor penguin colonies that is close to the research station, which offers an advantage for studying the species and its habitat.

2. Aims and Objectives

The main focus of ASPA surveys is to gain a better understanding of how natural and anthropic environmental changes affect the state and dynamics of populations and how such changes affect the interaction of key species in the Antarctic ecosystem.

Management of the Area has the following aims:

- To prevent direct impacts to the Area during logistical operations;
- To establish regulated human access to the Area;
- To prevent changes in the structure and abundance of local populations, in the composition of flora and fauna as a result of anthropogenic activity;
- To create conditions for scientific research of urgent scientific nature that cannot be carried out elsewhere;
- To promote scientific research in the field of ecology in connection with monitoring populations and assessing the impact of human activity on them;
- To contribute to the improvement of knowledge about the Antarctic environment and its protection.

3. Management Measures

The following actions should be taken to protect the values of the Area:

- When approaching to Mirny station by ship and upon arrival at the station, everyone arriving at the station should be informed of the presence and location of the ASPA and the existing provisions of this Management Plan.
- Copies of the Management Plan and the terrain map showing the location of the Area should be kept in all units performing logistical and scientific operations in the Haswell Archipelago area.
- In order to avoid unintentional entry into the Area after the formation of fast ice, which is safe for walking on and movement of vehicles, at the point of intersection of the directions Goreva Island – Fulmar Island and Mabus Point – eastern tip of Haswell Island a signpost shall be installed indicating the directions of the protected area fringes and a marking of restricted access ("No Entry! Antarctic Specially Protected Area").
- Information signposts shall be installed at the point of descent from Mabus Point and at station activity areas in close proximity to the Area.
- Mark signs and signposts installed at the Area shall be durable, maintained in good condition, and shall have no impact on the environment.

- Aerial flights over the Area may be conducted only under the conditions set forth in Section 7. Terms and conditions of Permit Issue.

This Plan is periodically reviewed in order to properly monitor the process of protecting the values of this Antarctic Specially Protected Area. Any activity in the area must be preceded by an environmental impact assessment.

4. The term for the Area designation as the ASPA

The designation is for an indefinite period.

5. Maps

Map 1. General view of the location of the Haswell Archipelago islands, Mirny station, and logistical activity sites.

Map 2. Boundaries of the Antarctic Specially Protected Area No. 127 Opistobranch gastropods "Haswell Island".

Map 3. Location of nesting colonies of sea birds.

Map 4. Haswell Island. Topography.

6. Description of the Area and fringe determination

6(i) Geographic coordinates, special fringe markers, and natural features

The Area covers a field within the ABFEDC polygon (the coordinates are 66°31'10"S, 92° 59'20"E; 66°31'10"S, 93°03'E; 66°32'30"S, 93°03'E; 66°32'30"S, 93°01'E; 66°31'45"S, 93°01'E; 66°31'45"S, 92°59'20"E) (Map 2). The designated fast ice field of the Davis Sea provides coverage of the most likely movements of emperor penguins during their annual breeding season.

- *Topography*

Approximately (on the spot), the nearest to the station fringes of the Area on fast ice can be determined visually as directions: EF (Vkhodnoy Island – Fulmar Island) ED (Mabus Point – eastern tip of Haswell Island). A signpost shall be installed at point E indicating the directions of the protected area boundaries and a marking of restricted access ("No Entry! Antarctic Specially Protected Area"). Information signposts indicating the distance to the Area fringe shall be installed in all places of the station activities, in the immediate vicinity of the Area (at the point of descent from Mabus Point, on Buromsky, Zykov, Fulmar, and Tokarev Islands).

It is virtually impossible to violate the distant seaward fringes of the Area, due to the current absence of any station activity there. They have no visual indications and are determined by map.

There are no trails or roads in the Area.

- *Ice conditions*

The Area includes Haswell Island (the largest of the Haswell Archipelago islands), its intertidal zone, and the adjacent section of the fast ice of the Davis Sea. To the south of the ASPA on the coastal nunataks of the Mirny Peninsula, a Russian observatory (now station) Mirny has been operating since 1956.

For most of the year, the marine part of the Area is covered with fast ice, the width of which reaches 30-40 km by the end of winter. The breakup of the fast ice occurs from 17 December to 9 March, with the average date of 3 February, and the establishment of the fast ice takes place from 18 March to 5 May, with the average date of 6 April. The duration of the ice-free period at the roadstead of Mirny station lasting more than one month is 85%, more than two months – 45% and more than three months – 25%. There are always a lot of icebergs in the Area. In summer, when the sea is free of fast ice, they drift along the coast in the western direction. The seawater is characterised by constant negative temperatures. Tides have an irregular diurnal character.

- *Analysis of ecological domains*

According to the Antarctic Ecological Domain Analysis (Resolution 3 (2008)), Haswell Island belongs to Natural Environment L "Continental Coast Glacial Sheet".

- *Biological features*

Benthic fauna of coastal waters is rather rich. Amongst the fish species in the area the most characteristic are various species of Trematomus, whilst the Antarctic toothfish Dissostichus mawsoni and the Antarctic silverfish Pleuragramma antarcticum are less common. An abundant food base and suitable nesting places create favourable conditions for the existence of numerous sea bird populations. A total of 14 bird species were recorded in the vicinity of Mirny station (Table 1).
Typical representatives of the coastal fauna are pinnipeds. The most common is the Weddell seal Leptonychotes weddelli, whilst other Antarctic seal species are found in single specimens. Common minke whales Balaenoptera acutorostrata and the killer whale Orcinus orca often approach the coast in the vicinity of Mirny station.

Table 1. Listing of the avifauna of the Haswell Archipelago (ASPA No 127).

1	Emperor penguin Aptenodytes forsteri	B, H
2	Adelie penguin Pygoscelis adeliae	B, H
3	Chinstrap penguin Pygoscelis antarctica	M
4	Macaroni penguin Eudyptes chrysolophus	M
5	Southern fulmar Fulmarus glacioloides	B

6	Antarctic petrel Thalassoica antarctica	B
7	Pitado petrel Daption capense	B
8	Snow petrel Pagodroma nivea	B
9	Southern giant petrel Macronectes giganteus	M
10	Wilson's storm petrel Oceanites oceanicus	B
11	Pomarine skua Stercorarius pomarinus	M
12	South polar skua Catharacta maccormicki	B
13	Lonnberg’s skua Catharacta Antarctica lonnbergii	B
14	Kelp gull Larus dominicanus	M

Legend: B – a breeding species; H – there are moulting sites near the station; M – a migrant species.

At present, sea birds nest on ten of the seventeen islands of the Haswell Archipelago. Seven species nest directly on the islands, and one of them, the emperor penguin Aptenodytes forsteri, breeds on the fast ice. In addition, several species of poultry were occasionally recorded in the study area. In general, the core of the avifauna of the area remains unchanged during the last 60 years and is characterised by the composition of species that is typical for the coastal regions of East Antarctica.

Addition of migrant species to the avifauna list of the Haswell Archipelago testifies to intensification of ornithological sightings. At the same time, the southern giant petrel observed for the first time in 2006 apparently acquires the status of a rare but regularly migrating species, and the traced introduction of the Lonnberg's skua and its recorded breeding on the archipelago most probably indicate a natural expansion of its breeding ground.

Since 2012, cases of nesting of hybrid pairs of Antarctic skuas Catharacta antarctica and South Polar skuas Catharacta maccormicki has been observed on Haswell Island.

- *Emperor penguin (Aptenodytes forsteri)*

The colony of emperor penguins of the Haswell Archipelago resides on fast ice of the Davis Sea 2-3km north east of Mirny station and usually within 1km of Haswell Island. The colony was discovered and described by the Western party of the Australian Antarctic Expedition on 25 November 1912, but its detailed survey was started only after the establishment of Mirny Observatory. Since the establishment of the observatory in 1956, the nesting population has been monitored there on an irregular basis. The first year-round sightings of this colony were carried out in 1956 by E.S. Korotkevich (1958) and continued until 1962 (Makushok, 1959; Korotkevich, 1960; Pryor, 1968); later they were resumed by V.M. Kamenev in the late 1960s and early 1970s (Kamenev, 1977). After a long break, ornithological sightings at the observatory were continued in 1999 – 2015 (Gavrilo and Mizin, 2007, Gavrilo and Mizin, 2011, Neelov et al. 2007, unpublished RAE reports).

The timing of the phenological events onset in the colony of emperor penguins of the Haswell Archipelago area is presented in Table 2.

Table 2. Dates of the phenological events onset in the colony of emperor penguins of the Haswell Island area.

Coming to the colony	Last ten days of March
Mating peak	End of April – first ten days of May
Beginning of egg laying	The first five days of May
Start of chick hatching	5-15 July
Beginning of exiting of chicks from hatching bags	The last ten days of August
Beginning of nursery formation	The first ten days of September
Start of chick moulting	End of October – beginning of November
Start of adult moulting	The last ten days of November – the first five days of December
Start of colony collapse	The last ten days of November – mid-December
Poultry leaves the colony	The last five days of December – the first ten days of January

According to estimates and counts obtained in the period from 1956 to 1966, the total number of emperor penguins in the colony ranged from about 14,000 to 20,000 individuals (Korotkevich, 1958, Makushok, 1959, Pryor, 1964, Kamenev, 1977).

In the 1970s and 1980s, the numbers had declined by about a third, but began to gradually recover in the 2000s.

Counts of the 2010/2011 season made in the period of maximum concentration of adult poultry during egg laying revealed that their numbers in the colony reached nearly 13,000 individuals, and the 2015 nestling counts admitted that the number of adult emperor penguins in the colony could exceed 14,000 individuals (RAE, unpublished data).

The total count of the colony in June 2020 was about 6,000 incubating males.

A comparative analysis of the population dynamics of emperor penguins in the colonies of Haswell Island and Géologie archipelago (Pointe-Géologie Archipelago, Terre Adelie, ASPA 120) located in the same region (80°E - 140°E) of Dumont d'Urville Station had revealed their similarity during the last 50 years (Barbraud et al., 2011). Until the early 1970s, the penguin population was almost stable in the colony at the Géologie Archipelago and might have decreased a little in the Haswell Island area. During the regime climate shear of the 1970s–1980s, the annual population growth rate dropped markedly and colony numbers declined. The amplitude of the decline was also similar, and the numbers of breeding pairs correlated. All of this may suggest that the cause was a general large-scale ecosystem perturbations associated with the regime shear traced across the Southern Ocean.

Clearly, the same strong negative factor impacted both populations. Such a factor was probably the ice cover, with the state of which the ecology of emperor penguins is strongly related. In particular, reduced ice cover extent and earlier breakup of fast ice had a negative effect on poultry survival and food availability, as well as on breeding bird numbers, as has been shown previously (Barbraud, Weimerskirch, 2001, Jenouvrier et al., 2009). In the last twenty years, both colonies have shown positive population dynamics against the background of an increase in the area of ice coverage in the region and the later timing of fast ice breakup.

Table 3. Factors affecting the population of emperor penguins in the Area and measures to reduce their impact.

<table>
<tr><td colspan="2">Impact factors</td><td>Measures to reduce the impact of anthropic factors</td></tr>
<tr><td rowspan="3">Anthropic factors</td><td>Disturbance when visiting the colony</td><td>Strict regulation of the colony visits</td></tr>
<tr><td>Egg collection</td><td>Eggs may only be collected under a scientific survey permit issued by a national body</td></tr>
<tr><td>Disturbance when aerial work is carried out</td><td>Selection of routes and flight heights according to the regulations of the area management plan</td></tr>
<tr><td>Environmental factors</td><td colspan="2">Climate change and associated changes in food reserves. Ice conditions affect the availability of food and survival rate of adult poultry and chicks (a decrease in the area of ice cover in April-June has resulted in a decrease in population growth rate and numbers), and early breakup of fast ice has resulted in increased mortality of chicks.</td></tr>
</table>

Data on the dynamics of other species are more fragmentary: we have three more or less complete counts for comparison, with considerable time lag between counts (Table 4). The long-term changes in abundance for most species may show a negative trend, but regular monitoring studies need to be continued to make valid conclusions.

Table 4. Poultry population dynamics on the islands of the Haswell Archipelago (long-term trend: 1 – positive; 0 – not expressed, -1 – negative, ? – supposed trend)

Species	1960s–1970s, number of adults	1999/2001	2009/10, number of adults	2020/2021, number of adults	2020/ 2021, number of adults
Adelie penguin	41-44.5 thousand	Around 31 thousand of adult specimens	Around 27 thousand	Around 37 thousand	0
Southern fulmar	9.5-10 thousand	2300 nests with clutches	Around 5000	-	-1
Antarctic petrel	900-1050	150-200 nests with clutches	Around 500	-	-1
Pitado petrel	750	150 habitable nests with clutches	Around 300	-	-1
Snow petrel	600-700	60-75 habitable nests	No data	-	-1 ?
Wilson's storm petrel	400-500	At least 30 habitable nests	Over 80	-	-1 ?
South polar skua	48 (24 pairs)	Min. 38 (19 pairs)	170 (62 pairs)	Over 208 (104 nests)	1

The available data from the Haswell Island area suggest a long-term negative population trend in several sea bird species, both penguins and flying birds. It is possible that a common cause determining the similar population dynamics of not only emperor penguins, but also other sea bird species of the Haswell Island area are climate changes. However, there are no data on their abundance dynamics over the last 10–15 years. The exception is the South polar skua, whose population has increased approximately threefold over the entire observation period.

In order to make more informed conclusions about the factors affecting the state of the bird populations of the Haswell Island area and related mechanisms, it is necessary to continue monitoring and systematic surveys.

6(ii) Definition of seasons and controlled access zones or prohibited zones

Entry into any part of the Area shall be permitted only on the basis of a specially issued permit.

Special regulation of activities in the area is carried out during the breeding period of poultry:

- From mid-April to December in the emperor penguin colony area and
- From October to March in the Haswell Island breeding areas

Locations of breeding colonies are shown on Map 3. Particularly disturbance-sensitive emperor penguins must also be protected outside the area identified as the breeding sites, as the colony may change location.

6(iii) Buildings in the Area

On Haswell Island there is a geodetic signpost in the form of a metal mast, the buttress of which is reinforced with stones; there are no other buildings on the island.

A heated small frame hut with emergency food supplies may be placed on one of the nearby islands (excluding Haswell).

6(iv). Presence of other protected territories in the immediate vicinity of the Area

200m from the fringe of the Area there is historical site and artefact No 9 “Cemetery on Buromsky Island".

7. Conditions of Permits Issue

7(i) Conditions of authorisation

Access to the Area is possible only with a Permit issued by the national competent body. Conditions of issuing Permits to visit the Area:

- Permits can be issued only for the purposes set forth in p. 2 of the Plan.
- Permits are issued for a strictly defined period of time.
- Only activities that do not pose a risk to the ecosystems of the Area and conducted scientific activities are permitted in the Area.
- Visits to the Area may be made only on the basis of a Permit and accompanied by an authorised person, with an appropriate note in the register of visits to the Area stating the date, the purpose of the visit, and the list of visitors. The register of visits is kept by the head of Mirny station.
- The authorised person shall be appointed in accordance with national procedures.
- A report of the visit to the Area shall be submitted to the national competent body specified in the Permit at the end of the Permit validity, but at least once a year.

Permits are issued for certain scientific surveys, monitoring or inspections that do not require withdrawal of biological material or fauna specimens or require their withdrawal in small quantities. For visits and stays in the Area, a programme of work shall be prepared specifying the scope of the tasks, the period of their execution and the maximum number of personnel entitled to visit the Area.

7(ii) Access to and movement along the Area

Access to and movement within the Area by land vehicles (except snowmobiles) is prohibited.

Care must always be taken when entering and moving along the Area so as not to disturb poultry and seals, especially during the breeding season. Under no circumstances should the condition of poultry nests, seal hauling grounds or approaches to them be allowed to deteriorate.

Haswell Island. The most convenient ascent is from the west or south west side of the island (Map 4). Only walking is permitted.

The fast ice area. During the period of fast ice formation providing safe walking and movement of vehicles the entrance to the site shall be performed from the side of Mirny Observatory, in a convenient place. During the brooding period (May-July) movement of any vehicles in the Area is prohibited. It is forbidden to approach the colony of Emperor penguins closer than 500 m (regardless of its location) when riding a snowmobile.

Aviation flights over the Area are prohibited during the most vulnerable period of the emperor penguin breeding period: from 15 April to 31 August

At other times, the following restrictions are established for aircraft flights in the Area (Table 5). At that, flights directly over poultry breeding sites should always be avoided if possible.

Table 5. Minimum flight altitude over the Area, depending on the type of aircraft.

Type of aircraft	Number of engines	Minimum height above ground	
		Feet	Metres
Helicopter	1	2460	750
Helicopter	2	3300	1000
Aeroplane	1 or 2	2460	750
Aeroplane	4	3300	1000

7(iii) Activities carried out or permitted in the Area, including time or location restrictions:

- Ornithological and other environmental surveys that cannot be conducted elsewhere;
- Management activities, including monitoring;

- Educational visits to the colony of emperor penguins, except for the first half of the nesting period (from May to July).

7(iv) Installation, modification or demolition of buildings

Erection of buildings and scientific equipment is possible in the Area only to perform urgently needed scientific tasks or management measures permitted by the competent body in accordance with applicable regulations.

7(v) Location of field camps

Laying out of camps is permitted only for safety reasons, provided all precautions are taken to avoid damage to the local ecosystem and disturbance to local fauna.

7(vi) Restrictions on bringing materials and organisms into the Area

It is prohibited to bring any living organisms into the Area, as well as chemicals other than chemicals necessary for the scientific purposes specified in the Permit (the latter must be removed from the Area before the Permit expires).

Storage of fuel within the ASPA is prohibited except for important purposes related to the activity for which the Permit was issued. All materials brought into the Area must be stored within the stated period, used with minimal risk to the ecosystem, and removed from the Area at the end of the period specified in the Permit. The establishment of permanent storage facilities is prohibited.

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

Removal or harmful interference with representatives of native flora and fauna is possible only on the basis of a Permit. If the activity is determined to have less than minor or time-limited impacts, it should be conducted in accordance with SCAR's Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica, which are the minimum standard.

7(viii) Collection and removal of materials that were not brought into the Area by the Permit holder

Collection and removal of objects that have not been brought into the Area by the Permit holder is permitted only for scientific tasks or management measures listed in the Permit.

Dead or pathological specimens of fauna and flora may be withdrawn for laboratory study.

7(ix) Waste disposal

All waste shall be removed from the Area.

7(x) Measures necessary to ensure the possibility to further achieve the goals and objectives of the Management Plan

Permits to enter the Area may be issued for scientific observations, monitoring, site inspections, including the collection of a limited number of specimens of animals, eggs, and other biological objects for scientific purposes.

In order to maintain the conservation and scientific values of the Area, all possible precautions must be taken against the inadvertent introduction of foreign materials and alien organisms.

Any long-term sightings areas should be mapped and marked on the ground. A map showing the boundaries of the ASPA and a copy of the Management Plan must be provided and freely available at Mirny Station.

Visits to the Area are limited to scientific, educational, and management purposes.

7(xi) Requirements for reporting visits to the Area

For each visit to the Area, the Permit holder shall submit a report to the competent national body as soon as possible, but not later than six months after the completion of the visit. Those visit reports should contain, as appropriate, the information specified in the recommended visit report form given in Annex 2 to the Revised Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas attached to Resolution 2 (2011), which is available on the Secretariat of the Antarctic Treaty website (www.ats.aq).

If necessary, the national body is encouraged to send a copy of the visit report also to the Party that have prepared the Management Plan as a reference material for management of the Area and revision of the Management Plan.

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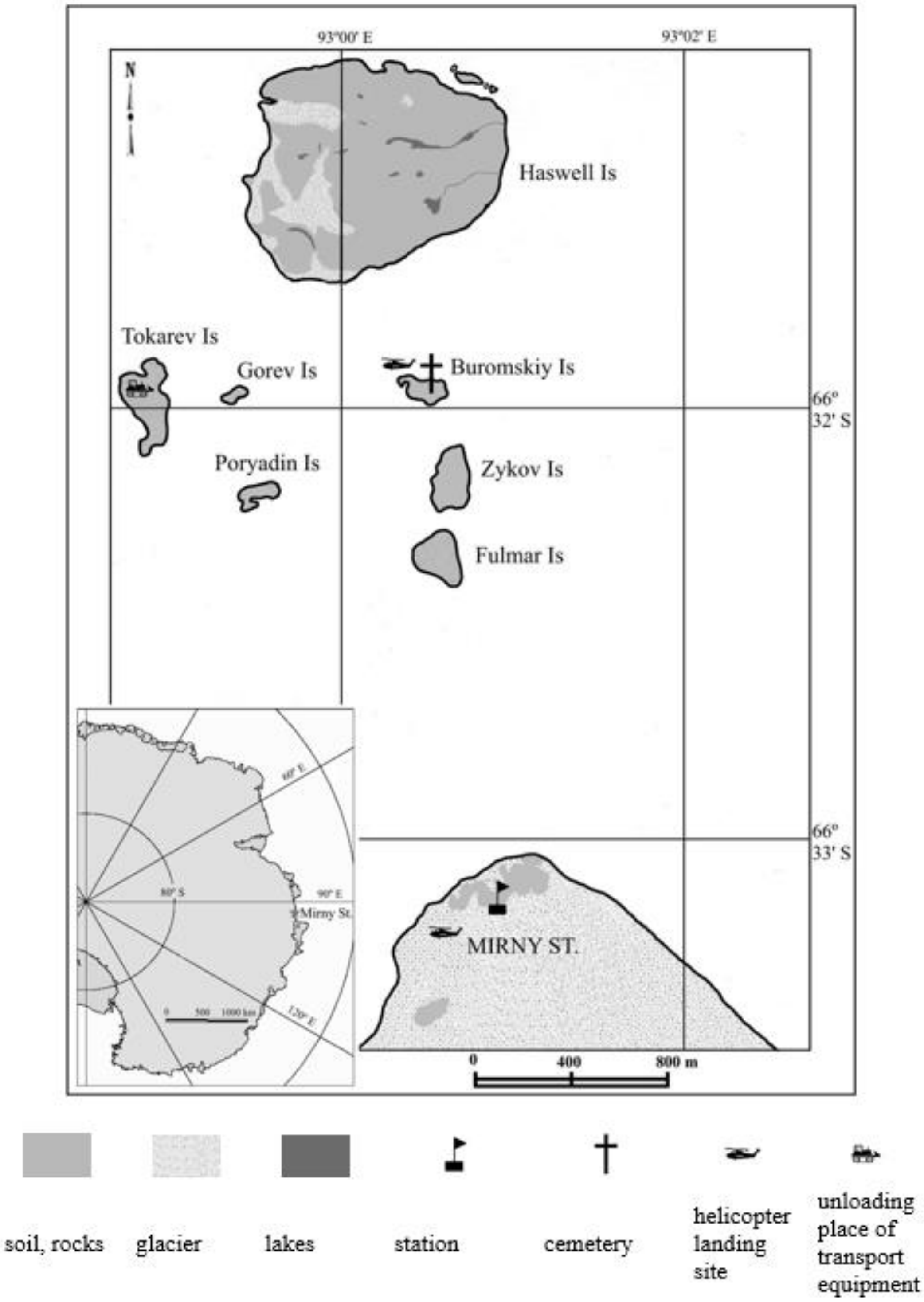
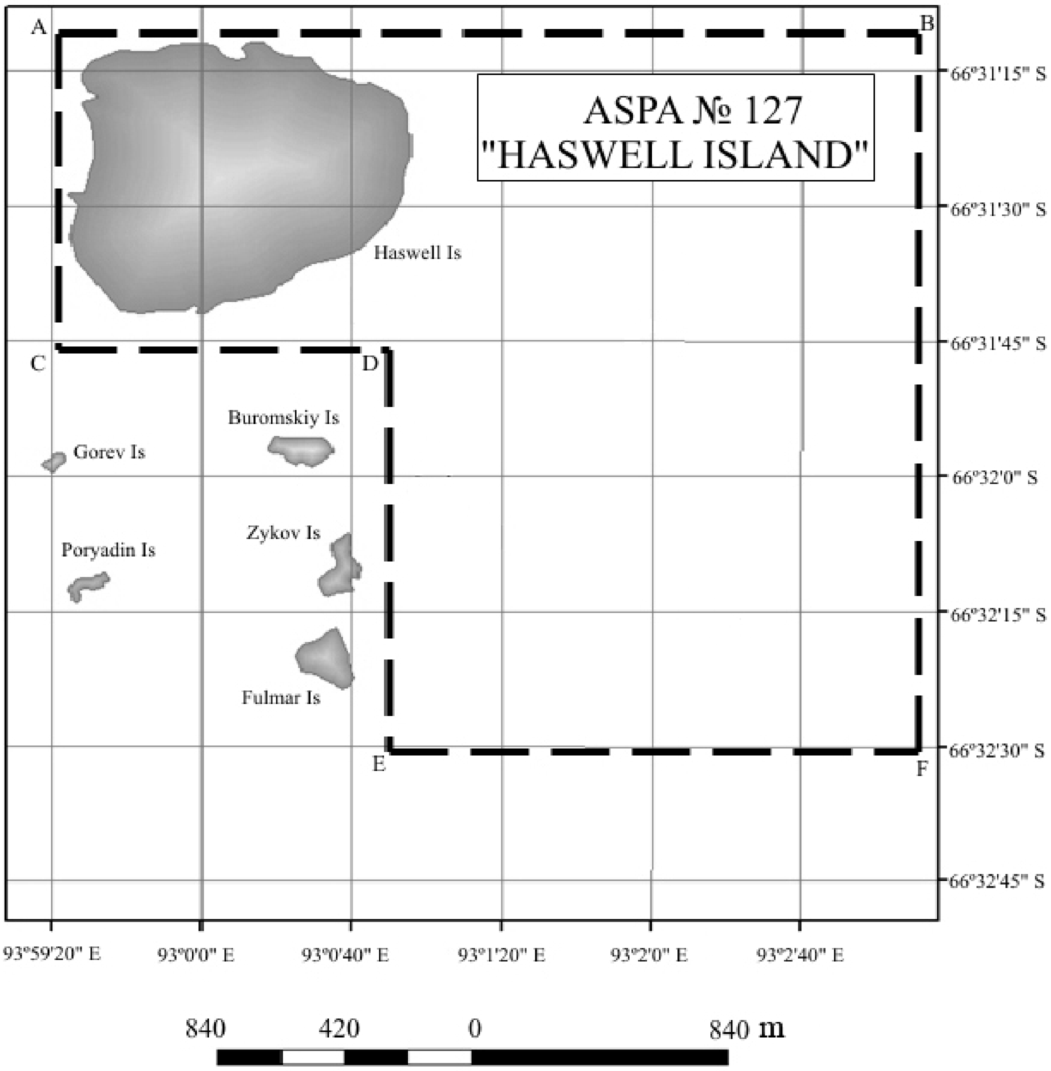
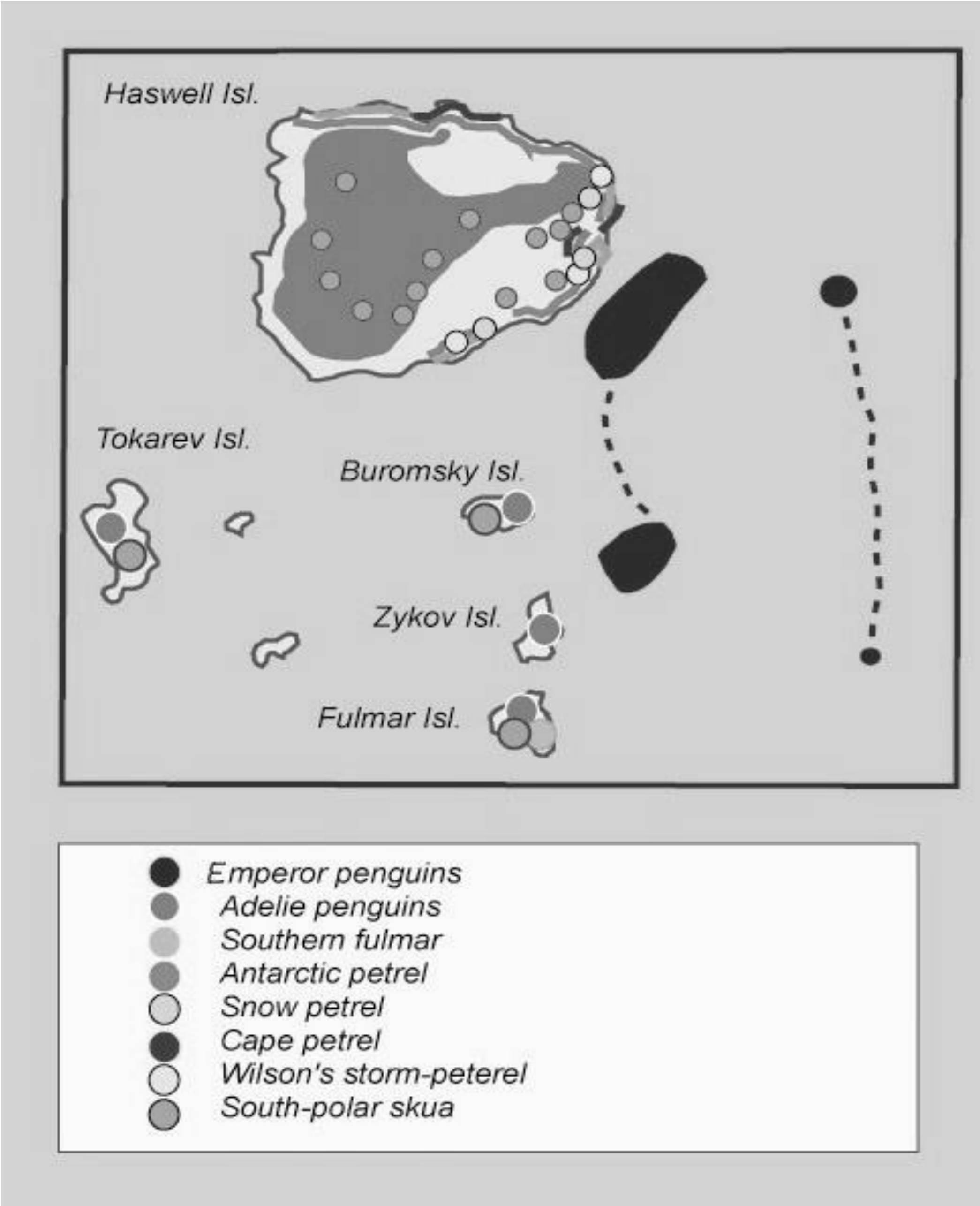
Map 1. General view of the location of the Haswell Archipelago islands, Mirny station, and logistical activity sites



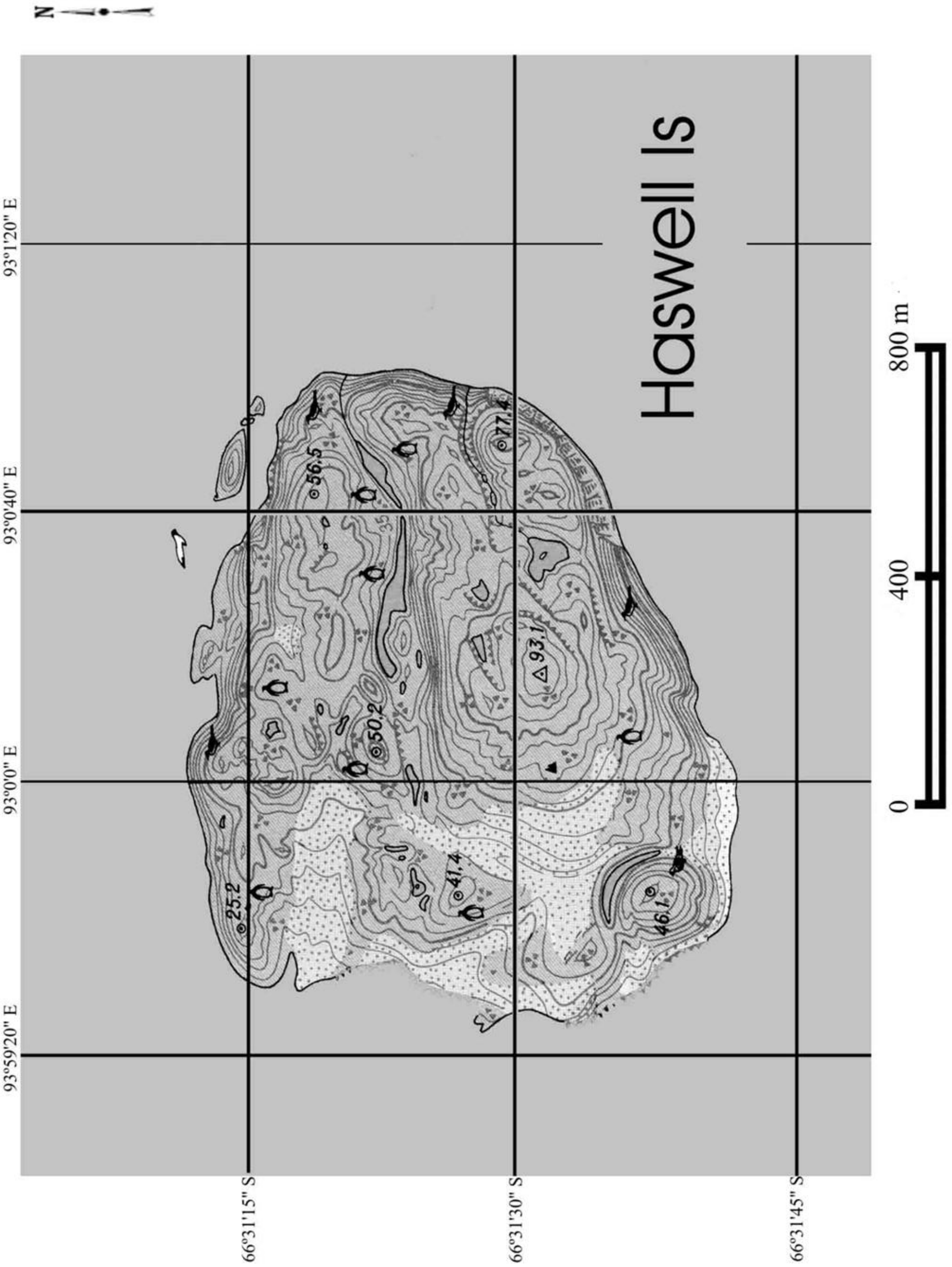
Map 2. Boundaries of the Antarctic Specially Protected Area No. 127 Opistobranch gastropods "Haswell Island"



Map 3. Location of nesting colonies of sea birds



Map 4. Haswell Island. Topography



Measure 12 (2022)

Antarctic Specially Protected Area No 129 (Rothera Point, Adelaide 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 XIII-8 (1985), which designated Rothera Point, Adelaide Island as Site of Special Scientific Interest ("SSSI") No 9 and annexed a Management Plan for the Site;
- Resolution 7 (1995), which extended the expiry date of SSSI 9;
- Measure 1 (1996), which annexed a revised description and a revised Management Plan for SSSI 9;
- Decision 1 (2002), which renamed and renumbered SSSI 9 as ASPA 129;
- Measure 1 (2007), which adopted a revised Management Plan for ASPA 129 and revised its boundaries;
- Measures 6 (2012) and 5 (2017), which adopted a revised Management Plan for ASPA 129;

Recalling that Resolution 7 (1995) was designated as no longer current by Decision 1 (2011) and that Measure 1 (1996) did not become effective and was withdrawn by Measure 10 (2008);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 129;

Desiring to replace the existing Management Plan for ASPA 129 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 129 (Rothera Point, Adelaide Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 129 annexed to Measure 5 (2017) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 129

ROTHERA POINT, ADELAIDE ISLAND

Introduction

The primary reason for the designation of Rothera Point, Adelaide Island (Lat. 68°07'S, Long. 67°34'W), South Shetland Islands, as an Antarctic Specially Protected Area (ASPA) is to protect scientific values, primarily that the Area would serve as a control area, against which the effects of human impact associated with the adjacent Rothera Research Station (UK) could be monitored in an Antarctic fellfield ecosystem. Rothera Point was originally designated in Recommendation XIII-8 (1985, SSSI No. 9) after a proposal by the United. Recent research has shown the ASPA to contain rich and diverse vegetation. Rothera Point along with nearby Léonie Island (part of which is included in ASPA 177 Léonie Islands and southeast Adelaide Island) are the two sites with the largest foristic richness and most complex vegetation within the wider geographical context of Marguerite Bay and Adelaide Island.

The Area is unique in Antarctica as it is the only protected area currently designated predominantly for its value in the monitoring of human impact. The objective is to use the Area as a control area which has been relatively unaffected by direct human impact, in assessing the impact of activities undertaken at Rothera Research Station on the Antarctic environment. Monitoring studies undertaken by the British Antarctic Survey (BAS) began at Rothera Point in 1976, before the establishment of the station later that year. On-going environmental monitoring activities within the Area and Rothera Point include:(i) assessment of heavy metal concentrations in lichens; (ii) measurement of hydrocarbon and heavy metal concentrations in gravel and soils and (iii) survey of the breeding bird populations.

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, Rothera Point is predominantly Environment Domain E (Antarctic Peninsula and Alexander Island main ice fields) which is also found in ASPAs 113, 114, 117, 126, 128, 129, 133, 134, 139, 147, 149, 152 and ASMAs 1 and 4. However, given that Rothera Point is predominantly ice-free this domain may not be full representative of the environment encompassed within the Area. Although not specifically described as such, Rothera Point may also contain Environment Domain B (Antarctic Peninsula mid-northern latitudes geologic). Other protected areas containing Environment Domain B include ASPAs 108, 115, 134, 140 and 153 and ASMA 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. ASPA No. 129 sits within

Antarctic Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula.

1. Description of values to be protected

- The Area has scientific value as a control area, against which the effects of human impact associated with the adjacent Rothera Research Station (UK) could be monitored in an Antarctic fellfield ecosystem.
- The Area contains one of the richest and most complex vegetations in the Marguerite Bay area and is representative of the plant life found in the north-western Antarctic Peninsula.
- The Area has value as a biological research site, particularly for scientists working in the Bonner Laboratory (Rothera Research Station).

2. Aims and objectives

Management of the Area aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- avoid major changes to the structure and composition of the terrestrial ecosystems, in particular to the fellfield ecosystem and breeding birds, by (i) preventing physical development within the site, and (ii) limiting human access to the Area to maintain its value as a control area for environmental monitoring studies;
- allow scientific research and monitoring studies in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- minimize to the maximum extent practicable, the introduction of non-native species, which could compromise the scientific values of the Area;
- preserve the natural ecosystem of the Area as a reference area for future comparative studies;
- allow regular visits for management purposes in support of the objectives of the management plan.

