

Management Plan for Antarctic Specially Protected Area No. 170

MARION NUNATAKS, CHARCOT ISLAND, ANTARCTIC PENINSULA

Introduction

The primary reason for the designation of Marion Nunataks, Charcot Island, Antarctic Peninsula (69°45'S, 75°15'W) as an Antarctic Specially Protected Area (ASPAs) is to protect primarily environmental values, and in particular the terrestrial flora and fauna within the Area.

Marion Nunataks lie on the northern edge of Charcot Island, a remote ice-covered island to the west of Alexander Island, Antarctic Peninsula, in the eastern Bellingshausen Sea. Marion Nunataks form a 12 km chain of rock outcrops on the mid-north coast of the island and stretch from Mount Monique on the western end to Mount Martine on the eastern end. The Area is 106.5 km² (maximum dimensions are 9.2 km north-south and 17.0 km east-west) and includes most, if not all, of the ice-free land on Charcot Island.

Past visits to the Area have been few, rarely more than a few days in duration and focussed initially on geological research. However, during visits between 1997 and 2000, British Antarctic Survey (BAS) scientists discovered a rich biological site, located on the Rils Nunatak at 69°44'56"S, 75°15'12"W.

Rils Nunatak has several unique characteristics including two lichens species that have not been recorded elsewhere in Antarctica, mosses that are rarely found at such southerly latitudes and, perhaps most significantly of all, a complete lack of predatory arthropods and Collembola, which are common at all other equivalent sites within the biogeographical zone. The nunataks are extremely vulnerable to introduction of locally and globally non-indigenous species that could be carried unintentionally to the site by visitors.

ASPAs No. 170, Marion Nunataks was originally designated as an ASPAs through Measure 4 (2008) after a proposal by the United Kingdom.

The Area fits into the wider context of the Antarctic Protected Area system by protecting the unique species assemblage found on Marion Nunataks and being the first to protect a substantial area of ground that is representative of the permanent ice-cap and nunataks that exist commonly in the southern Antarctic Peninsula. Resolution 3 (2008) recommended that the Environmental Domains Analysis for the Antarctic Continent, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, ASPAs No. 170 is contained within Environment Domain C (Antarctic Peninsula southern geologic) and Domain E (Antarctic Peninsula and Alexander Island main ice fields). Other protected areas containing Domain C include ASPAs No. 147 (although not specifically stated in Morgan et al., 2007). Other protected areas containing Domain E include ASPAs Nos. 113, 114, 117, 126, 128, 129, 133, 134, 139, 147, 149, 152, and ASMA Nos. 1 and 4. The ASPAs sits within Antarctic Conservation Biogeographic Region (ACBR) 4 Central South Antarctic Peninsula, and is one of only two ASPAs in ACBR 4, the other being ASPAs No. 147 (Terauds et al., 2012).

1. Description of values to be protected

The outstanding environmental value of the Area, which is the primary reason for designation as an ASPAs, is based on the following unique species assemblage found in the terrestrial environment:

- The terrestrial fauna is unique for the maritime Antarctic in that it appears to contain neither predatory arthropods nor Collembola (springtails), which are otherwise ubiquitous and important members of the terrestrial fauna of the zone. As such, the site provides unique opportunities for the scientific study of terrestrial biological communities from the maritime Antarctic where key ecological components are absent.

- The Marion Nunataks flora includes an exceptional development of three mosses that are encountered only rarely at latitudes south of 65°S (*Brachythecium austrosalebrosus*, *Dicranoweisia crispula* and *Polytrichum piliferum*).
 - The Area includes two lichen species that are previously unrecorded from Antarctica (*Psilolechia lucida* and *Umbilicaria* aff. *thamnodes*) and represents the furthest south known occurrence for several lichen species (including *Frutidella caesioatra*, *Massalongia* spp., *Ochrolechia frigida*, *Usnea aurantiaco-atra* and *Usnea trachycarpa*).
1. The values are vulnerable to human impacts including damage to habitat by, for example, trampling, or the introduction of non-indigenous species that may disrupt ecosystem structure and function.

2. Aims and Objectives

The aims and objectives of this Management Plan are to:

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

3. Management Activities

Management activities that involve visits to the Area and erection of permanent structures may themselves significantly increase the risk of irreversible human impact, through introductions of locally non-native species. Therefore, the emphasis for management of the site should be to avoid unnecessary visits and importation of materials into the Area. The following management activities are to be undertaken to protect the values of the Area:

- Due to the sensitive nature of the Area and the severity of the consequences should non-native species be introduced, management visits shall be kept to an absolute minimum and erection of permanent structures, including notice boards and signs, on ice-free ground shall be avoided.
- Visiting field parties shall be briefed fully by the national authority on the values that are to be protected within the Area and the precautions and mitigation measures detailed in this Management Plan.
- Copies of this Management Plan shall be made available to vessels and aircraft planning to visit the vicinity of the Area.
- The Management Plan shall be reviewed at least every five years and updated as required.
- A copy of this Management Plan shall be made available at Rothera Research Station (UK; 67°34'S, 68°07'W) and General San Martín Station (Argentina; 68°08'S, 67°06'W).
- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I of the Protocol on Environmental Protection to the Antarctic Treaty.
- National Antarctic Programmes operating in the Area shall consult together with a view to ensuring the above management activities are implemented.

