Management Plan for Antarctic Specially Managed Area No.1

ADMIRALTY BAY, KING GEORGE ISLAND

Introduction

Admiralty Bay is an area of outstanding environmental, historical, scientific, and aesthetic values. It was first visited by sealers and whalers in the 19th and early 20th centuries, and relics from these periods still remain. The area is characterized by magnificent glaciated mountainous landscape, varied geological features, rich sea-bird and mammal breeding grounds, diverse marine ecosystems, and terrestrial plant habitats. Scientific research in Admiralty Bay in post IGY times has been performed in a more permanent way for some three decades now. The studies on penguins have been undertaken continuously in the area for 28 years, and is the longest ever done in Antarctica. Admiralty Bay also has one of the longest historical series of meteorological data collected for the Antarctic Peninsula, one of the areas of the planet most sensitive to climate change.

Admiralty Bay has become a site of increasingly diverse human activities, which are continuously growing and becoming more complex. Along the last 30 years, more stations were settled and have grown in area, and visitors increased in numbers per year, from a few hundreds to over 3000. Better planning and co-ordination of existing and future activities will help to avoid or to reduce the risk of mutual interference and minimize environmental impacts, thus providing an effective mechanism for the conservation of the valuable features that characterize the area.

Five parties: Poland, Brazil, United States, Peru and Ecuador have active research programmes in the area. Poland and Brazil operate two all-year round stations (Poland: Henryk Arctowski Station at Thomas Point; and Brazil: Comandante Ferraz Antarctic Station at Keller Peninsula). Peru and United States operate two summer stations (Peru: Machu Picchu at Crepin Point; USA: Copacabana at Llano Point). Ecuador has a refuge at Hennequin Point. There are several small removable and permanent installations elsewhere.

The Area includes one ASPA (ASPA No. 128 Western Shore of Admiralty Bay – former SSSI No. 8) and one Historic Monument (No. 51: a grave) at Arctowski Station.

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

A Management Plan for designating Admiralty Bay and its surroundings (herein called the Area) as an Antarctic Specially Managed Area (ASMA), under Annex V of the Protocol to the Antarctic Treaty on Environmental Protection (herein called Protocol), was jointly proposed by Brazil and Poland, in coordination with Ecuador and Peru and voluntarily adopted by the ATCPs at ATCM XX (Utrecht, 1996). This document is a revision of the former Management Plan, as required at ATCM XX.

1. Description of values

Aesthetic values

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

Environmental values

The area of Admiralty Bay is representative of the terrestrial, limnic, coastal, near-shore, pelagic, and fjord-bottom ecosystem of King George Island.

Flora is mostly represented by mosses, lichen and fungi formations. Twenty four species of birds and six species of pinnipeds have been registered for the Area, but only thirteen species of birds and three species of pinnipeds actually breed within the Area.

The marine ecosystem of the bay largely reflects the general environmental conditions prevailing in the South Shetland Islands. However, there is a unique site, Napier Rock, at the entrance of the bay, where a rich and highly diverse benthic invertebrate fauna is found. Fish are represented by fifteen species of Nototheniidae.

Scientific values

Diverse and continuous scientific activities have been undertaken in the Area for almost 30 years supported by the Polish Henryk Arctowski Station, by the Brazilian Comandante Ferraz Station and by the US Antarctic Program at ASPA No. 128 Western Shore of Admiralty Bay. Research activities at the Peruvian Machu Picchu Station (at Crepin Point) and at the Ecuadorian refuge (at Hennequin Point) have occurred intermittently during the summer.

Many features of Admiralty Bay are of considerable scientific interest. The main themes of field and laboratory research at the Polish and Brazilian stations have been marine and terrestrial biology, including physiology and adaptation of Antarctic fish and krill; taxonomy and ecology of the benthic fauna; vascular plants; mosses and lichens; terrestrial and marine ecology; migration and dispersion of birds. A long-term research project on the biology and dynamics of bird populations (mainly Pygoscelid penguins) has been carried out by the US Antarctic Program since 1976. This study is of relevance for the CCAMLR Ecosystem Monitoring Programme (CEMP). Other studies include geology and palaeontology, glaciology and palaeoclimatology of the King George Island ice cap; and glacio-marine sedimentation in Admiralty Bay. A year-round seismic and Earth-magnetism observatory, established at Arctowski Station in 1978, is the only station of its kind in the South Shetland Islands. Studies on atmospheric chemistry, geomagnetism, the ionosphere and astrophysics have been conducted at Ferraz Station since 1984. A meteorological station has been operational at Arctowski since 1977 and at Ferraz Station since 1984 to provide basic data and to support logistic operations. Research on upper atmosphere winds is being developed at Machu Picchu Station using MST radar.