3. Management activities

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

- Signboards illustrating the location and boundary of the Area and stating entry restrictions shall be erected at the major access points and serviced on a regular basis;
- A map showing the location and boundaries of the Area and stating entry requirements shall be displayed in a prominent position at Rothera Research Station;

- Visits shall be made as necessary to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- 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.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1. ASPA No. 129 Rothera Point, location map.
Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45'W.

Map 2. ASPA No. 129 Rothera Point, topographic map.
Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45'W.

6. Description of the Area

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

- *Boundaries and co-ordinates*

Rothera Point (67°34'S, 68°08'W) is situated in Ryder Bay, at the south-east corner of Wright Peninsula on the east side of Adelaide Island, south-west Antarctic Peninsula (Map 1). The Area is the north-eastern one-third of Rothera Point (Map 2), and is representative of the area as a whole. It is extends about 280 m from west to east and 230 m from north to south, and rises to a maximum altitude of 36 m. At the coast, the Area boundary is the 5 m contour. No upper shore, littoral or sublittoral areas of Rothera Point are therefore included within the ASPA. The southern boundary of the Area, running across Rothera Point, is partially marked by rock filled gabions, in which are placed ASPA boundary signs. The remaining boundary is unmarked. There are two signboards just outside the perimeter of the Area located at the starting points of the pedestrian access route around Rothera Point (see Map 2). The boundary is broadly represented by the following co-ordinates, listed in a clockwise direction, starting with the most northerly point:

Area	Number	Latitude	Longitude
ASPA 129 Rothera Point	1	67°33'59'' S	068°06'47'' W
	2	67°34'06'' S	068°06'48'' W
	3	67°34'06'' S	068°07'00'' W
	4	67°34'02'' S	068°07'08'' W

Rothera Research Station (UK) lies about 250 m west of the western boundary of the Area (see inset on Map 2).

- *General description*

Small areas of permanent ice occur to the north and south of the summit of the ASPA. There are no permanent streams or pools. The rocks are predominantly heterogeneous intrusions of diorite, granodiorite and adamellite of the mid-Cretaceous-Lower Tertiary Andean Intrusive Suite. Veins of copper ore are prominent bright green stains on the rock. Soil is restricted to small pockets of glacial till and sand on the rock bluffs. Local deeper deposits produce scattered small circles and polygons of frost sorted material. There are no extensive areas of patterned ground. Accumulations of recent and decaying limpet (Nacella concinna) shells forming patches of calcareous soil around prominent rock outcrops used as bird perches by Dominican gulls (Larus dominicanus). There are no accumulations of organic matter. There are no special or rare geological or geomorphological features in the Area.

Areas of terrestrial biological interest are mostly on the rock bluffs where there is a locally abundant growth of lichens. The vegetation is representative of the southern "maritime" Antarctic fellfield ecosystem and is dominated by the fruticose lichens Usnea antarctica, Usnea sphacelala, and Pseudephebe minuscula, and the foliose lichen Umbilicaria decussata. Numerous crustose lichens are found, but bryophytes (mainly Andreaea spp.) are sparse. The vegetation of Rothera Point is representative of some of the foristic diversity typical of vegetation communities of the north-western Antarctic Peninsula. Furthermore, Rothera Point along with Leonie Island (part of which is included in the newly designated ASPA 177 Leonie Islands and southeast Adelaide Island) are the two sites with the largest foristic richness and most complex vegetation within the wider geographical context of Marguerite Bay and Adelaide Island. As such the vegetation on Rothera Point is of exceptional value. Although Rothera Point and Léonie Island both have a high plant biodiversity, the number of shared plant species is not high, indicating the need to protect different vegetated sites within the Ryder Bay area.

The invertebrate fauna is impoverished and consists only of a few species of mites and springtails, of which Halozetes belgicae and Cryptopygus antarcticus are the most common. There are no special or rare fauna in the Area. During monitoring studies undertaken in January 2015, no non-native springtails were found within the ASPA or elsewhere on Rothera Point.

South polar skuas ((Stercorarius maccormicki) are the most abundant breeding birds found in the Area, with up to five pairs of skuas recorded nesting. A pair of Dominican gulls (Larus dominicanus) nest in the Area and one Wilson's storm petrels (Oceanites oceanicus) nest has been found. The south polar skuas at Rothera Point have been monitored annually since the 1988/89 season. Nest sites are often reused but may be inactive for a number of consecutive years. Long-term data indicated that the population size at Rothera Point varied considerably between years, increasing overall by 1.9% per annum from 11 breeding pairs in 1975/76 to 24 breeding pairs in 2017/18. ASPA 129 is contained within Antarctic Important Bird Area (IBA) No. 47236 (AQ205), which was designated in 2018; this is the first IBA to be identified in Antarctica since the wider review of candidate sites by Harris et al. (2015) (see Resolution 5 (2015)). The IBA qualifies on the basis of the large breeding populations of south polar skua and Antarctic shag (although no shags breed within the ASPA 129). The IBA includes Rothera Point and the islands in Ryder Bay, which in January 2018 held 978 occupied territories of south polar skuas, 259 south polar skuas at club sites and 405 pairs of Antarctic shags. Based on these counts, the islands in the wider Ryder Bay area contain an estimated c. 3.5% of all breeding Antarctic shags, and c. 10.3% of all breeding south polar skuas.

6(ii) Access to the Area

- Access to the Area shall be by foot.
- Helicopter landings are prohibited within the Area.
- The operation of aircraft should be carried out, to the maximum extent possible, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). However, the Area is only c. 250 m from the Rothera Research Station runway and for reasons of safety it is recognized that full compliance may not always be possible.
- The Area boundary extends to the 5 m contour at the coast. There is unrestricted pedestrian access below this contour height around the boundary of the Area. The recommended pedestrian access route follows the Mean High Water Mark (MHWM) and is shown on Map 2. During periods when the ground is snow-covered and sea ice has formed, pedestrians should ensure that they are at a safe distance from the shoreline and are not in danger of straying onto unreliable sea ice or into tide cracks.

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

A rock cairn marks the summit of the Area (36 m; Lat. 68°34'01.5'' S, Long. 068°06'58'' W) and 35 m to the east south east of it there is another cairn marking a survey station (35.4 m; Lat. 68°34'02'' S, Long. 068°06'55'' W).

Rothera Research Station (UK) lies about 250 m west of the western boundary of the Area (see inset on Map 2). A number of masts and aerials exist on the raised beach that is adjacent to the southern boundary of the Area.

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

ASPA No. 177 Léonie Island and southeast Adelaide Island, Antarctic Peninsula is the closest ASPA to ASPA 129 Rothera Point, with the closest sub-site located 4 km away. ASPA No. 107, Emperor Island, Dion Islands, Marguerite Bay, lies about 15 km south of Adelaide Island. ASPA No. 115, Lagotellerie Island, Marguerite Bay, lies about 11 km south of Pourquoi Pas Island. ASPA No. 117, Avian Island, Marguerite Bay, lies about 0.25 km south of the south-west tip of Adelaide Island. The locations of these ASPAs are shown on 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 only for compelling scientific reasons which cannot be served elsewhere or it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the environmental or scientific values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- 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

- Access to, and movement within, the Area shall be on foot.
- Land vehicles are prohibited in the Area.
- Landing of helicopters within the Area is prohibited.
- All movement shall be undertaken carefully so as to minimize disturbance to soil and vegetation.
- The Rothera Research Station runway commenced operation in 1991 and is located within 400 m of the Area. Given the proximity of the runway, on occasions overflight of the Area may be necessary for operational or scientific reasons. To the maximum extent possible, the operation of aircraft over the Area should be carried out, in compliance with the Guidelines for the Operation of Aircraft near Concentrations of Birds contained in Resolution 2 (2004) (available at: http://www.ats.aq/documents/recatt/Att224_e.pdf).
- 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 are or may be conducted within the Area are:

- scientific research or monitoring which will not jeopardise the ecosystems of the Area;
- essential management activities.

7(iv) Installation, modification or 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 a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be 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 of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

7(v) Location of field camps

Camping in the Area is prohibited. Accommodation may be available at Rothera Research Station.

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 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. No poultry or egg products shall be taken into the Area. Further guidance can be found in the CEP Non-native Species Manual (Resolution 4 (2016)) and COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species. 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 shall not be permitted. Fuel, food and other materials are not to be deposited within the Area, unless authorized by Permit for specific scientific or management purposes. Permanent depots are not permitted. All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of the stated period, and shall be stored and handled so that risk of their introduction into the environment is minimised. 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 shall be notified of any materials released and not removed that were not included in the authorised Permit.

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 to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of, or harmful interference with, animals is involved this should in accordance with the SCAR Code of Conduct for the use of Animals for Scientific Purposes in Antarctica (Resolution 4 (2019)), as a minimum standard.

7(viii) The collection or removal of materials not brought into the Area by the Permit holder

Material of a biological or geological nature may be collected and/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 reasonable concern that the sampling proposed would take, remove or damage such quantities of soil, sediment, flora or fauna that their distribution or abundance within the Area would be significantly affected. Material of human origin not brought into the site by the Permit holder, or otherwise authorised, which is likely to compromise the values of the Area shall be removed unless the impact of removal is likely to be greater than leaving the material in situ. In the latter case the appropriate authority shall be notified.

7(ix) Disposal of wastes

All wastes shall be removed from the Area in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998). All solid and/or liquid 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 scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, 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 SCAR's environmental code of conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018)).

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 as an Appendix in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (available from the website of the Secretariat of the Antarctic Treaty; www.ats.aq)). 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.

8. Supporting documentation

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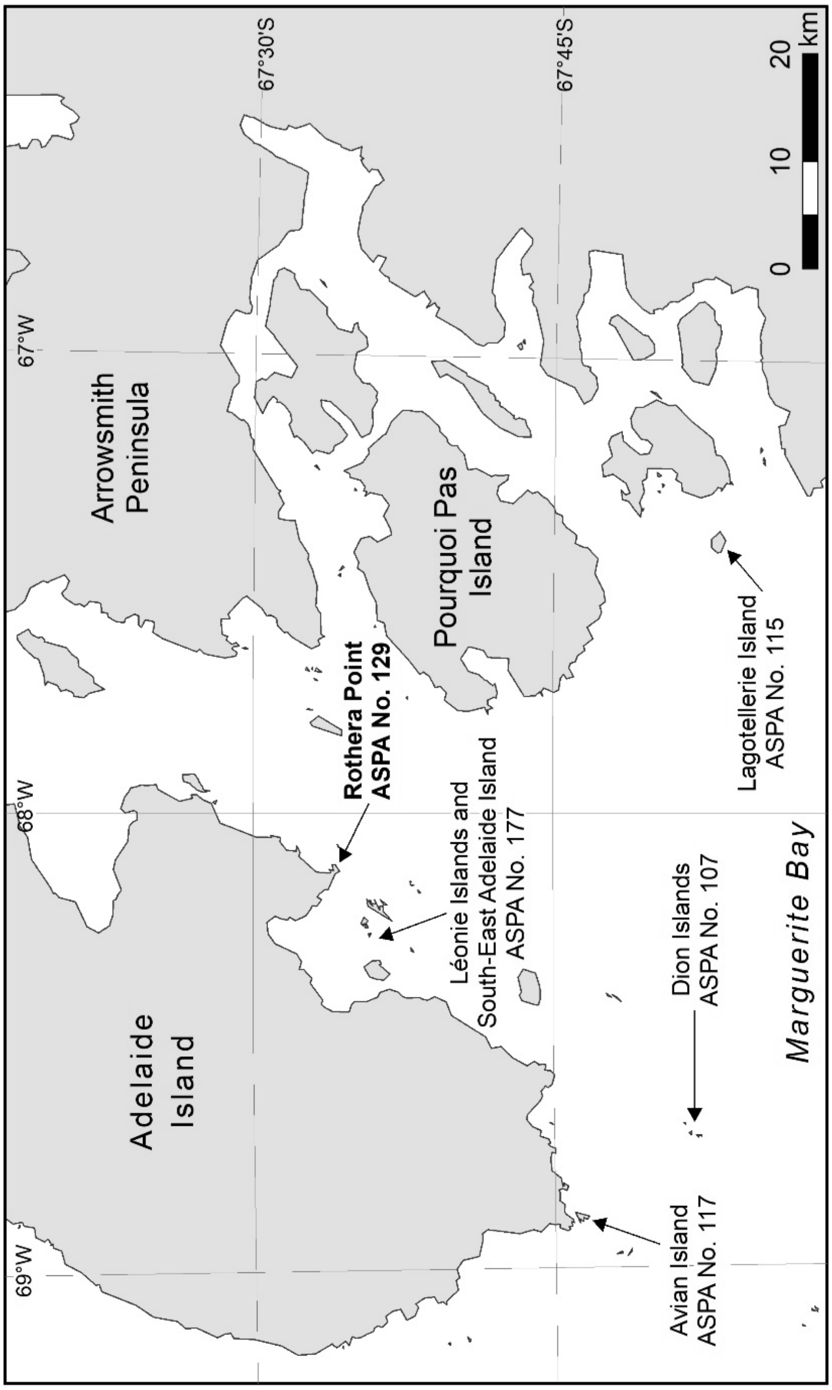
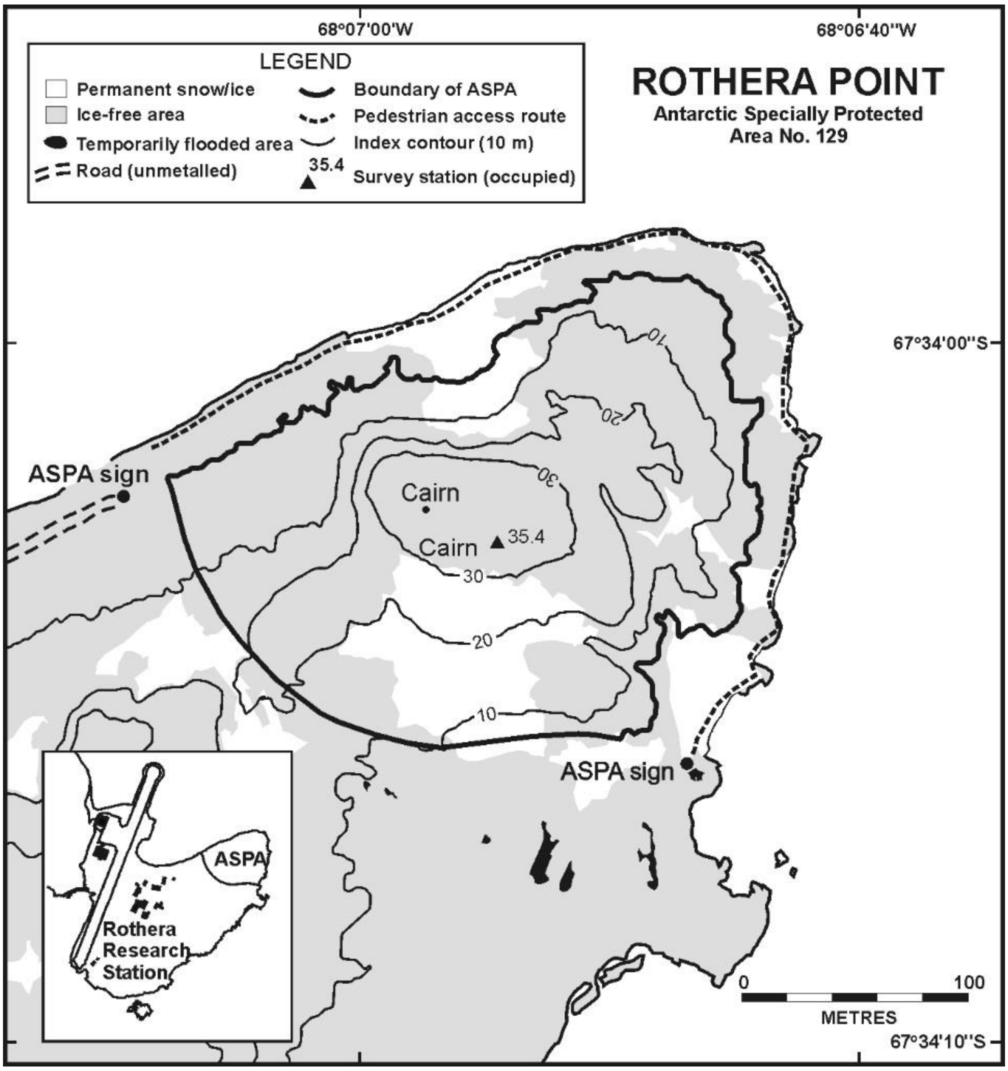
Map 1. ASPA No. 129 Rothera Point, location map.
Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45’W.



Map 2. ASPA No. 129 Rothera Point, topographic map.
Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45'W.



Measure 13 (2022)

Antarctic Specially Protected Area No 133 (Harmony Point, Nelson 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 XIII-8 (1985), which designated Harmony Point, Nelson Island, South Shetland Islands as Site of Special Scientific Interest ("SSSI") No 14;
- Resolution 7 (1995), which extended the expiry date for SSSI 14;
- Measure 3 (1997), which adopted a revised Management Plan for SSSI 14;
- Decision 1 (2002), which renamed and renumbered SSSI 14 as ASPA 133;
- Measures 2 (2005) and 7 (2012), which annexed a revised Management Plan for ASPA 133;

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

Recalling that Measure 3 (1997) did 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 133;

Desiring to replace the existing Management Plan for ASPA 133 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 133 (Harmony Point, Nelson Island, South Shetland Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 133 annexed to Measure 7 (2012) be revoked.

Management Plan for Antarctic Specially Protected Area No. 133

HARMONY POINT, NELSON ISLAND, SOUTH SHETLAND ISLANDS

Introduction

This Area was originally designated as Site of Special Scientific Interest No. 14 under ATCM Recommendation XIII-8 (1985), following a proposal by Argentina, considering that the Area constitutes an excellent example of bird communities and terrestrial ecosystems of the maritime Antarctic in the South Shetland Islands region, and allows for long-term research without damage or interference.

In 1997, the Management Plan was adapted to the requirements of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty, and approved by Measure 3 (1997). A second revised Management Plan was approved through Measure 2 (2005). The latest version constitutes the revision of the Management Plan approved by Measure 7 (2012) and was the third revision since the entry into force of Annex V.

The original reasons for its designation are still valid and in recent years further reasons have made it even more significant. One of the central issues relates to the problems and threats associated with human activities. Based on global drivers (climate change, changes in ocean conditions, etc.), it has been established that the northern area of the Antarctic Peninsula where ASPA 133 is located is suffering the consequences of these drivers, showing glacier retreat, sea ice loss, ocean acidification and warming, among others (Morley et al. 2020). Anthropic disturbance could endanger the long-term studies carried out there, especially at times that coincide with the reproductive periods of the fauna in the area. The main global drivers are tourism, pollution, and the risks of introducing non-native species (Morley et al. 2020). The presence of man-made debris in ASPA No. 133 has recently been assessed, having found mainly plastics and other waste (Finger et al. 2021).

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 No. 133 is crucial for this type of study and other comparative studies between its fauna and that of other Antarctic areas. Climatic and oceanographic variability 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, increased temperatures, the 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 extent of sea ice (Stammerjohn et al., 2008; Thompson and Solomon, 2002), and has repercussions for Antarctic flora and fauna.

In this context, ASPA No. 133 is an area that has suffered little disturbance, which allows comparative studies with populations that inhabit areas of frequent human disturbance (accumulation of refuse, pollution, tourism and fishing; Woehler et al., 2001, Patterson et al., 2008). In recent years, the numbers of several stocks that inhabit the ASPA, have remained stable, as is the case of giant petrels, although the current size of the stock shows much lower values than previous decades (Krüger, 2019). It is also important to study in the ASPA the impacts of processes such as the increase in temperature, which has direct consequences in the increase of ice-free areas and the resulting formation of soils that are important in the dynamics of the area and the formation of bodies of water.

Its designation as an ASPA ensures that current long-term research programmes will not be adversely affected by accidental human interference, destruction of vegetation and soil, pollution of bodies of water, and disturbance of birds, especially in seasons coinciding with breeding periods. Among the scientific investigations carried out in ASPA No. 133 are the research activities carried out by Chile in the Area, including the projects "Marine Protected Areas: Monitoring of oceanographic conditions, top predators and benthic habitats in the western Antarctic Peninsula", by researchers from the Chilean Antarctic Institute, and "Molecular Migration Route of Emerging Viruses: The role of Chionis albus as a reservoir in the transport of viruses with zoonotic risk to the southern cone", led by researchers from the University of Chile.

1. Description of values to be protected

The values to be protected in the Area continue to be associated with the composition and biological diversity of this site. Harmony Point is a promontory with an ice-free area located on the west coast of Nelson Island in the South Shetland Islands. It has an undulating topography that rises to 40 metres above sea level, with numerous streams and abundant vegetation. The closest permanent scientific station is Great Wall (CHN), a year-round facility with capacity for 40 people located on King George Island, 16 km northeast of Harmony Point (COMNAP, Antarctic facilities).

The ice-free areas are home to important breeding colonies of 12 species of birds, including one of the largest colonies of chinstrap penguins (Pygoscelis antarctica) in Antarctica (Silva et al., 1998). There is also a large colony of giant petrels (Macronectes giganteus), a species that is highly sensitive to human disturbance, and a large colony of gentoo penguins (Pygoscelis papua). The importance of the ASPA for birds is proved by the fact that it has been designated Important Bird Area (IBA ANT) No 049.

The Area has abundant vegetation, developed on various types of soils, particularly characterised by the presence of extensive moss carpets, as well as lichens and fungi. The presence of two species of vascular plants, Deschampsia antarctica and Colobanthus quitensis has also been reported in the Area (Harris et al., 2015): while the former is more abundant and broadly distributed, the latter, according to some authors, is not found on the island (Rodrígues et al., 2019). Taking into account that vegetation is an important factor in soil formation, protection of the Area ensures the possibility to conduct research related to the soils and flora present in the area.

Although Antarctica is considered one of the few uncontaminated areas of our planet because it is relatively isolated and distant from large industrial and urban centres, there is evidence of an excessive presence of pollutants in the north of the peninsula in the recent detection of substances associated with human activity in places that should be considered intact (Olalla et al., 2020).

For all the above reasons, its particular geographical location in the Northwest of the Antarctic peninsula gives this ASPA and the numerous scientific research programmes that are developed in the area a crucial importance in order to explain, at least partially, alterations in the Antarctic ecosystems as a result of climate change and/or human disturbance.

According to Morgan et al. (2007) ASPA No. 133 represents the environmental domain “Environment Domain E – Antarctic Peninsula and Alexander Island Main Ice Fields” and, according to Terauds et al. (2012) the area is in the “Northwest of the Antarctic Peninsula” biogeographic region. Additionally, according to the “Important Bird Areas in Antarctica 2015” (Harris et al. 2015), Harmony Point, Nelson Island, constitutes IBA ANT049.

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

- Personnel authorised to enter the ASPA will be instructed on the particular conditions of the Management Plan.
- Collection of samples will be limited to the minimum required for approved scientific research plans.
- All signs, as well as other structures constructed in the Area for scientific or management purposes, must be adequately secured and maintained in good condition.
- 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.
- Distances from fauna must be respected, except when the scientific projects require otherwise and providing the relevant permits have been issued.
- In accordance with the requirements of Annex III to the Protocol on Environmental Protection to the Antarctic Treaty, any equipment or material abandoned or no longer used must be removed providing its removal does not adversely affect the environment.
- All those responsible for aircraft operating in the area must be informed of the location, limits and restrictions that apply to entry and overflight of 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 Management Plan must be reviewed not less than once every five years and updated if necessary.
- 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

Designation is for an indefinite period.

5. Maps

The following maps are included as Annexes at the end of the Management Plan:

Map 1: General location of Nelson Island and ASPA No. 133 in the Northern Region of the Antarctic Peninsula.

Map 2: General location of ASPA No. 133 on Nelson Island.

Map 3: Specific location of ASPA No. 133 on Nelson Island.

Map 4: Gurruchaga Shelter Area (ARG) in Harmony Point

Map 5: Finger Point Area.

6. Description of the Area

6(i) Geographical coordinates and boundaries

The Area is located on the west coast of Nelson Island (62°18'S; 59°14'W), between King George Island, to the northeast, and Robert Island, to the southwest, and includes Harmony Point and Finger Point, the ice-covered sector and the adjacent maritime area, as shown on Map 3.

6(ii) Natural features

From a geomorphological point of view, Harmony Point presents three well-defined units: an andesitic plateau, coastal and platform outcrops, and paleo-beaches. The plateau reaches 40 metres above sea level and is covered by debris resulting from the action of erosive agents on andesite rocks, with extensive development of lichen and moss communities. There are three successive levels of elevated paleo-beaches between the coast and the glacier. The paleo-beaches are defined by accumulations of boulders of variable height in some cases, and soil development in another. Temporary lagoons and small streams are observed in the irregularities of the terrain. Isolated andesite rocks and ancient nunataks can be seen beyond the limits of the glacier, which shows that the glacier covered Harmony Point in the past.

- *Weather*

Long-term meteorological data is not available for the site since there is no permanent weather station installed. 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.

There is no weather station at the site, but Rodrigues et al. (2019) point out that the nearest station is 17 km to the north on the Fildes Peninsula. The average annual temperature there is -1.6 °C and the average annual rainfall is 630 mm. These authors indicate that a well drilled in 1985 in the polar cap of Nelson Island revealed a temperature of -1.5 °C at a depth of 10 m, which would be close to the average annual air temperature at that time (Ren, 1990). Pervasive permafrost at elevations above 26 m may imply a colder climate in ice-free areas. Records indicate that the abundance of ventifacts in rock outcrops suggests that wind is an important geomorphic agent on the island.

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.

One of the effects of climate change observed in ASPA No. 133 is the increased surface of the lakes associated with the melting of glaciers. Marginal ice lakes, which are part of the paraglacial system, can occur in direct contact with a glacier front and can be dammed by recession moraines. Furthermore, it has been suggested that glaciofluvial channels feed these marginal lakes. According to Shridhar et al. (2015), proglacial lakes serve as an indicator of local climate change through modified hydrological flow regimes and trapped sediments.

Da Rosa et al. (2021) studied the expansion of these lakes on King George Island and Nelson Island between 1986 and 2020. They found that both lakes with marginal ice (lakes in contact with glaciers) and those not in contact with glaciers have been expanding since 1986 in the coastal environments of both islands. The results show that the lakes experienced an area increase of 732% (from 0.18 km^2 to 1.39 km^2) between 1986 and 2020. Most lake expansions occurred at glacial fronts and can be attributed to the melting of glacial fronts and subsequent glacial retreat.

The authors have determined that from 1989 to 2020, Nelson Island showed a glacial area loss of 12 km^2, 8.4% of the total area in 1989. Marine glaciers have retreated in recent decades, some have changed their calving fronts to glaciers ending in lakes, and there are new ice-free land areas and marginal ice lakes. During the periods of 1989–2003 and 2003–2020, there was an increase in lake area of 0.103 km^2 (an increase by 190% of the total area from 0.054 in 1989), and 0.135 km^2 (86% of the total area of 0.157 in 2003), respectively.

- *Geology and Soils*

The geology of Nelson Island, according to Manfroi et al. (2015), as in other South Shetland Islands, consists mainly of andesitic and intrusive lavas, with some thin layers of volcanoclastic sediments. Fildes Strait separates southern Nelson Island from King George Island, where other Upper Cretaceous rock layers are exposed. Paleontological studies have shown that the fossil-bearing levels are restricted to the northeastern part of the island and occur in an isolated outcrop at Rip Point, on the coast of Fildes Strait, approximately 1.0 km north of Brazil's Crulls Hut (62°14′19" S; 58°59′0" W).

Nelson Island has an ice cap that is a remnant of a larger ice cap that once covered the entire southern Shetland Islands. It is geologically composed of an andesite core surrounded by pillow lavas, tuffs and agglomerates (Smellie et al., 1984). Nelson Island was extensively glaciated during the Last Glacial Maximum, around 16 kyr B.P. The island has been subject to postglacial cryoplanation, resulting in successive uplifted marine terraces, separated by scarps, and felsenmeers on cores of strong rock (mainly igneous andesites).

In regards to the area's geology, according to Smellie et al. (1984), the Harmony Point area is dominated by basaltic lavas with a thickness that varies between 4 and 20 m (Figure 1). According to these authors, the most common clastic rocks are non-stratified fine to coarse grained lapillistones. Thin-bedded volcanic mudstones and fine volcanic sandstones occur locally at Harmony Point. At this location they form beds that are 0.5–20 cm thick (including a 1 cm thick coal seam) that are locally disrupted and show cross-bedding, washout structures and normal grading.

Rodrigues et al. (2019) mention that Nelson Island has a total area of 165 km² with only 5% (8 km²) of the island being ice-free. The authors mention that the soils and landforms on Nelson Island remain some of the least studied in the South Shetland archipelago, despite the fact that it is one of the oldest ice-free areas and is highly vegetated. The soils of Harmony Point vary according to the interaction between the terrain, the parent material and the vegetation. The soils are mostly shallow, rocky and cryoturbid, both dystrophic and eutrophic (op. cit.).

These same authors determined that the presence of continuous permafrost below 30 cm in soils above 26 m of elevation proves the importance of cryopedogenesis in soil formation in this area. Soils with humic (umbric) A horizons are very common, indicating long-term stabilisation and humification of organic matter. Chemical weathering is effective on the ground and at the umbric horizon, due to landscape stability and plant cover. Furthermore, ornithogenesis and the formation of umbric horizons is widespread, corroborating the importance of phosphatisation as a soil-forming process in this part of Antarctica, which occurs in no other areas of Maritime Antarctica and East Antarctica (op. cit.).

In relation to the processes of cryoturbation and phosphatisation, both are key processes for soil formation at Harmony Point, and well-developed ornithogenic soils with a high degree of weathering and clay-enriched phosphate B horizons are common. On the other hand, soils without bird activity are coarse-grained and contain primary minerals even in the clay fraction, revealing poor chemical weathering, despite active physical weathering (Rodrigues et al. 2019).

The main pedogenetic processes observed in this area are marked phosphating, melanisation due to the accumulation of organic matter, and cryoturbation. Soil development varies from poorly developed, shallow, stony, cryoturbated soils to well-developed, organic-rich phosphate soils with colours ranging from grey to brown. The mineralogical composition of the clay fraction contains secondary minerals, indicating the active role of chemical weathering. Ornithogenic soils have mature phosphate minerals such as vivianite and taranakite, as well as poorly crystalline leucophosphite. Intensively cryoturbated soils are underlain by permafrost and are classified as typical haploturbels; polygonal soils are widespread on the cryoplanated plateau. Phosphatisation is a dominant soil-forming process in this area and is associated with past and present guano accumulation by nesting birds and has led to the development of deeper ornithogenic haplorthels. Ornithogenic soils occur at different topographic levels on the cryoplanated platform and marine terraces. High P concentrations can be used as an indicator of past nesting bird activities, with far-reaching implications, especially with regard to plant growth and microbial activity and diversity (Rodrigues et al. 2019).

According to Rodrigues et al. (2019) two landscape domains are recognised in Harmony Point, the coastal and upper platforms, with their respective landscape units (Figure 2). The coastal landscape occurs between sea level and the slope that limits the higher elevated marine terrace. Above that, extending inland to the edge of the glacier and the paraglacial area, are the upper platforms (cryoplanated surface and felsenmeers) (op cit.). The coastal domain is made up of rocky cliffs, the current sand and gravel beaches, raised marine terraces and volcanic piles, which form resistant intrusive bodies (microgabbros) or dikes of basaltic lava.

Regarding the soils, Rodrigues et al. (2019) indicate that its colour is greatly influenced by the composition of the original material. Soils developed from a mixture of tuffs, andesitic basalts, and andesites show greyish to dark green colours. These andesitic rocks are typically greyish/greenish due to hydrothermal alteration processes and chloritisation during crystallisation (Moura et al., 2012). Poorly drained areas show strong greyish colours, while the more evolved and deeper soils, especially ornithogenic ones, show reddish-yellow colours, revealing an advanced degree of weathering.

Five soil orders have been recognised in the Area to date, according to the taxonomic system of Soil Taxonomy (1999): Histosols (Hidric Cryfibrists), Entisols (Lithic Criorthents), Spodosols (Oxiaquic Humicryods), Mollisols (Lithic Haplocryolls) and Inceptisols (Lithic Eutrocryepts and Histic Cryaquepts). Rodrigues et al. (2019) have carried out the latest soil classification at Harmony Point (Figure 3).

- *Flora*

Vegetation in the Antarctic environment is restricted to ice-free areas, mainly on the Antarctic islands and in the coastal areas of continental regions. These plant communities are predominantly cryptogamic and the length of their growing season depends on climate, latitude and relief. The availability of liquid water is the most critical factor for the development of plant communities in Antarctica. Such liquid water is available during some months when the snow melts and when it rains in summer, or when moisture can be absorbed directly from the air. According to da Fonseca et al. (2021) between 2016 and 2021 on Nelson Island the surface in which algae were recorded went from 0.67 to 1.11 km², for lichens it went from 1.60 to 2.17 km² and for mosses from 0.02 to 0.11 km², which indicates a gradual increase in the area occupied by vegetation, surely associated with environmental changes and the increase in the ice-free area in the area due to the retreat of the glacier.

In general, the vegetation of Harmony Point can be said to be made up of a variety of plant communities, dominated by bryophytes and lichens, similar to those of King George Island (Pereira). et al. 2007). The most common mosses are Sanionia uncinata and Polytrichastrum alpinum (Ochyra, 1998). Among the vascular plants, the grass Deschampsia antarctica is rare and Colobanthus quitensis has not been reported on the island in recent years. In the Area there are extensive areas covered by rich and diverse communities of bryophytes and lichens (which are being classified), dominated mainly by Usnea fasciata and by Himantormia lugubris, while D. Antarctica and C. quitensis present less development, especially in sectors less affected by recent anthropic disturbance or breeding activities. Moss turf subformations are found in humid sites protected from the wind, while subformations dominated by lichens appear in sectors with high wind exposure (Figure 4).

The vegetation cover at the different levels of the marine terrace corresponds to their age. The oldest (and highest) are covered with carpets of Sanionia uncinata and patches of Polytrichastrum alpinum turves in drier areas, while Sanionia georgicouncinata and Warnsdorf spp., occur in the more humid sectors, occasionally associated with Bryum spp., and rarely with Brachythecium autrosalebrosum. The intermediate level of the terrace is normally covered by crustose/fruticose lichens, mainly by the dominant Acarospora macrocyclus and Caloplaca spp. The most recent marine terrace (first level) is covered mainly by formations of Prasiola crispa at certain points, associated with vagrant bird guano.

The vegetation of the higher areas basically consists of nitrophobic species that are highly resistant to wind exposure and drying out. The main formation is a dense carpet of muscular lichen Himantormia lugubris, in close association with mosses Andreaea gainii and A. depressinervis, but occasionally attached to other carpet-forming mosses. Other muscular lichens are also very common, particularly Ochrolechia frigida, Psoroma hypnorum and Cladonia spp. The formations of Andreaea spp., are sometimes lichen-free, forming dark brown to black cushions covering exposed rock as a primary coloniser. Usnea aurantiacotra is sterile on low hills above plateaus, associated with mosses and other lichens on rocky outcrops (Rodrigues et al. 2019) (see Figure 4).

The depressions are surrounded mainly by a dense carpet of mosses, common with a marginal strip (up to 50 cm long) of Bryum spp., and/or B. austrosalebrosum around flooded areas. Further away, with water-saturated soils, there is a carpet of moss made up of Warnsdorfia sarmentosa, partially parasitised by muscular lichens, such as Cystocoleus niger or O. frigida. As long as the surrounding areas are better drained and drier, they are dominated by S. uncinata. In shallow pools where birds are occasional visitors and some guano is deposited, the waters are colonised by the algae Prasiola crispa (Rodrigues et al., 2019) (see Figure 4).

The area is frequently used as a nesting area by birds (giant petrels and skuas, especially), resulting in guano-enriched soils and mixed vegetation. Soils with a high content in organic matter present an abundant mixed vegetation, consisting of lichens, such as Usnea spp., Sphaerophorus globosus and Stereocaulon spp., and mosses such as S. uncinata and Chorisodontium acyphyllum. These areas are covered mainly by saxicolous lichen species, without any clear pattern. In some felsenmeers where vertical to subvertical rock walls form below the nests, the rock surfaces are covered by Umbilicaria spp. and Usnea spp., associated with Lecidea spp. and Buellia spp. On more stable rock surfaces, other encrusting lichens are common, particularly Rhizoplaca spp., Lecidea spp., Carbonea spp., and Buellia spp., with occasional presence of Rhizocarpon geographicum in guano-free areas. Wherever water-saturated soil accumulates, there can also be a thick moss bank of Sanionia spp., Polytrichum juniperinum and P. piliferum (Rodrigues et al. 2019) (see Figure 4).

One of the important discoveries of recent years was the confirmation of the presence of Hygrolembidium isophyllum at Harmony Point (Putzke et al., 2020) during a survey carried out in the summer of 2019, where a large population of this species was found. The population is 200 m north of the Gurruchaga Shelter and is located within Antarctic Specially Protected Area No 133. The findings reinforce the need to protect this area, as this species is very rare in Antarctica. A small lake nearby and the snow deposits that supply it with meltwater, in addition to the low incidence of wind, are abiotic factors that could be influencing the occurrence of the species in the area (Putzke et al., 2020).

- *Fauna*

The area is home to breeding colonies for 12 species, which at the time of the previous renewal numbered 3 347 pairs of gentoo penguins (Pygoscelis papua), 89 685 pairs of chinstrap penguins (Pygoscelis antarctica), 479 pairs of cape petrel (Daption capense), 69 pairs of blue-eyed shag (Leucocarbo bransfieldensis), 144 pairs of snowy sheatbill (Chionis alba), 71 pairs of skuas (Stercorarius antarctica, 61 and S. maccormicki, 11), 128 pairs of kelp gulls (Larus dominicanus) and 746 pairs of giant petrels (Macronectes giganteus).