4. Period of Designation

Designated for an indefinite period.

5. Maps

Map 1. Charcot Island in relation to Alexander Island and the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -55°, Standard parallel: -71°.

Map 2. Charcot Island, including ASPANo. 170 Marion Nunataks situated in the northwest of the island. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel: -71.0°.

Map 3. ASPANo. 170, Marion Nunataks, Charcot Island, Antarctic Peninsula. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel: -71.0°. Developed from USGS Landsat Image Mosaic of Antarctica, Scene ID: x-2250000y+0450000. Metadata available at <http://lima.usgs.gov/>.

6. Description of the Area

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

Charcot Island is roughly circular in shape, approximately 50 km across and is separated from northwest Alexander Island (~100 km away) by Wilkins Sound to the east and Attenborough Strait to the south (Maps 1 and 2). Until recently, Charcot Island was connected to Alexander Island by the Wilkins Ice Shelf, but substantial collapse occurred in 2008 and the ice bridge gave way in April 2009 (Vaughan et al., 1993; Braun et al., 2009). Charcot Island is ice-covered with the exception of Marion Nunataks (69°45'S, 75°15'W), which form a 12 km chain of rock outcrops that overlook the mid-north coast of Charcot Island, and consist predominantly of steep north-facing cliffs (Map 3). Mount Monique lies towards the western end of the Marion Nunataks chain and Mount Martine to the eastern end. The summits of both peaks are between 750 and 1000 metres above sea level.

The Area boundary is defined as follows:

The point on the northern coast of Charcot Island at 69°43'07"S, 75°00'00"W represents the most northeasterly point of the Area. From here, the Area boundary follows the coastline westwards to the point on the coast at 69°48'00"S, 75°19'19"W. The boundary then extends eastward inland to a point on the Charcot Island ice-cap at 69°48'00"S, 75°00'00"W. From there the boundary extends northwards to the coast at 69°43'07"S, 75°00'00"W. The Area also includes Cheeseman Island (located at 69°43'24"S, 75°11'00"W). There are no boundary markers delimiting the Area. The maximum dimensions of the Area are 9.2 km north-south and 17.0 km east-west (106.5 km²). The Area includes ice cap that extends at least 4 km to the south and east of Marion Nunataks, which is intended to act as a buffer zone to prevent accidental importation of species not native to the Area (see Map 3). The steep ice cliffs on the north coast of Charcot Island, make access from the sea difficult.

Climatic conditions

No climatic data are available, but Charcot Island lies in the track of depressions approaching the Antarctic Peninsula from the west. Satellite imagery indicates that the island is predominantly covered by cloud, and may not become free of winter pack ice until late summer, if at all.

Biogeography

Research by Smith (1984) and Peat et al. (2007) describes the recognised biogeographical regions present within the Antarctic Peninsula. Antarctica can be divided into three major biological provinces: northern maritime, southern maritime and continental. Charcot Island lies within the southern maritime zone (Smith, 1984), approximately 600 km north of the major biogeographic discontinuity that separates the Antarctic Peninsula and continental Antarctica known as the Gressitt Line (Chown and Convey, 2007). It also lies within ACBR 4, Central South Antarctic Peninsula (Terauds et al., 2012; Terauds and Lee, 2016)

Geology

The rocks of Marion Nunataks are turbiditic sandstones and mudstones, similar in appearance to those found on nearby Alexander Island. However, geochronology and isotopic analyses from detrital minerals (grains that survive erosion, transport and deposition and so preserve information on the source rock) suggest that

Charcot Island rocks are different to those on Alexander Island, and possibly the whole of the Antarctic Peninsula (Michael Flowerdew, pers. comm.). Alexander Island rocks are thought to have formed from sediments eroded off rocks from the Antarctic Peninsula. However, Charcot Island sediments were originally deposited within a deep marine trench that formed as a result of the destruction of the Pacific plate beneath the edge of the ancient continent of Gondwana. The sedimentary rocks were scraped off the Pacific plate as it was destroyed and accreted to the Gondwana continent, causing them to be folded and metamorphosed under high pressure. Charcot Island sedimentary rocks are thought to be Cretaceous (deposited around 120 million years ago), and may have been transported over long distances in a relatively short time interval before becoming juxtaposed to Alexander Island around 107 million years ago.

Biology

The known terrestrial biological site (located on the Rils Nunatak at 69°44'56"S, 75°15'12"W) extends approximately 200 m east-west, by a maximum of 50 m north-south and harbours an extensive biota (Convey et al., 2000). This vegetated bluff consists of rock gently sloping to the north-west, which rapidly steepens to broken cliffs that drop to the sea. Water has been observed to be freely available at the site during all summer visits between December 1997 and January 2000.