Both Arctowski and Ferraz stations have hosted many foreign scientists (Argentineans, Belgians, Chileans, Germans, former Soviets and Russians, Netherlands, New Zealanders, Americans, Uruguayans and others). There is a strong tradition of co-operation between Polish and Brazilian scientists in matters related to Admiralty Bay and the South Shetland Islands as a whole.

A comprehensive study of the state of the environment in the Area is under way at Ferraz Station, comprising the analysis of a series of biotic and abiotic parameters. Results will serve as a baseline for future monitoring of activities and for implementation of a strategy for environmental management of the ASMA.

Historic values

Sheltered deep harbours and accessible beaches ensured an early start to activities in Admiralty Bay. The bay offered protection for ships in the area during the sealing and whaling periods in the 19th and early 20th centuries, and ruins of installations related to the latter period still exist. Whale bones cover the beaches and are part of the landscape, remaining as heritage of this period.

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

During the International Geophysical Year (1957-58), the UK Base "G", on Keller Peninsula, Admiralty Bay (opened in 1947 and closed in 1961), later dismantled, was the center of meteorological observations and glaciological and geological research.

Establishment of the Polish Arctowski Station in 1977 at Thomas Point, of the Brazilian Ferraz Station at Keller Peninsula in 1984, and of the Peruvian Machu Picchu Station at Crepin Point in 1989 has provided a sound basis for permanent research in Biological, Earth and Atmospheric sciences, which continues up to now. Ornithological research by US biologists began in 1976, with the establishment of Copacabana Station (unofficially called Pietr J. Lenie) covering the entire western side of Admiralty Bay, from Italian Valley (in Ezcurra Inlet) to Patelnia Point. Since 1985, ornithological research has also been occasionally undertaken at Keller Peninsula, by Brazilian biologists.

Educational and touristic values

Sites of ecological interest and scientific installations in the Area are frequently visited by tourists and participants in non-governmental expeditions, who have thus an opportunity to become familiar with Antarctic environment and activities.

2. Aims and Objectives

Taking into account that the Area is already the locus of multiple and continuous activities which tend to become even more intense and diverse in the near future, the present Management Plan is designed to provide mechanisms for:

- Safeguarding the long-term scientific research in the Area while maintaining stewardship of the environment;
- Protecting important physiographic features, and the outstanding biological, ecological, historical and aesthetic values of the Area;
- Improving the understanding of natural processes at work in the Area which in turn will help to protect the environment from unnecessary disturbance;
- Managing potential or actual conflicts of interest between different activities, including science, logistics and tourism;
- Avoiding or minimizing the risk of mutual interference and cumulative impacts on the terrestrial and marine environments; and
- Improving the level of mutual assistance and co-operation among Parties operating in the Area.

3. Management Activities

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

- Parties that have active research programmes within the Area should establish an international Admiralty Bay Management Group, which will hold regular meetings (at a convenient time) to:
    - review the functioning and implementation of the Management Plan;
    - facilitate communication between those working in or visiting the Area;
    - monitor the Area to investigate possible sources of environment impact including cumulative impacts;
    - promote the dissemination of information on this Management Plan to all parties operating in the Area, and all other visitors to the Area;
    - maintain a record of activities in the Area;
    - provide the name and address of their co-ordinator.
- Parties that have active research programmes within the Area should consult amongst themselves with a view to:
    - designating a person to coordinate the implementation of the Management Plan in the Area (ASMA Coordinator). Designation will be for a 5 year period on a rotational basis;

  - developing contingency plans for each station, as well as for the whole Area, for oil spills and any other accident with possible significant impact on the environment, including attendance in an emergency;
  - establishing a waste management plan for the Area.