The ice-free area at Harmony Point supports a wide range of birds, including one of the largest colonies of chinstrap penguins in the Antarctic Peninsula region, with approximately 90 000 pairs present in 1995/96 (Silva et al., 1998). In 1995/96, 3347 breeding pairs of gentoo penguins and 69 breeding pairs of blue-eyed shag (Leucocarbo bransfieldensis) (Oosthuizen et al., 2020. N. Coria (Pers. Comm., 2010) reported 395 pairs of southern giant petrels (Macronectes giganteus) breeding in 2009/10, compared to 485 pairs recorded in 2004/05. Silva et al. (1998) reported 479 pairs of cape petrels (Daption capense), 144 pairs of snowy sheatbills (Chionis albus), 61 pairs of brown skua (Stercorarius antarctica), 128 pairs of kelp gulls (Larus dominicanus), 173 pairs of Antarctic terns (Sterna vittata), and a total of about 1 000 pairs of Wilson's storm-petrel (Oceanites oceanicus) and black-bellied storm-petrel (Fregetta tropica) at Harmony Point in 1995/96 (Harris et al., 2015). Most of the bird colonies are distributed along the northwestern and southern coasts of Harmony Point. Colonies of giant petrel are found around the Gurruchaga Shelter. Figure 5 represents a map with the location of the colonies according to Silva et al. (1998).

A declining trend has been reported in Antarctica for many of the colonies of blue-eyed shag (Leucocarbo bransfieldensis) (Casaux and Barrera-Oro, 2015). These authors detected negative trends in the number of breeding pairs of this species in the colonies on Nelson Island (Figure 6). According to these authors, the number of breeding pairs of Antarctic shags in the two colonies on Nelson Island have shown a downward trend during the sampling periods. The Punta Duthoit colony (eastern sector of Nelson Island) was monitored for almost 15 consecutive years (except in 1991), for a total period of 19 years. The time series at Harmony Point was not that long due to logistical limitations, reaching approximately 10 years. In both colonies, the number of breeding pairs decreased from the late 1980s to 2004, then stabilised around the lower values. These authors recorded a parallel decrease in the abundance of the two fish species exploited in Potter Cove (King George Island) and that of the Antarctic shag (L. bransfieldensis) on Nelson Island, locations which are close to one another in the South Shetland Islands (Casaux and Barrera-Oro, 2015). Oosthuizen et al. (2020) indicate that the blue-eyed shag nests in a single, segregated colony on the north coast of Harmony Point and that most of the nests are located on three promontories that face the sea, with steep slopes that prevent easy access on foot. In December 2018, the authors recorded through images captured with a DJI Phantom 4 Advanced unmanned aerial vehicle a total of 69 reproductive pairs of L. bransfieldensis, whose nests were located between 10 and 20 metres above sea level, oriented mainly towards the southeast.

According to Krüger (2019) the observations of the last two decades seem to indicate that the populations of some species of the southern giant petrel (Macronectes giganteus) at Harmony Point have decreased. According to this author, 746 pairs were counted in 1995/96 (Silva et al. 1998), compared to 485 pairs recorded in 2005 (ACAP 2010) and 395 pairs in 2009 (Harris et al. 2015). Silva et al. (1998) mentioned that the distribution of flying seabird colonies coincided with that of previous mapping studies. In this work, the authors counted a total of 481 active nests and point out that the largest colony was located on the north coast. Small scattered breeding groups (< 30 nests) and isolated nests were found in the higher inland area and on the southern shores. Nest distribution was similar to that of previous studies, with the exception of one colony recorded in previous studies that currently had no nests, and one new colony that was not recorded in previous studies. The number of nests had decreased over practically the entire area, with the exception of the large colony on the north coast (Figure 7).

Krüger (2019) notes that there are few areas in the Western Antarctic Peninsula where southern giant petrels breed in large numbers, and Harmony Point, with more than 450 nests, is one of such areas. The apparent increase in population at Harmony Point in 1997 (746, Silva et al., 1998), compared to 1965 (417; Araya and Aravena, 1965) and 1989 (494; Favero et al., 1991) was attributed to the closure of the area to tourist activity in 1988, implying the effectiveness of the protection measures established for the site (Silva et al., 1998). However, since then the population appears to have declined to its numbers before protection and may be fluctuating around 450 pairs (Harris et al., 2015 and references therein). The changes in the populations of Macronectes giganteus elsewhere were attributed to interactions with fishing (Quintana et al., 2006; Krüger et al., 2017), to changes in food sources (Bruyn et al., 2007), the intense human disturbance near the colonies and the influence of climate/weather (Krüger et al., 2012; Schulz et al., 2014; Petry et al., 2016). Giant petrels are very sensitive to constant human presence and local declines in colonies in places such as King George Island (Sander et al., 2005; Petry et al., 2016) and Penguin Island (Harris et al., 2015), in the South Shetland Islands, where human presence is intense due to research stations and tourism (Bender et al., 2016), seem to support that view. However, the causes of the fluctuation at Harmony Point have yet to be properly evaluated. For example, chinstrap penguins (Pygoscelis antarcticus) and papuan penguins (P. papua), which are potential inland food sources for giant petrels (penguin remains found in >90% of diet samples and may influence population dynamics, according to Bruyn et al., 2007; Bezerra et al., 2015), are numerous at Harmony Point (Silva et al., 1998). The lowest population count for this site was 395 pairs in 2009. This coincides with a strong El Niño effect (Lee et al., 2010), which could also have been responsible for the lower reproductive success on Elephant Island (Schulz et al., 2014; Petry et al., 2018).

The importance of ASPA 133 for the conservation of Antarctic seabirds is relevant, being recognised as an Important Antarctic Bird Area, with the designation IBA ANT 049 (Figure 8).

Regarding marine mammals, three species are usually found in the Area: Weddell seals (Leptonychotes weddelli), southern elephant seals (Mirounga leonina) and Antarctic fur seals (Arctocephalus gazella). Occasionally, crabeater seals (Lobodon carcinophaga) have also been spotted. The number of mammals in the Area is variable, with maximum sightings of fur seals, Weddell seals and elephant seals of 320, 550 and 100, respectively. The Weddell seal usually breeds in the area, with significant numbers, which can reach 60 females with pups for a season. Calvings of fur and elephant seals have also been recorded, although in much smaller numbers.

6(iii) Access to the Area

The area should preferably be entered by sea. To access by sea, the landing area is located on the east coast of the Gurruchaga Shelter, about 200 metres to the north in the area near the Glacier (see Map 4), on a protected beach of boulders generally without a significant presence of fauna. There is an alternative landing area on the coast just in front of the shelter, but its use is not recommended because a giant petrel nesting area must be crossed to get to the shelter from there. During access to the area, care must be taken not to circulate over areas of vegetation.

Access to the navigation lighthouse located at the west end of Harmony Point is by disembarking to the south of the lighthouse (see Map 3). Both this access and the entrance to Finger Point will be carried out only by sea (see Map 5).

Access by air will only be allowed when there are no means of access by sea, and in the event of an emergency that puts people's lives at risk. In order not to interfere with the breeding settlements of birds near the shelter, particularly giant petrels, small planes are allowed to land over the Nelson Island glacier (see Map 3), taking into account that flying over Harmony Point or Finger Point, or between them, over Harmony Cove, is not permitted on the approach routes. For the approach, the structures indicated in Map 3 should be used. During the manoeuvres, please take into account that planes must not fly over the ice-free area of the Area to avoid disturbing the bird colonies. Aircraft landing must be carried out following the provisions of Resolution 2 (2004), Guidelines for the Operation of Aircraft near Concentrations of Birds.

If absolutely necessary, helicopters may be allowed to land on the ice-free areas of Harmony Point at one of the two possible sites indicated on Map 4. For this, the provisions of the "Guidelines for the Operation of Aircraft near Concentrations of Birds" (Resolution 2, 2004) will be observed as a minimum standard, except in cases of emergency or air safety, to ensure that there is no taking of or harmful interference with the fauna and flora of the area.

The National Antarctic Programme in charge of the activities carried out may use the heliport located to the west of the deposit a single time, only to evacuate historical waste or waste generated during the summer. This task can only be carried out at the end of the campaign, and not before March to ensure that the bird species are not in the critical period for raising chicks. Once this task has been completed, there will be no helicopter access to the area, except in the event of a life-threatening emergency.

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

Located within the Area are structures that remain inside the Area year-round.

- Shelters: Within the Area there is the "Gurruchaga" Shelter (ARG), used as accommodation by the research teams that visit the Area, and a storage shed, which have approximate surfaces of 30 m² and 12 m², respectively. The facilities are only used during spring and summer, with a maximum capacity for 4 people (see section 7(ix) on Disposal of Waste).
- Beacons: There is a Chilean radio beacon for navigation at the western end of Harmony Point, and another Argentine radio beacon at Finger Point.
- Marker boards: A sign warning of the beginning of the Protected Area is located on the sandy beach in front of the shelter. Another sign installed in the shelter indicates its name and ownership.

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

- ASPA No. 112, Coppermine Peninsula, Robert Island, South Shetland Islands, approximately 30 km to the southwest.

- ASPA 125, Fildes Peninsula, King George Island, South Shetland Islands, 23 km north-northeast.
- ASPA No. 128, West Coast of Admiralty Bay, King George Island, South Shetland Islands, approximately 45 km east-northeast.
- ASPA No. 132, Potter Peninsula, King George Island, South Shetland Islands, approximately 30 km east-northeast.
- ASPA 150, Ardley Peninsula (Ardley Island), King George Island, South Shetland Islands, about 19 km northeast.
- ASPA 171, Narebski Point, Barton Peninsula, King George Island, about 25 km northeast of Harmony Point.

6(vi) Restricted Areas within the Area

There are no restricted areas within the Protected Area.

7. Permit conditions

7(i) General permit conditions

Entry to the Area is prohibited except under a permit issued by appropriate national Authorities.

The conditions for the granting of permits are that:

- 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.

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

- Within the ASPA, all movements will be carried out exclusively on foot.
- The circulation of land vehicles in the Area is prohibited.
- The area closest to the coast that lacks vegetation should be used for any movements.

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 monitoring.
- Activities aimed at the promotion of scientific activity, within the framework of the National Antarctic Programmes.
- If access to certain nesting sites for birds and mammal colonies is deemed necessary for scientific or conservation reasons, it could include greater restrictions between late October and early December. This period is considered especially sensitive because it coincides with the egg-laying peaks of nesting birds in the Area.
- 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(iv) Installation, modification or removal of structures

- No additional structures may be built nor equipment installed within the ASPA, except for essential scientific or management activities and with proper permits.
- 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 main researcher, and year of installation.
- Any element to be installed must be of such a nature as to present a minimum risk of contamination in the Area, or of causing damage to vegetation or disturbance to fauna.
- Research markings must not remain after the permit expires. If any specific project cannot be completed within the authorised period and the material cannot be withdrawn, it shall be recorded in the Post-Visit Report and request an extension permitting its permanence in the Area.

7(v) Location of field camps

- Parties using the Area will normally have the Gurruchaga Shelter available. Use of the shelter for scientific purposes by personnel not belonging to the Argentine Antarctic Programme must be coordinated previously with the latter. If tents are needed to be installed, these must be located immediately next to said shelter. Other sites should not be used for this purpose in order to limit human impact. Due to the presence of abundant flora and fauna, a total of four is established as the adequate number of people that can inhabit the shelter, in addition to a camp of approximately six people.
- Not considered within this limit is the installation of tents with instruments or scientific material, or those used as an observation base, which must be removed as soon as the activity concludes.

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

- The deliberate introduction of live animals or plant material is not allowed. 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".
- Uncooked farm products may not be introduced.
- No herbicides or pesticides may be brought into the Area. Any other chemical product, which must be introduced with the corresponding permit, will have to be removed from the Area at the end of the activity. The use and type of chemical products must be documented in the best possible way for the knowledge of future researchers.
- Fuel, food, and other materials must not be deposited within the Area unless they are essential to the activity authorised in the corresponding permit, and as long as they are accumulated inside or close to the shelter. The fuels used in the Gurruchaga Shelter must be handled in accordance with the procedures duly established by the National Antarctic Programme involved in the activity.

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

- Any taking or harmful interference is prohibited, except in accordance with a Permit. When an activity involves taking or harmful interference, it must be consistent with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica, as a standard minimum and with the SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica.
- Information on any taking and harmful interference must be duly exchanged through the Antarctic Treaty Information Exchange System, as established in Article 10.1 of Annex V to the Madrid Protocol.
- Researchers taking samples of flora or fauna of any kind in the Area must ensure that they are familiar with previous collections to minimise the risk of possible duplication. To do so, they should consult the Antarctic Treaty Electronic Information Exchange System (available at https://eies.ats.aq/Login?ReturnUrl=%2F) and/or contact the relevant National Antarctic Programmes.

7(viii) Collection or removal of materials not brought into the Area by the permit holder

- 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) Disposal of Waste

- Any non-physiological waste must 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.
- The waste water from the kitchen of the Gurruchaga Shelter cannot be discharged to the adjacent land. It must therefore be collected in drums and subsequently evacuated from the ASPA at the end of the campaign.
- Waste resulting from research activities in the Area may be temporarily stored next to the Gurruchaga Shelter, pending removal. Said storage must be carried out in accordance with the provisions of Annex III to the Madrid Protocol, marked as waste and duly closed to avoid accidental leaks. They will be removed when the group leaves, in conditions that ensure that they do not disperse or become accessible to the fauna. This waste will be collected by the Antarctic Programme that generates it, to be disposed of in accordance with Annex III of the Madrid Protocol.

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

- Permits to enter the Area may be granted for biological monitoring and inspection activities, which may include the taking of samples of vegetation or animals for research purposes as well as the erection and maintenance of signs or any other management measure.
- All structures and markings installed in the Area for scientific purposes, including signs, must be approved in the Permit and clearly identified by country, indicating the name of the main researcher and year of installation. Research markings and structures must be removed on or before the permit expiry date. If a project cannot be concluded within the time allowed, an extension must be requested authorising the permanence of any element in the Area.

7(xi) Reporting requirements

- The Parties granting entry permits to ASPA No. 133 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 appropriate 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 No. 133 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 managing the Area and reviewing 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.

8. Support documentation

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Figure 1: Geological sketch map of Harmony Point, reproduced from Smellie et al (1984).

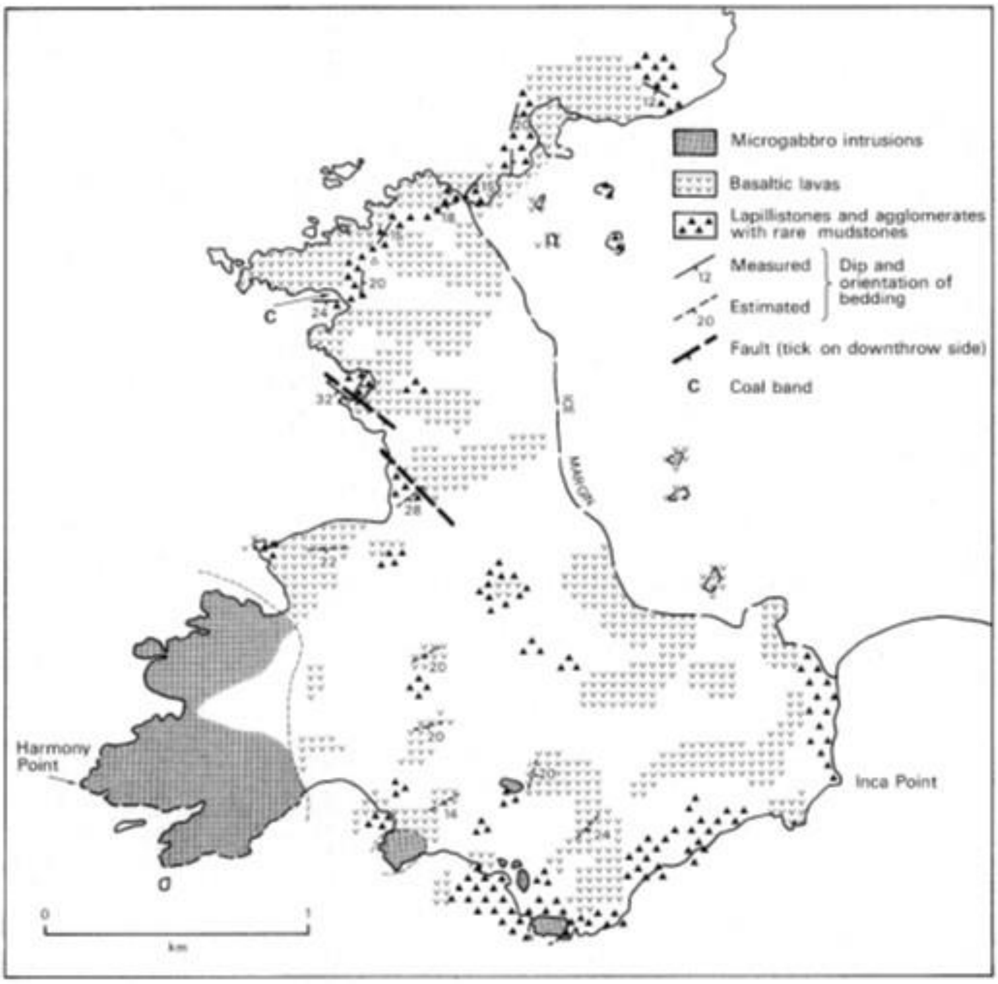


Figure 2: Map of geographic features of Harmony Point, Nelson Island, with the respective extensions in hectares (reproduced from Rodrigues et al., 2019).

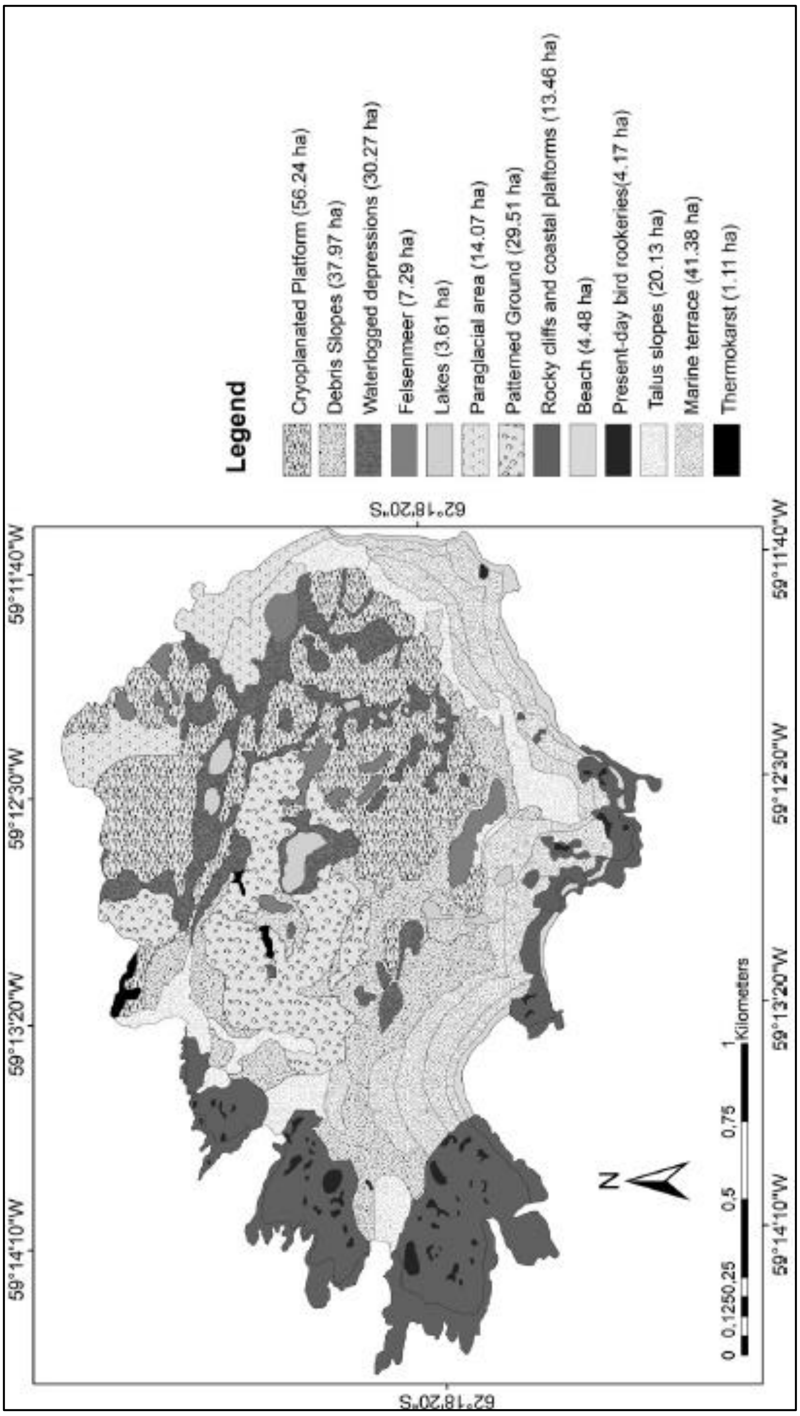


Figure 3: Soil map of Harmony Point, Nelson Island, with the respective extensions in hectares (reproduced from Rodrigues et al., 2019).

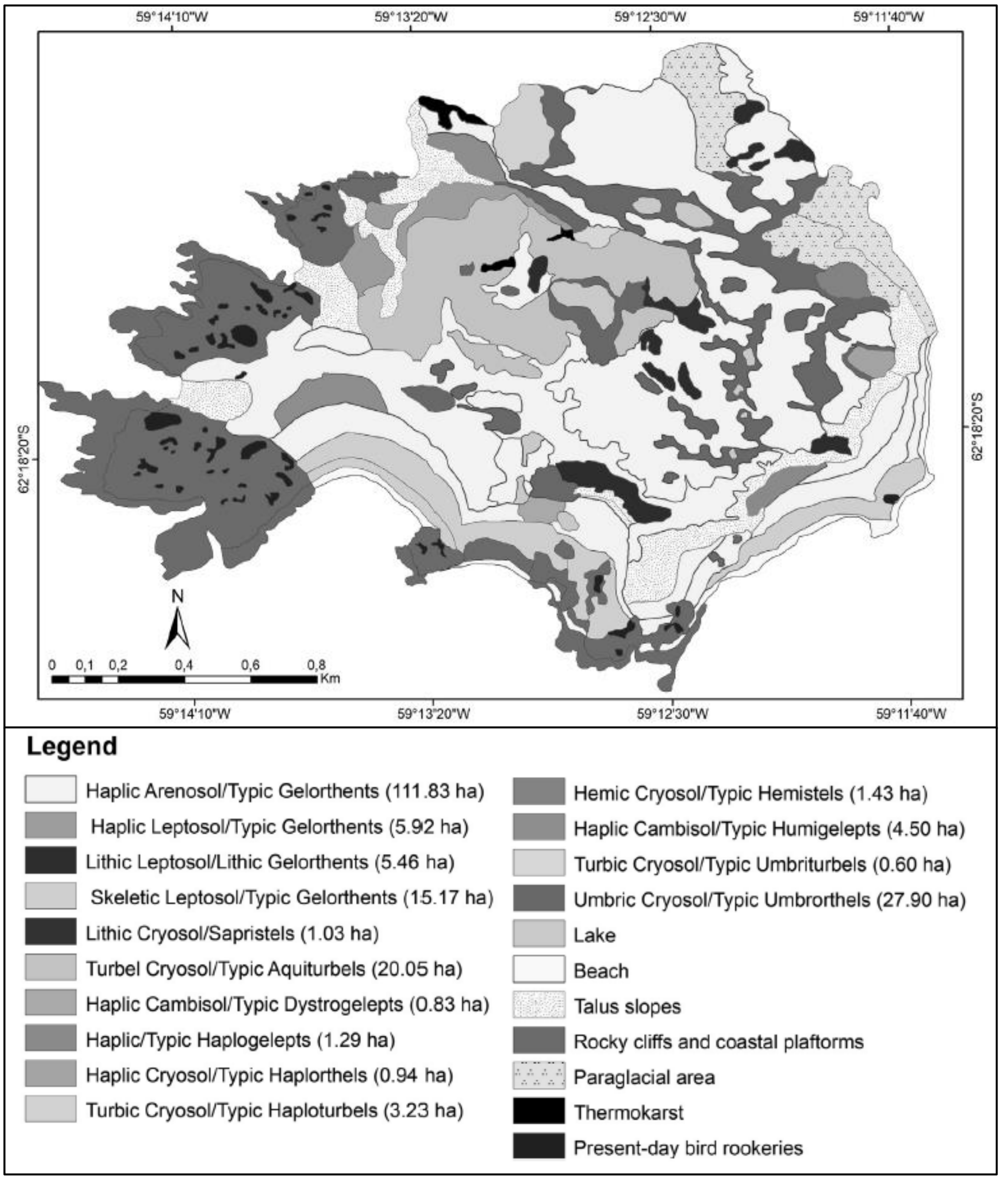


Figure 4: A block diagram illustrating the main landforms, according to landscape chronology, ranging from periglacial domains formed after glacial retreat (last 8 000 years), uplifted marine terraces (middle to late Holocene), the current beach and the volcanic stacks. Penguin colonies and rubble slopes arenot represented in this diagram, although they are very representative in the southern part of Harmony Point (reproduced from Rodrigues et al., 2019).

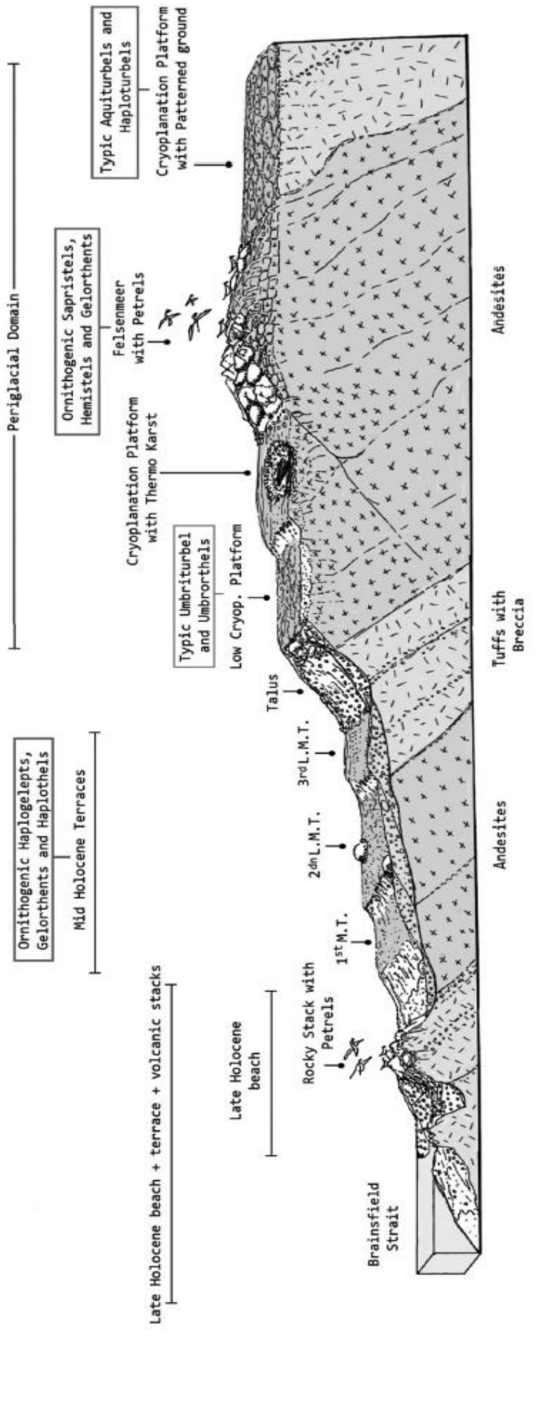


Figure 5: Distribution and abundance (in pairs) of the nesting species of Harmony Point, Nelson Island. Legend: GTP gentoo penguin, CHP chinstrap penguin, MG giant petrel, DC cape petrel, FT black-bellied storm-petrel, OO Wilson's storm-petrel, LD kelp gull, SV Antarctic tern, PHA blue-eyed shag, CA Antarctic pigeon. (Taken from Silva et al., 1998).

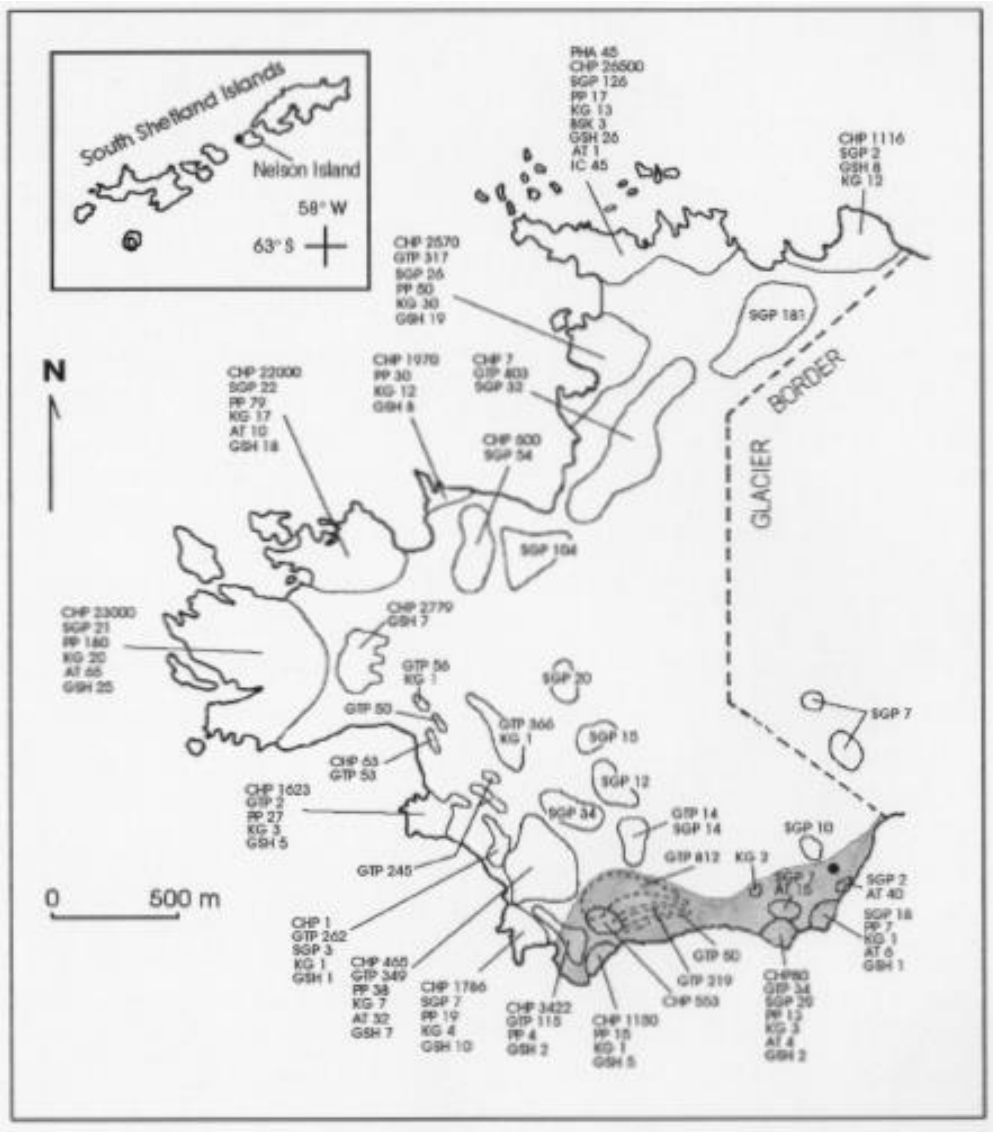


Figure 6: Population trends observed in Antarctic shag colonies at Harmony Point and Punta Duthoit, Nelson Island, South Shetland Islands (reproduced from Caseux and Barrera-Oro, 2015).

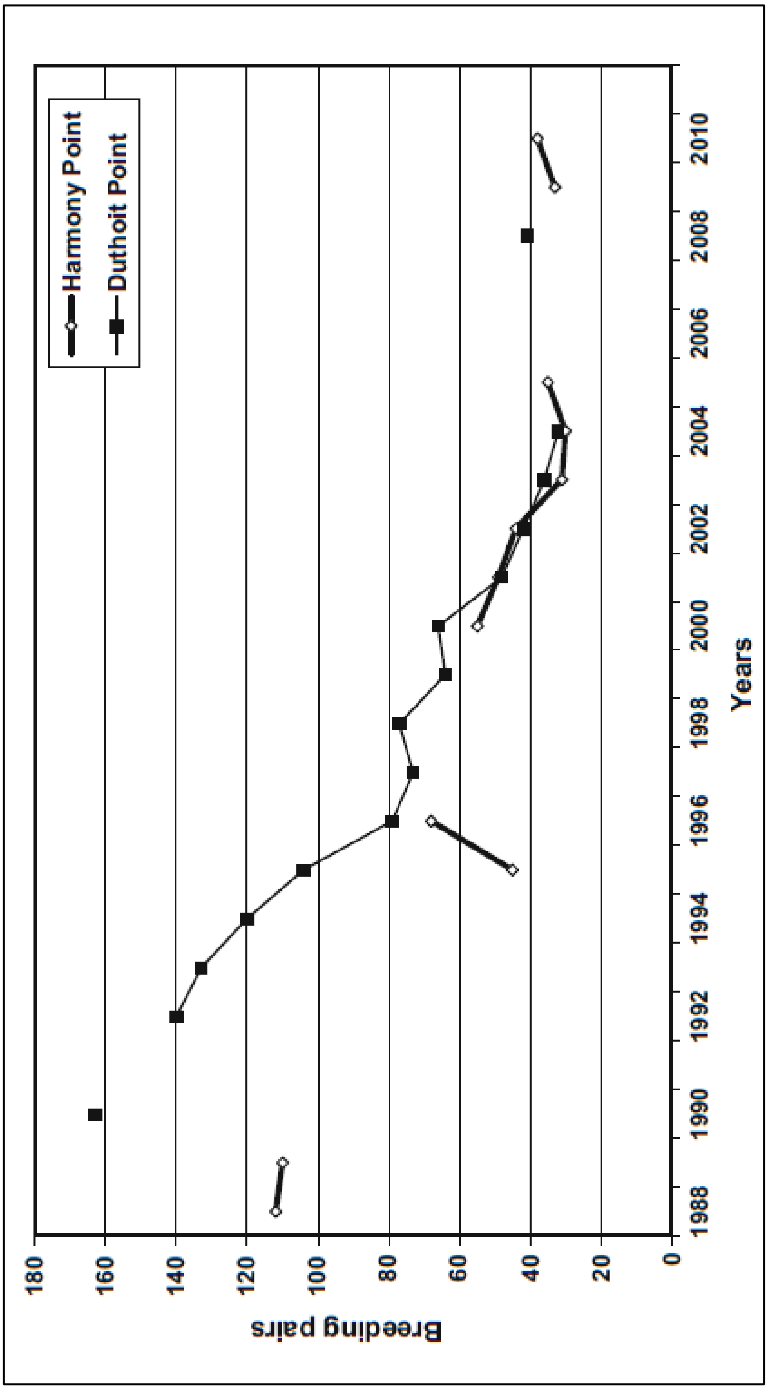


Figure 7: Number of active southern giant petrel (Macronectes giganteus) nests for each colony at Harmony Point in 1995/96 (Silva et al., 1998, dark grey area in circular plots) compared to counts made in 2018/19 (this study, white area in circular plots). Colony distribution (grey polygons) was adapted from Silva et al., (1998) (reproduced from Krüger, 2019).