Biota in the known terrestrial biological site include:

- Bryophytes: 16 mosses (including *Andreaea* spp., *Bartramia patens*, *Bryum pseudotriquetrum*, *Brachythecium austrosalebrosus*, *Ceratodon purpureus*, *Dicranoweisia crispula*, *Grimmia reflexidens*, *Hennediella heimii*, *Hypnum revolutum*, *Pohlia* spp., *Polytrichum piliferum*, *Schistidium antarctici*, *Syntrichia princeps*) and one liverwort (*Cephaloziella varians*). The dominant species are *Andreaea* spp., *Dicranoweisia crispula* and *Polytrichum piliferum*, which are usually only common in the sub-Antarctic. The abundance of *B. austrosalebrosus* is remarkable as it is a hydric species requiring a continuous supply of water. The mosses generally occur on wet rock slabs irrigated by trickling melt water from late snow patches which has allowed the formation of cushions c. 15 cm deep. (Smith, 1998; Convey et al., 2000).
- Foliose alga: *Prasiola crispa* (Smith, 1998; Convey et al., 2000).
- Lichens: 34 species, plus two identified to genus level. The dominant lichen species are *Pseudophebe minuscula*, *Umbilicaria decussata*, *Usnea sphacelata* and various crustose taxa (Smith, 1998; Convey et al., 2000). Lichen communities occupy much of the dry, windswept stony ground and ridges. Melt channels on sloping rock slabs are lined with large thalli (up to ~15 cm across) of *Umbilicaria antarctica*. The Area includes two lichen species that are previously unrecorded from Antarctica (*Psilolechia lucida* and *Umbilicaria aff. thamnodes*) and represents the furthest south known occurrence for several lichen species (including *Frutidella caesioatra*, *Massalongia* spp., *Ochrolechia frigida*, *Usnea aurantiaco-atra* and *Usnea trachycarpa*). Unusually, the widespread *Usnea antarctica* was not recorded from the site.
- Invertebrates: Seven species of Acari, seven Nematoda and four Tardigrada were present in collections from Marion Nunataks. Uniquely, neither acarine predators nor Collembola were recorded (Convey, 1999; Convey et al., 2000).
- Vertebrates: A small colony of 60 Adélie penguins (*Pygoscelis adeliae*) containing many chicks was reported from the small islands just to the northwest of Mount Monique (Henderson, 1976; Croxall and Kirkwood, 1979). The colony was still present at the location in January 2011 with 70 breeding pairs and numerous chicks recorded. This is thought to be the most southerly colony of Adélie penguins on the Antarctic Peninsula. Other than the penguin colony, the Area has little vertebrate influence. South polar skuas (*Stercorarius maccormicki*) are observed in the Area and a single nest was found on moss turf. Other birds observed and considered likely to breed in the area were small numbers of Antarctic terns (*Sterna vittata*), snow petrels (*Pagodroma nivea*), Antarctic petrels (*Thalassoica antarctica*) and Wilson's storm petrels (*Oceanites oceanicus* K \ddot{u} hl) (Henderson, 1976; Smith, 1998; Convey et al., 2000).

Although all elements of the biota recorded are typical of the maritime Antarctic biogeographical zone (Smith, 1984), community composition differs strikingly in detail from that found at other sites in the biome. The apparent absence of Collembola, recorded at all other known maritime Antarctic sites, contrasts directly with their importance elsewhere. Numbers of other animal species recovered from Marion Nunataks, suggest population densities comparable with those found in many other coastal maritime Antarctic sites and

at least an order of magnitude greater than those usually found in Continental Antarctic sites, or on south-east Alexander Island at the southern limit of the maritime Antarctic. The numerical contribution made by springtails to faunas elsewhere in the maritime Antarctic appears to be replaced by several smaller prostigmatid mites (*Nanorchestes nivalis* and *Eupodes minutes*) on Charcot Island. The absence of predatory taxa is also an exceptional element of the Charcot Island arthropod community, particularly given the arthropod population densities.

The terrestrial biological communities on Charcot Island are extremely vulnerable to accidental human-mediated introduction of both native Antarctic and non-native biota. Convey et al. (2000) write:

'As visitors to this island will inevitably arrive from other locations within the [Antarctic] Maritime zone, the potential for accidental transfer in soil or vegetation adhering to boots or clothing, rucksacks, etc. is great. Extreme caution is therefore required to avoid the transfer of native species between isolated populations within the Maritime Antarctic, highlighting an urgent need for strict control measures to be applied to all visitors to the site and others like it to conserve them for the future.'

Past human activity

The Area is extremely isolated and difficult to access, other than by air, and as a result has been visited by only a small number of people, and these visits have been generally brief. Charcot Island was discovered on 11 January 1910 by Dr Jean Baptiste Charcot of the French Antarctic Expedition. The first landing on the island was made on 21 November 1947 by the Ronne Antarctic Research Expedition (RARE) when parts of the island were photographed from the air (Searle, 1963).

A temporary hut (30 m²) and airstrip were established by the Chilean Antarctic Expedition and Chilean Air Force (FACH) in November 1982. The camp was situated on ice a few kilometres east of Mount Martine (69°43'S, 75°00'W), on what is now the eastern boundary of the Area. The hut was buried by snow during the winter of 1983 and no evidence of the station remains on the surface (Comite Nacional de Investigaciones Antárticas, 1983; Veronica Vallejos, pers comm.).

British Antarctic Survey (BAS) geologists and cartographers made brief visits to Marion Nunataks in January 1975, 9-13 February 1976 and 17 January 1995. BAS biologists made day trips to Rils Nunatak on 22 December 1997, 20-21 January 1999, 5 February 1999 and 16 January 2000. Reports suggest that there have been fewer than 10 field party visits to Marion Nunataks since their first visit in 1975. Visits have generally been limited to a few days or hours. Importantly, no further visits have been made to Marion Nunataks, inland from the coast, since the discovery of its unique ecosystems (Convey *et al.*, 2000). As a result, it is probable that the ecosystem still exists in its original pristine state and no introduction of macrobiota has occurred.