- National Programmes operating within the Area, as well as all other visitors, should undertake activities in accordance with the environmental Code of Conduct contained in this Management Plan.
- Wherever feasible, markers delimiting boundaries of already existing protected areas and other zones of ecological or scientific interest identified in this Management Plan and warnings for visitors about their nature should be provided, and removed when no longer necessary.
- National Programmes that have active research programmes in the Area should make arrangements with other parties that have installations and/or structures now abandoned to consider their value. Conservation plans should be formulated if any of the installations are assessed to be of historical value. If not, plans should be formulated for their removal in accordance with the provisions of Annex III on Waste Disposal and Waste Management to the Protocol on Environmental Protection.
- National Programmes operating in the Area should ensure that all personnel in their programmes visiting the Area have been briefed on the requirements of the Management Plan and, in particular, on the Environmental Code of Conduct that applies within the Area.
- Tour operators visiting the Area should ensure that their staff, crew and passengers are briefed on, and are aware of the requirements of this Management Plan and supporting documentation.
- Copies of this management plan and supporting documentation, such as maps and appendices, should be kept in appropriate stations and research hut facilities and be made available to all persons in the Area.

4. Period of Designation

Designated for an indefinite period.

5. Description of the Area

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

General description

ASMA No. 1: Admiralty Bay, King George Island (62º 01’21”S – 62º14’09”S/58º 15’05”W– 58º41’02”W) comprises the terrestrial and marine areas immediately within the glacial drainage basin of this bay (Fig. 2). In addition, it includes ASPA No. 128 Western Shore of Admiralty Bay, part of which is outside the drainage basin area.

The Area is bounded by a line extending from its southern margin at Telefon Point to The Tower, and then toward Jardine Peak intersecting the ice divide of the Warszawa ice-field, thence following this divide to the west of Ezucurra Inlet, north-eastward to enclose Mackellar and Martel inlets, and then southward through Ternyck Needle to Cape Syrezol on the eastern shore of, Admiralty Bay. The waters of Admiralty Bay and a small part of Bransfield Strait north of a straight line between Cape Syrezol and Telefon Point are also included in the ASMA. There are no fixed survey points available at the Area boundaries, but markers indicating the ASMA will be fixed at appropriate arrival points on land.

The revised total area of ASMA No. 1 is 360 km², of which 194 km² are ice covered, including 138 km² of Admiralty Bay Waters and an adjoining 7 km^2 of the Bransfield Strait (Admiralty Chart N° 6258, 1968, London; Polish Chart Admiralty Bay, King George Island, 1:50,000, Battke, S, Warszawa, 1990; ASPA No. 128: Western Shore of Admiralty Bay, King George Island, 1:12 500, ed. Department of Antarctic Biology, Polish Academy of Sciences, Pudełko R., 2002; Brazilian Chart No. 25121, Baía do Almirantado, 1:40,000, 1984, Rio de Janeiro; Braun *et al.* 2001a and b; Arigony-Neto, 2001).

Approximately 90% of the land area within the proposed ASMA is ice-covered, the ice-free areas representing about 37 km².

Earth Science features

The glacial drainage basin is formed mainly by the main ice cap of King George Island which flows from north, east and west towards the trough of Admiralty Bay. At the head of the bay, the ice cap spills into three inlets: Ezcurra, Mackellar and Martel inlets. Heavily crevassed outlet glaciers descend towards the sea becoming tidewater glaciers. Along the west coast, in the area of ASPA No. 128, some glaciers descending from Warszawa Peninsula (ice cap) terminate on land; others form tidewater ice cliffs. The eastern coast of the bay, from Cape Syrezol to Hennequin Point, is bordered mainly by ice-cliffs of tidewater glaciers descending from Krakow Ice Field, and by rocky spurs and narrow beaches. In the whole area of Admiralty Bay intensive deglaciation is well documented.

Geomorphology of the area is dominated by glacial erosional and depositional landforms, pebble to cobble covered beaches and raised marine terraces. Igneous and sedimentary rocks outcropping around Admiralty Bay record a complex Cenozoic evolution of a volcanic island arc intercalated with terrestrial and glacial deposits.

Climate

The climate of the Area is typical of maritime Antarctica. Based on data of more than 20 years obtained at the Polish Arctowski Station and at the Brazilian Comandante_Ferraz Station, the local microclimate is characterized by an average annual temperature of around -l.8ºC and an average annual wind speed in the order of 6.5 m s^{-1}. Annual average precipitation is 508.5 mm, humidity is 82% and pressure is 991 hPa. The waters of Admiralty Bay have an average annual temperature range of -1.8° to +4°C, being well mixed by tides and strongly influenced by currents from the west of Bransfield Strait.