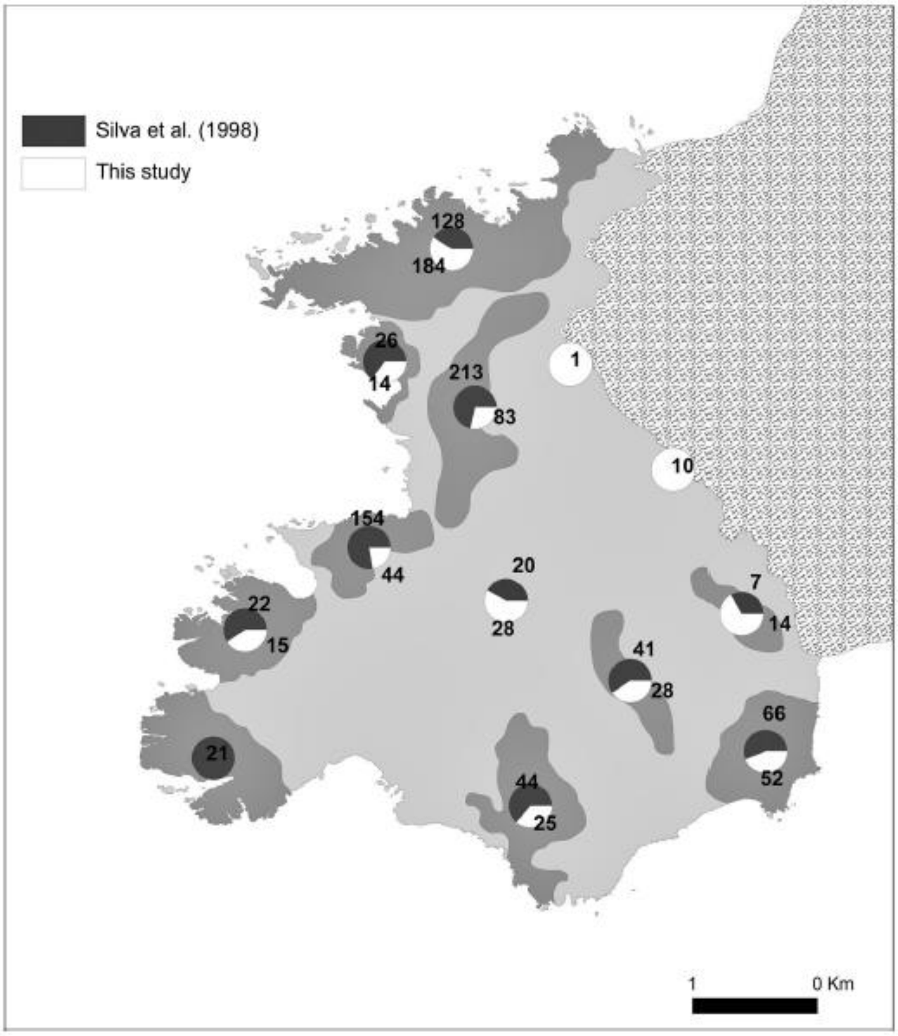
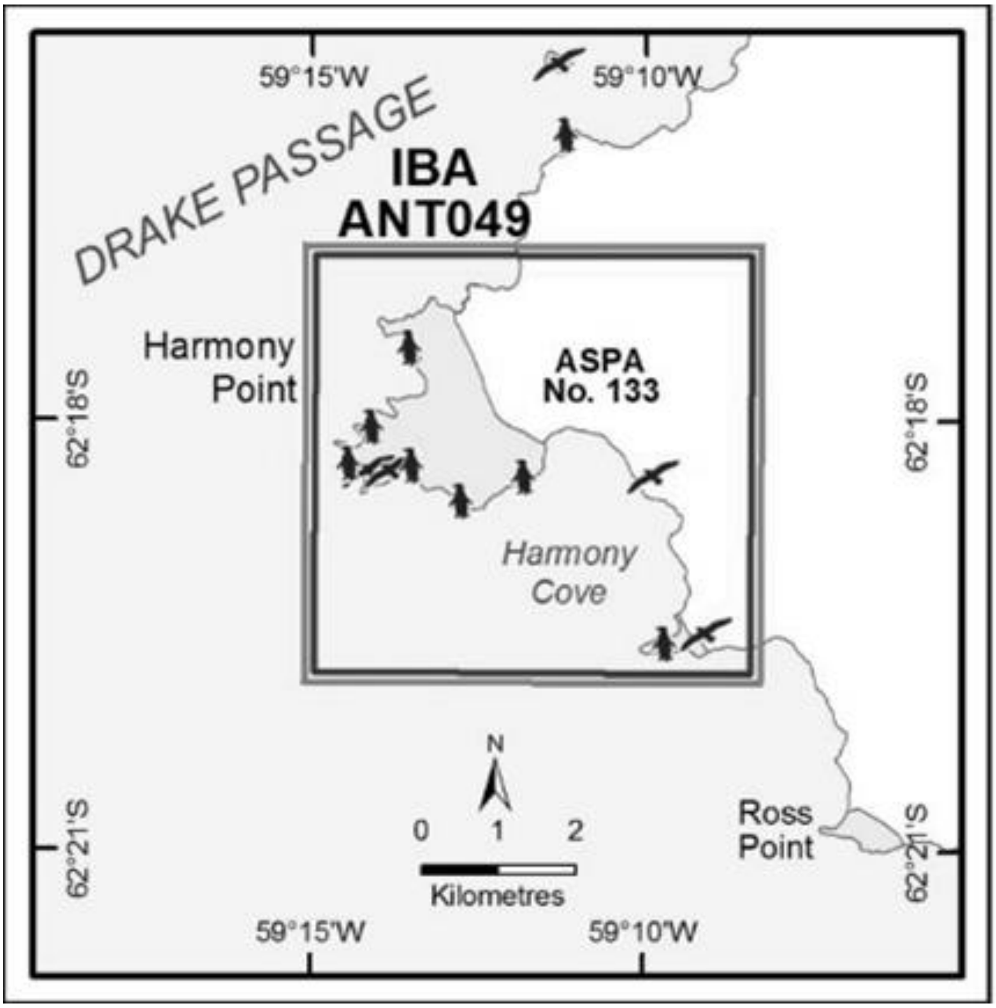
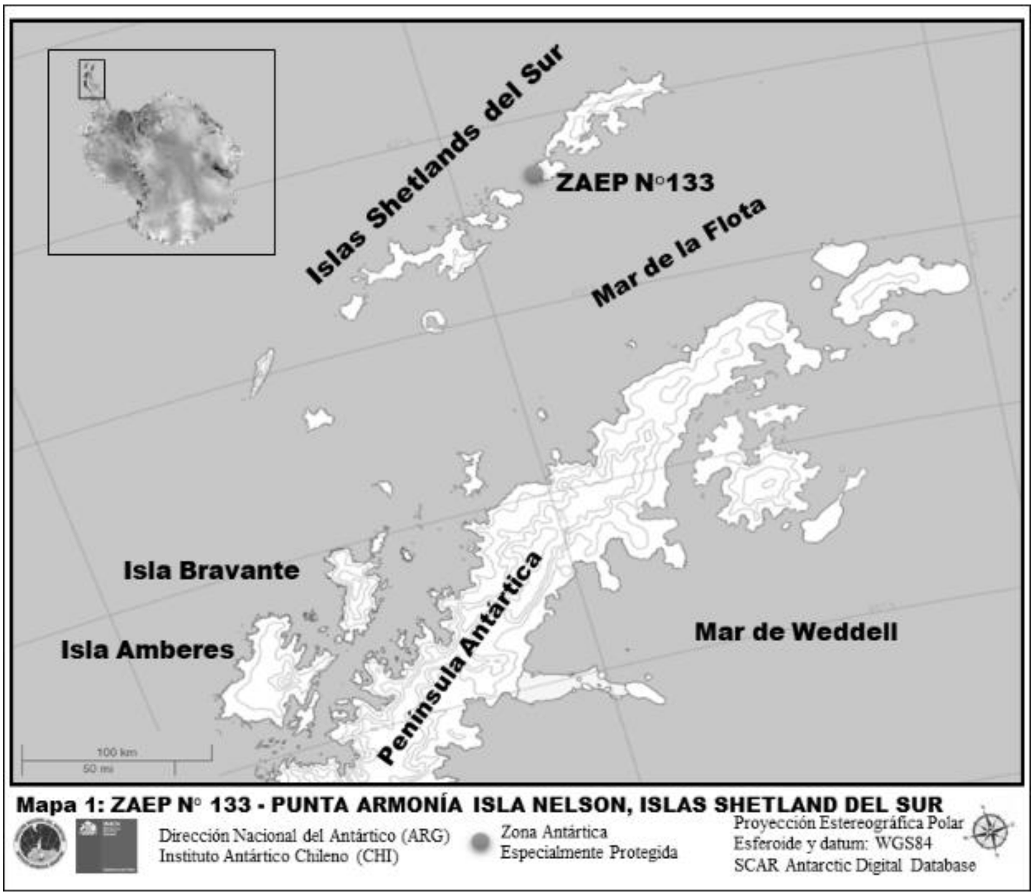


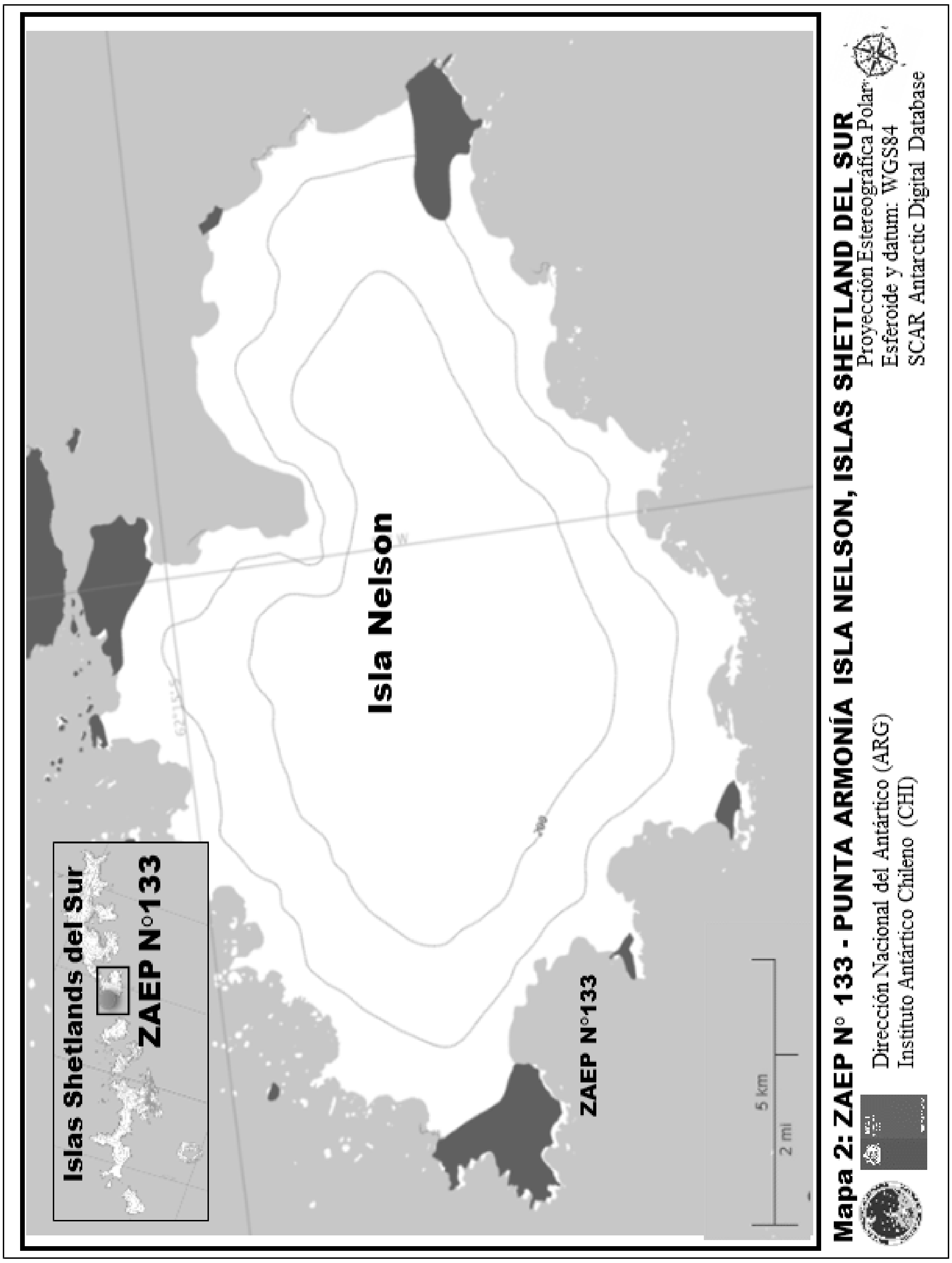
Figure 8: Location of Important Bird Area (IBA) No 049, whose position coincides with ASPA 133 Harmony Point.



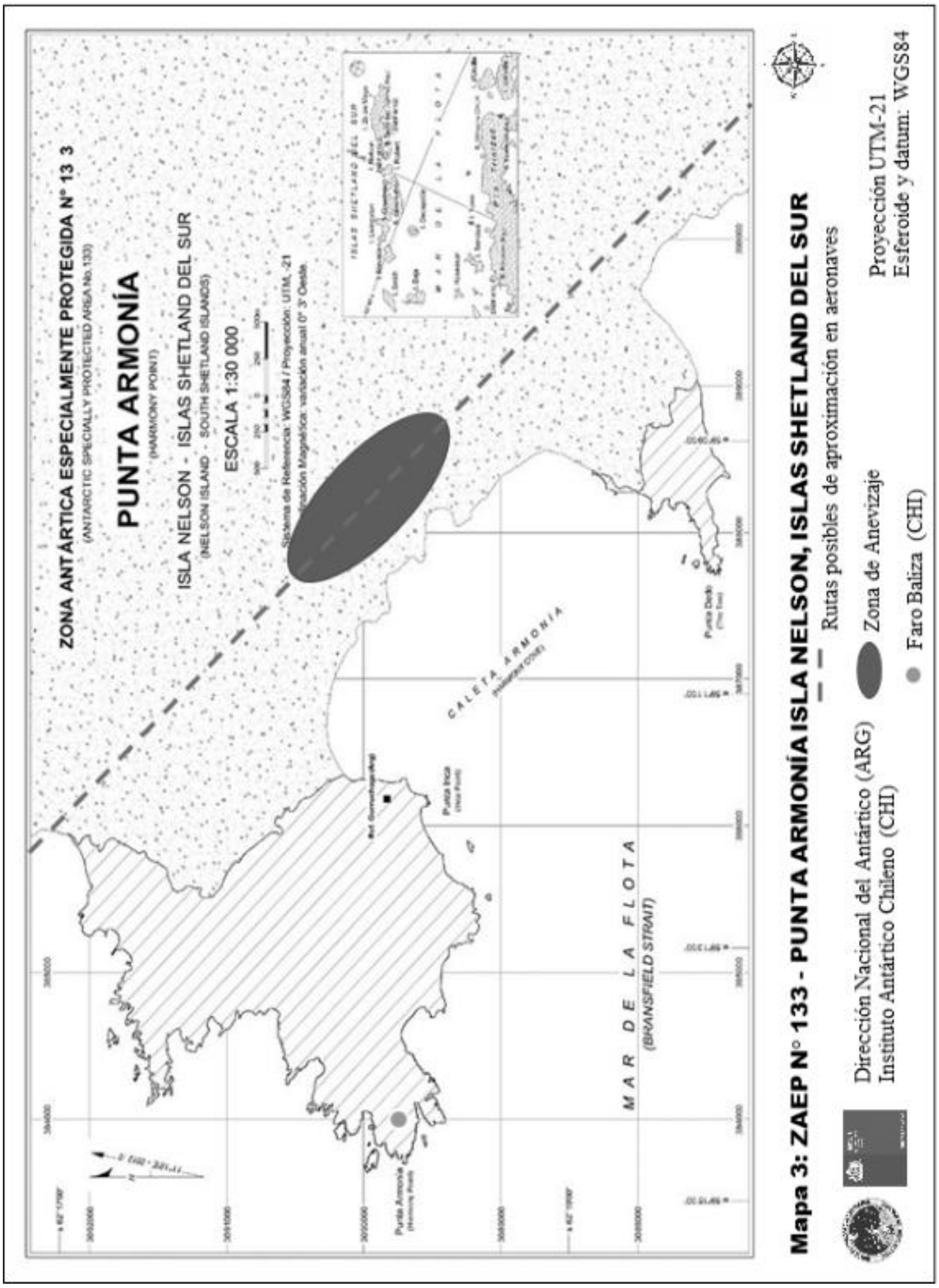
Map 1: Antarctic Specially Protected Area No. 133. Location of the ASPA in the Northern Region of the Antarctic Peninsula and in the South Shetland Islands, north of Fleet Sea/Bransfield Strait).



Map 2: Antarctic Specially Protected Area No. 133. General location of the ASPA on Nelson Island.

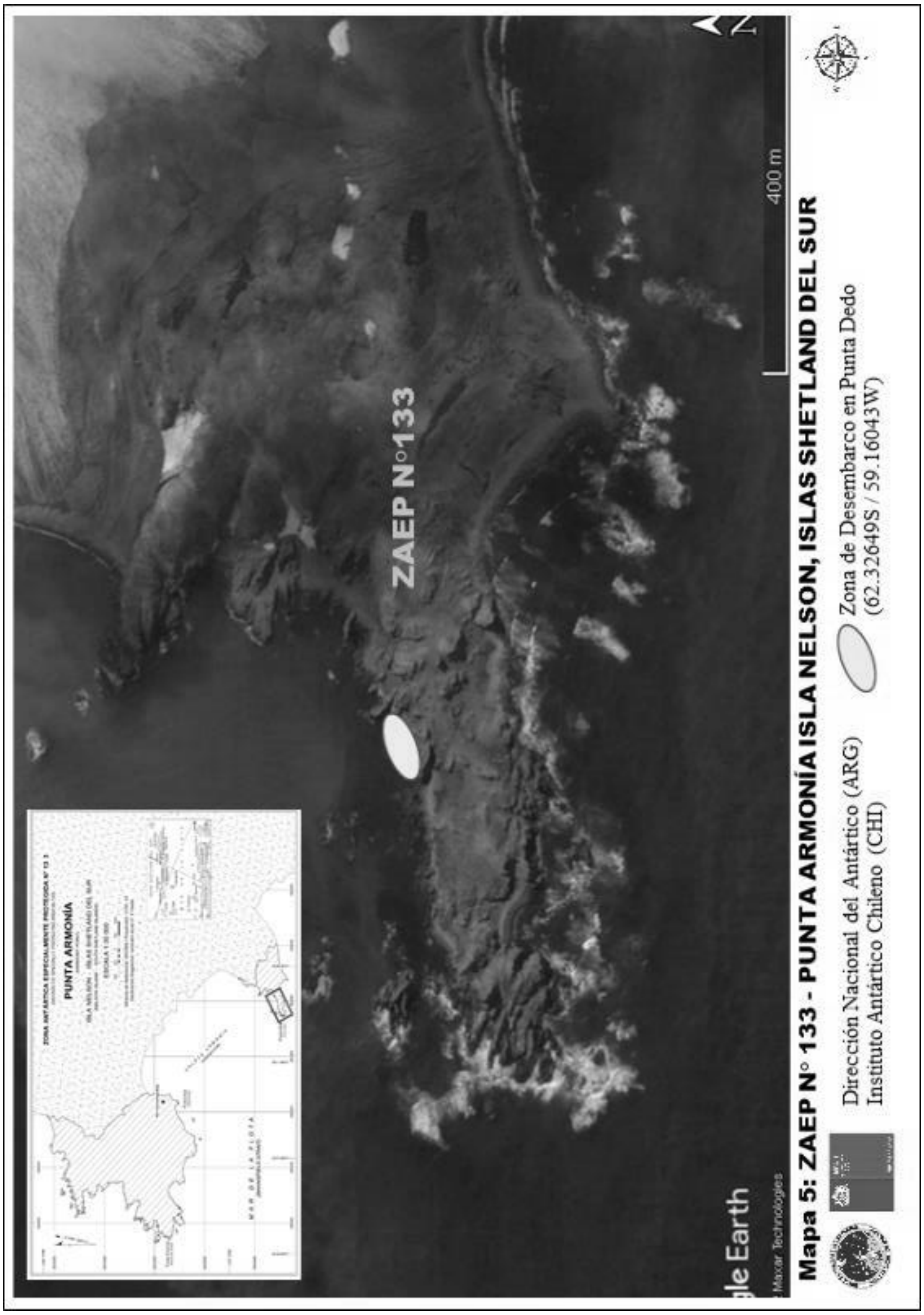


Map 3: Antarctic Specially Protected Area No. 133. Specific location of the ASPA on Nelson Island. Ice-free areas marked in continuous diagonal stripes. Areas covered by ice marked by dotted area.



Map 4: Antarctic Specially Protected Area No. 133. Specific location of important facilities and sites in the area occupied by the Gurruchaga Shelter (ARG), Harmony Point.

Map 5: Antarctic Specially Protected Area No. 133. Location of the landing area on Finger Point.



Measure 14 (2022)

Antarctic Specially Protected Area No 139 (Biscoe Point, Anvers Island, Palmer Archipelago): Revised Management Plan

The Representatives,

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

Recalling

- Recommendation XIII-8 (1985), which designated Biscoe Point, Anvers Island, Palmer Archipelago as Site of Special Scientific Interest (“SSSI”) No 20 and annexed a Management Plan for the Site;
- Resolution 3 (1996) and Measure 2 (2000), which extended the expiry date of SSSI 20;
- Decision 1 (2002), which renamed and renumbered SSSI 20 as ASPA 139;
- Measures 2 (2004), 7 (2010) and 6 (2014), which adopted a revised Management Plan for ASPA 139;

Recalling that Resolution 3 (1996) was 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 139;

Desiring to replace the existing Management Plan for ASPA 139 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 139 (Biscoe Point, Anvers Island, Palmer Archipelago), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 139 annexed to Measure 6 (2014) be revoked.

Management Plan for Antarctic Specially Protected Area (ASPA) No. 139

BISCOE POINT, ANVERS ISLAND, PALMER ARCHIPELAGO

Introduction

The Biscoe Point Antarctic Specially Protected Area is located near the south-west coast of Anvers Island, in the Palmer Archipelago, Antarctic Peninsula, at 64°48'40"S, 63°46'27"W. Approximate area: 0.59 km². The primary reason for the designation of the Area is its extensive vegetation communities, soils and terrestrial ecology. The Area contains the most extensive stands of Antarctic hair grass (Deschampsia antarctica) and Antarctic pearlwort (Colobanthus quitensis) in the Anvers Island region, as well as numerous species of mosses and lichens. The Area is a breeding site for several bird species, including Adélie (Pygoscelis adeliae) and gentoo (P. papua) penguins, brown (Catharacta antarctica), south polar (C. maccormicki) and hybrid skuas, which have been the subject of long-term monitoring and ecological research. Furthermore, the long history of protection of the Area makes it a valuable reference site for comparative studies and long-term monitoring.

The Area was proposed by the United States of America and adopted through Recommendation XII-8 [1985, Site of Special Scientific Interest (SSSI) No. 20]; date of expiry was extended by Resolution 3 (1996) and through Measure 2 (2000); and the Area was renamed and renumbered by Decision 1 (2002). The boundary of the Area was revised through Measure 2 (2004) to remove its marine component, and following the collapse of the ice ramp joining the island to Anvers Island. A revised Management Plan was adopted through Measure 7 (2010) and through Measure 6 (2014).

The Area is situated within Environment E – Antarctic Peninsula, Alexander and other islands based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) and within Region 3 – Northwest Antarctic Peninsula based on the Antarctic Conservation Biogeographic Regions (Resolution 3 (2017)). Biscoe Point lies within Antarctic Specially Managed Area No.7 Southwest Anvers Island and Palmer Basin (adopted through Measure 11 (2019)).

1. Description of values to be protected

Biscoe Point (64°48'47"S, 63°47'41"W, 0.59 km²), Anvers Island, Palmer Archipelago, Antarctic Peninsula, was designated on the grounds that the "Site contains a large (approximately 5000 m²) but discontinuous stand of the two native vascular plants, Antarctic hair grass (Deschampsia antarctica) and, less commonly, Antarctic pearlwort (Colobanthus quitensis). A relatively well developed loam occurs beneath closed swards of the grass and contains a rich biota, including the apterous midge Belgica antarctica. Long-term research programs could be jeopardised by interference from nearby Palmer Station and from tourist ships."

The present management plan reaffirms the exceptional ecological and scientific values associated with the rich flora and invertebrate fauna within the Area. In addition, it is noted that the first observation of C. quitensis growing south of 60°S was made at Biscoe Point, reported by Jean-Baptiste Charcot from the Expédition Antarctiques Française in 1903-05. The island on which Biscoe Point lies contains the most extensive communities of D. antarctica and C. quitensis in the Anvers Island vicinity, and they are of unusual abundance for this latitude. The abundance is much greater than previously described, with almost half of the island of Biscoe Point, and much of the ice-free area of the peninsula to the north, possessing significant stands of vegetation. The communities extend over a large proportion of the available ice-free ground, with a discontinuous cover of D. antarctica, C. quitensis and bryophytes and lichens of several species varying in density over an area of approximately 250,000 m². One stand of mosses in the prominent valley on the northern side of the main island extends almost continuously for 150 m along the valley floor, covering an area of approximately 6500 m². Individual, near-continuous stands of D. antarctica and C. quitensis reach a similar size, both on the main island and, to a lesser extent, on the promontory to the north.

Several plant community studies were in progress when the Area was designated in 1985. Although these studies were discontinued soon after site designation, botanical research at the site has continued. For example, D. antarctica and C. quitensis seeds have been collected from Biscoe Point for plant studies examining the influence of climate change and enhanced UV-B radiation (Day pers. comm. 1999). Biscoe Point was valuable for these studies because of the amount and quality of seeds available within the Area. Cores containing plant material and soils have been collected within the Area to investigate carbon and nitrogen fluxes within the ecosystem and to evaluate the influence of increased temperature and precipitation on the ecosystem (Park et al. 2007, Day et al. 2009). In addition, Biscoe Point is one of the few low-lying vegetated sites that has not yet been substantially damaged by Antarctic fur seals, and as such the Area has been identified as a potential control site for assessing Antarctic fur seal impacts on vegetation and soils in this region. While recent expansion of the gentoo penguin colony has resulted in damage to and loss of some vegetation surrounding nest sites, these are relatively small compared to the overall vegetation cover at Biscoe Point, and the vegetation values of the Area are not considered to have been significantly compromised.

Biscoe Point is also valuable for ornithological research. Research into seabird ecology and long-term monitoring studies are being conducted on Adélie (Pygoscelis adeliae) and gentoo (P. papua) penguin colonies, as well as brown (Catharacta antarctica) and hybrid skuas (Patterson-Fraser pers. comm. 2010). The gentoo penguin colony became established at Biscoe Point around 1992 and, as a recently founded colony, is of particular value for monitoring long-term ecological changes to the local bird population structure and dynamics (Fraser pers. comm. 1999). The Adélie penguin colony is valuable for long-term monitoring and comparison with other colonies in Arthur Harbor that are subjected to higher levels of human influence. In this respect, the fact that the Area has been protected from significant human use, and that use allowed has been regulated by permit, for such a long period of time is of particular value. The Adélie penguin colony is one of the oldest in the southern Anvers Island region (more than 700 years), and as such is valuable for paleoecological studies. The site is also the only site in the region where brown (C.antarctica), south polar (C. maccormicki) and hybrid skuas are known to occur annually.

Until recently, Biscoe Point was on a peninsula joined to Anvers Island by an ice ramp extending from the adjacent glacier. The ice ramp disappeared as the glacier retreated, and a narrow channel now separates Anvers Island from the island on which Biscoe Point lies. The original boundary of the Area was of geometric shape and extended to include a separate ice-free promontory 300 m to the north of this island, and also included the intervening marine environment. The Area is now defined to include all land above the low tide water level of the main island on which Biscoe Point is situated (0.48 km^2), all offshore islets and rocks within 100 m of the shore of the main island, and most of the predominantly ice-free promontory 300 m to the north (0.1 km^2). The marine component is now excluded from the Area because of the lack of information on its values. The Area in total is now approximately 0.59 km^2.

In summary, the Area at Biscoe Point therefore has high value for its outstanding:

- examples of vegetation communities, soils and associated terrestrial ecology;
- ornithological interest, with several of the resident breeding bird species and associated paleoecological features possessing unusual properties, and which are the subject of long-term studies; and
- utility as a reference site for comparative studies and monitoring.

In order to protect the values of the Area, it is important that visitation continues to remain low and is carefully managed by permits and by this Management Plan.

2. Aims and objectives

Management at Biscoe Point 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 and physical environment in the Area provided it is for compelling reasons which cannot be served elsewhere and that will not compromise the values for which the Area is protected;
- Allow visits for educational and outreach purposes (such as documentary reporting (visual, audio or written) or the production of educational resources or services) provided such activities are for compelling reasons that cannot be served elsewhere and will not compromise the values for which the Area is protected;
- Minimize the possibility of introduction of non-native species (e.g. 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, and copies of this management plan, including maps of the Area, shall be made available at Palmer Station (US) on Anvers Island and at Yelcho Station (Chile) on Doumer Island;
- Copies of this management plan shall be made available to all vessels and aircraft visiting the Area and/or operating in the vicinity of Palmer Station, and all personnel (national program staff, field expeditions, tourist expedition leaders, pilots and ship captains) operating in the vicinity of, accessing or flying over the Area, shall be informed by their national program, tour operator or appropriate national authority 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 erected within the Area for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer required;
- National Antarctic programs operating in the Area should maintain a record of all new markers, signs and structures erected within the Area;
- The Area shall be visited as necessary (at least 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.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No. 139 Biscoe Point, Arthur Harbor, Anvers Island, showing the location of nearby stations (Palmer Station, US; Yelcho Station, Chile; Port Lockroy Historic Site and Monument No. 61, UK), the boundary of Antarctic Specially Managed Area No. 7 Southwest Anvers Island and Palmer Basin, and the location of nearby protected areas. Projection: Lambert Conformal Conic; Central Meridian: 64° 00' W; Standard parallels: 64° 40' S, 65° 00' S; Latitude of Origin: 66° 00' S; Spheroid and horizontal datum: WGS84; Contour interval: Land – 250 m, Marine – 200 m. Data sources: coastline & topography SCAR Antarctic Digital Database v4.1 (2005); Bathymetry: IBCSO v.1 (2013); Protected areas: ERA (2020); Stations: COMNAP (2020). Inset: the location of Anvers Island and the Palmer Archipelago in relation to the Antarctic Peninsula.

Map 2: ASPA No. 139 Biscoe Point – Topography and access. Projection: Lambert Conformal Conic: Central Meridian: 63° 46' W; Standard parallels: 64° 48' S; 64° 50' S; Latitude of Origin: 65° 00' S; Spheroid and horizontal datum: WGS84; Vertical datum: mean sea level; Contour interval: 5 m. The coastline of the island on which Biscoe Point lies is digitized from an orthophoto (Nov 2009) estimated as accurate to ± 1 m (ERA 2010). The peninsula to the north of Biscoe Point, several offshore islands and Anvers Island are also derived from the recent orthophoto and a georeferenced WorldView-2 image (16 Jan 2012) (Imagery © 2012 Digital Globe). Penguin colonies and other features: orthophoto (Nov 2009) and GPS survey (ERA 2001).

Map 3: ASPA No. 139 Biscoe Point – Penguin colonies, vegetation extent, and contaminated sites. Map specifications as for Map 2. Contamination: partial survey (Feb 2001); Vegetation: estimated from air and ground photos.

6. Description of the Area

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

- *Overview*

Biscoe Point (64° 48' 47" S, 63° 47' 41" W) is at the western extremity of a small island (0.48 km²), located close to the southern coast of Anvers Island (2700 km²) about 6 km south of Mount William (1515 m), in the region west of the Antarctic Peninsula known as the Palmer Archipelago (Map 1). Until recently, this island was joined to Anvers Island by an ice ramp extending from the adjacent southward-flowing glacier, and many maps (now incorrectly) show Biscoe Point as lying on a peninsula. A narrow, permanent, marine channel of approximately 50 m in width now separates the island on which Biscoe Point lies from Anvers Island. This mostly ice-free island lies south-east of Biscoe Bay and to the north of Bismarck Strait. A smaller extent of mostly ice-free land about 300 m to the north remains joined as a peninsula to Anvers Island by an ice ramp.

The island on which Biscoe Point lies is approximately 1.8 km long in an east-west direction and of up to about 450 m in width (Map 2). Topography consists of a series of low-lying hills, with the main east-west oriented ridge rising to a maximum altitude of about 24 m. A small ice cap that previously rose to 12 m at the eastern end of the island no longer exists. The coastline is irregular and generally rocky, studded by offshore islets and rocks, and pitted by numerous bays. A number of the more sheltered bays harbor gentle and accessible gravel beaches. The unnamed promontory to the north is approximately 750 m in length (east-west) by 150 m wide and is of similar character, although of lower topography.

Palmer Station (US) is located 13.8 km north-west of the Area at Arthur Harbor, Yelcho Station (Chile) is located approximately 12 km to the southeast at Doumer Island, while 'Base A' (UK, Historic Site No. 61) is located at Port Lockroy, Goudier Island (off Wiencke Island) approximately 13 km to the east (Map 1).

- *Boundaries*

The Area is defined to include all land above the low tide water level of the main island on which Biscoe Point is situated (0.48 km²), all offshore islets and rocks within 100 m of the shore of this main island, and most of the predominantly ice-free promontory 300 m to the north (0.1 km²) (Map 2). The landward (eastern) boundary on the northern promontory bisects the peninsula at the point where it protrudes from Anvers Island, distinguished by a small bay cutting into the glacier in the south and a similar, although less pronounced, coastline feature in the north. The total area including the main island and the northern promontory is approximately 0.59 km².

- *Climate*

No meteorological data are available for Biscoe Point, although data are available for Palmer Station (US), where conditions are expected to be broadly similar. Longer-term data available for Palmer Station show regional temperatures to be relatively mild because of local oceanographic conditions and because of the frequent and persistent cloud cover in the Arthur Harbor region (Lowry 1975). Annual average air temperatures recorded at Palmer Station during the period 1974 to 2012 show a distinct warming trend, although also demonstrate significant inter-annual variability. Between 2010-17 the mean annual temperature at Palmer Station was –1.8° C, with an average monthly air temperature in August of –5.94° C, and in January 1.72° C. The minimum temperature recorded between 1974 to 2018 was -26°C (Aug 1995) and the maximum was 11.6°C (Mar 2010).

Storms at Palmer Station are frequent, with precipitation in the form of snow and rain giving an annual average snowfall depth of 344 cm and ~636 mm water equivalent of precipitation. Winds are persistent but generally light to moderate in strength, prevailing from the north-east. Cloud cover is frequent and extensive, often with a ceiling of less than 300 m.

These patterns are expected to be broadly similar at Biscoe Point, although the Area will have minor climatic differences as a result of local geography.

- *Geology and soils*

Specific descriptions are not available of the geology of island on which Biscoe Point lies, or of the peninsula to the north. However, the bedrock appears to be composed mainly of gabbros and adamellites of Late Cretaceous to Early Tertiary age belonging to the Andean Intrusive Suite, which dominate the composition of southeastern Anvers Island (Hooper 1958). Gabbro is a dark, coarse-grained plutonic rock that is mineralogically similar to basalt, and which is composed mainly of calcium-rich plagioclase feldspar and pyroxene. Adamellite is a granitic rock composed of 10-50% quartz and which contains plagioclase feldspar. A fine mineral soil is present on the gentle terrain, although precise soil characteristics have yet to be described. A relatively well-developed, loamy soil is associated with the closed swards of Deschampsia. Cores extracted in the south of the island, close to the Adélie penguin colony, consisted of an organic horizon, overlying a sandy loam glacial drift or bedrock (Day et al. 2009).

- *Freshwater habitat*

A number of small seasonal streams and ponds are present on the island on which Biscoe Point lies, although they have not been scientifically described. A small pond (perhaps the largest, at approximately 30 m x 8 m) and stream occur in a valley on the southern side of the principal ridge of the island, 50 m NE of the southern small boat landing site (Map 2). The presence of a long rubber hose suggests that at one time visitors may have collected fresh water from this site. The hose was removed in 2009/10 and disposed of at Palmer Station. Another freshwater pond of similar size (approximately 25 m x 6 m) is found in the prominent east-west trending valley on the northern side of the island. A small associated stream drains this pond to the west. A series of small ponds appear present in satellite imagery (mid-Jan 2012) at the eastern end of the island, nestled in depressions where a small ice cap previously existed. The freshwater environment has thus far escaped significant disturbance from seals. Some ponds near the gentoo penguin colony are frequented by washing / bathing penguins, and as a result have become locally enriched by nutrients (Patterson-Fraser pers. comm. 2014). Information on the hydrology of the separate promontory to the north is not available.

- *Vegetation*

The most significant aspect of the vegetation at Biscoe Point is the abundance and reproductive success of the two native Antarctic flowering plants, the Antarctic hair grass Deschampsia antarctica and Antarctic pearlwort Colobanthus quitensis. The communities of D. antarctica and C. quitensis at Biscoe Point are the most extensive in the Anvers Island vicinity and are considered particularly abundant for such a southerly location (Greene and Holtom 1971; Komárková 1983, 1984; Komárková, Poncet and Poncet 1985). The first observation of C. quitensis growing south of 60°S was made near Biscoe Point, recorded (as C. crassifolius) by the biologist Turquet on Jean-Baptiste Charcot’s Expédition Antarctiques Française (1903-05). More recently, seeds from both flowering plants within the Area have been collected for propagation in studies on the effects of climate change and UV-B exposure on these species being conducted out of Palmer Station (Day pers. comm. 1999; Xiong 2000). In January 2004, cores of plant material and soils were collected from Biscoe Point and were used in multi-year experiments into the tundra ecosystem. The cores were used in combination with precipitation and surface runoff samples to measure pools and fluxes of carbon and nitrogen within the Biscoe Point ecosystem and to evaluate the role of nitrogen inputs from the nearby penguin colony (Park et al., 2007). Cores were also used in climate manipulation experiments at Palmer Station, which investigated the influence of increased temperature and precipitation on plant productivity and the abundance of the springtail Cryptopygus (Day et al. 2009).

The abundance of D. antarctica and C. quitensis is much greater than previously described, and almost half of the island on which Biscoe Point lies, and much of the ice-free area of the peninsula to the north, possess significant stands of these species and a wide range of bryophytes and lichens. The approximate distribution of the most substantial stands of vegetation on the main island has been estimated from air and ground photography (Map 3). The distribution illustrated in Map 3 is intended as a general guide to the main areas of vegetation cover, rather than as a definitive description, and is not based on a precise ground survey. However, it does serve to indicate the scale of the vegetated communities, which comprise a discontinuous cover of varied composition and density over an area of approximately 250,000 m². Komárková (1983) noted a discontinuous stand of D. antarctica and C. quitensis reaching approximately 5000 m² on the main island. One particularly extensive stand of mosses in the principal valley on the northern side of the main island extends almost continuously for 240 m along the valley floor, occupying an area of approximately 8000 m² (Harris 2001). Stands of lesser extent are present elsewhere on the island and on the separate promontory 300 m to the north. Colonization has been observed occurring on recently deglaciated material.

Mosses tend to dominate on valley floors, close to streams and ponds, and in moist depressions. Mosses specifically recorded at Biscoe Point include Bryum pseudotriquetrum and Sanionia uncinata (Park et al. 2007). On valley sides, mixed communities of moss and C. quitensis are frequent on lower north-facing slopes, with an increasing prevalence of D. antarctica with elevation. Mixed D. antarctica and C. quitensis communities are particularly prolific on northern slopes between 10-20 m, while D. antarctica tends to be more frequent on the higher exposed sites above 20 m. Mosses and lichens are frequently co-dominants or subordinate taxa. In some habitats C. quitensis may occur in small patches alone. Plant communities are commonly found on snow-free benches below the ridgelines on which Adélie and gentoo penguins nest (Park and Day 2007).Patches of dead vascular plants of up to 20 m² have been observed within the Area, believed to result from the effects of desiccation, flooding and frost during some summers (Komárková, Poncet and Poncet 1985).

Unlike many other low-lying coastal sites in the vicinity, the vegetation at Biscoe Point does not appear to have been severely affected by the recent regional increase in numbers of Antarctic fur seals (Arctocephalus gazella). As such, the Area has been identified as a potential control site for assessing Antarctic fur seal impacts on vegetation and soil (Day pers. comm. 1999). Expansion of the gentoo penguin colony has resulted in local damage to areas of vegetation where the birds are concentrated and building nests (Patterson-Fraser pers. comm. 2014). These sites are relatively small compared to the overall area of vegetation cover at Biscoe Point, and the vegetation values of the Area are not considered to have been significantly compromised as a result (Fraser pers. comm. 2020).

- *Invertebrates, bacteria and fungi*

The apterous midge Belgica antarctica has been observed associated with the well-developed loam and closed swards of grass. Cores collected at Biscoe Point contained several species of microarthropod, including several species or genera of Acari, one species of Diptera and three species of Collembola. The springtail Cryptopygus antarcticus was the most abundant microarthropod (Day et al. 2009)

No further information is available on the invertebrate assemblages in the Area, although in view of the well-developed plant communities a rich invertebrate fauna might be expected. There is no information available on local bacterial or fungal communities.