Brief boat landings were made at the Adélie penguin colony on the coast northwest of Mount Monique by scientists from the United States in early 2010 and 2011.

6 (ii) Access to the Area

No access points are specified, but landings are usually most safely made by aircraft on areas of permanent ice, as accessing inland locations from the sea is made difficult due to step ice cliffs around much of the coastline. Aircraft landing within the Area must comply with the condition described in section 7(ii). In early 2010 and 2011, brief landings were made from the sea by scientist from the United States to visit the Adélie penguin colony situated on ice-free ground to the northwest of Mt. Monique (approximate location 69°45'40" S, 75°25'00" W). The landings were made despite difficult sea ice conditions, which are common in this area. Furthermore, sea ice conditions prevented further landings in 2012. Consequently, this route is not recommended for general access to the Area.

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

No installations or caches are known to exist in the Area. One cairn was constructed on the highest point (~126 m above sea level) of the small nunatak at 69°44'55" S, 75°15'00" W during the 1975-76 United States Geological Survey (USGS)-British Antarctic Survey Doppler Satellite Programme (Schoonmaker and

Gatson, 1976). The 0.6 m high cairn marks the site of Station Jon and contains a standard USGS brass Antarctica tablet stamped 'Jon 1975-1976' set loosely in faulted rock. A metal tent pole (2.4 m) was erected in the cairn; however, there was no record of it in visit reports from 1995 onwards (Anonymous, 1977; Morgan, 1995).

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

There are no other ASPAs or ASMAs in the vicinity, with the nearest protected area being ASPA No. 147 Ablation Valley and Ganymede Heights, which is situated 270 km away on the eastern coast of Alexander Island.

6 (v) Special zones within the Area

There are no special zones in the Area.

7. Terms and conditions for entry permits

7(i) General permit conditions

Entry into the Area is prohibited except in accordance with a permit issued by an appropriate national authority under Article 3, paragraph 4, and Article 7 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty.

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

- it is issued for a compelling scientific reason, which cannot be served elsewhere, or for reasons essential to the management of the Area;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental and scientific values of the Area;
- the activities permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, shall be carried when in the Area;
- the Permit shall be issued for a finite period;
- a report is supplied to the authority or authorities named in the Permit; and
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

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

Where possible, day visits to the Area are strongly recommended in order to remove the requirement for camping equipment, and therefore reduce the risk of transferring locally non-native species into the Area. If management or scientific requirements cannot be met within the time scale of a single day visit, then longer visits requiring camping within the Area are permitted, but only after all other options have been fully explored and rejected.

Entry of personnel or equipment arriving directly from other terrestrial biological field sites to the Area is prohibited. It is a condition of entry into the Area that all visitors and equipment must travel via an Antarctic station or ship where thorough cleaning of clothing and equipment has been performed, as detailed in this Management Plan (section 7(x)).

To protect the values of the Area and minimise the risk of introduction of locally non-native species, the following restrictions apply within the Area:

(a) Aircraft and Remotely Piloted Aircraft Systems (RPAS)

Aircraft are only permitted to land in the Area if they have performed the measures as detailed in this Management Plan (section 7(x)). Otherwise aircraft must land outside the Area. Within the Area, fixed and rotary wing aircraft are prohibited from landing within 100 m of ice-free ground and the associated flora and fauna. The remaining 100 m of the approach to the ice-free ground must be made on foot.

An Adélie penguin colony is present within the Area on coastal ground to the northwest of Mount Monique (approximate location 69°44'40" S, 75°25'00" W). The operation of aircraft over the Area should be carried out, as a minimum requirement, in compliance with the *Guidelines for the Operation of Aircraft near Concentrations of Birds* contained in Resolution 2 (2004). Overflight of bird colonies within the Area by RPAS shall not be permitted unless for scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority

(b) Ships and small boats

Little information is available on locations appropriate for ship and small boat landings (see section 6(ii)). Given the unpredictable nature of sea ice conditions in the region, landings by boat are not recommended for general access to the Area. However, boat lands may be appropriate for visiting coastal locations, such as the Adélie penguin colony northwest of Mt. Monique (approximate location 69°45'40" S, 75°25'00" W).

(c) Land vehicles and sledges

Land vehicles shall not be taken into the Area unless essential for scientific, management or safety reasons. Land vehicles and sledges are only permitted within the Area if they are compliant with the measures as detailed in this Management Plan (section 7(x)). Once inside the Area, skidoos, sledges and other land vehicles are prohibited within 100 m of all ice-free ground and associated flora and fauna. The remaining 100 m of the approach to the ice-free ground must be made on foot.

(d) Human movement

Pedestrian traffic shall be kept to an absolute minimum necessary to be consistent with the objectives of any permitted activities. Where no routes are identified, pedestrian traffic should be kept to the minimum necessary to undertake permitted activities and every reasonable effort should be made to minimise trampling effects. Visitors should avoid areas of visible vegetation and care should be exercised walking in areas of moist ground, particularly the stream course beds, where foot traffic can easily damage sensitive soils, plant and algal communities, and degrade water quality.