Flora

In the adjoining ice-free areas of Admiralty Bay, the distribution of plant communities is closely related to geoforms and to the presence of birds and soil. Wherever edaphic conditions are favorable, mosses form strands which also contain lichen and fungi formations. The lichenized mycobiota is restricted to the rock fragments and rock outcrops, sometimes associated to bird colonies. The coastal areas are the most densely covered, being represented mostly by moss carpet formations. Near the Brazilian Station two of these areas occur, both of which are almost 300 m long. As elevations start up, showing rocky outcrops, crustose lichens and mosses which grow directly on rock predominate. The species are listed at Appendix A.

Birds

Within the Area, 13 species of birds breed. Three sympatrica1ly breeding Pygoscelid penguins make up 91% of the number and up to 95% of the biomass of the breeding community. Other seabirds breeding in the Area are: southern giant petrel*;* blue-eyed shag*;* brown skua; south polar skua; Wilson's storm petrel*;* black-bellied storm petrel, cape petrel, kelp gull, Antarctic tern and American sheathbill. The areas of ASPA No. 128 Western Shore of Admiralty Bay, Cape Vauréal, Chabrier Island and surroundings, are the most important bird breeding locations in Admiralty Bay. Around Vaureal Cape are found nests of all species mentioned above, including all of the Area's blue-eyed shags and 50% of its giant petrels. The species are listed at Appendix B.

Mammals

Six species of pinnipeds occur in the Area (Appendix B). The most frequent mammal during winter is the crabeater seal. During summer, elephant seals and fur seals are the most frequent and abundant. Fur seals, once relatively rare, have increased in number in recent years. Elephant seals and Weddell seals breed in the area. Leopard seals are found throughout the year in varying numbers. Ross seals rarely occur in the Area. Humpback whale is the most frequent cetacean during summer.

Marine Ecosystem

II.Measures

Macroalgae, predominantly Phaeophyta and Rhodophyta, characterize the shallow water bottom community down to 50-60 m depth. With the exception of *Nacella concinna*, epifauna is practically absent in the intertidal zone. The vagile benthos is abundant with a high variety and density of Amphipoda. Below 4-5 m, substrata are typically sandy and dominated by Isopoda, particularly the genus *Serolis*. With the increasing depth, vagile species such as *Sterechinus, Neobuccinum* and *Parborlasia* dominate. In deeper waters, on a muddy and more stable substrata, sessile forms include sponges, anemones, the bivalve *Laternula elliptica* and tunicates, besides high-density concentrations of echinoderms such as *Amphioplus acutus, Ophionotus victoriae* and *Odontaster validus.* Scavenger invertebrates include *Labidiaster annulatus, Gliptonotus antarcticus, Parborlasia corrugatus* and *Neobuccinum eatoni*. The species found in the area are largely the same as those observed on similar substrata at other sites in the region, indicating homogeneity in the benthic fauna of the Antarctic Peninsula and related areas. Fish are represented by fifteen Nototheniidae, mainly *Notothenia neglecta, N. gibberifrons, N. coriiceps, Nototheniops nudifrons, Trematodus newnesi, T. borchgrewincki* and *Pleuragramma antarcticum*, two Channichthydae species, Hapagiferidae and Zoarcidae.

5 (ii) Access to the Area

In order to minimize the risks of accidents, environmental damage or harmful interference with research activities, pedestrians, ships, small boats, aircrafts and land vehicles entering and/or operating in the Area should follow the Environmental Code of Conduct that applies within the Area. (See Section 8).

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

Main permanent structures in the Area (Fig. 2).

Henryk Arctowski Station (Poland) - 62°09´34´´S – 058°28´15´´W

The station was established by Poland at Thomas Point on 26th February 1977 as a facility for continuous scientific research and associated logistic operations of the Polish Antarctic Programme, and has been in year-round operation since then. It has dormitories with 10 berths in summer and up to 14 in winter; biological, meteorological and geophysical laboratories; storage facilities; a small hospital unit; double-walled fuel tanks with total capacity of 1,000 tonnes; hangars for boats and land vehicles etc. The station is equipped with two helicopter pads.