- *Breeding birds and mammals*

At least six species of birds breed on the island on which Biscoe Point lies. An Adélie penguin (Pygoscelis adeliae) colony is located on the ridge of a promontory on the south side of the island, above a narrow cove on the southern coast (Map 3). Numbers at this colony have declined from around 3000 in the 1980s to around 500-600 in recent years (Table 1). A gentoo penguin (Pygoscelis papua) colony was discovered on slopes on the northern side of this cove, on the southern side of the main island ridge, in 1992-93 (Fraser, pers. comm., 1999) (Map 3) and gentoo numbers increased significantly from 2002 with 3197 breeding pairs in the 2012/13 season (Patterson-Fraser pers. comm. 2010, 2014; Ducklow et al. 2013) (Table 1). Since then, numbers have stabilized, with the gentoo and Adélie colonies maintaining populations of ~3200 and ~550 breeding pairs respectively in the years through to 2019/20 (Fraser pers. comm. 2020).

Table 1. Numbers of breeding Adélie (Pygoscelis adeliae) and gentoo (Pygoscelis papua) penguins on the island on which Biscoe Point lies 1971-2012.

	Pygoscelis adeliae			Pygoscelis papua		
Year	Breeding pairs	Count type1	Source	Breeding pairs	Count type1	Source
1971/72	3020	N3	2	0	N3	2
1983/84	3440	C3	3	0	C3	3
1984/85	2754	N1	3	0	N1	3
1986/87	3000	N4	4			
…						
1994/95				14	N1	5
1995/96				33	N1	5
1996/97	1801	N1	5	45	N1	5
1997/98				56	N1	5
1998/99				26	N1	5
1999/2000	1665	N1	5	149	N1	5
2000/01	1335	N1	5	296	N1	5
2000/02	692	N1	5	288	N1	5
2002/03	1025	N1	5	639	N1	5
2009/10	594	N1	6	2401	N1	6
2010/11	539	N1	7	2404	N1	7
2011/12	567	N1	7	3081	N1	7
2012/13	522	N1	7	3197	N1	7

N = Nest, C = Chick, A = Adults; 1 = < ± 5%, 2 = ± 5-10%, 3 = ± 10-15%, 4 = ± 25-50% (classification after Woehler, 1993)

1. Müller-Schwarze and Müller-Schwarze, 1975

2. Parmelee and Parmelee, 1987
3. Poncet and Poncet 1987 (note: the number of 3500 given in Woehler (1993) appears to be in error).
4. Fraser data supplied February 2003, based on multiple published and unpublished sources.
5. Patterson-Fraser data supplied March 2010 based on census at time of peak egg presence.
6. Ducklow et al. 2013.

The Adélie penguin colonies are some of the oldest in the region (more than 700 years), and have been the subject of paleoecological studies (Emslie 2001), while the gentoo penguin colony is considered particularly interesting because it has been recently established (Fraser pers. comm. 1999). Long-term studies are being conducted on the population structure and dynamics of the penguin colonies within the Area, which make a useful comparison with other colonies in Arthur Harbor that are subjected to higher levels of human influence (Fraser pers. comm. 1999). The pattern of a decline in the Adélie penguin breeding population at Biscoe Point and increasing gentoo penguin breeding population is consistent with recent observations of colonies at nearby Palmer Station (Ducklow et al. 2013) and elsewhere in the Antarctic Peninsula region (Hinke et al. 2007, Carlini et al. 2009).

South polar skuas (Catharacta maccormicki) and brown skuas (C. antarctica) breed within the Area annually, and hybrids also occur. On the island on which Biscoe Point lies, 132 pairs of south polar skuas and one pair of brown skuas were counted on 26-27 February 2001 (Harris 2001). Concurrently, 15 pairs of south polar skuas, usually with one or two chicks, were counted on the promontory 300 m to the north. Kelp gulls (Larus dominicanus) and Antarctic terns (Sterna vittata) breed within the Area (Fraser pers. comm. 2000), although data on numbers are not available. Information on other bird species that breed within the Area, or that transiently visit, is not available.

Small numbers of non-breeding Antarctic fur seals (Arctocephalus gazella) (several counted on the island in late-February 2001 – Harris 2001), Weddell seals (Leptonychotes weddellii) and southern elephant seals (Mirounga leonina) have been observed on beaches in summer. Despite the presence of beaches and terrain suitable for haul-out, relatively few seals are typically observed within the Area. This may be a result of the observed frequent persistence of dense brash ice originating from glaciers calving from nearby Anvers Island (Fraser pers. comm. 1999). Further information on numbers and breeding status, or on other seal species, is not available. No information is available on the local marine environment.

- *Human activities and impact*

Human activity within the Area appears to have been minimal, but few details have been recorded. The first documented human activity in the vicinity of Biscoe Point occurred over 150 years ago, when John Biscoe, Royal Navy, entered the bay now named after him on 21 February 1832. Biscoe recorded a landing on Anvers Island, probably near Biscoe Point, which he believed to be part of the mainland of

Antarctica (Hattersley-Smith 1991). The next recorded visit to Biscoe Point was in 1903-05, when Turquet made observations of C. quitensis at the site on the Première Expédition Antarctiques Française led by Charcot.

More recently, formal plots for plant studies were established on the island near Biscoe Point in 1982 (Komárková 1983), although the long-term research originally planned was discontinued soon thereafter. Komárková used welding rods inserted into the soil to mark study sites. A partial survey accurately mapped the positions (± 2 m) of 44 welding rods found in soils and vegetation during a systematic search made on the northeastern side of the island in February 2001 (Map 3) (Harris 2001). The rods were located in an area of some of the richest vegetation on the island, and distributed over an area of at least 8000 m². In general, they had been inserted into soil or vegetation with chemically coated ends downwards. Contaminants from the rods appeared to kill all vegetation up to 20 cm from where the rods lay. Numerous rods have been found in previous seasons, possibly numbering in the hundreds (Fraser, Patterson, Day: pers. comms. 1999-2002). Additional welding rods were found on and near the beach during the 2009/10 season, which were collected and disposed of at Palmer Station (Patterson-Fraser pers. comm. 2010). The Area is not considered suitable as a reference site for measuring chemical contamination, because there remains uncertainty over contaminant types and concentrations, which sites have been affected, and the extent to which contaminants may have moved through soil, water and biological systems.

Fraser (pers. comm. 2001) also reported markers made of lead present in the gentoo penguin colony. In addition, seaborne litter (mostly wood) may be found on beaches. A rubber hose (15 m long, ~15 cm diameter) was removed from a small valley near the southern small boat landing site in 2009/10.

Recent scientific studies within the Area have focused on monitoring the breeding status of penguins and skuas The Area has also been used for the collection of seeds of Deschampsia and Colobanthus and cores of soil and plant material for ecological research in the Palmer Station region. Permits have been required to visit the Area since the site was specially protected in 1985.

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. Particular routes have not been designated for small boat access to the Area. Overflight, preferred helicopter access routes and aircraft landing restrictions apply within the Area, the specific conditions for which are set out in Section 7(ii) below. The designated Helicopter Access Zone that applies around the Area is described in Sections 6(v) and 7(ii) below.

The seasonal cycle of sea ice formation in the Palmer area is highly variable, with sea ice formation beginning between March and May. For the period 1979 to 2004, the seasonal duration of sea ice in the Palmer area varied between five and 12 months (Stammerjohn et al. 2008). Dense brash ice is frequently found in the vicinity of the island and originates from calving glaciers on Anvers Island, which may impede small boat access.

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

No structures or instruments are known to be present within the Area. A permanent survey marker, consisting of a 5/8" stainless steel threaded rod, was installed on the island on which Biscoe Point lies by the USGS on 31 January 1999. The marker, named BIS1, is located at 64°48'40.12"S, 63°46'26.42"W at an elevation of 23 m (Maps 2 & 3). It is sited approximately midway along the principal ridgeline of the island, about 100 m north of the southern small boat landing site. The marker is set in bedrock and marked by a red plastic survey cap.

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

The nearest protected areas to Biscoe Point are: Litchfield Island (ASPA No. 113) which is 16 km west of the Area in Arthur Harbor; South Bay (ASPA No. 146), which is approximately 12 km to the southeast at Doumer Island (Map 1). ASPA No. 176 Rosenthal Islands is located ~30 km to the northwest.

6(v) Special zones within the Area

An Helicopter Access Zone (Maps 2 and 3) has been defined within the Management Plan for Antarctic Specially Managed Area No. 7, which applies to aircraft accessing the designated landing sites within the Area. The Helicopter Access Zone extends in northwesterly and northeasterly directions from the designated landing sites out to a distance of 2000 feet (610 m) from the edges of known bird colony breeding locations 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, and in particular for research on the terrestrial ecosystem and fauna in the Area, 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 and scientific values of the Area;
- It is issued for compelling educational or outreach reasons 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 when in the Area.

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

Access to the Area shall be by small boat, by aircraft, or over sea ice by vehicle or on foot. 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.

\- *Foot access and movement within the Area*

Movement on land within the Area shall be on foot. All people in aircraft, boats, or vehicles are prohibited from moving on foot beyond the immediate vicinity of their landing or access site unless specifically authorised by permit.

Pedestrians should maintain the following minimum approach distances from wildlife, unless it is necessary to approach closer for purposes allowed for by the permit:

- Southern giant petrels (Macronectes giganteus) – 50 m
- Antarctic fur seals (for personal safety) – 15 m
- other birds and seals – 5 m.

Visitors should move carefully so as to minimize disturbance to flora, fauna, soils, and water bodies. Pedestrians should walk on snow or rocky terrain if practical, but taking care not to damage lichens. Pedestrians should walk around the penguin colonies and should not enter sub-groups of nesting penguins unless required for research or management purposes. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

\- *Small boat access*

The recommended landing sites for small boats are at either of the following locations (Maps 2 & 3):

- on the beach on the northern shore of the elongated cove on the southern coast of the island, which is the site most likely to be free of sea ice;
- on the beach in the small cove mid-way along the northern coast of the island, adjacent to the designated camp and helicopter landing sites.
- 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.

\- *Aircraft access and overflight*

Restrictions on aircraft operations apply during the period between 01 October and 15 April inclusive, when aircraft shall operate and land within the Area according to strict observance of the following conditions:

- Overflight of the Area by piloted aircraft below 2000 ft (~610 m) is prohibited outside of the Helicopter Access Zone (Map 2), except when specifically permitted for purposes allowed for by the Management Plan. It is recommended that piloted aircraft maintain a 2000 ft (~610 m) horizontal separation distance from the edges of bird colonies breeding within the Area as shown in Map 2, unless accessing the designated landing sites through the Helicopter Access Zone;
- Helicopter landing is permitted at two designated sites (Map 2), the first (A) on the main island on which Biscoe Point lies, and the second (B) on the separate promontory 300 m further to the north. The landing sites with their coordinates are described as follows:
  - 64° 48.59' S, 63° 46.82' W – on beach gravels a few meters above sea level 35 m east of the beach on the eastern shore of a small cove on the northern coast of the island. A small tidal pool of about 25 m in diameter is located 30 m east of the landing site; and
  - 64° 48.37' S, 63° 46.40' W – on the lower (western) slopes of a ridge, which may be snow-covered, extending from Anvers Island towards the northern promontory. Care should be exercised on snow slopes extending east and up-slope on Anvers Island, which are likely to be crevassed.
  - Piloted aircraft landing within the Area should approach within the Helicopter Access Zone to the maximum extent practicable. The Helicopter Access Zone allows access from the north and west, from the region of Biscoe Bay, to landing site (A), and from the north and east to landing site (B) (Map 2). The Helicopter Access Zone extends over the open water between landing sites (A) and (B).
  - 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 ecosystem or values of the Area;
- Activities with educational and / or outreach purposes (such as documentary reporting (e.g. visual, audio or written) or the production of educational resources or services) that are for compelling reasons that cannot be served elsewhere. Educational and / or outreach activities do not include tourism;
- Essential management activities, including monitoring and inspection.

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

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

- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator, 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 or 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 (01 Oct – 31 Mar);
- 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

Temporary camping is allowed within the Area at the designated site located approximately 50 m north-east of helicopter landing site (A), on the northern coast of the main island on which Biscoe Point lies. The camp site is located on beach gravels and rocky ground a few meters above sea level, immediately north of a transient tidal pool, and is separated from the sea further to the north by a low rocky ridge of about 8 m. When necessary for essential purposes specified in the permit, temporary camping is allowed on the separate peninsula 300 m to the north, although a specific camping site has not been determined. Camping on surfaces with significant vegetation cover is prohibited.

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 sampling equipment 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 e.g. backpacks, carry-bags, tents, walking poles, tripods and other 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));

- Raw poultry is prohibited from the Area. All poultry brought into and not consumed or used within the Area, including all parts, products and / or wastes of poultry, shall be removed from the Area or disposed of by incineration or equivalent means that eliminates risks to native flora and fauna;
- 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 accidental 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 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 or essential logistic 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 are strongly encouraged to consult with established programs working within the Area, such as those of 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 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 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, or anything removed, or anything released and not removed, that were not included in the authorized permit.

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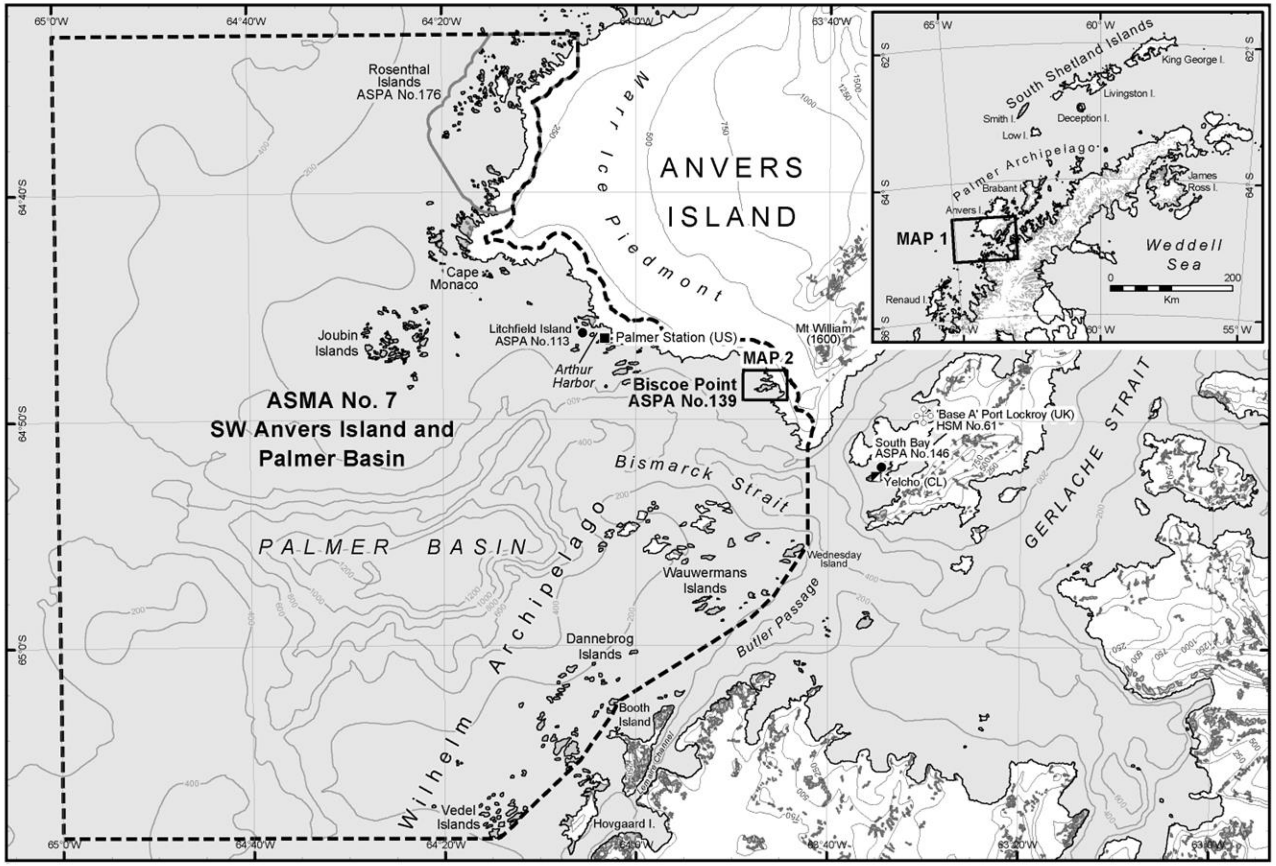


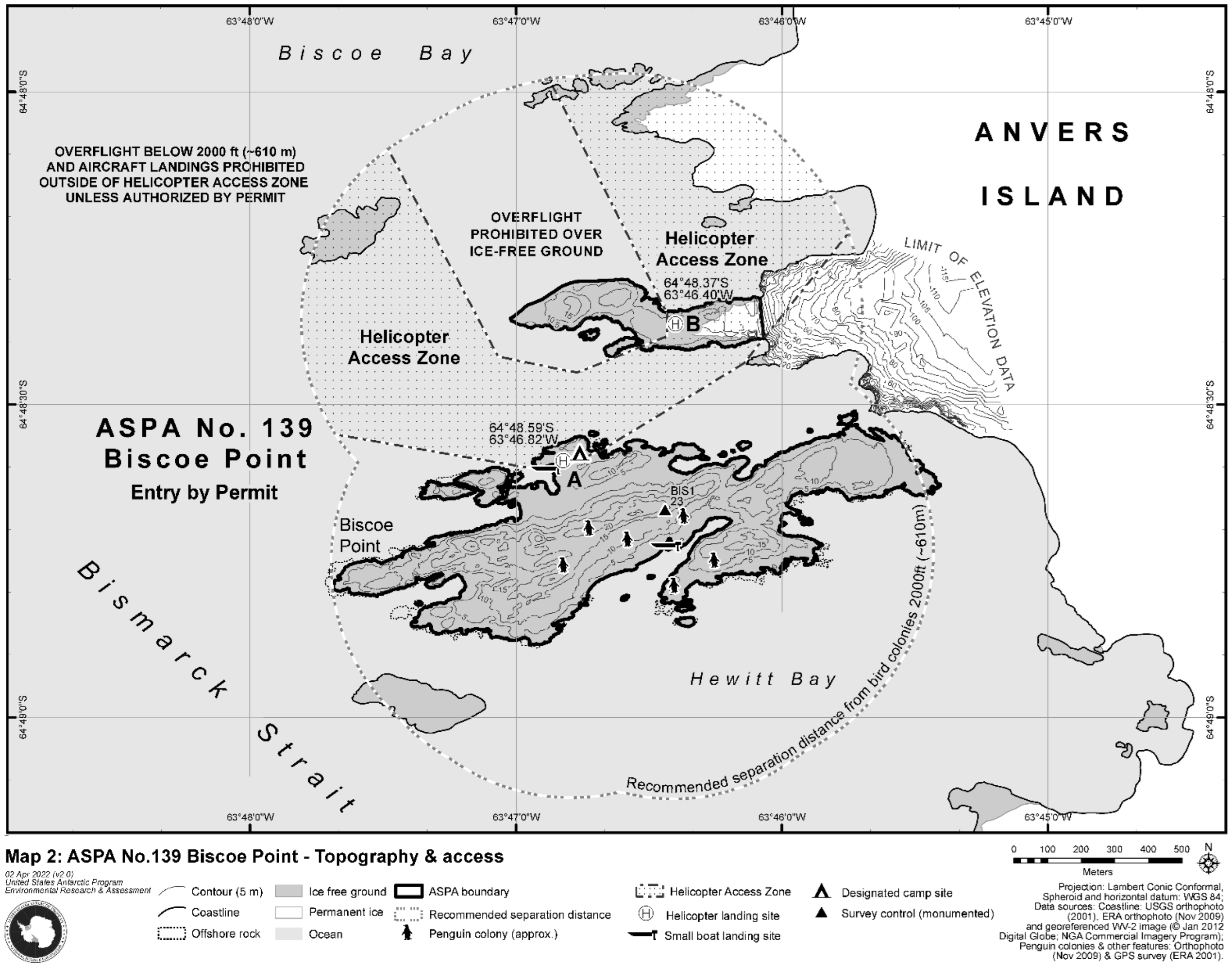
Map 1: ASPA No.139 Biscoe Point, Anvers Island - Location

02 Apr 2022 (v2.0)
United States Antarctic Program
Environmental Research & Assessment

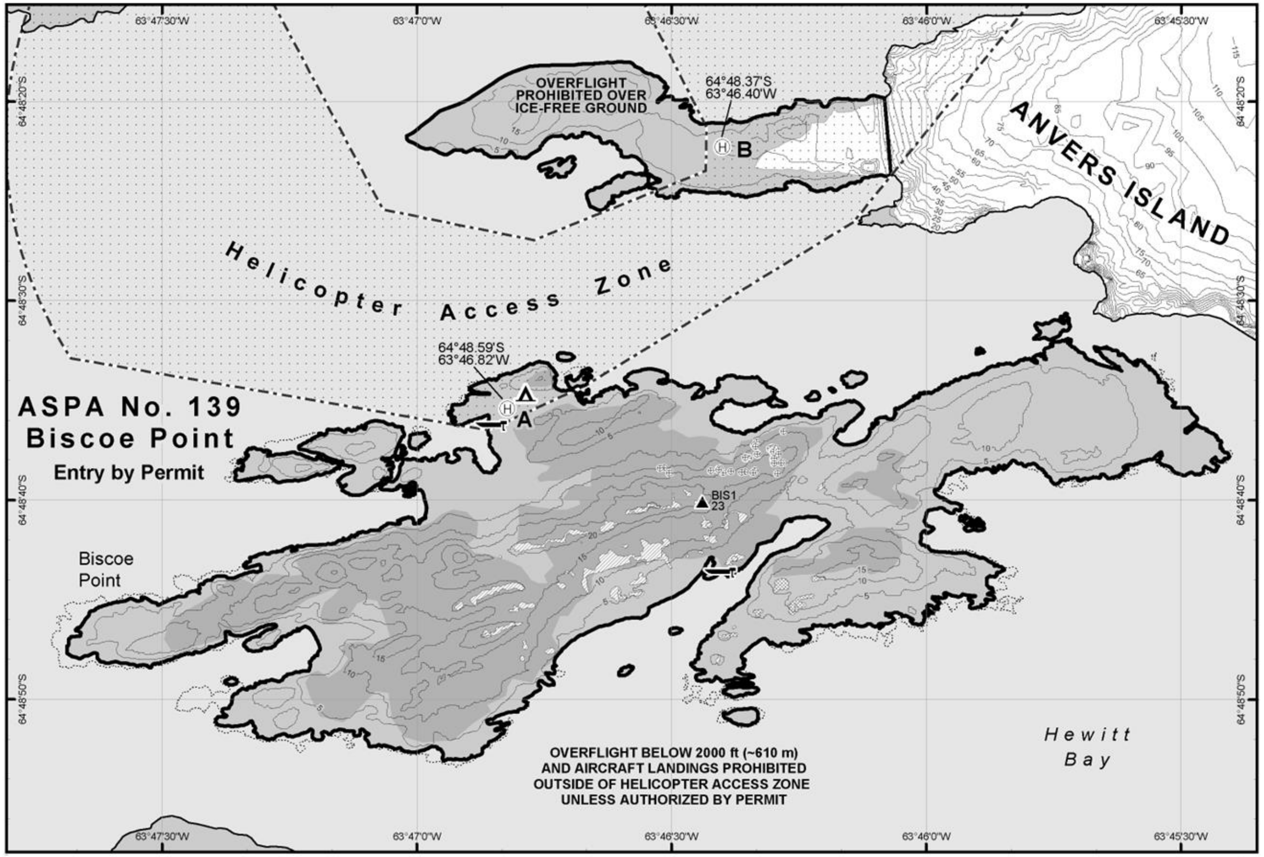
- Coastline
- Contour (250 m)
- Isobath (200 m)
- Permanent ice
- Ice free ground
- Ocean
- Antarctic Specially Managed Area (ASMA)
- Antarctic Specially Protected Area (ASPA)
- Antarctic Specially Protected Area (ASPA)
- Station (year round)
- Station (seasonal)
- Historic Site & Monument (HSM)

0 5 10
Kilometers

Projection: Lambert Conic Conformal,
Spheroid and horizontal datum: WGS 84;
Data sources: Bathymetry: IBCSO v.1 (2013) (http://www.ibcso.org);
Topography: SCAR ADD v4.1 SQ19-20 (2005);
Protected areas: ERA (2020); Stations: COMNAP (2020).



Map 2: ASPA No.139 Biscoe Point - Topography & access



Map 3: ASPA No.139 Biscoe Point - Penguin colonies, vegetation extent & contaminated sites

02 Apr 2022 (v2.0)
United States Antarctic Program
Environmental Research & Assessment

Contour (5 m)
Coastline
Offshore rock
Ice free ground
Permenant ice
Ocean
ASPA boundary
Pygoscelis adeliae (Nov 2009)
Pygoscelis papua (Nov 2009)
Principal areas of vegetation (approx.)
Helicopter Access Zone
Helicopter landing site
Small boat landing site
Designated camp site
Survey control (monumented)
Contaminated site

0 50 100 150 200
Meters

Projection: Lambert Conic Conformal, Spheroid and horizontal datum: WGS 84; Data sources: Coastline: USGS orthophoto (2001), ERA orthophoto (Nov 2009); Contamination: partial survey (Feb 2001); Penguin colonies & other features: Orthophoto (Nov 2009) & GPS survey (ERA 2001); Vegetation: estimated from air and ground photos.

Measure 15 (2022)

Antarctic Specially Protected Area No 140 (Parts of 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 XIII-8 (1985), which designated Shores of Port Foster, Deception Island, South Shetland Islands as Site of Special Scientific Interest ("SSSI") No 21 and annexed a Management Plan for the Site;
- Resolution 7 (1995) and Measure 2 (2000), which extended the expiry date for SSSI 21;
- Decision 1 (2002), which renamed and renumbered SSSI 21 as ASPA 140;
- Measures 3 (2005), 8 (2012) and 6 (2017), which adopted a revised Management Plan for ASPA 140;

Recalling that Resolution 7 (1995) 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);

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 140;

Desiring to replace the existing Management Plan for ASPA 140 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 140 (Parts of Deception Island, South Shetland Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 140 annexed to Measure 6 (2017) be revoked.

Management Plan for Antarctic Specially Protected Area No 140

PARTS OF DECEPTION ISLAND, SOUTH SHETLAND ISLANDS

Introduction

The primary reason for the designation of Parts of Deception Island, (Lat. 62°57'S, Long. 60°38'W), South Shetland Islands, as an Antarctic Specially Protected Area (ASPA) is to protect environmental values, predominantly the terrestrial flora within the Area. The flora of the island is unique in Antarctic terms, particularly where associated with these geothermal areas, but also because of the recently formed surfaces that provide known-age habitats for the study of colonisation and other dynamic ecological processes by terrestrial organisms (Smith 1988).

Deception Island is an active volcano. Recent eruptions occurring in 1967, 1969 and 1970 (Baker et al. 1975) altered many of the topographical features of the island and created new, and locally transient, surfaces for the colonisation of plants and other terrestrial biota (Collins 1969; Cameron & Benoit 1970; Smith 1984a,b,c). There are a number of sites of geothermal activity, some with fumaroles (Smellie et al. 2002).

Five small Sites around the coast of Port Foster were adopted under Recommendation XIII–8 (ATCM XIII, Brussels, 1985) as Site of Special Scientific Interest No 21 on the grounds that 'Deception Island is exceptional because of its volcanic activity, having had major eruptions in 1967, 1969 and 1970. Parts of the island were completely destroyed, new areas were created, and others were covered by varying depths of ash. Few areas of the interior were unaffected. The island offers unique opportunities to study colonization processes in an Antarctic environment'. Following an extensive scientific survey, protection of the island's botanical values was enhanced through Measure 3 (2005) when the number of Sites of botanical interest included within the ASPA was increased to 11.

ASPA 140 makes a substantial contribution to the Antarctic protected areas system as it (a) contains a particularly wide diversity of species, (b) is distinct from other areas due to the geothermally-heated ground in some parts of the island which create habitats of great ecological importance unique to the Antarctic Peninsula region and (c) is vulnerable to human interference, in particular, due to highly restricted spatial distribution of many plant species, particularly those associated with heated ground. While ASPA 140 is protected primarily for its outstanding environmental values (specifically its biological diversity) it is also protected for its scientific values (i.e., for terrestrial biology, zoology, geomorphology and geology). In particular, scientific research includes long-term colonisation studies and ground temperature measurements.

The 11 Sites within the Area (c. 2.7 km²) encompass terrestrial and lagoon habitats around geo-thermally heated ground, areas of rich flora and known-age surfaces created following eruptions of 1967, 1969 and 1970, which are potentially useful for recolonisation studies. The Area is considered to be of sufficient size to provide adequate protection of the values identified, which may be highly susceptible to direct physical disturbance, due to activities of national and non-governmental visitors, and the identified boundaries provide an adequate buffer around sensitive features.

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, Deception Island is predominantly Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment Domain G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 109, 111, 112, 125, 126, 128, 145, 149, 150, and 152 and ASMAs 1 and 4. Environment Domain B (Antarctic Peninsula mid-northern latitudes geologic) is also present. Other protected areas containing Environment Domain B include ASPAs 108, 115, 134 and 153 and ASMA 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 paragraph 2 of Article 3 of Annex V to the Environmental Protocol'. ASPA 140 sits within Antarctic Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula.

Through Resolution 5 (2015) Parties recognised the usefulness of the list of Antarctic Important Bird and Biodiversity Areas (IBAs) in planning and conducting activities in Antarctica. No IBAs are within the boundaries of the ASPA sites.

1. Description of values to be protected

Following a detailed botanical survey of the island in 2002 (reviewed in 2010 and 2014/15), 11 Sites of unique botanical interest were identified. Consequently, the values specified in the original designation were reaffirmed and considerably augmented.

These values are set out as follows:

- The island has the greatest number of rare (i.e., known to grow at a few localities in the Antarctic and often in small quantity) and extremely rare (i.e., known to grow at only one or two localities in the Antarctic) plant species of any site in the Antarctic. Twenty eight of the 54 mosses recorded on the island, four of the eight liverworts and 14 of the c. 75 lichens are considered to be rare or extremely rare. Annex 1 lists the plant species classed as rare or extremely rare in the Antarctic Treaty area, which occur on Deception Island. These represent 25%, 17% and c. 4% of the total number of mosses, liverworts and lichens, respectively, known from the Antarctic (Aptroot &

van der Knaap 1993; Bednarek-Ochyra et al. 2000; Ochyra et al. 2008; Øvstedal & Lewis Smith 2001). Thirteen species of moss (including two endemics), two species of liverwort and three species of lichen growing on Deception Island have not been recorded elsewhere in the Antarctic. No other site in the Antarctic is comparable. This suggests that there is a significant deposition of immigrant propagules (by wind and seabirds), particularly of southern South American provenance, over the Antarctic, which become established only where favourable germinating conditions prevail (e.g., the heat and moisture provided around fumaroles) (Smith 1984b; c). Such sites are unique in the Antarctic Treaty area.

- The more stable geothermal areas, some of which have fumaroles issuing steam and sulphurous gas, have developed bryophyte communities of varying complexity and density, each with a distinct and unique flora. Most of these areas were created during the 1967-70 series of eruptions, but at least one (Mt. Pond) predates that period. Species growing close to active vents are continuously subjected to temperatures between 30 to 50°C, thereby posing important questions regarding their physiological tolerance.
- Areas of volcanic ash, mudflows, scoria and lapilli deposited between 1967 and 1970 provide unique known-age surfaces. These are currently being colonised by vegetation and other terrestrial biota, allowing the dynamics of immigration and colonisation to be monitored. These areas are unstable and subject to wind and water erosion, so exposing some areas to continual surface change and a cycle of recolonisation.
- Kroner Lake, the only intertidal lagoon with hot springs in Antarctica, supports a unique community of brackish-water algae.
- Several Sites within the Area, unaffected by ash deposits during the 1967-70 eruptions, support long-established mature communities with diverse vegetation and are typical of the older stable ecosystems on the island.
- The largest known stand of Antarctic pearlwort (Colobanthus quitensis), one of only two flowering plants in the Antarctic, is located within the Area. After being virtually eradicated by burial in ash during the 1967 eruption, it has recovered and is now spreading at an unprecedented rate. This correlates with the current trend in regional climate change, particularly increasing temperature.
- The Area contains some Sites where on-going scientific research is performed including long-term colonization experiments (Collins Point) and long-term ground temperature variation measurements (Caliente Hill).
- The Area also contains some Sites with surfaces that date from the eruption in 1967, which allowing accurate monitoring of colonisation by plants and other biota and are of important scientific value.

2. Aims and objectives

Management of the Area aims to:

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

- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- prevent or minimise the introduction to the Area of alien plants, animals and microorganisms;
- ensure that the flora is not adversely affected by excessive sampling within the Area;
- preserve the natural ecosystem of the Area as a reference area for future comparative studies and for monitoring floristic and ecological change, colonisation processes and community development.

3. Management activities

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

- Visits shall be made as necessary to assess whether the individual Sites continue to serve the purposes for which they were designated and to ensure management and maintenance measures are adequate.
- Markers, signs or other structures (e.g., fences, 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 of 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.
- A map showing the location of each Site on Deception Island (stating any special restrictions that apply) shall be displayed prominently and a copy of this Management Plan shall be made available at Gabriel de Castilla Station (Spain) and Decepción Station (Argentina). Copies of the Management Plan shall be freely available and carried aboard all vessels planning visits to the island.
- Where appropriate, National Antarctic Programmes are encouraged to liaise closely to ensure management activities are implemented (including through the Deception Island Antarctic Specially Managed Area Management Group). In particular, National Antarctic Programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area, particularly given the often slow rate of re-growth and limited quantity and distribution of some flora. Also, National Antarctic Programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.
- At Site K Ronald Hill to Kroner Lake, any wind-blown debris from HSM No 71 shall be removed. At Site G Pendulum Cove, any wind-blown debris from HSM No 76 shall be removed (see Section 7(viii)).
- At Site A Collins Point, the existing staked plots should be maintained to allow continued monitoring of vegetation change since 1969.

- At Site C Caliente Hill, no more than two individuals shall access the site at any time, in order to reduce the risk of trampling of the vulnerable vegetations.

4. Period of designation

Designated for an indefinite period.

5. Maps

Figure 1: Antarctic Specially Protected Area No 140, Deception Island, showing the location of Sites A – L (Scale 1:100 000).

Figures 1a–d: Topographic Maps of Antarctic Specially Protected Area No 140 showing Sites A – L (Scale 1: 25 000). The 'hill shade' effect has been added to highlight the topography of the areas.

6. Description of the Area

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

- *General description*

Research by Smith (1984a) and Peat et al. (2007) described the recognised biogeographical regions present within the Antarctic Peninsula. Antarctica can be divided into three major biological provinces: northern maritime, southern maritime and continental. Deception Island lies within the northern maritime zone (Smith 1984a).

- *Natural features, boundaries, and scientific values*

ASPA 140 comprises 11 Sites, shown in Figures 1 and 1a-1d. Annotated photographs of each Site are shown in Annex 2. This fragmented distribution is characteristic of the vegetation cover of Deception Island. Because of the patchy nature of stable and moist substrata not subjected to erosion, the vegetation has a disjunct distribution and is consequently restricted to widely scattered, and often very small, habitats. Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA sites to be 0.10 km² (4% of the ASPA area).

The Sites are lettered A to L (but excluding I), in a clockwise direction from the south-west of the caldera and referred to by the most prominent named geographical feature associated with each Site. Photographs of each Site are shown in Annex 2. Boundary co-ordinates are listed in Annex 3, but as many of the boundaries follow natural features, the boundary description outlines below should also be consulted.

Site A - Collins Point

Area encompassed. The north-facing slopes between Collins Point and the unnamed point 1.15 km to the east (0.6 km west of Entrance Point), directly opposite Fildes Point, and extending from the back of the beach to a ridge extending up to c. 1 km inland from the shoreline.

Boundaries. The eastern boundary of Site A runs south from the shore at the unnamed point 0.6 km west of Entrance Point, following the outline of a ridge to an elevation of 184 m. The western boundary extends from Collins Point, following a ridge south to an elevation of 145 m. The southern boundary is delimited by the arcuate ridge crest (following a line of summits east to west at 172, 223 and 214 m) joining points 184 and 145 m. The beach area, including the Collins Point light beacon (maintained by the Chilean Navy), to the 10 m contour is excluded from the Site.

Scientific value. No geothermally-heated ground is known within the Site boundary. The Site contains some of the best examples of the island's longest established vegetation, largely unaffected by the recent eruptions, with high species diversity and several Antarctic rarities, some in considerable abundance. A few small plants of Colobanthus quitensis have recently become established, while the large liverwort (Marchantii berteroana) is a fairly recent and spreading colonist. Research on seals is undertaken on the beach to the north of the Site, and the Site also contains a colony of kelp gulls in the low cliffs above the beach. Six 50 × 50 cm plots marked with wooden corner stakes (Lat. 62°60'00''S, Long. 060°34'48''W) were established by the British Antarctic Survey in 1969 to monitor changes in the vegetation in subsequent years (Collins 1969).

Human impact. The non-native springtails Hypogastrura viatica and Ceratophysella succinea are found within the Site A.

Site B - Crater Lake

Area encompassed. Crater Lake and its shoreline, the flat ground to its north and the scoria-covered lava tongue to the south.

Boundaries. The northern boundary extends along the foot of the slope to the north of the broad valley c. 300 m north of Crater Lake (at c. 30 m altitude). The western boundary follows the ridgeline immediately west of the lake, and to the east of the small unnamed lake at Lat. 62°59'00''S, Long. 060°40'30''W. The southwestern and southern boundaries follow the top of the slope (at altitude c. 80 m) that extend to the southwest and south of the lake. The eastern boundary passes to the east of the lava tongue south of Crater Lake, around the eastern rim of the lake and c. 300 m across the flat plain to the north of the Crater Lake.

Scientific value. No geothermally-heated ground is known within the Site boundary. The principal area of botanical interest lies on a scoria-covered lava tongue south of the lake. The Site was unaffected by the recent eruptions. The vegetation on the scoria tongue has a diverse cryptogamic flora, including several Antarctic rarities, and exceptional development of turf-forming moss, dominated by one relatively common species (Polytrichastrum alpinum). Of particular interest is that it reproduces sexually in great abundance here. Sporophytes of this species are not known in such profusion in this, or any other moss, anywhere else in the Antarctic. The extensive, virtually monospecific, moss carpet (Sanionia uncinata), on the flat ground to the north of Crater Lake, is one of the largest continuously vegetated stands on the island.

Human impact. The non-native springtail Hypogastrura viatica is found within Site B.

Site C – Caliente Hill, southern end of Fumarole Bay

Area encompassed. A narrow line of fumaroles extending c. 40 × 3 m along the gently sloping summit ridge at c. 95 to 107 m elevation on Caliente Hill above the north-west side of Albufera Lagoon northwest of Decepción Station (Argentina) at the southern end of Fumarole Bay.