Strict personal quarantine precautions shall be undertaken as described in section 7(x) of this Management Plan.

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

Activities which may be conducted in the Area include:

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

7(iv) Installation, modification or removal of structures

- No structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit.
- Permanent structures or installations are prohibited.
- All markers, structures or scientific equipment installed in the Area must be clearly identified by country, name of the principal investigator or agency, year of installation and date of expected removal.

- All such items should be free of organisms, propagules (e.g. seeds, eggs, spores) and non-sterile soil (see section 7(x)), and be made of materials that can withstand the environmental condition and pose minimal risk of contamination of the Area.
- Removal of specific structures or equipment for which the permit has expired shall be the responsibility of the authority which granted the original permit and shall be a condition of the Permit.
- Existing structures must not be removed, except in accordance with a permit.

7(v) Location of field camps

Camping within the Area is only permitted if scientific and management objectives cannot be achieved during a day trip to the Area. Camping may also occur within the Area during an emergency. Unless unavoidable for safety reason, tents should be erected on permanent snow or ice, at least 500 m from the nearest ice-free area. Field camp equipment must be cleaned and transported as described in section 7(x) of this Management Plan.

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

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

- The deliberate introduction of animals, plant material, microorganisms and non-sterile soil into the Area shall not be permitted.
- Precautions shall be taken to prevent the unintentional introduction of animals, plant material, microorganisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area). Visitors should also consult and follow, as appropriate, recommendations contained in the *CEP non-native species manual* (CEP, 2011), and in the *Environmental code of conduct for terrestrial scientific field research in Antarctica* (SCAR, 2009). Additional site-specific biosecurity measures are listed in section 7(x).
- No poultry products, including food products containing uncooked dried eggs, shall be taken into the Area.
- No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for a compelling scientific purpose specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided.
- Fuel, food and other materials are not to be deposited in the Area, unless required for essential purposes connected with the activity for which the Permit has been granted. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Fuel, food and other materials must only be stored on snow or ice that is at least 500 m from the nearest ice-free ground. Permanent depots are not permitted.
- Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period.

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

Taking of, or harmful interference with, native flora and fauna is prohibited, except in accordance with a permit issued in accordance with Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved this should, as a minimum standard, be in accordance with the *SCAR code of conduct for the use of animals for scientific purposes in Antarctica* (2011). Any soil or vegetation sampling is to be kept to an absolute minimum required for scientific or management purposes, and carried out using techniques which minimise disturbance to surrounding soil, ice structures and biota.

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

Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs. Material of human origin likely to compromise the values of the Area, and which was not brought into the Area by the Permit Holder or otherwise authorised may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ: if this is the case the appropriate national authority must be notified and approval obtained.

7(ix) *Disposal of waste*

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

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

To help protect the ecological and scientific values derived from the isolation and low level of human impact at the Areas, visitors shall take special precautions against the introduction of non-native species. Further guidance can be found in the *CEP non-native species manual* (CEP, 2017) and the *Environmental code of conduct for terrestrial scientific field research in Antarctica* (SCAR, 2009). Of particular concern are animal or plant introductions sourced from:

- soils from any other Antarctic sites, including those near stations
- soils from regions outside Antarctica

It is a condition of entry to the Area that visitors shall minimize the risk of introductions in accordance with the following measures:

(a) Aircraft

The interior and exterior of aircraft shall have been carefully inspected and cleaned as near as possible to the time of departure of the aircraft from the originating Antarctic station or ship. It is recommended that this include thorough sweeping and vacuuming of the inside of the aircraft and steam-cleaning or brushing of the exterior of the aircraft. Any aircraft that has landed at other rock airstrips or near biologically rich sites since being cleaned at the Antarctic station or ship is not permitted to enter the Area.

Fixed-wing aircraft that departed from a gravel runway must have landed, or trailed their skis, on clean snow outside the Area in an attempt to dislodge any soil from the skis, before landing within the Area.

(b) Small boats

Small boats used to transport visitors from a support vessel to the Area boundary shall be cleaned (with particular attention paid to the inside of the boats) to ensure they are free of soil, dirt and propagules.

(c) Land vehicles and sledges

Before land vehicles and sledges enter the Area, all mud, soil, vegetation and excessive dirt and grease must be removed. Ideally, this should have been completed on the originating Antarctic station or ship before transfer of the vehicles into the field. Land vehicles shall not enter the Area if after cleaning they have been driven over areas of rock or soil outside the Area.

(d) Field camp equipment

All camping equipment, including emergency camping equipment, shall be cleaned thoroughly (i.e. free of soil and propagules and, if practicable, sealed in plastic bags or sheeting) before being taken into the Area. This includes emergency camping equipment carried aboard any aircraft landing in the Area.

(e) Sampling equipment, scientific apparatus and field-site markers

To the greatest extent possible, all sampling equipment, scientific apparatus and markers brought into the Area shall have been sterilized, and maintained in a sterile condition, before being used within the Area. Sterilization should be by an accepted method, including UV radiation, autoclaving or by surface sterilisation using 70% ethanol or a commercially available biocide (e.g. Virkon®) (see the *Environmental code of conduct for terrestrial scientific field research in Antarctica* (SCAR, 2009)).