Comandante Ferraz Station (Brazil) – 62º05'07" S - 58º23'32"W

The station was established in 1984 on the eastern coast of Keller Peninsula as the base for scientific research and associated logistic operations conducted by the Brazilian Antarctic Programme. It started year-round operations in 1986. The station consists of 64 containers including biological, chemical, meteorological and geophysical laboratories; dormitories with a capacity of 46 berths; storage facilities; a garage for land vehicles, diesel generators etc. Fuel is stored in 17 large double-walled steel tanks with a total capacity of 316,000 liters of diesel, and in a small tank (3,000 L) for gas. The station is equipped with one helicopter pad.

Machu Picchu Station (Peru) - 62º05'07'' S - 58º23'32''W

The station was established in 1988 at Crépin Point, Mackellar Inlet. At present, it used for summer operations. The station consists of five metallic modules including: Scientific Laboratory, Power House/Garage/Waste Management, Living quarters, Emergency refuge and Dining-room/Kitchen. The station is equipped with one Portable helicopter pad.

Copacabana Field Station (United States of America) - 62º10'45" S - 58º26'49" W

At Llano Point, has been in use annually, during the summer, since 1978, for ornithological research, in close cooperation with Arctowski station.

Refuge at Hennequin Point (Equador) - 62º 07' 16" S - 58º 23' 42" W

The refuge was built in 1989, and has occasionally been used since then during summer.

Minor and/or semi-permanent structures.

There are a number of minor structures in the area, such as (Fig. 3):

a) the remains of Italian hut Campo Bove at Italian Valley, Ezcurra Inlet;

b) an old whaling boat, on Keller Peninsula;

c) an assembled whale skeleton on Keller Peninsula;

d) wooden barrels from whaling period at Barrel Point, Ezcurra Inlet;

e) a collection of whaling harpoons assembled on the shores of Admiralty Bay, exhibited at Arctowski Station;

f) a group of five crosses and graves on Keller Peninsula. Four of these are British graves, with crosses erected in memory of members of British expeditions who perished at sea and on ice, and one was erected in honour of a deceased member of the Brazilian military;

g) a wooden cross on top of Mount Flagstaff on Keller Peninsula;

h) two Brazilian emergency refuges on Keller Peninsula;

i) removable Polish caravans functioning as summer field laboratories (e.g. at Demay Point).

5 (iv) Location of protected areas within the ASMA (Fig. 2)

The following areas are currently designated within the proposed ASMA:

ASPA No. 128 (Western shore of Admiralty Bay)

62º09´46´´S - 62º14´10´´S – 58º25´15´´W - 58º29´58´´W

This area is the site of long-term studies on bird biology performed by the US Antarctic Program.

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

This consists of the grave with a cross of Eng. W. Puchalski, an internationally acclaimed Polish nature photographer and director of Arctic and Antarctic nature films.

6. Special Zones within the Area

In addition to ASPA No. 128 and Historic Site No. 51, and to sites specified in section 5.3, the following zones were identified within the ASMA as being zones in which activities should be managed.

6 (i) Zones visited by tourists and other visitors

• Arctowski and Ferraz Stations: movement of tourists and other visitors should follow the pre-established tour routes (Fig. 5). In the future, routes for tourists may be established at Machu Picchu Station and Ecuador field camp;

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

6(ii) Zones of scientific and/or ecological interest where access by tourists and other visitors should be managed (Fig. 4):

a) Fresh water lakes around Arctowski Station: example of freshwater environment;

b) Italian Valley: concentration of seals;

c) Dufayel Island: concentration of seals;

d) Crépin Point: concentration of seals;

e) Area north-west of Ferraz Station: concentration of seals;

a) Area west of Ferraz Station: concentration of seals;

b) Coastal area from Refuge No. 1 (Ferraz Station) to Plaza Point: concentration of seals and penguins;

h) Crosses Hill on northern flank of Ferraz, on Keller Peninsula: Concentrations of terns. Except in connection with scientific activities, survival cache replacement, or emergencies, and essential

station operations, visits should be limited during the critical bird breeding season from 1 October to 31 December.

i) Coastal area up to 7 m in shore, north of Base "G" hill: presence of vegetation banks;

c) Freshwater ponds near Arctowski and Ferraz stations: example of freshwater environment;

d) Ullman Point (Ullman Spur): concentration of seals;

e) Hennequin Point: concentration of seals; plant fossil localities;

f) Cape Vaureal - Chabrier Rock: breeding area for penguins, southern giant petrels and blue-eyed shags. Visits should be avoided during the breeding season, from 1 October to 1 March, except in connection with scientific activities;

g) Shallow marine waters down to 100 m in front of: ASPA No. 128, Martel, Mackellar and Ezcurra Inlets; Napier Rock and Monsinet Cove: diverse benthic communities and scientific experiments and concentrations of different species of adult and juvenile fish.