Boundaries. The area includes all the ground above the 90 m contour on the hill, with the exception of the ground south east of a point 10 m north west of the cairn (Lat. 62°58’27’’S, Long. 060°42’31’’W) at the southeast end of the ridge. Access to the cairn at the southeast end of the ridge is not restricted.

Scientific value. Geothermally-heated ground is included within the Site. Several rare species of moss, some unique to the island, colonise the heated soil crust close to the vents, of which only two or three are visible. The vegetation is extremely sparse and not obvious, in total encompassing less than c. 1 m² in area, and is therefore particularly vulnerable to trampling and over-sampling. Structures within the Site include experimental apparatus monitoring long-term ground temperature variations (operated by the Spanish Antarctic programme) and several short metal stakes arranged along the ridgeline near the highest point of the ridge.

Human impact. The non-native springtails Hypogastrura viatica and Proisotoma minuta are found within the Site A. In recent years, the sparse vegetation has been subject to substantial human trampling, which has reduced the vegetation cover in the area.

Site D - Fumarole Bay

Area encompassed. The unstable moist scree slopes below the precipitous lava cliffs on the east side of the southern end of Stonethrow Ridge to the break of slope beyond the beach west of mid-Fumarole Bay. No structures are located within the Site, although much timber debris is found at the back of the beach several metres above the high tide mark. The timber may have been deposited at this location by a tsunami generated by earlier vulcanological activity.

Boundaries. The southern end of the cliffs terminate in a prominent ridge sloping southeastward down to the beach. The southern boundary of the Site extends from the base of this ridge (at altitude c. 10 m) along the ridge line to the base of the cliffs at an altitude of c. 50 m. The western boundary follows the limit of the scree at the base of the cliffs roughly northwards for 800m at altitude of approximately 50 m. The eastern boundary extends northwards along the break-of-slope at the back of the beach for 800 m including all the large boulders. The northern boundary (c. 100 m in length) joins the break of slope at the back of the beach to the scree at the base of the lava flow cliffs. The flat beach area from the shore, including two prominent inter-tidal fumaroles to the south of Fumarole Bay, to the break-of-slope is excluded from the Site.

Scientific value. No geothermally-heated ground is known within the Site, although fumarole activity is present in the inter-tidal zone east of the Site. The Site has a complex geology and contains the most diverse flora on the island, including several Antarctic rarities. It was unaffected by the recent eruptions.

Human impact. The non-native springtails Hypogastrura viatica and Protaphorura fimata are found within Site D.

Site E – west of Stonethrow Ridge

Area encompassed. The Site encompasses an area of fumarole activity and includes a red scoria cone at c. 270 m altitude, on the northern side of the east-west trending ridge, c. 600 m south-southwest of the highest point on Stonethrow Ridge (330 m), west of central Fumarole Bay. It comprises two fumaroles about 20 m apart, the more easterly fumarole being more highly vegetated with lichens, mosses and liverworts covering an area of c. 15 × 5 m.

Boundaries. The boundary extends to 10 m beyond all evidence of geothermal activity and the non-heated ground linking the two fumaroles.

Scientific value. Areas of geothermally-heated ground are present within the Site. The Site possesses several very rare mosses, liverworts and lichens, two of the dominant species being a liverwort (Clasmatocolea grandiflora) and lichen (Stereocaulon condensatum), neither of which is known elsewhere in Antarctica. Photographs taken in the mid-1980s indicate that the development and diversity of this vegetation has advanced considerably. A skua nest (noted in 1993 and 2002 and occupied in 2010) is present within the vegetation. These birds may be responsible for introducing some of the plants from Tierra del Fuego, notably the dominant liverwort.

Site F - Telefon Bay

Area encompassed. The Site incorporates several features created during the 1967 eruption in Telefon Bay: Pisagua Hill on the south side of the Site, the small shallow Ajmonecat Lake on the ash plain north of Stancomb Cove and the low flat ash plain extending from the shoreline of Telefon Bay to the steep slopes and lava outcrops c. 0.5 km inland. Pisagua Hill was created as a new island in 1967, but is now joined to the main island by the aforementioned ash plain. At the northern end of the plain is Extremadura Cove, which was a lake until the narrow isthmus (c. 2 m wide and

50 m long) separating it from Port Foster was breached sometime around 2006. Extremadura Cove is excluded from the Site.

Boundaries. The north shoreline of the lagoon (Stancomb Cove) at the southwest of Telefon Bay marks the southern boundary of the Site, while the southwest shore of the Extremadura Cove to the north of Telefon Bay marks the northeastern boundary of the Site. The southeast boundary extends along the shore south of Pisagua Hill, northwards to the shoreline of the Extremadura Cove at the northern end of Telefon Bay. The northwest boundary is roughly delineated by the 10 m contour of Telefon Ridge that links Stancomb Cove to Extremadura Cove. Ajmonecat Lake (Lat. 62°55’23’’S, Long. 060°40’45’’W), including its shoreline, is included in the Site. The shoreline of Telefon Bay is excluded from the Site to allow access past the Site. Those boating within Extremadura Cove without a permit to enter the ASPA should be careful not to land passengers on the southwest shore of the Cove, as this marks the boundary of Site F (see Figure 1c).

Scientific value. No geothermally-heated ground is known within the Site. The main point of botanical interest is that all surfaces within the Site date from 1967, thereby allowing accurate monitoring of colonisation by plants and other biota. The Site has a generally barren appearance, but close inspection reveals an abundance of inconspicuous mosses and lichens. In the absence of geothermal activity here, colonisation processes may be related to aspects of the current trend in climate change. Although species diversity is low, the developing communities are typical of non-heated habitats throughout the island.

Human impact. The non-native springtail Hypogastrura viatica is found within the Site F.

Site G - Pendulum Cove

Area encompassed. The Site comprises the uneven gentle slope of coarse grey, crimson, and red scoria and occasional disintegrating blocks of yellowish tuff, east-northeast of Crimson Hill and c. 0.4 – 0.8 km east of Pendulum Cove. It extends c. 500m from west to east and is up to c. 400m wide from north to south. It was created largely by the 1969 eruption which destroyed the nearby abandoned Chilean Base (Historic Site and Monument No 76). The Site includes the slope and undulating “plateau” behind Pendulum Cove.

Boundaries. The western boundary follows the 40m contour line and the eastern boundary follows the 140 m contour line east-southeast of Pendulum Cove. The northern and southern boundaries follow the edge of the volcanic debris-covered permanent ice that borders the Site.

Scientific value. Geothermal activity was recorded during a survey in 1987, with substantial heat being emitted from crevices amongst scoria. There was no such evidence in 2002. Although vegetation is very sparse, this known-age site is being colonised by numerous moss and lichen species. Two of the mosses (Racomitrium lanuginosum and R. heterostichoides) are unique both on the island and in the Antarctic, and both are very rare here. Several other mosses are Antarctic rarities.

Human impact. The non-native springtail Deuteraphorura cebennaria has been found in Pendulum Cove, but just outside Site G. Other non-native springtails found in the vicinity of Site G include Hypogastrura viatica and Proisotoma minuta.

Site H - Mt. Pond

Area encompassed. The Site is situated c. 1.4 to 2 km north-north-west of Mount Pond summit. The extensive area of geothermally-heated ground includes an area (c. 150 × 500 m) on the north eastern side of the gently sloping upper part of a broad ridge at c. 385 to 500m elevation (Smith 1988). At the northern end of the Site there are numerous inconspicuous fumarole vents in low mounds of very fine, compacted baked soil. The higher, southern, part of the Site is close to a large rime dome at 512 m, in the lee of which (at c. 500 to 505 m) are numerous active fumaroles, also surrounded by fine, compacted baked soil, on a steep, moist, sheltered slope. The extensive areas of heated ground surrounding the fumaroles comprise a fine soil with a soft crust that is extremely vulnerable to trampling. There are several stands of dense, thick (up to 10 cm) bryophyte vegetation associated with these areas. The adjacent yellowish tuff outcrops support a different community of mosses and lichens.

Boundaries. The northern boundary is marked by Lat. 62°55’51’’S, the southern boundary by Lat. 62°56’12’’S and the eastern boundary is marked by Long. 060°33’30’’W. The western boundary follows the ridgeline of the broad ridge that slopes north northwest from the summit of Mt. Pond between Long. 060°33’48’’W and Long. 060°34’51’’W.

Scientific value. This is an outstanding site of botanical interest, unique in the Antarctic. It possesses several moss species which are either unique to the Antarctic or are extremely rare in Antarctica. The development of the moss turf (Dicranella hookeri and Philonotis polymorpha) in the main upper part of the Site is exceptional, and two or more species have colonised profusely since last inspected in 1994. The large liverwort (Marchantii berteroana) is rapidly colonising the warm moist soil crust at the periphery of the moss stands. At least one species of toadstool fungus also occurs amongst the moss, the highest known record for these organisms in Antarctica. A totally different community of mosses and lichens occurs on the rock outcrops, and also includes several extremely rare species (notably Schistidium andinum and S. praemorsum).

Human impact. The non-native springtail Proisotoma minuta is found within Site H.

Site J - Perchuć Cone

Area encompassed. This ash cone lies c. 750 m northeast of Ronald Hill and comprises a very narrow line of fumaroles and adjacent heated ground on the west-facing slope at c. 160-170 m elevation (Lat. 62°58'00.9' S; Long. 060°33'39.7" W). The geothermal area covers c. 25 × 10 m, and the fine ash and lapilli surface of the entire slope is very vulnerable to pedestrian damage.

Boundaries. The northern boundary is marked by Lat. 62°57’50’’S, the southern boundary by Lat. 62°58’05’’S, the eastern boundary is marked by Long. 060°33’25’’W and the western boundary by Long. 060 °33’50’’W. Site J Perchuć Cone has been designated as a Prohibited Zone to protect the vulnerable vegetation and soil structures at this location. Access to Site J Perchuć Cone is strictly prohibited until such time that it is agreed, during a Management Plan review, that access should be allowed.

Scientific value. The Site contains several mosses that are extremely rare in Antarctica. Photographic evidence suggests that the extent of moss colonisation has decreased since the mid-1980s.

Human impact. The non-native springtails Hypogastrura viatica and Proisotoma minuta are found within Site J.

Site K – Ronald Hill to Kroner Lake

Area encompassed. This Site includes the circular flat plain of the crater immediately to the south of Ronald Hill, and extends along the prominent broad shallow outwash gulley with a low bank on either side, leading southwards from here to Kroner Lake. The substratum throughout the area is consolidated mud, fine ash and lapilli deposited by the lahar during the 1969 eruption. Part of the Site, notably the gulley, remains geothermally active. The Site also includes the intertidal geothermal lagoon (Kroner Lake) as it is part of the same volcanological feature. This small, shallow, circular, brackish crater lake was broached by the sea during the 1980s, and is now the only geothermally heated lagoon in the Antarctic.

Boundaries. The boundary surrounds the crater basin, gulley, Kroner Lake and an area between c. 100 – 150 m wide around the lake. A corridor below Ronald Hill, from the break-of-slope to the lowermost massive boulders about 10 to 20 m beyond, remains outside the boundary to allow access past the Area.

Scientific value. The surfaces of this Site are of a known age and are being colonised by numerous moss, liverwort and lichen species, several of which are extremely rare in the Antarctic (eg, the mosses Notoligotrichum trichodon and Polytrichastrum longisetum, and a rare lichen, Peltigera didactyla, is colonising >1 ha of the crater floor). The geothermal northern intertidal shore of Kroner Lake possesses a unique community of algae.

Human impact. The non-native springtails Hypogastrura viatica , Mesaphorura macrochaeta and Proisotoma minuta and mites Speleorchestes sp., Terpnacarus gibbosus and Coccotydaeolus cf. krantzii are found at several site around Whalers Bay and may be present within Site K. The non-native springtail Folsomia candida was reported from Whalers Bay in the 1960s but has not been found in subsequent surveys. On 24 January 2015, 15 individuals of Ceratophysella succinea, a non-native Collembolon not previously reported in Antarctica, were found in Kroner Lake. Other non-native springtails found at Site K include Protaphorura fimata and Hypogastrura viatical. Kroner Lake presents the greatest non-indigenous species richness along with Pendulum Cove (i.e., three species each).

Site L - South East Point

Area encompassed. An east-west trending rocky ridge c. 0.7 km north of South East Point, extending from the top of the sea cliff (c. 20 m altitude) westwards for c. 250 m, to a point about 80m altitude. The north edge of the ridge is a low vertical lava outcrop, giving way to a steep unstable slope leading to the floor of a gully parallel to the ridge. The south side of the Site is the gently sloping ridge crest covered with ash and lapilli.

Boundaries. The Site extends 50 m north and south of the lava outcrop.

Scientific value. This Site has the most extensive population of Antarctic pearlwort (Colobanthus quitensis) known in the Antarctic. It was the largest population before the 1967 eruption (Longton 1967), covering c. 300 m^2, but was almost completely destroyed by ash burial. It gradually recovered, but since about 1985-1990 there has been a massive increase in seedling establishment and the population has expanded downwind (westwards, uphill). It is now very abundant in an area of c. 2 ha. It is also remarkable for the absence of the other native vascular plant, Antarctic hairgrass (Deschampsia antarctica), almost always associated with this plant. Photographs of the Site immediately after the eruption revealed almost total loss of lichens, but these too have recolonised rapidly and extensively, the large bushy Usnea antarctica being particularly abundant and attaining a considerable size after the relatively short period since recolonisation. The cryptogamic flora of the Site is generally sparse and typical of most of the island. The Site is particularly important for monitoring the reproduction and spread of the pearlwort in a known-age site.

6(ii) Access to the Area

- Access to the Sites shall be by foot or small boat.
- Helicopter landings are prohibited within the Area. The Management Plan for Deception Island ASMA 4 shows recommended helicopter landing sites on Deception Island, which are also shown in Figure 1. Helicopter landings sites which may be useful for accessing Sites are located at: Decepción Station (Argentina; Lat. 62°58’30’’S, Long. 060°42’00’’W), northern Fumarole Bay (Lat. 62°57’18’’S, Long. 060°42’48’’W), the south of Cross Hill (Lat. 62°56’39’’S, Long. 060°41’36’’W), eastern Telefon Bay (Lat. 62°55’18’’S, Long. 060°38’18’’W), Pendulum Cove (Lat. 62°56’12’’S, Long. 060°35’45’’W) and Whalers Bay (Lat. 62°58’48’’S, Long. 060°33’12’’W).
- All travel to the Sites shall be undertaken carefully so as to minimize disturbance to soil and vegetation en route.
- The operation of aircraft 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). Particular care should be taken when overflying Site A Collins Point, which contains a colony of kelp gulls in the low cliffs above the beach.

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

- Two research stations are found close to the ASPA sites: Decepción Station (Argentina; Lat. 62°58'30''S, Long. 060°41'54''W) and Gabriel de Castilla Station (Spain; Lat. 62°58'36''S, Long. 060°40'30''W). Two Historic Sites or Monuments are found close to the ASPA sites: Whalers Bay (HSM 71; Lat. 62°58'42''S, Long. 060°33'36''W) and the ruins of the Base Pedro Aguirre Cerda Station (HSM 76; Lat. 62°56'12''S, Long. 060°35'36''W). Collins Point navigation beacon is situated at Lat. 62°59'42''S, Long. 060°35'12''W. At Site A, Collins Point, there are six 50 × 50cm plots marked with wooden corner stakes, although not all of the four stakes per plot remain (Lat. 63°00'00''S, Long. 060°34'48''W). These were established by the British Antarctic Survey in 1969 to monitor changes in the vegetation in subsequent years (Collins 1969); data were obtained in 1969 and 2002. These markers should be maintained.
- Structures within the Site C, Caliente Hill, include some experimental apparatus monitoring long-term ground temperature variations (operated by the Spanish National Antarctic Programme) and several short metal stakes arranged along the ridgeline near the summit.
- Other structures near to the Area are listed in the ASMA Management Plan for Deception Island.

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

ASPA 145 comprises three sites of benthic importance within Port Foster. Deception Island and Port Foster are managed within ASMA 4 Deception Island.

6(v) Special zones within the Area

Site J Perchuć Cone has been designated as a Prohibited Zone to protect the vulnerable vegetation and soil structures at this location. Access to Site J Perchuć Cone is strictly prohibited until such time that it is agreed, during a Management Plan review, that access should be allowed.

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 only for compelling scientific reasons which cannot be served elsewhere; or
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the floristic, ecological or scientific values of the Area;

- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- 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

- Land vehicles are prohibited in the Area.
- Helicopter landings are prohibited within the Area. The Management Plan for Deception Island ASMA 4 shows recommended helicopter landing sites on Deception Island (see also Figure 1).
- 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).
- Movement within the Area Sites shall be on foot.
- Rowing boats are permitted for sampling purposes in the lakes in Site B - Crater Lake and Site F - Telefon Bay, and the lagoon in Site K - Ronald Hill to Kroner Lake. Prior to use at each Site, boats shall be cleaned to reduce the risk of introductions of non-native species from outside the Treaty area and other Antarctic locations, including other Sites within ASPA 140. Engine powered boats must not be used.
- All movement shall be undertaken carefully so as to minimize disturbance to soil and vegetation:
    - The vegetation at Site C - Caliente Hill is sparse and not obvious and is therefore particularly vulnerable to trampling. Extreme care should be taken to avoid trampling of vegetation when visiting this site. Given its reduced size, it is recommended that no more than two people enter at the same time within the Site C
    - The soil in the vicinity of Site J Perchuć Cone is extremely friable and exceptionally vulnerable to damage by trampling. Compared to other fumeroles on Deception Island, Perchuć Cone has experienced relatively little human visitation and associated trampling impact and may provide a representative site for future scientific studies. Consequently, Site J has been designated as a Prohibited Zone and entry is strictly prohibited until such time that it is agreed, during a Management Plan review, that access should be allowed.

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

Activities include:

- compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the flora and ecology of the Area;
- essential management activities, including monitoring.
- surveys, to be undertaken as necessary, to determine the state of the botanical values for which each Site has been designated, in support of the aims of this Management Plan.

7(iv) Installation, modification or removal of structures

Structures shall not be erected within the Area except as specified in a Permit. All scientific equipment, botanical quadrats or other markers installed in the Area must be approved 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 (see Section 7(vi)).

7(v) Location of field camps

Camping is not permitted within the Area. The ASMA Management Plan for Deception Island shows recommended sites for field camps on the island, but outside ASPA 140. Campsites which may be useful for accessing Sites are located at: northern Fumarole Bay (Lat. 62°57’18’’S, Long. 060°42’42’’W), the south of Cross Hill (Lat. 62°56’36’’S, Long. 060°41’30’’W), eastern Telefon Bay (Lat. 62°55’18’’S, Long. 060°38’12’’W), Pendulum Cove (Lat. 62°56’12’’S, Long. 060°35’42’’W) and Whalers Bay (Lat. 62°58’54’’S, Long. 060°33’0’’W) (see Figure 1). When planning camping locations and activities, recommendation within the SCAR Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica Resolution 3 (2016), should be taken into consideration, as appropriate.

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

The deliberate introduction of animals, plant material, microorganisms and non-sterile soil into the Area shall not be permitted. Deception Island has the highest concentration of established non-native species anywhere in Antarctica. Therefore, to ensure that the floristic and ecological values of the Area are maintained, special 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). Care should be taken to prevent distribution of species between ASPA sites. Visitors should take into consideration the recommendations contained within the SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)) and in the SCAR Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica (Resolution 3 (2016)) as appropriate (available at: https://www.scar.org/policy/scar-codes-of-conduct/). Visitors should also consult and follow, as appropriate, recommendations contained in the CEP Non-native Species Manual (Resolution 4 (2016)). In particular, 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. No poultry or egg products shall be taken into the Area.

No herbicides or pesticides shall be brought into the Area, unless considered essential for the control or eradication of a non-native species. 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 shall not be permitted.

Fuel, food and other materials are not to be deposited within the Area, unless authorized by Permit for specific scientific or management purposes. Permanent depots are not permitted. All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of the stated period, and shall be stored and handled so that risk of their introduction into the environment is minimised. 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 shall be notified of any materials released and not removed that were not included in the authorised Permit.

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

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of or harmful interference with animals is involved, the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica (Resolution 4 (2019)) should be used as a minimum standard.

7(viii) The collection or removal of materials not brought into the Area by the Permit holder

Material of a biological, geological (including soil and lake sediment), or hydrological nature 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 reasonable concern that the sampling proposed would take, remove or damage such quantities of soil, 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, which was not brought into the Area by the Permit Holder or otherwise authorised, may be removed unless the impact of removal is likely to be greater than leaving the material in situ; if this is the case the appropriate authority should be notified. If wind-blown debris is found in the Area it should be removed. Plastic debris should be disposed of in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998). Other wind-blown material should be returned to the Historic Site or Monument from which it originated and secured to prevent further dispersal by wind. A report describing the nature of the material removed from the ASPA and the location within the Historic Site and Monument where it has been secured and stored, should be submitted to the Deception Island Antarctic Specially Managed Area (ASMA) Management Group, via the Chair, to establish the most appropriate way to deal with the debris (i.e, conservation to preserve any historic value or appropriate disposal) (see Deception Island ASMA website: http://www.deceptionisland.aq/contact.php).

7(ix) Disposal of waste

All wastes shall be removed from the Area in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998). In order to avoid anthropogenic microbial and nutrient enrichment of soils, no solid or liquid human waste should be deposited within the Area. Human wastes may be disposed of within Port Foster, but avoiding ASPA 145.

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, vulcanological or seismic monitoring and site inspection activities.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Permits may be granted to allow for monitoring of the Area, or to allow for some active management as set out in Section 3.
- Scientific activities shall be performed in accordance with the SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)), the SCAR Environmental Code of Conduct for Geosciences Field Research Activities in Antarctica (Resolution 1 (2021)) and/or the SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)), as appropriate.

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 as an Appendix in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (available from the website of the Secretariat of the Antarctic Treaty; www.ats.aq)). 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.

8. Supporting documentation

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Figure 1. Map of Deception Island showing the 11 sites that make up ASPA 140 Parts of Deception Island, South Shetland Islands.

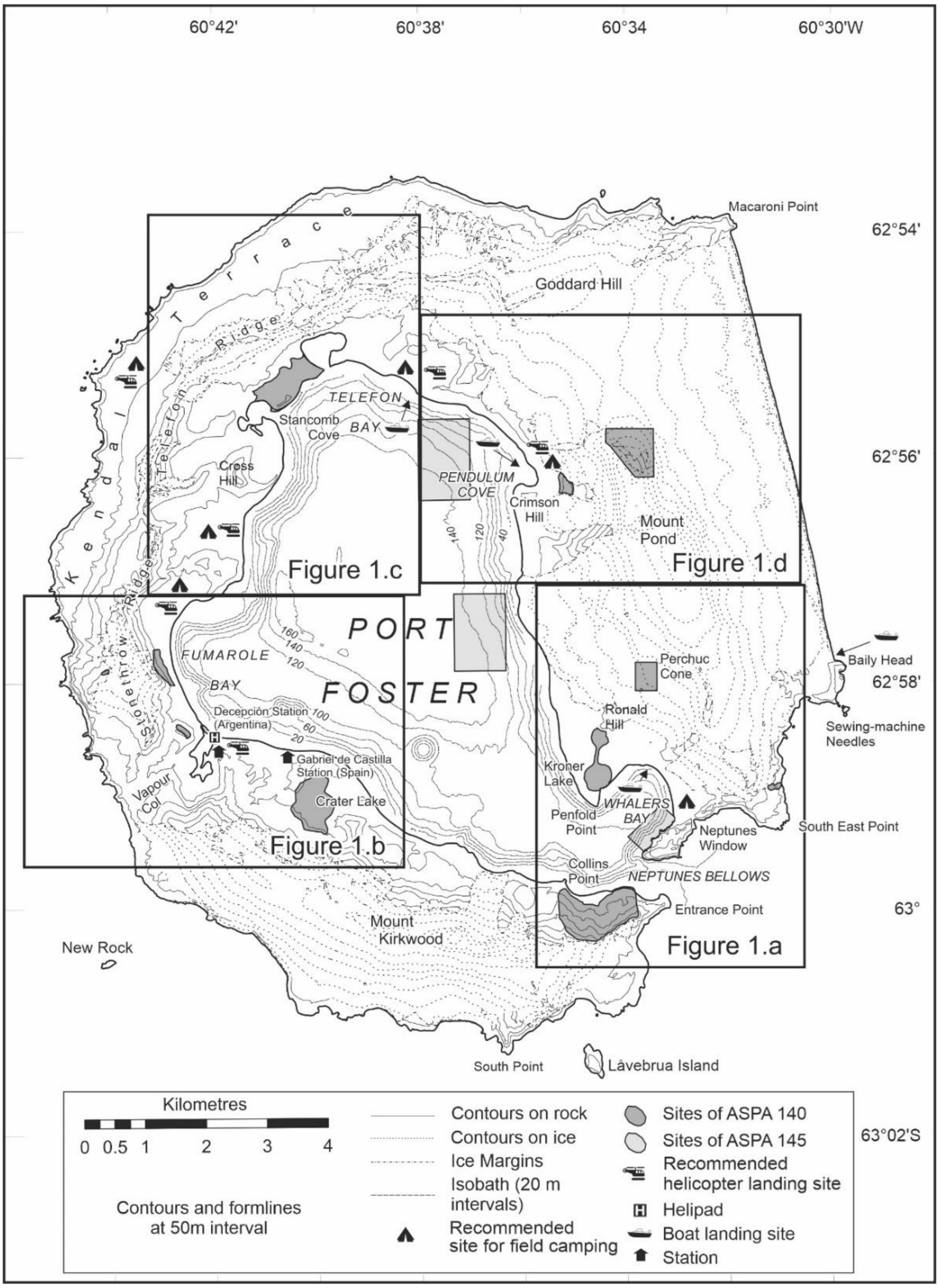


Figure 1a. Map showing the location of ASPA No. 140 Sites A, J, K and L.

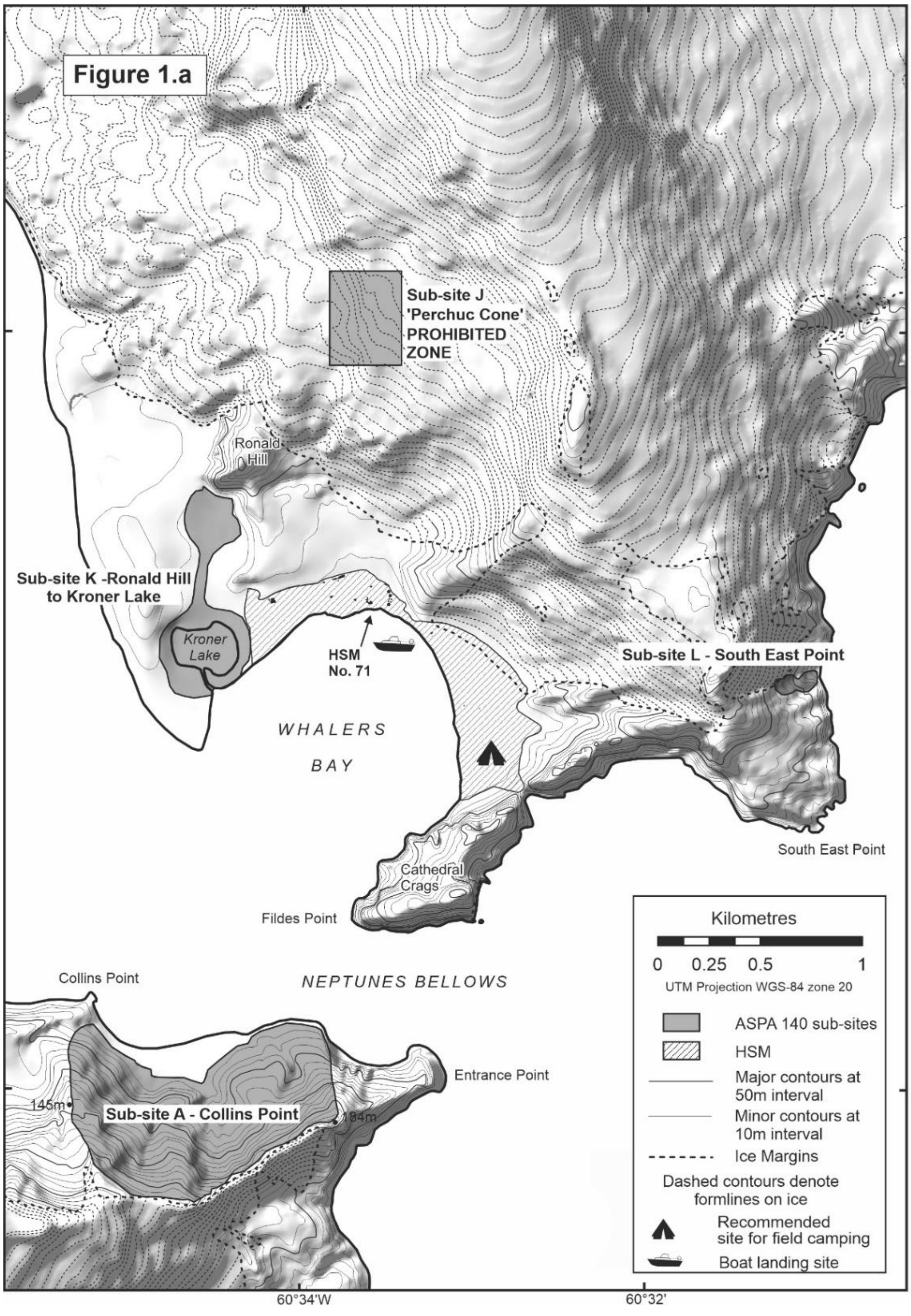


Figure 1b. Map showing the location of ASPA No. 140 Sites B, C, D and E.

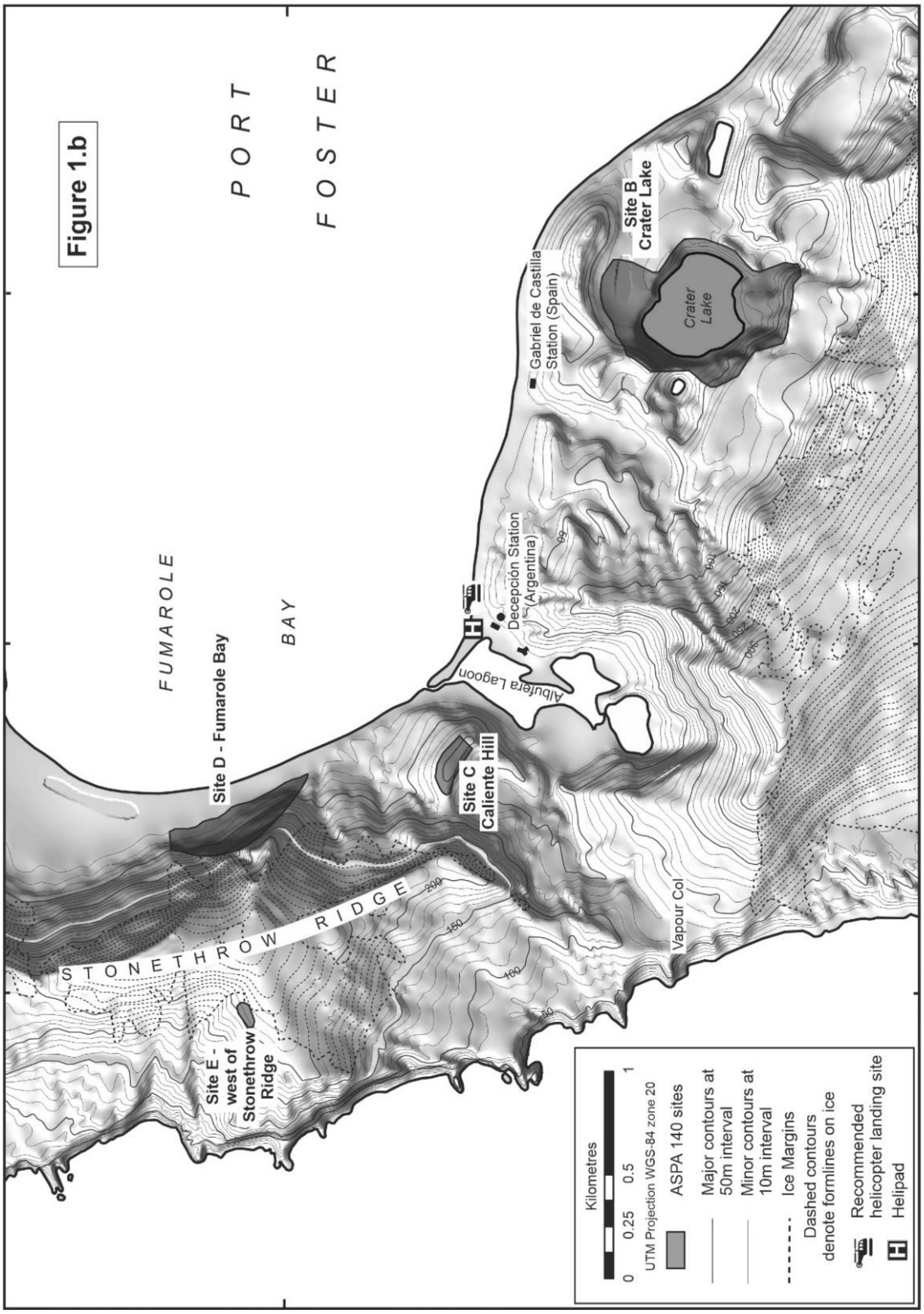


Figure 1c. Map showing the location of ASPA No. 140 Site F.

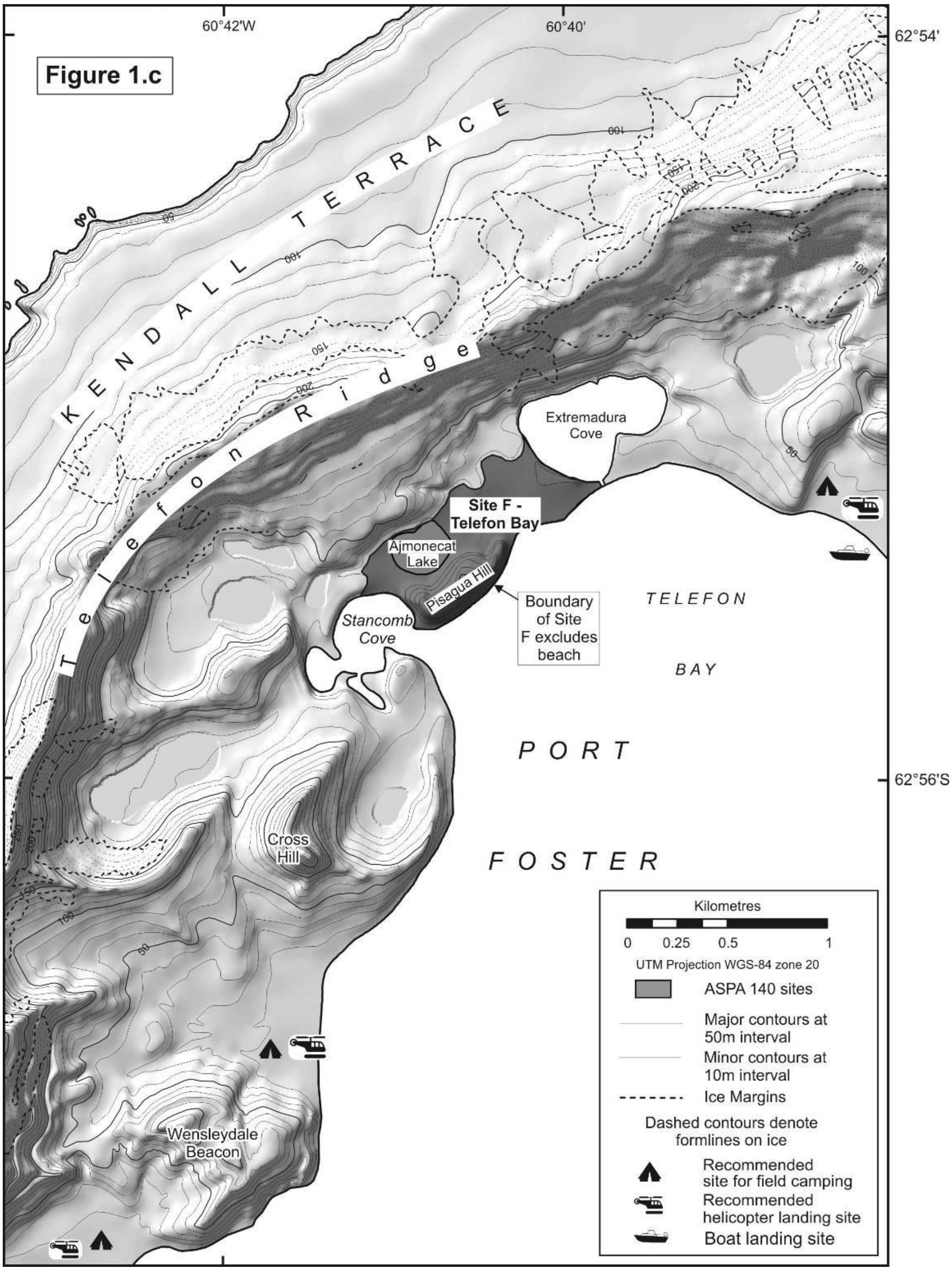
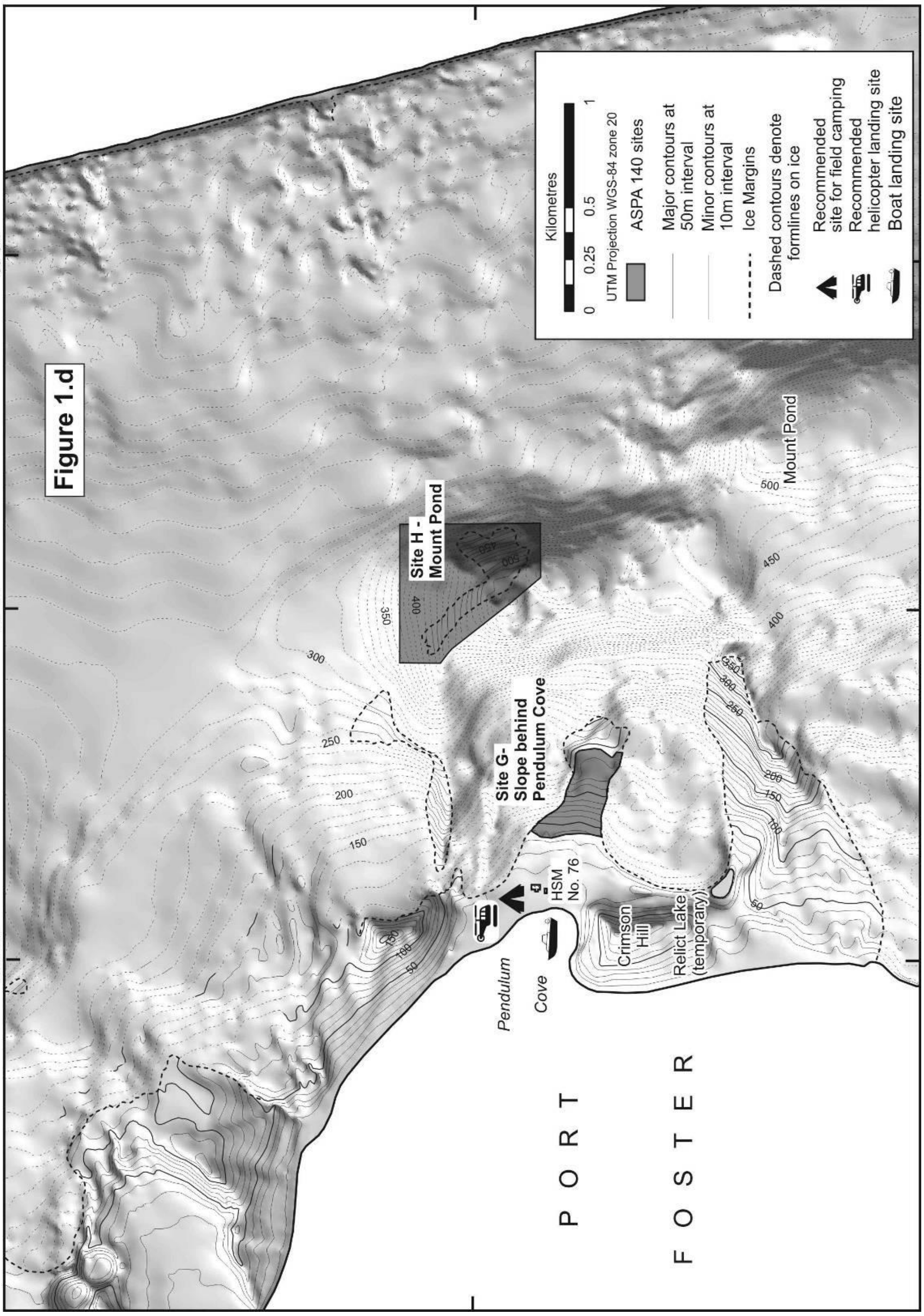


Figure 1d. Map showing the location of ASPA No. 140 Sites G and H.