(f) General field equipment

General equipment includes harnesses, crampons, climbing equipment, ice axes, walking poles, ski equipment, temporary route markers, pulks, sledges, camera and video equipment, rucksacks, sledge boxes and all other personal equipment.

All equipment used inside the Area should be free of biological propagules such as seeds, eggs, insects, fragments of vegetation and soil. To the maximum extent practicable, all equipment used, or brought into the Area, shall have been thoroughly cleaned at the originating Antarctic station or ship. Equipment shall have been maintained in this condition before entering the Area, preferably by sealing in plastic bags or other clean containers.

(g) Outer clothing

Outer clothing includes hats, gloves, fleeces or jumpers, jackets, fabric or fleece trousers, waterproof trousers or salopettes, socks, boots and any other clothing likely to be worn as a surface layer. Outer clothing worn inside the Area should be free of biological propagules such as seeds, eggs, insects, fragments of vegetation and soil. To the maximum extent practicable, footwear and outer clothing used, or brought into the Area, shall have been thoroughly laundered and cleaned since used previously. Particular attention should be given to removing seeds and propagules from Velcro®. New clothing, taken straight out of the manufacturer's packaging just before entering the Area, need not undergo cleaning.

Further procedures for ensuring non-native species are not transferred into the Area on footwear and clothing depend upon whether the visit is via (i) a direct aircraft landing in the Area, (ii) overland movement into the Area from outside its boundaries or (iii) movement to the Area boundary by small boat:

i. Direct aircraft landing in the Area. Sterile protective over-clothing shall be worn. The protective clothing shall be put on immediately prior to leaving the aircraft. Spare boots, previously cleaned using a biocide then sealed in plastic bags, shall be unwrapped and put on just before entering the Area.

ii. Overland movement into the Area from outside its boundaries. Sterile protective over-clothing is not recommended as, once within the Area, significant amounts of travel over crevassed ground may be required and use of sterile protective over-clothing may interfere with safety equipment such as ropes and harnesses. For overland movement into the Area, alternative measures must be used. Each visitor is required to bring at least two sets of outer clothing. The first set shall be worn for the journey to the Area boundary. The second set of outer clothing, which has previously been cleaned and sealed in plastic bags, shall only be worn inside the Area. Immediately before entering the Area, visitors shall change into their clean set of outer clothing. Spare boots, previously cleaned using a biocide then sealed in plastic bags, shall be unwrapped and put on just before entering the Area. The removed unclean outer clothing shall be stored in sealed, labelled plastic bags, preferably outside the Area. On leaving the Area by overland travel, the clothing worn in the Area should be removed and stored in a clean, labelled plastic bag until needed for any further trips into the Area, or returned to the originating Antarctic station or ship for cleaning.

iii. Movement to the Area boundary by small boat. When aboard the support vessel, and immediately prior to entering the small boat to travel to the Area, each visitor, including the boat crew, shall put on clean clothing (including boating suits, life jackets and footwear) which is free of soil, seeds and other propagules. Alternatively, on arrival at the Area boundary, and before exiting the small boat, visitors shall cover all clothing in clean protective oversuits. Additional clothing or footwear required by visitors when within the Area, shall be cleaned before leaving the support vessel, and stored in a sealed container (e.g. plastic bag) until needed.

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the *Antarctic Specially Protected Area visit report form* contained in the *Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas* (Appendix 2). In this report, particular note should be made of the specific ice-free locations visited within the Area (including, if possible, GPS coordinates), the length of time spent at each location and the activities undertaken. Wherever possible, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

8. Supporting documentation

Anonymous. (1977). British Antarctic Survey Archives Service, Arc. Ref. ES2/EW360.1/SR17-18/7,8.

Antarctic Treaty Consultative Meeting. (2004). Guidelines for the operation of aircraft near concentrations of birds in Antarctica. ATCM Resolution 2 (2004).

Braun, M., Humbert, A., and Moll, A. (2009). Changes of Wilkins Ice Shelf over the past 15 years and inferences on its stability. *The Cryosphere* 3: 41-56.

Comite Nacional de Investigaciones Antarticas. (1983). Informe de las actividades Antarticas de Chile al SCAR. Santiago, Instituto Antartico Chileno.

Committee for Environmental Protection (CEP). (2017). Non-native species manual – 2nd Edition. Manual prepared by Intersessional Contact Group of the CEP and adopted by the Antarctic Treaty Consultative Meeting through Resolution 4 (2016). Buenos Aires, Secretariat of the Antarctic Treaty.

Chown, S. L., and Convey, P. (2007). Spatial and temporal variability across life's hierarchies in the terrestrial Antarctic. *Philosophical Transactions of the Royal Society B - Biological Sciences* 362 (1488): 2307-2R31.

Convey, P. (1999). Terrestrial invertebrate ecology. Unpublished British Antarctic Survey internal report Ref. R/1998/NT5.

Convey, P., Smith, R. I. L., Peat, H. J. and Pugh, P. J. A. (2000). The terrestrial biota of Charcot Island, eastern Bellingshausen Sea, Antarctica: an example of extreme isolation. *Antarctic Science* 12: 406-413.

Croxall, J. P., and Kirkwood, E. D. (1979). The distribution of penguins on the Antarctic Peninsula and islands of the Scotia Sea. British Antarctic Survey, Cambridge.