Although not officially designated as protected areas under Annex V of the Protocol, the zones listed above have considerable scientific/ecological interest as breeding sites and/or concentrations of birds and/or mammals, as feeding sites for birds and marine mammals, as sites of typical vegetation cover, varied marine habitats, or sites of special scientific interest. Some of these zones, such as Chabrier Rock and Vaureal Cape, on the eastern shore of Admiralty Bay (Fig. 2) are of great relevance, as it is the only breeding site for the Antarctic blue-eyed shag, penguins and southern giant petrel outside ASPA 128 Western Shore of Admiralty Bay.

Activities in all zones should be carried out with particular care to avoid or minimize disturbance of wildlife, trampling of vegetation and interference with on-going research. Freshwater lakes around Arctowski and Ferraz should be only accessed for the purpose of water supply and associated station operations and for relevant scientific research.

The marine benthic and pelagic organisms are of considerable scientific interest and are fundamental links in the marine food chain of the area. They are critically linked to maintenance of the ecological balance including that of birds and marine mammals.

7. Maps

Figure 1: Location of ASMA No. 1 in King George Island, Antarctic Peninsula
Figure 2: Admiralty Bay Antarctic Specially Managed Area – ASMA No. 1
Figure 3: Location of Structures and anchoring sites
Figure 4: Location of Zones of Scientific and/or Ecological Interest
Figure 5A: Vehicles and Pedestrians Limits and Tour Routes – Comandante Ferraz Station
Figure 5B: Facilities Zones – Comandante Ferraz Station
Figure 5C: Vehicles and Pedestrians Limits and Tour Routes – Henryk Arktowski Station
Figure 5D: Facilities Zones – Machu Picchu Station
Figure 6: Flora (colonized areas) and Birds (occurrence sites)

8. General Code of Conduct

With regard to the provisions of Articles 4-6 of Annex V to the Protocol on Environmental Protection on Area Protection and Management, the following Code of Conduct is proposed as a framework to guide on-going and future research and logistic operations of the parties which have permanent and/or summer installations in the Area; and similar activities of other parties.

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

Ships

- Anchoring inside Mackellar Inlet should be undertaken with caution because of' the large number of rocks in its central part. It is recommended that only one ship at any time should anchor in the inlet.
- Anchoring inside Martel Inlet should be limited to three ships as follows: two immediately offshore from Ferraz Station and the third at the eastern end of the inlet;

- Anchoring inside Ezcurra Inlet should be limited to two ships, one immediately east of Dufayel Island and the other south of Dufayel Island, opposite Italian Valley;
- Caution should be exercised when anchoring near Arctowski Station owing to strong currents and winds from different directions.

Small boats

- Landing on the shore in front of Arctowski Station (Arctowski Cove and Halfmoon Cove), Ferraz Station (Visca Anchorage) and other installations should be made at the recommended landing sites shown in Figure 3;
- In addition to the provisions applicable to ASPA No. 128 Western Shore of Admiralty Bay, and except in case of emergencies and activities related to research, monitoring or replacement of survival food and fuel storage, small boats should avoid landing on areas of scientific and/or ecological interest identified in Figure 4.

Aircraft

- Except in emergencies, or in the course of carrying out inspections under Article VII of the Antarctic Treaty, helicopters ferrying scientists and visitors to and from Arctowski, Ferraz and Machu Picchu stations and Ecuador field camp should notify the relevant station/camp leader well in advance of the estimated time of arrival. They should land only on helicopter pads/landing sites indicated at each of the stations (Figure 2). There are no refueling facilities at the stations;
- In addition to the provisions applicable to ASPA No. 128: Western Shore of Admiralty Bay, and except in case of emergency or research activities, no helicopter should land in or nearby, or fly at altitudes of less than 600 m over the areas of biological/ecological interest shown in Figure 4;
- There are no landing sites for fixed-wing aircraft in the Area.