Annex 1. List of plant species, classed as rare or very rare in the Antarctic Treaty Area, occurring on Deception Island.

A. Bryophytes (L = Liverwort)

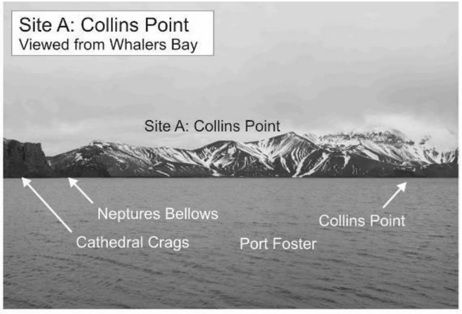
Species	**Sites where species occurs**	**Notes**
Brachythecium austroglareosum	D	Few other known Antarctic sites
B. fuegianum	G	Only known Antarctic site
Bryum amblyodon	C, D, G, K	Few other known Antarctic sites
B. dichotomum	C, E, H, J	Only known Antarctic site
B. orbiculatifolium	H, K	One other known Antarctic site
B. pallescens	D	Few other known Antarctic sites
Cryptochila grandiflora (L)	E	Only known Antarctic site
Dicranella hookeri	C, E, H	Only known Antarctic site
Didymodon brachyphillus	A, D, G, H	Locally more abundant than any other known Antarctic site
Ditrichum conicum	E	Only known Antarctic site
D. ditrichoideum	C, G, J	Only known Antarctic site
D. heteromallum	C, H	Only known Antarctic site
D. hyalinum	G	Few other known Antarctic sites
D. hyalinocuspidatum	G	Few other known Antarctic sites
Grimmia plagiopodia	A, D, G	A continental Antarctic species
Hymenoloma antarcticum	B, C, D, E, G, K	Few other known Antarctic sites
H. crispulum	G	Few other known Antarctic sites
Notoligotrichum trichodon	K	One other known Antarctic site
Philonotis polymorpha	E, H	Only known Antarctic site
Platyneurum jungermannioides	D	Few other known Antarctic sites
Polytrichastrum longisetum (L)	K	One other known Antarctic site
Pohlia wahlenbergii	C, E, H	One other known Antarctic site
Racomitrium heterostichoides	G	Only known Antarctic site
R. lanuginosum	G	Only known Antarctic site

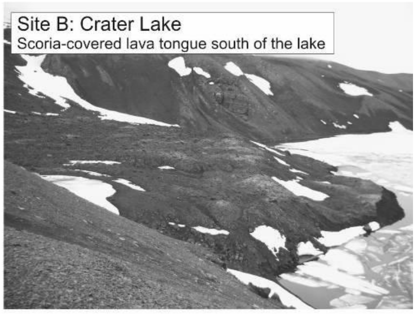
R. subsecundum	C	Only known Antarctic site
S. amblyophyllum	C, D, G, H	Few other known Antarctic sites
S. andinum	H	Few other known Antarctic sites
S. deceptionensis sp. nov.	C	Deception endemic
S. leptoneurum sp. nov.	D	Deception endemic
Schistidium praemorsum	H	One other known Antarctic site
Syntrichia andersonii	D, L	Only known Antarctic site

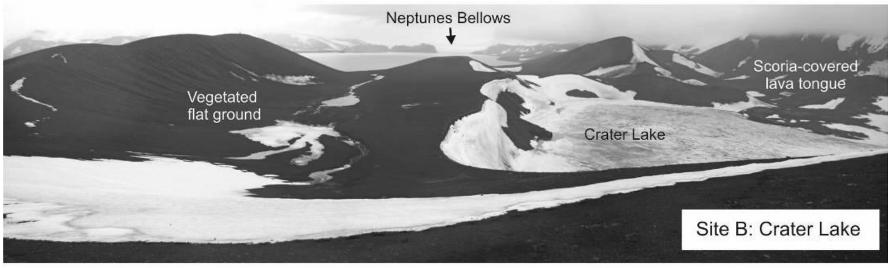
B. Lichens

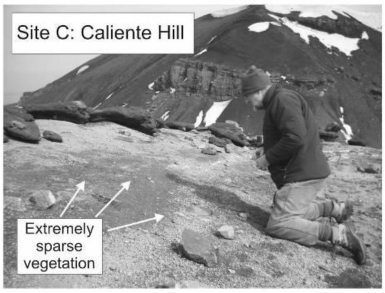
Species	**Sites where species occurs**	**Notes**
Acarospora austroshetlandica	A	One other known Antarctic site
Caloplaca johnstonii	B, D, F, L	Few other known Antarctic sites
Catapyrenium lachneoides	?	Few other known Antarctic sites
Cladonia galindezii	A, B, D	More abundant than any other known site
Degelia sp.	K	Only known Antarctic site
Ochrolechia parella	A, B, D	More abundant than any other known site
Peltigera didactyla	B, K	Very rare in B; very small colonising form abundant in K
Pertusaria excludens	D	Few other known Antarctic sites
P. oculae-ranae	G	Only known Antarctic site
Placopsis parellina	A, B, D, G, H	More abundant than any other known site
Protoparmelia loricata	B	Few other known Antarctic sites
Psoroma saccharatum	D	Only known Antarctic site
Stereocaulon condensatum	E	Only known Antarctic site
S. vesuvianum	B, G	Few other known Antarctic sites

Annex 2. Photographs of the Sites comprising ASPA 140. Photographs were taken between 19-26 Jan 2010 (K. Hughes: A, B, C, E, F, G, J, K, L; P. Convey: D, H).

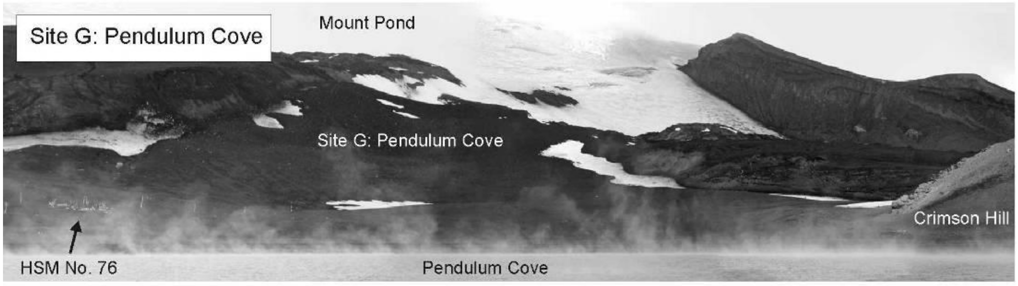


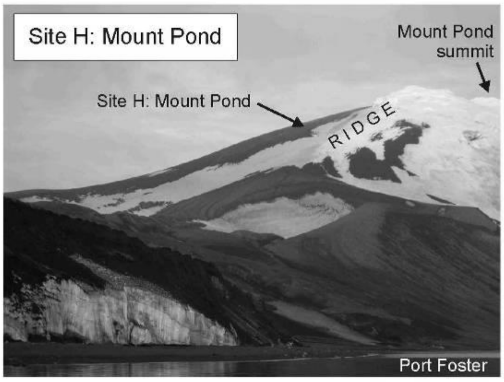


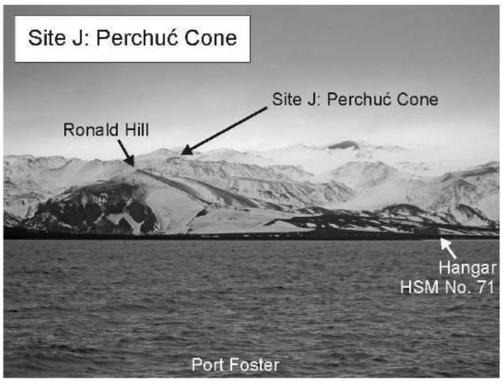


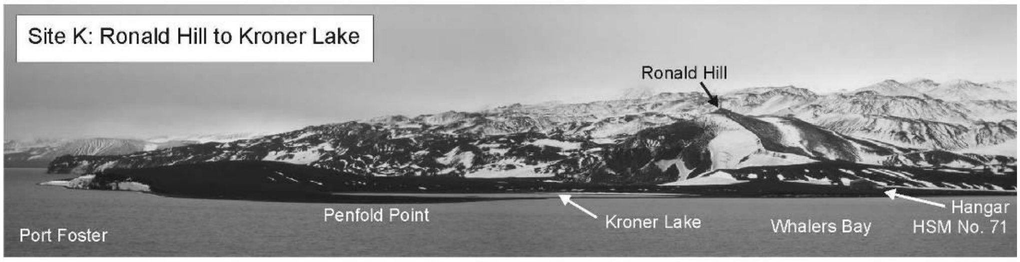



Site F: Telefon Bay
Telefon Ridge
Pisagua Hill
Site F: Telefon Bay
Stancomb Cove
Entrance to Extremadura Cove
Telefon Bay


Site G: Pendulum Cove
Mount Pond
Site G: Pendulum Cove
Crimson Hill
HSM No. 76
Pendulum Cove


Site H: Mount Pond
Mount Pond summit
Site H: Mount Pond
RIDGE
Port Foster


Site J: Perchuć Cone
Site J: Perchuć Cone
Ronald Hill
Hangar
HSM No. 71
Port Foster


Site K: Ronald Hill to Kroner Lake
Ronald Hill
Penfold Point
Kroner Lake
Whalers Bay
Hangar
HSM No. 71
Port Foster


Site L: South East Point
Cathedral Crags
Site L: South East Point
South East Point
Bransfield Strait

Annex 3. Boundary coordinates for the Sites that comprise ASPA 140 Parts of Deception Island. Many of the boundaries follow natural features and detailed descriptions of the boundaries are found in Section 6. The boundary coordinates are numbered, with number 1 the most northerly co-ordinate and further coordinates numbered sequentially in a clockwise direction around each Site.

Site	Number	Latitude	Longitude
A: Collins Point	1	62°59’50’’ S	060°33’55’’ W
	2	63°00’06’’ S	060°33’51’’ W
	3	63°00’16’’ S	060°34’27’’ W
	4	63°00’15’’ S	060°34’53’’ W
	5	63°00’06’’ S	060°35’15’’ W
	6	62°59’47’’ S	060°35’19’’ W
	7	62°59’59’’ S	060°34’48’’ W
	8	62°59’49’’ S	060°34’07’’ W
B: Crater Lake	1	62°58’48’’ S	060°40’02’’ W
	2	62°58’50’’ S	060°39’45’’ W
	3	62°58’56’’ S	060°39’52’’ W
	4	62°59’01’’ S	060°39’37’’ W
	5	62°59’11’’ S	060°39’47’’ W
	6	62°59’18’’ S	060°39’45’’ W
	7	62°59’16’’ S	060°40’15’’ W
	8	62°59’04’’ S	060°40’31’’ W
	9	62°58’56’’ S	060°40’25’’ W
C: Caliente Hill	1	62°58’33’’ S	060°42’12’’ W
	2	62°58’27’’ S	060°42’28’’ W
	3	62°58’29’’ S	060°42’33’’ W
	4	62°58’25’’ S	060°42’51’’ W
D: Fumarole Bay	1	62°57’42’’ S	060°43’05’’ W
	2	62°58’04’’ S	060°42’42’’ W
	3	62°57’53’’ S	060°43’08’’ W
	4	62°57’43’’ S	060°43’13’’ W
E: west of Stonethrow Ridge	1	62°57’51’’ S	060°44’00’’ W
	2	62°57’54’’ S	060°44’00’’ W
	3	62°57’54’’ S	060°44’10’’ W
	4	62°57’51’’ S	060°44’10’’ W
F: Telefon Bay	1	62°55’02’’ S	060°40’17’’ W
	2	62°55’11’’ S	060°39’45’’ W
	3	62°55’35’’ S	060°40’43’’ W
	4	62°55’30’’ S	060°41’13’’ W
	5	62°55’21’’ S	060°41’07’’ W

G: Pendulum Cove	1	62°56’10’’ S	060°35’15’’ W
	2	62°56’20’’ S	060°34’41’’ W
	3	62°56’28’’ S	060°34’44’’ W
	4	62°56’21’’ S	060°35’16’’ W
H: Mt. Pond	1	62°55’51’’ S	060°33’30’’ W
	2	62°56’12’’ S	060°33’30’’ W
	3	62°56’12’’ S	060°33’48’’ W
	4	62°55’57’’ S	060°34’42’’ W
	5	62°55’51’’ S	060°34’42’’ W
J: Perchuć Cone	1	62°57’50’’ S	060°33’50’’ W
	2	62°57’50’’ S	060°33’25’’ W
	3	62°58’05’’ S	060°33’25’’ W
	4	62°58’05’’ S	060°33’50’’ W
K: Ronald Hill to Kroner Lake	1	62°58’25’’ S	060°34’22’’ W
	2	62°58’32’’ S	060°34’20’’ W
	3	62°58’34’’ S	060°34’27’’ W
	4	62°58’41’’ S	060°34’30’’ W
	5	62°58’44’’ S	060°34’18’’ W
	6	62°58’50’’ S	060°34’18’’ W
	7	62°58’58’’ S	060°34’38’’ W
	8	62°58’49’’ S	060°34’53’’ W
	9	62°58’41’’ S	060°34’40’’ W
	10	62°58’24’’ S	060°34’44’’ W
L: South-east Point	1	62°58’53’’ S	060°31’01’’ W
	2	62°58’56’’ S	060°30’59’’ W
	3	62°58’57’’ S	060°31’13’’ W
	4	62°58’55’’ S	060°31’14’’ W

Annex 4. Recommended access to the Sites that comprise ASPA 140.

Site	Name	Recommended access route
A	Collins Point	By boat: land at the coast to the north of the site (Port Foster)
B	Crater Lake	Overland: traverse the west side of the ridge that rises to the south of Gabriel de Castilla Station for 500m, then travel east for 200 m until the western boundary of the Areas is reached.
C	Caliente Hill	Overland: access the site from Fumarole Bay to the north of the site, or along the prominent ridge that lies to the south west of the summit of Caliente Hill.
D	Fumarole Bay	By boat: access anywhere along the coast of Fumarole Bay.
E	west of Stonethrow Ridge	Overland: from Fumarole Bay, head southwest pass Albufera Lagoon then head north, traversing the west slope of Stonethrow Ridge. The Site lies on the north side of the east-west trending ridge that lies c. 600m south-southwest of the highest point on Stonethrow Ridge.
F	Telefon Bay	By boat: access the Site from either Telefon Bay or Stancomb Cove.
G	Pendulum Cove	By boat: access the site from Pendulum Cove, Port Foster, then overland past HSM No 76.
H	Mt. Pont	Overland: access with caution from Pendulum Cove via the prominent ice-free ridge to the west of the Site.
J	Perchuć Cone	Prohibited Zone: DO NOT ENTER
K	Ronald Hill to Kroner Lake	By boat: land in Whalers Bay, south of the Site - do not take boats into Kroner Lake to access the site (see Section 7(ii) for details) Over land: access from Whalers Bay to the east of the Site.
L	South-east Point	On foot: Access overland, with caution, from either Whalers Bay (to the west of the Site) or Bailey Head (to the north of the Site)

Measure 16 (2022)

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) and 7 (2016), which adopted a revised Management Plan 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 7 (2016) 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 km^2) 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 1.84°C (U.S. AMLR Program data, 2005-2010). The maximum air temperature recorded during this period was 19.9°C and the minimum was -8.1°C. 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 -6.7°C with a minimum of -20.6°C and a maximum of +0.9°C, and a mean daily temperature for Jun-Sep 2009 of -5.8°C with a minimum of -15.2°C and a maximum of +1.9°C.

- *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).

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 are permitted to operate as follows:

- in the coastal zone between Módulo Beach and the Chilean / U.S. camp facilities (Map 3); and
- in support of annual re-supply of the bird blind / emergency hut following the designated route (see Map 3), which should be undertaken prior to 15 November in a given season and only if the entire route is snow-covered to a depth of at least 40 cm, to minimise the possibility of damage to underlying soil and vegetation (Felix & Raynolds 1989). A journey after 15 November should be considered carefully, due to potential disturbance to adult female fur seals, which tend to arrive around that time of the year. No more than two re-supply journeys by vehicle to the emergency hut are allowed per season. An inspection of the route should be undertaken when it is snow-free to check for any evidence that vehicle use has caused damage to soils or vegetation.

Should any damage be observed, use of vehicles for the purpose of re-supply shall be suspended until such time as a review of this policy has been completed. As of 2021, the vehicle route between the main camp and the bird blind has never been used (Krause pers. comm. 2021).

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 are strongly encouraged to 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.

8. Supporting documentation

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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	aHinke et al. 2019, bWatters et al. 2020
1998/99	7581 (N1) a	830 (N1)b	aHinke et al. 2019, bWatters et al. 2020
1999/00	7744 (N1) a	922 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2000/01	7212 (N1) a	975 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2001/02	6606 (N1) a	907 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2002/03	5809 (N1) a	722 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2003/04	5635 (N1) a	751 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2004/05	4907 (N1) a	818 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2005/06	4847 (N1) a	807 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2006/07	4543 (N1) a	781 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2007/08	3032 (N1) a	610 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2008/09	4026 (N1) a	879 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2009/10	4339 (N1) a	802(N1)b	aHinke et al. 2019, bWatters et al. 2020
2010/11	4127 (N1) a	834 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2011/12	4100 (N1) a	829 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2012/13	4200 (N1) a	853 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2013/14	3582 (N1) a	839 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2014/15	3464 (N1) a	721 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2015/16	3325 (N1) a	655 (N1)b	aHinke et al. 2019, bWatters et al. 2020

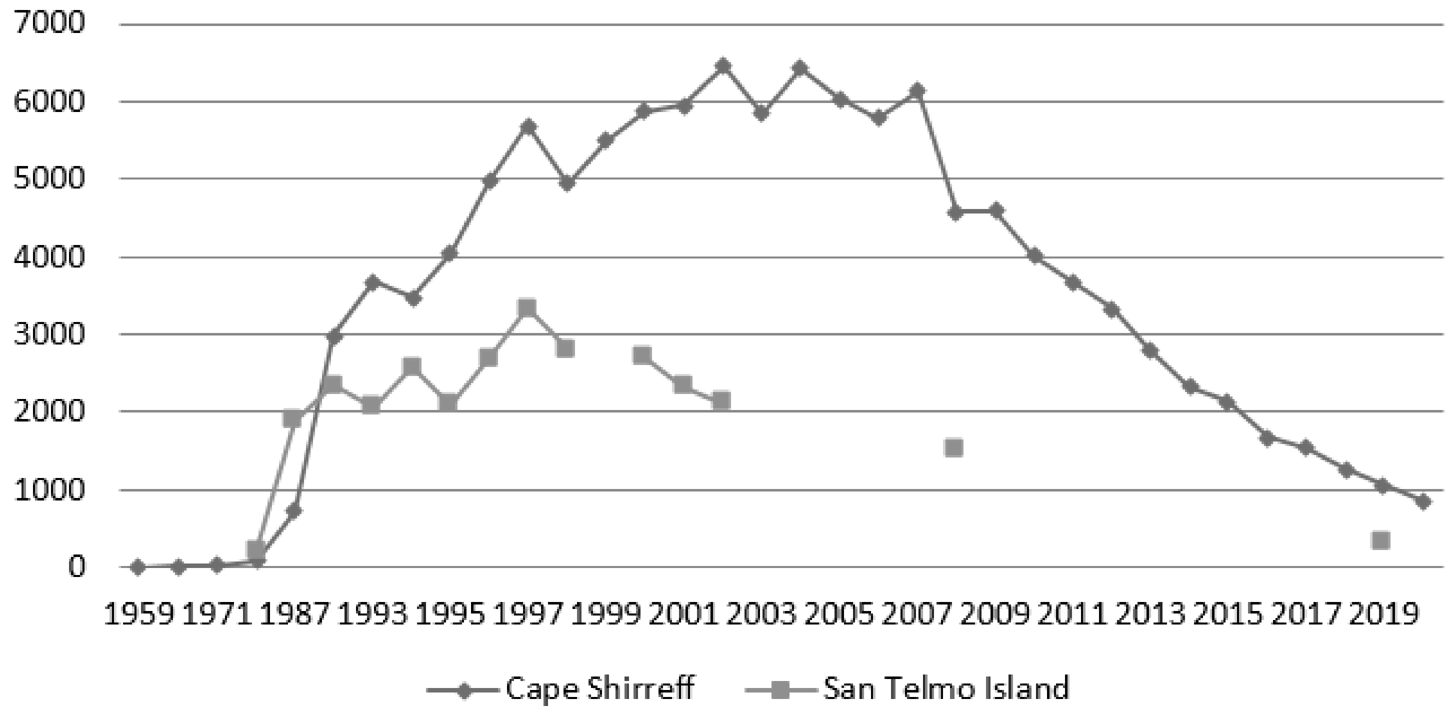
Year	Chinstrap (pairs)	Gentoo (pairs)	Source
2016/17	3060 (N1) a	771 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2017/18	2449 (N1) a	705 (N1)b	aHinke et al. 2019, bWatters et al. 2020
2018/19	2095 (N1)	674 (N1)	U.S. AMLR unpublished data
2019/20	2170 (N1)	708 (N1)	U.S. AMLR unpublished data

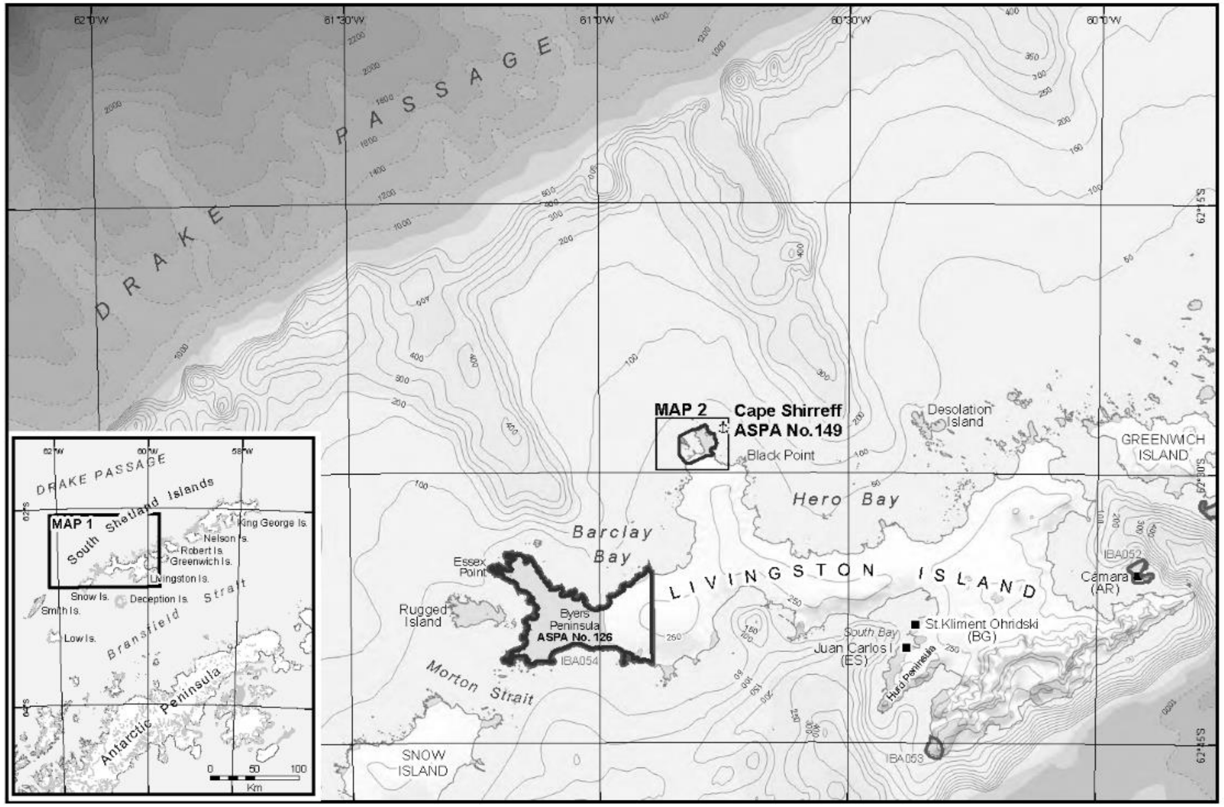
Alphanumeric code refers to the type of count, as in Woehler (1993).
Reported data did not specify species. It has been assumed that the higher number referred to chinstrap penguins. Data were reported as individuals, which have been halved to derive 'pairs' in the table.

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





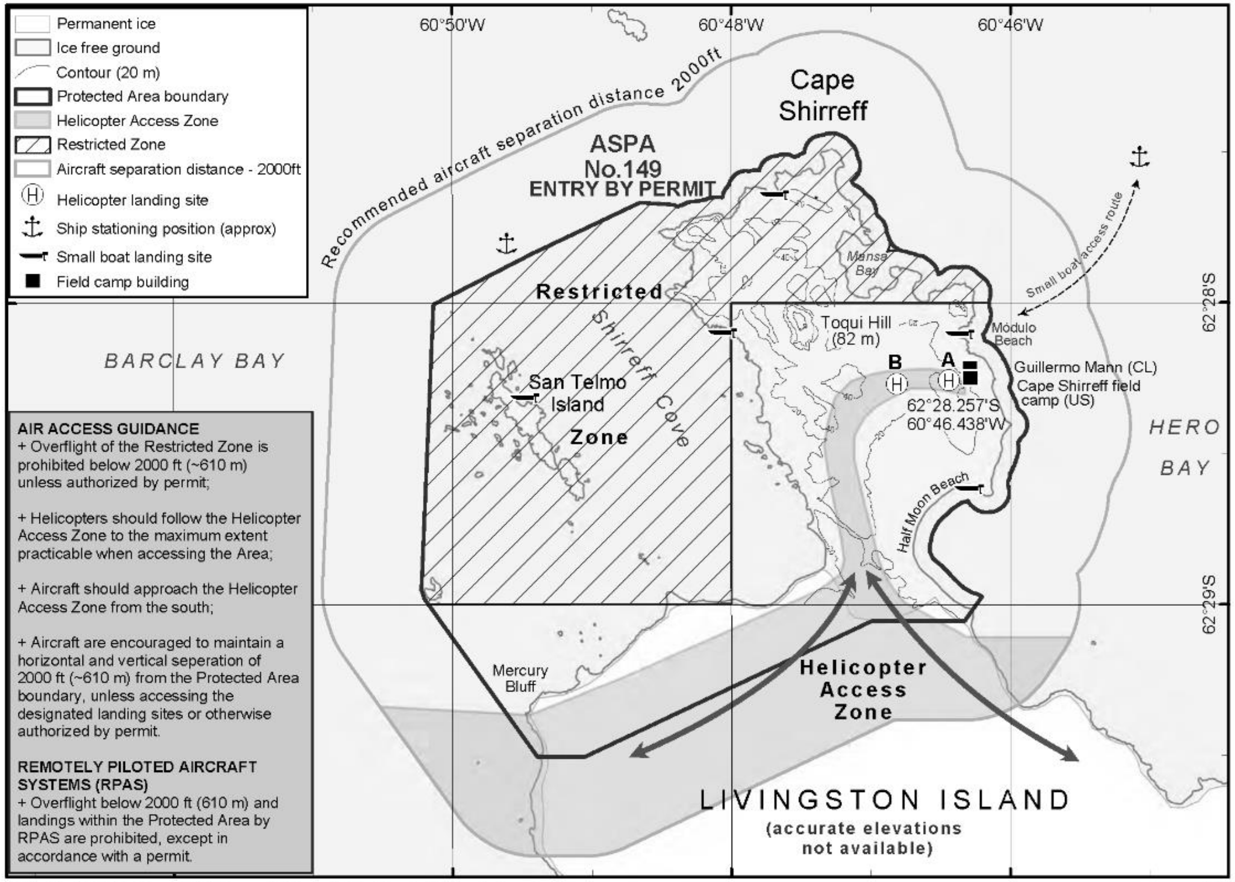
Map 1: ASPA No.149 - Cape Shirreff & San Telmo Island - Regional overview

26 Jan 2022 (v3)
United States Antarctic Program / INACH
Environmental Research & Assessment

0 10 20
Kilometers

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).

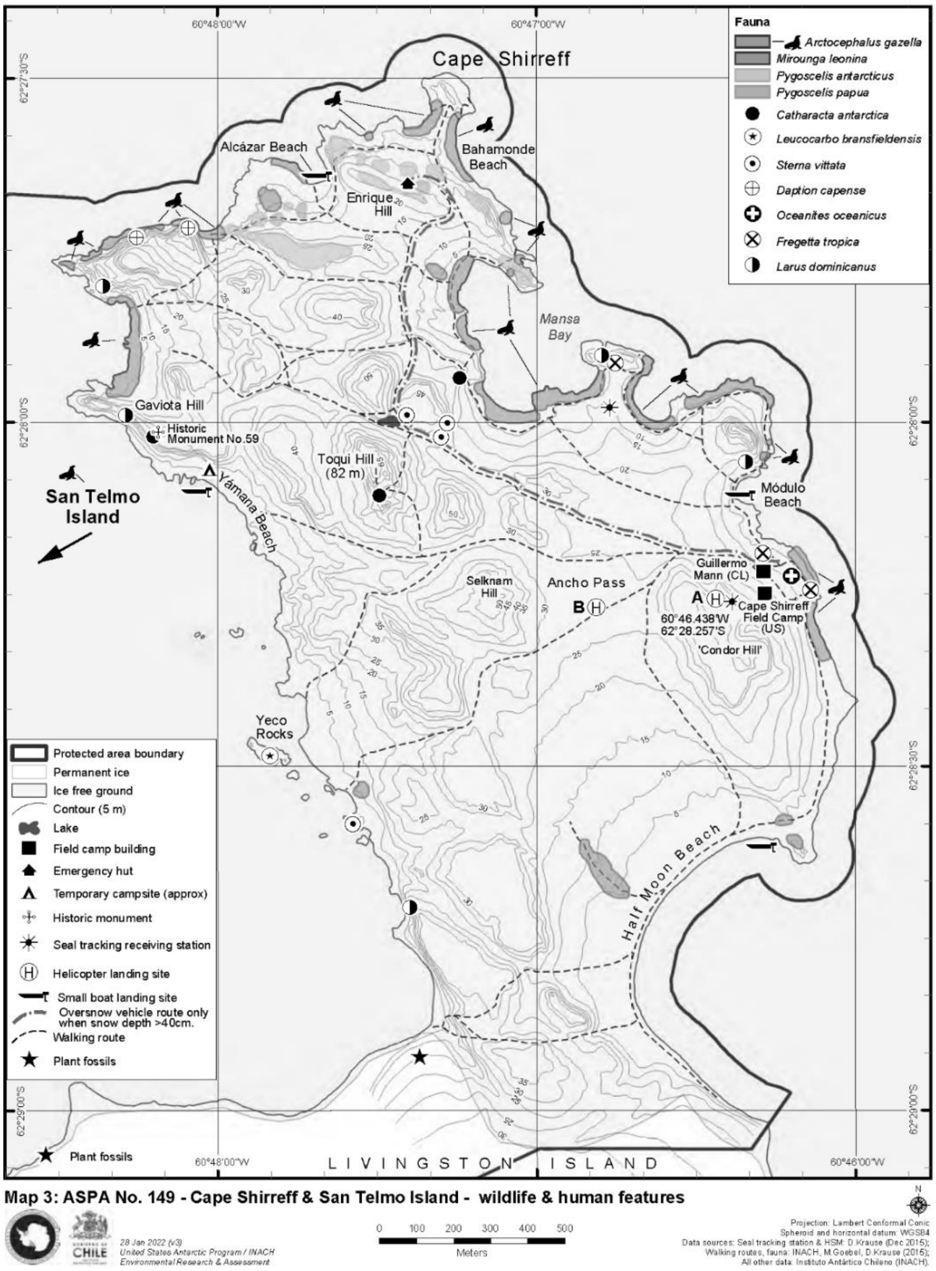


Map 2. ASPA No. 149 Cape Shirreff & San Telmo Island - access

Nautical Miles
Kilometers

28 Jan 2022 (v3)
United States Antarctic Program / INACH
Environmental Research & Assessment

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 17 (2022)

Antarctic Specially Protected Area No 164 (Scullin and Murray Monoliths, Mac.Robertson 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 2 (2005), which designated Scullin and Murray Monoliths, Mac.Robertson Land, East Antarctica as ASPA 164 and annexed a Management Plan for the Area;
- Measures 13 (2010) and 16 (2015), which adopted a revised Management Plan for ASPA 164;

Noting that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 164;

Desiring to replace the existing Management Plan for ASPA 164 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 164 (Scullin and Murray Monoliths, Mac.Robertson Land), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No 164 annexed to Measure 16 (2015) be revoked.

Management Plan for Antarctic Specially Protected Area No. 164

SCULLIN AND MURRAY MONOLITHS, MAC.ROBERTSON LAND

Introduction

Scullin Monolith (67°47’37”S, 66°43’8”E) and Murray Monolith (67°47’3”S, 66°53’17”E) (Map A) were designated as Antarctic Specially Protected Area (ASPA) No 164 under Measure 2 (2005), following a proposal by Australia. Revised management plans for the Area were adopted under Measure 13 (2010) and Measure 16 (2015). The Area is primarily designated to protect the greatest concentration of breeding seabirds in East Antarctica. Seven species occupy territories in the Area: five species of petrel (Antarctic petrels Thalassoica antarctica, Cape petrels Daption capense, southern fulmars Fulmarus glacialoides, snow petrels Pagodroma nivea, Wilson’s storm petrel Oceanites oceanicus), one penguin (Adélie penguin Pygoscelis adeliae) and one larid (south polar skua Catharacta maccormicki).

Scullin and Murray monoliths are visited infrequently, and with the one known exception, all visits have been brief (less than a day). Scullin and Murray monoliths were first visited on 13 February 1931 during the second British, Australian and New Zealand Antarctic Research Expedition (BANZARE) voyage. Sir Douglas Mawson named both monoliths during this visit. Murray Monolith was named after Sir George Murray, Chief Justice of South Australia, Chancellor of the University of Adelaide and a patron of the Expedition, while Scullin Monolith was named after James H. Scullin, Prime Minister of Australia from 1929–31.

On 26 February 1936, personnel from the R.R.S. William Scoresby briefly visited the site, and ascended Scullin Monolith to a height of several hundred metres. The Norwegian explorer Lars Christensen visited Scullin Monolith on 30 January 1937. Australian Antarctic Program personnel occasionally visit the Area from Mawson research station, approximately 160 kilometres to the west. The only recorded stay within the Area was a six-day visit in February 1987 when comprehensive ornithological surveys were conducted. The first visit by a commercial tourist vessel to the area occurred on 10 December 1992, and a small number of brief visits have been made in subsequent years.

1. Description of values to be protected

The Area is primarily designated to protect the outstanding ecological and scientific values associated with the important assemblage of seabirds occupying Scullin and Murray monoliths.

With at least 160,000 pairs, the Antarctic petrel colony on Scullin Monolith is smaller in population size to only two colonies elsewhere in Antarctica (Svarthameren in the Mühlig Hofmannfjella in Dronning Maud Land (ASPA 142) and Mount Biscoe).

Adélie penguin colonies occupy the lower slopes of both monoliths, extending almost to the foreshore. The most recent survey in December 2017/18 found approximately 45,000 breeding pairs on Scullin Monolith and a further 10,000 pairs on Murray Monolith. This represents approximately 4% of the breeding population of Adélie penguins in East Antarctica, and approximately 1% of the global population.

The ocean-facing slopes of both monoliths are occupied by several petrel species. Extensive breeding colonies occur on many of the steeper, higher-altitude slopes of both monoliths. South polar skuas nest throughout the Area, preying on the high density of seabirds during their breeding season.

Some large colonies of seabirds also occur in other parts of East Antarctica (e.g. the Rauer Group and Mount Biscoe). However, the two very small ice-free areas of Scullin and Murray monoliths (about 1.9 and 0.9 km^2, respectively) support one of the greatest concentrations of breeding seabirds, with the combined breeding population conservatively estimated at 230,000 pairs, and one of the most diverse seabird breeding localities in East Antarctica (Appendix 1).