Henderson, I. (1976). Summer log of travel and work of sledge kilo in northern Alexander Island and Charcot Island, 1975/1976. Unpublished British Antarctic Survey internal report Ref. T/1975/K11.

Morgan, F., Barker, G., Briggs, C., Price, R., and Keys, H. (2007). Environmental Domains of Antarctica Version 2.0 Final Report. Landcare Research Contract Report LC0708/055.

Morgan, T. (1995). Sledge echo travel report, 1994/5 season – geology in central Alexander Island. Unpublished British Antarctic Survey internal report Ref. R/1994/K7.

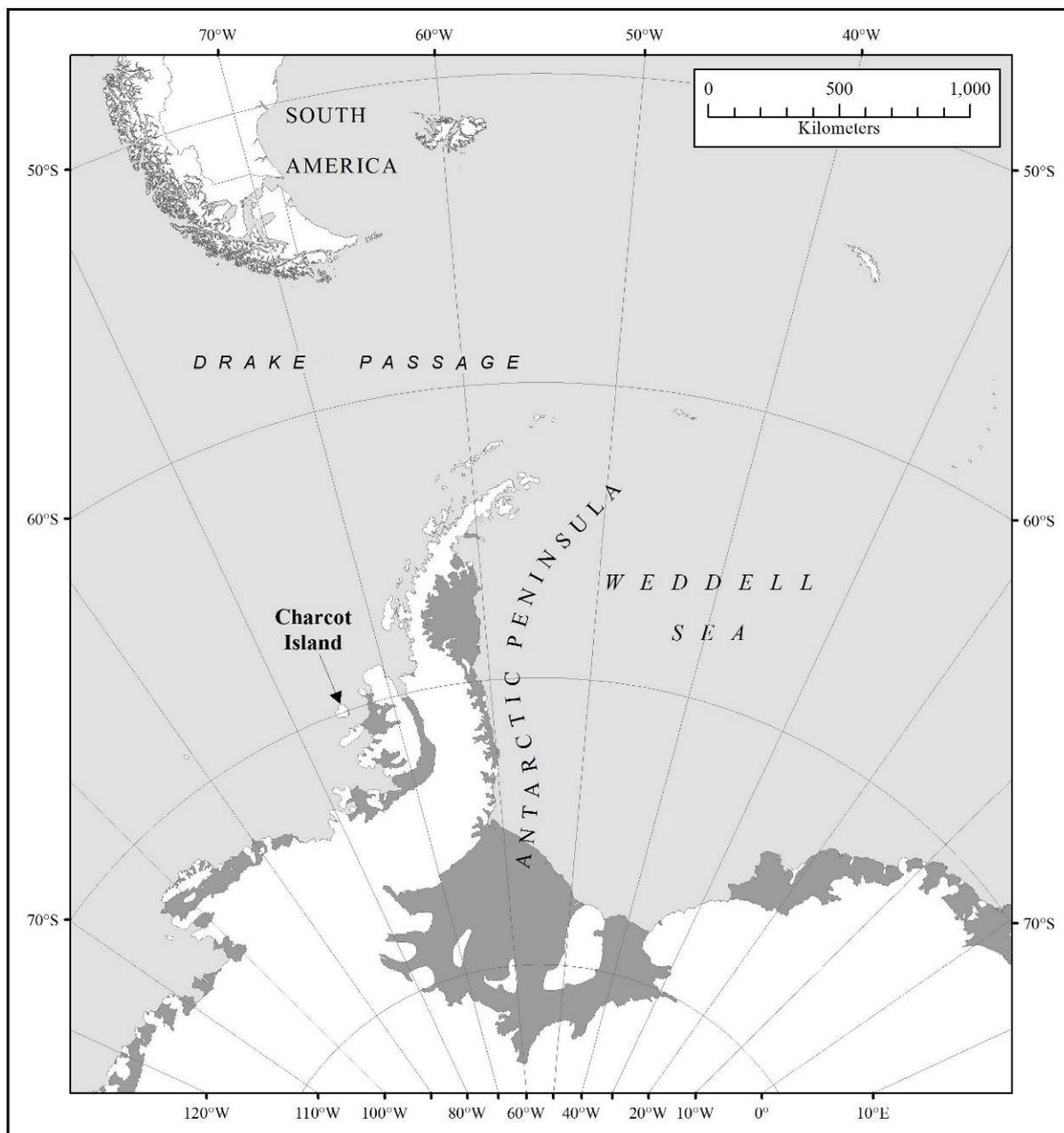
Peat, H. J., Clarke, A., and Convey, P. (2007). Diversity and biogeography of the Antarctic flora. *Journal of Biogeography* 34: 132-146.

Schoonmaker, J. W., and Gatson, K. W. (1976). U. S. Geological Survey/British Antarctic Survey Landsat Georeceiver Project. British Antarctic Survey Archives Service, Arc. Ref. ES2/EW360/56.