In addition to its outstanding ecological and scientific values, the Area possesses outstanding aesthetic values arising from the geomorphology of the two monoliths and the spectacular backdrop of glaciers that descend from the continental plateau and flow around the monoliths to end in calving glaciers.

The very large and diverse breeding assemblage of seabirds in a setting of high aesthetic and wilderness values warrants the highest level of protection.

2. Aims and Objectives

Management of Scullin and Murray Monoliths aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- maintain the undisturbed nature of the Area to permit its future use as a reference area;
- allow scientific research and monitoring on the ecosystem and values of the Area, providing it is for compelling reasons which cannot be served elsewhere and will not impact on the values of the Area, particularly ornithological values;
- grant high priority to the collection of seabird census data from representative sample areas, reference breeding groups (RBGs) or of whole breeding populations. These census data will be major determinants in, and contributions to, future revisions of management arrangements for the Area;
- accord high priority to the collection of other biological survey data, in particular flora and invertebrate surveys. These survey data will be incorporated into future revisions of the management arrangements for the Area;

- allow visits for management purposes in support of the aims of the management plan; and
- minimise the potential for introduction of non-native plants, animals and micro-organisms, particularly avian pathogens.

3. Management Activities

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

- where practical, the Area shall be visited as necessary, and preferably no less than once every five years, to conduct censuses of seabird breeding populations, including mapping of colonies and nest sites;
- information on the Area, including copies of this management plan, will be made available at both Davis research station and Mawson research station and to all visitors;
- national Antarctic programs operating in the vicinity or intending to visit the Area shall consult with other national programs to ensure that research projects do not overlap or conflict; and
- where practical, management visits will be made to remove unnecessary materials currently located within the Area.

4. Period of Designation

The Area is designated for an indefinite period.

5. Maps and Photographs

Map A: Antarctic Specially Protected Area No 164, Scullin and Murray Monoliths, Mac.Robertson Land, East Antarctica. The inset map indicates the location in relation to the Antarctic continent.

Map B: Antarctic Specially Protected Area No. 164, Scullin Monolith: Topography and Bird Distribution.

Map C: Antarctic Specially Protected Area No. 164, Murray Monolith: Topography and Bird Distribution.

Map D: Antarctic Specially Protected Area No. 164: Scullin Monolith: Helicopter approach and landing site.

Specifications for all maps: Horizontal Datum: WGS84; Vertical Datum: Mean Sea Level.

6. Description of the Area

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

Scullin Monolith (67°47’37”S, 66°43’8”E) and Murray Monolith (67°47’3”S, 66°53’17”E) are situated on the coast of Mac.Robertson Land some 160 km east of

Mawson station (Map A). The monoliths are approximately seven kilometres apart, and abut the sea at the edge of the continental ice sheet. The coastline to the west and east, and between the monoliths, consists of ice cliffs 30–40 m high; the Antarctic plateau rises steeply from there to the south. Scullin Monolith is a crescent-shaped massif whose highest point is 443 metres above sea level. It encloses a broad north-facing cove with an approximately one kilometre wide entrance. All upper slopes of the monolith are precipitous, but in the lower 100 metres the slope eases in many parts; these areas are strewn with boulders and large stones. Elsewhere in the lower parts the rock face falls sheer to the sea; there are also some scree slopes.

The walls of Murray Monolith rise from the sea to a dome-shaped summit 340 metres above sea level. On the western side of Murray Monolith, the lower slopes drop to a coastal platform. The Area extends over all ice-free areas associated with the two monoliths, and includes a portion of the adjacent continental ice as well as Torlyn Mountain to the south-west of Murray Monolith (which rises to about 400 metres above sea level).

The Area comprises two sectors (see Map B and Map C):

- Scullin Monolith: the boundary commences at the coastline at 67°46’59”S, 66°40’30”E. It then extends in a southerly direction to 67°48’03”S, 66°40’26”E, east to 67°48’06”S, 66° 44’33”E, and north to the coast at 67°46’41”S, 66°44’37”E. It follows the coastline west at the low tide mark to 67°46’59”S, 66° 40’30”E.
- Murray Monolith: the boundary commences on the coastline at 67°46’36”S, 66°51’01”E, and continues south to 67°48’03”S, 66° 50’55”E. It extends east to 67°48’05”S, 66°53’51”E, and north to 67°46’38”S, 66°54’00”E, then west following the coast line at the low tide mark to 67°46’36”S, 66°51’01”E.

There are no boundary markers delineating the site.

- *Birds*

Seven species occupy territories in the Area: five species of petrel (Antarctic petrels Thalassoica antarctica, Cape petrels Daption capense, southern fulmars Fulmarus glacialoides, snow petrels Pagodroma nivea, Wilson’s storm petrel Oceanites oceanicus), one penguin (Adélie penguin Pygoscelis adeliae) and one larid (south polar skua Catharacta maccormicki). Scullin Monolith hosts one of the largest colonies of Antarctic petrels in Antarctica and significant Adélie penguin colonies. Less is known about the species diversity and abundance at Murray Monolith.

There has been only one attempt (in 1986/87) to estimate the population of all species in the Area. This survey estimated at least 160,000 pairs of Antarctic petrels at Scullin Monolith, but this is likely an under-estimate because the survey occurred late in the breeding season. Counts of the other petrel species at Scullin Monolith were much smaller (next most abundant species the southern fulmar at 1350 breeding pairs). Subsequent surveys in 2010/11 and 2017/18 focussed on Adélie penguins only. Consequently, the Adélie penguin is the only species for which any data on population change is available. Analysis of population count and guano area data indicate that Adélie penguin populations at both Scullin and Murray monoliths have remained stable or decreased slightly over the past 3-4 decades. The most recent estimate in 2017/18 for Scullin and Murray monoliths combined was 55,000 breeding pairs. There is evidence that the amount of suitable breeding habitat available to individual Adelie penguins at the monoliths is limited and has constrained population growth over the past three decades. This is in contrast to many Adelie penguin breeding sites elsewhere in East Antarctica, where there is more suitable habitat and populations have grown substantially.

- *Geology*

The geology of the two monoliths is poorly understood, as they have been neither the subject of dedicated study nor specific geological mapping. Generally the geology of the monoliths appears to be similar to that of the region around Mawson station. The rocks consist predominantly of high-grade granulite facies gneisses of metasedimentary origin, including some sapphirine bearing rocks. The metamorphism occurred in anhydrous conditions about 1000Ma. An age range of between 1254Ma and 625Ma has been documented for the gneisses from Scullin Monolith. Metamorphism involved sedimentary rocks initially of Proterozoic age. These metamorphic basement rocks were intruded at about 920–985Ma by the Mawson Charnockite, a form of granite characterised by presence of orthopyroxene common in this region. It forms the faces of the monoliths. The recorded age of 433 and 450Ma may reflect a later influence of the '500Ma or Pan-African event' recorded widely throughout Gondwana. The margins of the monoliths contain some sediment carried by the icesheet and deposited by melting ice. The source cannot be specified but it may contain recycled material from farther inland and could perhaps provide evidence of some of the geology beneath the ice.

- *Environmental Domains, Antarctic Conservation Biogeographic Regions and Important Bird Areas*

Based on the Environmental Domains Analysis for Antarctica (Resolution 3(2008)), Scullin and Murray Monoliths are located within Environments D East Antarctic coastal geologic and L Continental coastal-zone ice sheet. Based on the Antarctic Conservation Biogeographic Regions (Resolution 3 (2017)), the Area is assigned to Biogeographic Region 16 Prince Charles Mountains. Scullin and Murray monoliths are identified as Antarctic Important Bird Area 126 Scullin Monolith/Murray Monolith (Resolution 5 (2015)).

- *Vegetation*

The flora reported from Scullin Monolith is listed in Appendix 3, based on visits in 1972 and 1987; all species of lichens and moss occur elsewhere in Mac.Robertson Land (Appendix 2). Vegetation occurs mainly on the western plateau and associated nunataks. The distribution of vegetation on the western plateau is influenced by microtopography that controls the extent of exposure and moisture availability. The coastal slopes are generally void of vegetation due to high levels of seabird guano.

Although not recorded, it is likely that vegetation at Murray Monolith is similar to that at Scullin Monolith.

- *Other biota*

There have been no comprehensive invertebrate studies at Scullin or Murray monoliths. A leopard seal Hydrurga leptonyx was sighted during a visit in 1936 and several Weddell seals Leptonychotes weddellii were observed during visits in 1997 and 1998; no further observations of other biota have been reported.

6(ii) Access to the Area

Travel to the Area is possible by small boat, by over-snow/ice vehicles or by aircraft, in accordance with section 7(ii) of this plan.

6(iii) Structures within and adjacent to the Area

At the time of writing (March 2022), a fibreglass 'Apple' hut is situated on the south western summit ridge of Scullin Monolith (approximately 67°47’24”S, 66°41’38”E) (Map B and Map D). The hut is not suitable for accommodation but may be used for the storage of equipment.

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

ASPA No. 102, Rookery Islands (67°36’36” S, 62°32’01” E), is located approximately 180 km to the west (less than 20 km west of Mawson). ASPA No. 101, Taylor Rookery (67°27’S; 60°53’E), is located approximately 250 km to the west.

6(v) Special zones within the Area

There are no special zones within the Area.

7. Permit conditions

7(i) General permit conditions

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

- it is issued only for compelling scientific or management purposes that cannot be served elsewhere, in particular for scientific study of the avifauna and ecosystem of the Area, or for essential management purposes consistent with plan objectives, such as inspection, maintenance or review;
- the actions permitted are in accordance with this management plan and will not jeopardise the values of the Area;
- it is issued for a specified period;

- it will authorise the entry into the Area of no more than 10 people at any one time during the seabird breeding season (1 October to 31 March), and no more than 15 people at any one time during the remainder of the year;
- the permit or an authorised copy shall be carried at all times when within the Area;
- a visit report shall be supplied to the appropriate national authority at the conclusion of the permitted activity; and
- the appropriate national authority shall 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

- Travel to the Area is possible by small boat, by over-snow/ice vehicles or by aircraft.
- Any movement within and around the Area shall observe the minimum specified wildlife approach distances (Appendix 3); closer approach may be allowed only if authorised under a permit.
- Movement by visitors within the Area shall be by foot only.
- Small boats used to approach the Area must be operated at or below five knots within 500 m of the shore.
- It is recommended that visitors not permitted to enter the Area do not approach within 50 m of the shoreline.
- To reduce disturbance to wildlife, noise levels, including verbal communication, are to be kept to a minimum. The use of motor-driven tools and any other activity likely to generate loud noise and thereby cause disturbance to nesting birds shall not be allowed within the Area during the summer seabird breeding season (1 October to 31 March).

Aircraft may operate in the airspace above the Area subject to the following points:

- Disturbance of wildlife colonies by aircraft shall be avoided at all times.
- All aircraft are prohibited from flying directly above or within the Scullin Monolith amphitheatre during the bird breeding season (1 October to 31 March).
- Twin-engine fixed wing aircraft and single-engine helicopters must not operate closer than 750 metres (2500 feet) from known wildlife concentrations during the bird breeding season (1 October - 31 March).
- Twin-engine helicopters must not operate closer than 1500 metres (5000 feet) from known wildlife concentrations during the bird breeding season (1 October to 31 March).
- Fixed-wing aircraft exceeding twin-engine must not operate closer than 2150 metres (7000 feet) from known wildlife concentrations during the bird breeding season (1 October to 31 March).

Aircraft may land in the Area subject to the following points:

- Single-engine helicopters may land at the Scullin Monolith designated landing site (Map D) at any time of the year. Helicopters must approach the landing site according to the approved flight corridor (Map D).
- Twin-engine helicopters may land at the Scullin Monolith designated landing site (Map D) outside of the bird breeding season (1 April to 30 September).
- Twin-engine helicopter may be allowed to land at the Scullin Monolith designated landing site, or an alternate landing site, during the bird breeding season (1 October to 31 March):
  - if it can be demonstrated that disturbance to concentrations of birds can be avoided; and
  - where essential for compelling scientific or management purposes; and
  - in accordance with a permit issued by an appropriate authority.
- Refuelling of aircraft is not to take place within the Area.

- *Aircraft operations outside of the Area*

- It is recommended that flights adjacent to the Area observe the separation distance from wildlife concentrations specified above, and at a minimum adhere to the Guidelines for the operation of aircraft near concentrations of birds in Antarctica (ATCM Resolution 2 (2004)).

- *Remotely Piloted Aircraft*

- Overflights of bird colonies in the Area by remotely piloted aircraft systems (RPAS) are prohibited, except where essential for compelling scientific or management purposes, and in accordance with a permit issued by an appropriate authority. Such flights shall be undertaken in accordance with the Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica.

7(iii) Activities that are, or may be conducted within the Area, including restrictions on time and place

The following activities may be conducted within the Area as authorised by permit:

- compelling scientific research that cannot be undertaken elsewhere, including the initiation or continuance of ongoing monitoring programmes; and
- other scientific research and essential management activities consistent with this Management Plan that will not affect the values of the Area or its ecosystem integrity.

7(iv) Installation, modification or removal of structures

No new temporary 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. Scientific markers and equipment must be secured and maintained in good condition, clearly identifying the permitting country, name of principal investigator and year of installation. All such items should be made of materials that pose minimum risk of harm to fauna and flora or of contamination of the Area.

A condition of the permit shall be that equipment associated with the approved activity shall be removed on or before completion of the activity. Details of markers and equipment temporarily left in situ (GPS locations, description, tags, etc. and expected removal date) shall be reported to the permitting authority.

7(v) Location of field camps

Temporary camps for field parties are permitted within the Area, but must be placed as far from seabird colonies and nesting sites as is practicable without compromising visitor safety. Camps shall be established for the minimum time necessary to undertake approved activities, and shall not be allowed to remain from one seabird breeding season to the next.

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

- A small amount of fuel is permitted within the Area for cooking purposes while field parties are present. Otherwise, fuel is not to be stored within the Area.
- No poultry products, including dried foods containing egg powder, are to be taken into the Area.
- No herbicides or pesticides are to be taken into the Area.
- All chemicals required for research purposes must be approved by permit, and shall be removed at or before the conclusion of the permitted activity to which they relate. The importation and use of radionucleides and stable isotopes within the Area is prohibited.
- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. The highest level 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) into the Area.
- To the maximum extent practicable, clothing, footwear and other equipment used or brought into the Area (including backpacks, carry-bags and other equipment) shall be thoroughly cleaned before entering and after leaving the Area.
- Boots and sampling/research equipment and markers that come into contact with the ground shall be disinfected or cleaned with hot water and bleach before entering and after visiting the Area to help prevent accidental introductions of animals, plant material, micro-organisms and non-sterile soil into the Area. Cleaning should be undertaken at station.
- Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual, and in the SCAR Environmental Code of Conduct for terrestrial scientific field research in Antarctica.

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. 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. Disturbance to wildlife should be avoided at all times.

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

Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or was otherwise authorised, may be removed unless the impact of the removal is likely to be greater than leaving the material in situ. If such material is found, the permit issuing authority shall be notified if possible while the field party is present within the Area.

Specimens of natural materials may only be collected or removed from the Area as authorised in a permit and should be limited to the minimum necessary to meet scientific or management needs.

7(ix) Disposal of waste

All wastes, including human wastes, shall be removed from the Area. Wastes from field parties shall be stored in such a manner to prevent scavenging by wildlife (e.g. skuas) until such time as the wastes can be disposed or removed. Wastes are to be removed no later than the departure of the field party.

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

Permits may be granted to enter the Area to carry out biological monitoring and Area management activities, which may involve the collection of samples for analysis or review.

- Ornithological surveys, including aerial photographs for the purposes of population census, shall have a high priority.
- Any specific sites of long-term monitoring shall be appropriately marked and a GPS position obtained for lodgement with the Antarctic Data Directory System through the appropriate national authority.
- Visitors shall take special precautions against the introduction of alien organisms to the Area. Of particular concern are pathogenic, microbial or vegetation introductions sourced from soils, flora or fauna at other Antarctic sites, including research stations, or from regions outside Antarctica. To minimise the risk of introductions, before entering the Area, visitors shall thoroughly clean footwear and any equipment to be used in the Area, particularly sampling equipment and markers.

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 visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. 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.

A copy of the report should be forwarded to the Party responsible for development of the Management Plan (Australia) to assist the management of the Area, and the monitoring of bird populations.

8. Supporting documentation

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Appendix 1: Estimates of breeding populations (pairs) of seabirds at Scullin and Murray Monoliths.

Species	**Scullin Monolith**	**Murray Monolith**
Adélie penguin Pygoscelis adeliae	55,000	10,000
Southern fulmar Fulmarus glacialoides	1,350	150
Antarctic petrel Thalassoica antarctica	157,000	3,500
Cape petrel Daption capense	14	ND
Snow petrel Pagodroma nivea	1,200	ND
Wilson's storm petrel Oceanites oceanicus	ND	ND
South polar skua Catharacta maccormicki	30	ND

Note: ND indicates no census data are available

Appendix 2: Flora recorded at Scullin Monolith

The following taxa were collected at Scullin Monolith in 1972 (R Seppelt) and in 1987 (D Bergstrom), and were published in Bergstrom & Seppelt 1990).

LICHENS **Acarosporaceae**	**Teloschistaceae**
Biatorella cerebriformis (Dodge) Filson	Caloplaca citrina (Hoffm.) Th. Fr.
AcarosporagwyniiDodge&Rudolph	Xanthoriaelegans(Link.)Th.Fr.
Lecanoraceae Lecanora expectans Darb Rhizoplaca melanophthalma (Ram.) Leuck.	Xanthoria mawsonii Dodge Candelariaceae Candellariella hallettensis Murray
Lecideaceae	Umbilicariaceae
Lecidea phillipsiana Filson	Umbilicaria decussata (Vill.) Zahlbr.
Lecidea woodberryi Filson Physciaceae Physcia caesia (Hoffm.) Hampe	Usneaceae Usnea antarctica Du Rietz Pseudophebe miniscula (Nyl. Ex Arnold) Brodo et Hawksw.
Buellia frigida Darb	
Buellia grimmiae Filson Buellia lignoides Filson	BRYOPHYTES
Rinodina olivaceobrunnea Dodge & Baker	Grimmiaceae Grimmia lawiana Willis Pottiaceae Sarconeurum glaciale (C. Muell.) Card. Et Bryhn

Appendix 3: Approach distances guide: minimum distances (m) to maintain when approaching wildlife without permit.

Species	People on foot/ski	Quad/skidoo	Hagglunds
Penguins in colonies Moulting penguins Seals with pups Seal pups on their own Prions and petrels on nest South Polar Skua on nest	15 m	Not permitted inside the Area.	Not permitted inside the Area.
Penguins on sea ice Non-breeding adult seals	5 m		

Notes:

1. These distances are a guide, and should you find that your activity is disturbing wildlife, a greater distance is to be maintained.
2. 'Prions and petrels' comprises Cape petrels, Antarctic petrels, Wilson's storm petrels, snow petrels and southern fulmars.

Australian Government
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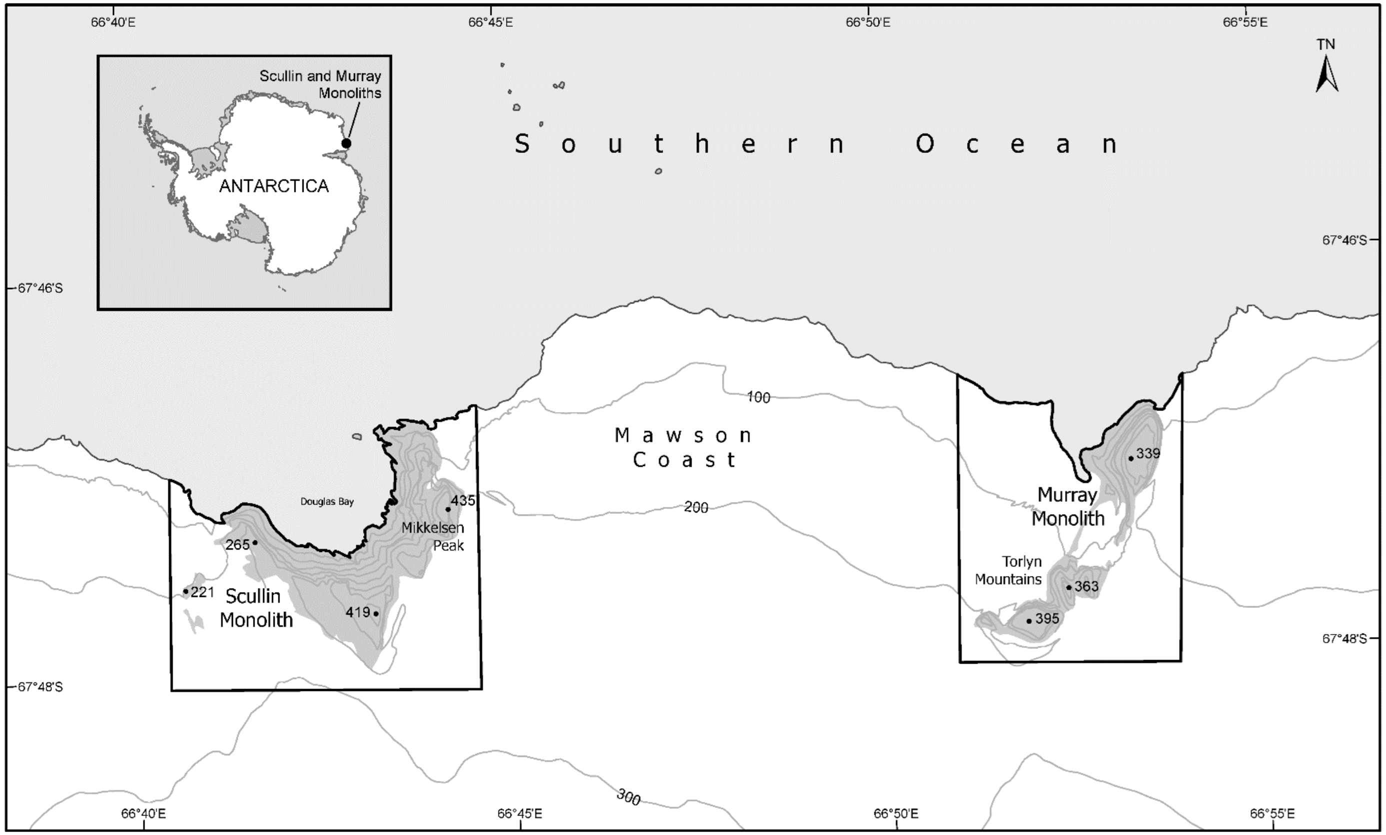
Australian Antarctic Division

Map A: Antarctic Specially Protected Area No. 164, Scullin and Murray Monoliths, Mac.Robertson Land, East Antarctica



Spot elevation (metres)
Contour (50 metre interval on rock)
Ice-free area
Antarctic Specially Protected Area

0 1 2 3 Kilometres

Horizontal Datum: WGS84
Projection: UTM Zone 42

Map Available at: *http://data.aad.gov.au/aadc/mapcat/*
Map Catalogue No. 15674
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, March 2022.

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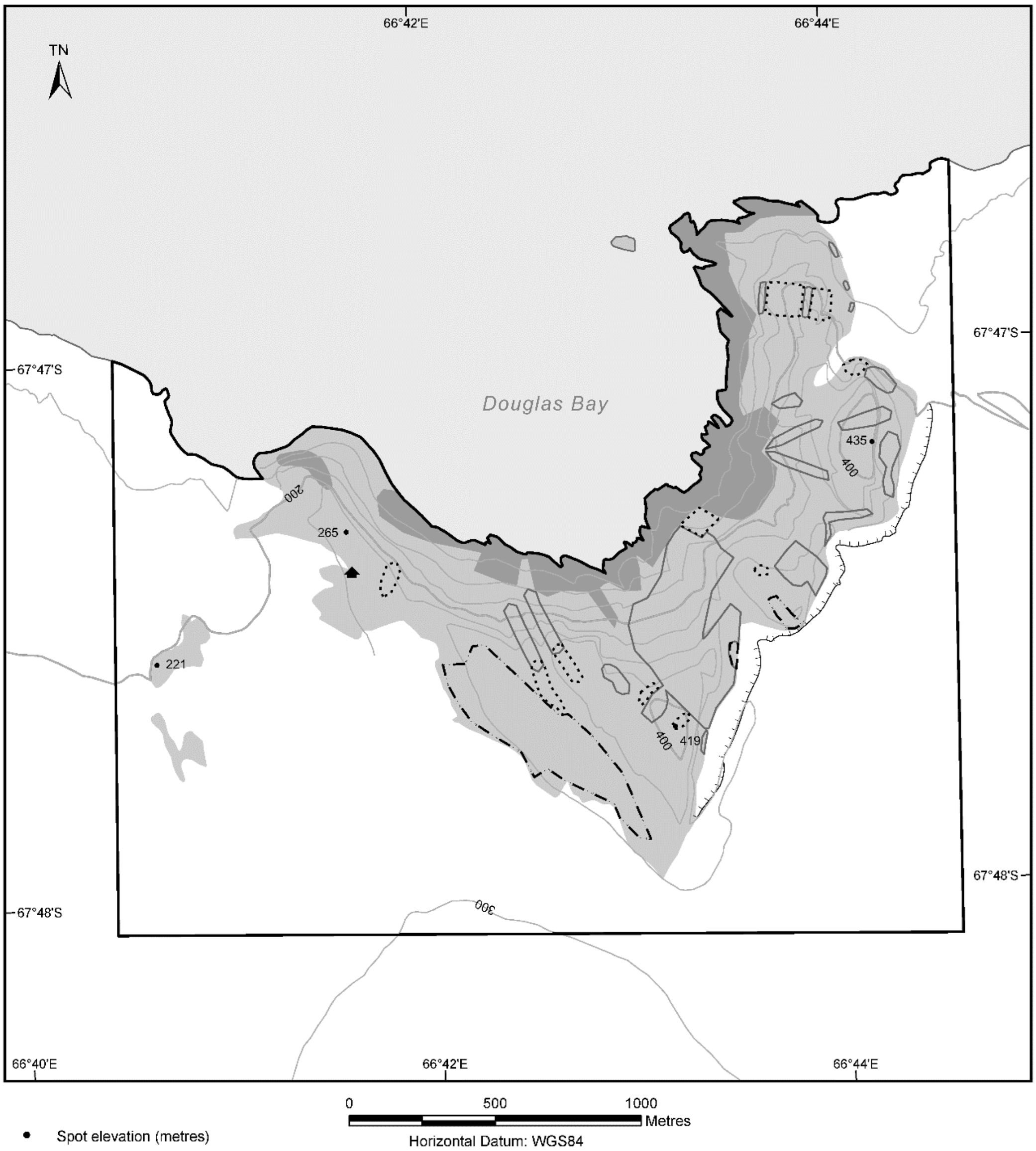
Department of Agriculture, Water and the Environment
Australian Antarctic Division

Map B: Antarctic Specially Protected Area No. 164
Scullin Monolith
Topography and Bird Distribution



Horizontal Datum: WGS84
Projection: UTM Zone 42

- Spot elevation (metres)
- Antarctic petrel colony
- Southern fulmar colony
- South polar skua colony
- Adélie penguin colony
- Refuge
- Cliff
- Ice-free area
- Antarctic Specially Protected Area
- Contour (50m interval on rock)
- Index contour (200m interval)

Map Available at: *http://data.aad.gov.au/aadc/mapcat/*
Map Catalogue No. 15675
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, March 2022.

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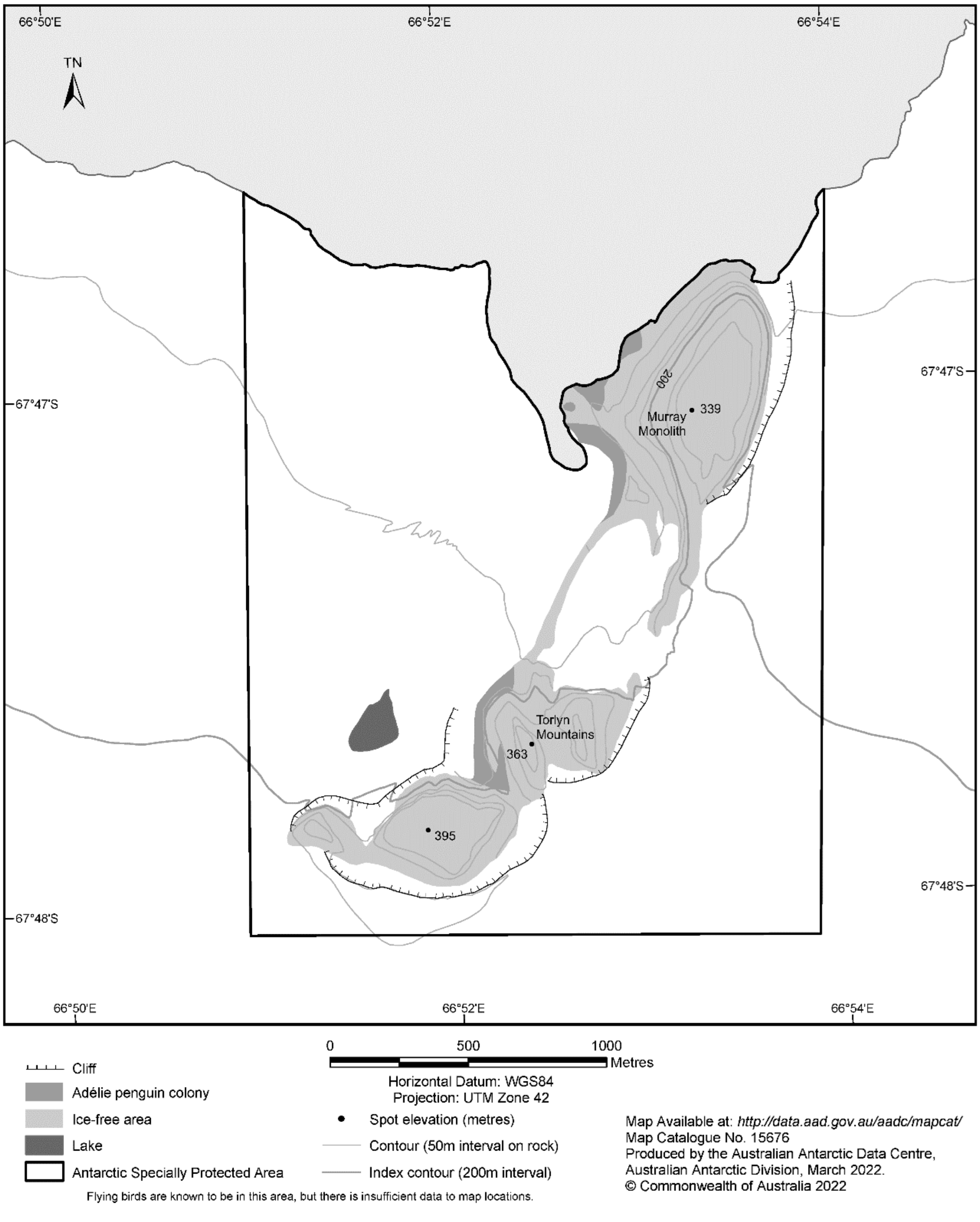
Department of Agriculture, Water and the Environment
Australian Antarctic Division

Map C: Antarctic Specially Protected Area No. 164
Murray Monolith
Topography and Bird Distribution



Horizontal Datum: WGS84
Projection: UTM Zone 42

Flying birds are known to be in this area, but there is insufficient data to map locations.

Map Available at: *http://data.aad.gov.au/aadc/mapcat/*
Map Catalogue No. 15676
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, March 2022.

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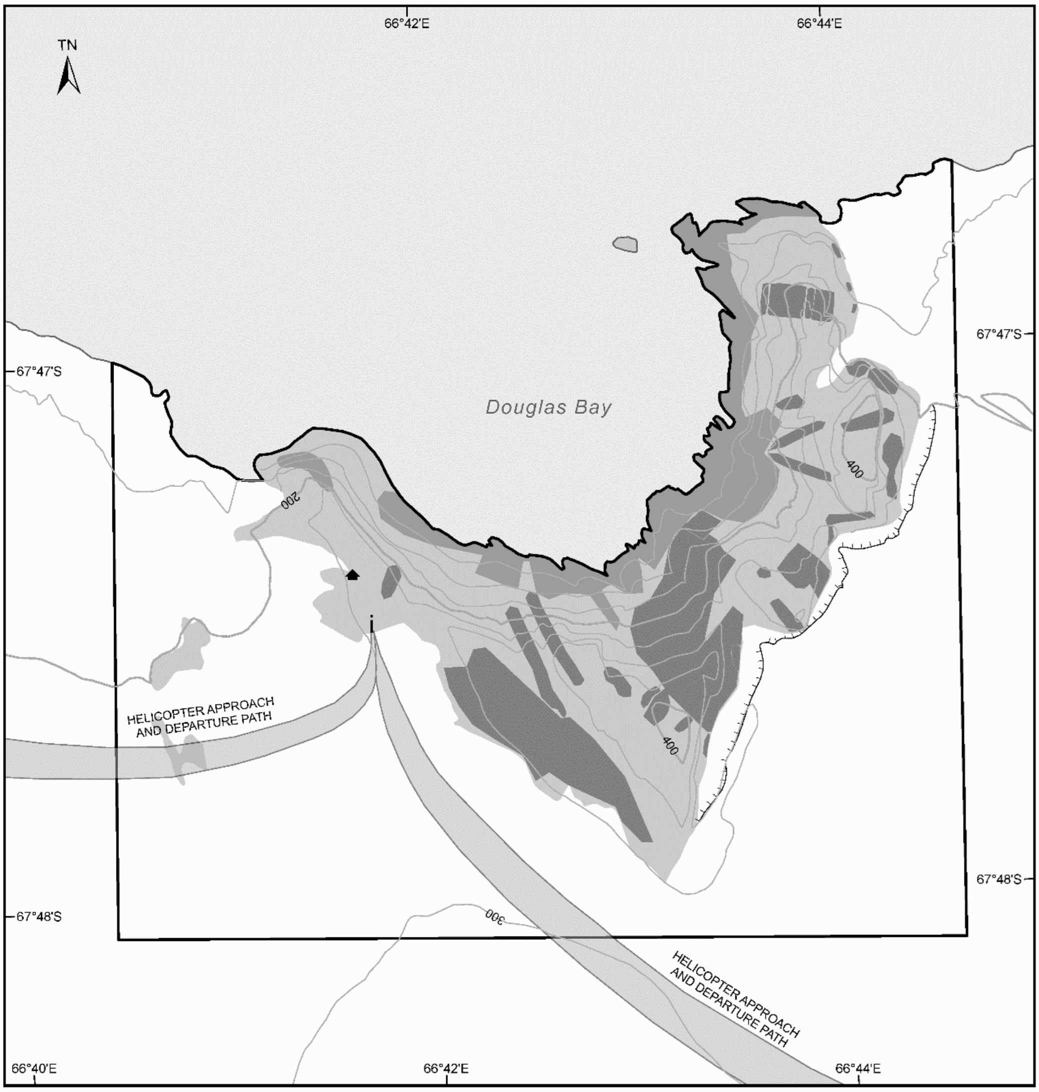
Department of Agriculture, Water and the Environment
Australian Antarctic Division

Map D: Antarctic Specially Protected Area No. 164
Scullin Monolith
Helicopter approach and landing site



Helicopter landing area
Refuge
Cliff
Flying bird colony
Adélie penguin colony
Ice-free area

0 500 1000 Metres

Horizontal Datum: WGS84
Projection: UTM Zone 42

Antarctic Specially Protected Area
Contour (50m interval on rock)
Index contour (200m interval)

Map Available at: *http://data.aad.gov.au/aadc/mapcat/*
Map Catalogue No. 15677
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, March 2022.

Measure 18 (2022)

Revised List of Antarctic Historic Sites and Monuments: Updating information for Historic Sites and Monuments No 26, 29, 36, 38, 39, 40, 41, 42, 43 and 93

The Representatives,

Recalling the requirements of Article 8 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty to maintain a list of current Historic Sites and Monuments ("HSM") and that such sites "shall not be damaged, removed or destroyed";

Recalling

- Resolution 3 (2009), which adopted the Guidelines for the designation and protection of Historic Sites and Monuments;
- Resolution 2 (2018), which adopted the Guidelines for the assessment and management of Heritage in Antarctica;
- Recommendation VII-9, which designated HSM 26, 29, 36, 38, 39, 40, 41, 42 and 43, and Measure 5 (1997) which amended HSM 41;
- Measure 12 (2019), which added the wreck of the Endurance to the list of HSM;
- Decision 1 (2019), which added new information fields to the List of HSM;
- Decision 1 (2021), which sets out the information contained in fields that continue to be a formal part of the List of HSM and that changes to these fields would require adoption through a Measure; and
- Measure 23 (2021), which adopted the reformatted List of HSM;

Recommend to their Governments the following Measure for approval in accordance with paragraph 2 of Article 8 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1. the information in the List of Historic Sites and Monuments ("HSM") for HSM 93, Wreck of Endurance, be amended as in the table below:

No	Name	Description	Location	Physical features of the environment and cultural and local context
93	Wreck of *Endurance*	Wreck of the vessel *Endurance*, including all artefacts contained within or formerly contained within the ship, which may be lying on the seabed in or near the wreck within a 500m radius. This includes all fixtures and fittings associated with the ship, including ship's wheel, bell, etc. The designation also includes all items of personal possessions left on the ship	68°44'21" S, 52°19'47" W	The wreck is located on the floor of the Weddell Sea at a depth of 3,008m.

		by the ship's company at the time of its sinking.		

2. the information in the List of HSM for HSM 26, 29, 36, 38, 39, 40, 41, 42 and 43, be amended as in the table below:

No	**Name**	**Location**
26	Ceremonial facilities of the San Martín Base	68°07'47"S, 67°06'05"W
29	Lighthouse 'Primero de Mayo"	64°17'58"S, 62°58'08"W
36	Dallmann Expedition Plaque	62°14'26"S, 58°40'45"W
38	Snow hill Swedish hut	64°21'50"S, 56°59'32"W
39	Hope Bay stone hut	63°23'44"S, 56°59'51"W
40	Ceremonial facilities of the Esperanza Base	63°23'49"S, 56°59'57"W
41	Historical remains of *Antarctic's* crew in Paulet island	63°34'29"S, 55°47'06"W
42	Laurie island observatories	60°44'18"S, 44°44'19"W
43	Belgrano station's cross	77°52'34"S, 34°37'43"W

3. the Secretariat of the Antarctic Treaty be requested to update the list annexed to Measure 23 (2021) and make it available on its website.

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