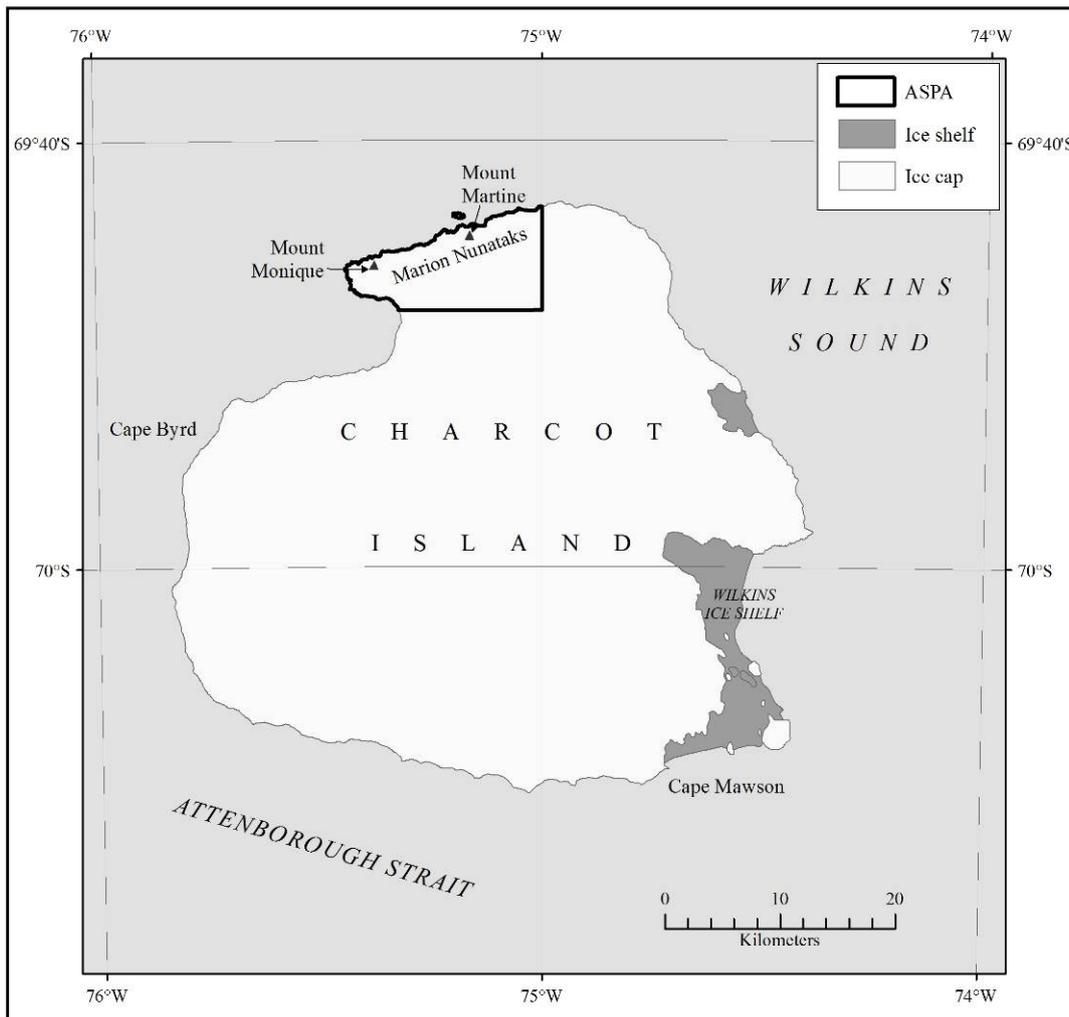
SCAR (Scientific Committee on Antarctic Research) (2009). Environmental code of conduct for terrestrial scientific field research in Antarctica. ATCM XXXII IP4.

- SCAR (Scientific Committee on Antarctic Research) (2011). SCAR code of conduct for the use of animals for scientific purposes in Antarctica. ATCM XXXIV IP53.
- Searle, D. J. H. (1963). The evolution of the map of Alexander and Charcot Islands, Antarctica. *The Geographical Journal* 129: 156-166.
- 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.
- Smith, R. I. L. (1998). Field report: sledge delta, November 1997 - January 1998. Unpublished British Antarctic Survey internal report Ref. R/1997/NT3.
- Terauds, A., and Lee, J. R. (2016). Antarctic biogeography revisited: updating the Antarctic Conservation Biogeographic Regions. *Diversity and Distribution* 22: 836-840.
- Terauds, A., Chown, S. L., Morgan, F., Peat, H. J., Watt, D., Keys, H., Convey, P., and Bergstrom, D. M. (2012). Conservation biogeography of the Antarctic. *Diversity and Distributions* 18: 726-41.
- Vaughan, D. G., Mantripp, D. R., Sievers, J., and Doake C. S. M. (1993). A synthesis of remote sensing data on Wilkins Ice Shelf, Antarctica. *Annals of Glaciology*: 17: 211-218.

Map 1. Charcot Island in relation to Alexander Island and the Antarctic Peninsula. Map specifications: WGS84 Antarctic Polar Stereographic. Central meridian -55°, Standard parallel: -71°.



Map 2. Charcot Island, including ASPA No. 170, Marion Nunataks situated in the northwest of the island. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel 1: -71.0°.



Map 3. ASP A No. 170, Marion Nunataks, Charcot Island, Antarctic Peninsula. Map specifications: WGS 1984 Antarctic Polar Stereographic. Central Meridian: -75°, Standard Parallel 1: -71.0°. Developed from USGS Landsat Image Mosaic of Antarctica, Scene ID: x-2250000y+0450000. Metadata available at <http://lima.usgs.gov/>.