Land vehicles

- Areas used by land vehicles for station and station-supported research operations should, in general, be restricted from Arctowski up to Thomas Point, and between Ferraz Station and the isolated modular laboratories around Ferraz and refuges on Keller Peninsula. Areas within which most vehicle operation are constrained and routes between Ferraz Station and the modular laboratories and refuges are shown in Figure 5A;
- No land vehicles should enter ASPA No. 128 Western Shore of Admiralty Bay;
- Use of station vehicles to visit Plaza Point laboratories and refuges on the Keller Peninsula should be conditional on previous arrangement with the station leader at Ferraz Station;
- Snow-mobiles and snow-cats should be used only on ground covered by snow or ice.

Pedestrians

- Areas of pedestrian activity are generally associated with stations and station-supported research operations. All movement should be undertaken carefully to minimize disturbance to animals, soil and vegetated areas, and not damage or dislodge flora. Whenever possible, routes shown in Figures 5A and B should be used;
- No person should enter ASPA No. 128 Western Shore of Admiralty Bay, except to conduct scientific research in accordance with a permit issued under Art. 3 of Annex II to the Protocol and with the approved management plan for the area.

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

- Scientific research;
- Logistical support of scientific research;

- Visitation for the purpose of education or recreation, including tourism;
- Management activities, including maintenance or removal of facilities; and monitoring the implementation of this Management Plan;
- Media, arts, or other official national program visitors.

Further restrictions apply to activities within ASPA No. 128 Western Shore of Admiralty Bay.

8 (iii) Installation, modification or removal of structures

Installation of new stations/refuges and modifications, or removal of already existing installations or other facilities in the Area, and location of field camps should be done only after consultation with the Parties that have active research programmes in the Area, and in conformity with provisions of Article 8 and Annex 1 of the Environment Protocol and this Management Plan; in a manner that does not compromise the values of the Area.

Scientific equipment installed in the Area should be clearly identified by country, name of principal investigator, contact details, and date of installation. All equipment and associated materials should be removed when no longer in use.

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

8 (iv) Taking or harmful interference with native flora and fauna

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

Taking of marine organisms for scientific purposes should be limited to that restrictedly necessary to meet the purpose of the research. Geological sampling of bottom sediments, particularly in shallow waters, should be carried out with extreme care so as to minimize adverse impact on the environment, or interference with other scientific research under way on benthic ecology.

8 (v) The collection or removal of materials not imported into the Area

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

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

It may be permissible to remove from the site materials such as beach litter, dead or pathological fauna or flora or abandoned relics and artifacts from previous activities.

8 (vi) Disposal of waste

Disposal of waste generated by scientific research programmes, tourism and all other governmental or non-governmental activities in the ASMA should be carried out in compliance with the provisions of Annex III to the Protocol.

All wastes, other than human and domestic liquid waste, should be removed from the Area.

8 (vii) Requirements for Reports

The ASMA coordinator should maintain a record and provide summary descriptions of the reports of activities in the Area in the Annual Exchange of Information under the Antarctic Treaty for the preceding year.

8 (ix) Exchange of information

Parties proposing to conduct, support, or authorize research or other activities in the Admiralty Bay ASMA are requested to inform the ASMA Coordinator as far in advance as possible of their planned activities. The Coordinator should make the information available to the other Parties. This will enable greater integration to be achieved between research programmes, enhance cooperation and avoid cumulative impacts, facilitating monitoring and management of the Area. Where applicable, provisions related to environmental impact assessment as established in the Protocol on Environmental Protection to the Antarctic Treaty should be followed.

At the end of each summer field season, Parties should notify the Coordinator of:

- any activities carried out by its nationals or other parties including tourists and participants in non-governmental expeditions in the ASMA contrary to the provisions of this Management Plan ; and
- steps taken to enforce the provisions of this Management Plan.

IAATO should, as far as practicable, provide the ASMA Coordinator with details of scheduled visits by IAATO-registered vessels. Tour operators not affiliated to IAATO should also inform the coordinator of planned visits.

9. Supporting Documentation

A proposal prepared by Brazil and Poland, in coordination with Ecuador and Peru, that Admiralty Bay, King George Island South Shetland Islands) be designated as an Antarctic Specially Managed Area (ASMA) 1996. Agenda item 20a XX ATCM WP 15 (Rev). Now reviewed.Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas, appended to Resolution 2 (1998) of Antarctic Treaty Consultative Meeting XXII.

Final Report of the Twelfth Antarctic Treaty Special Consultative Meeting**.** The Haque, 11-15 September 2000 Management Plan for Site of Special Scientific Interest No.8 (ASPA 121), Western shore of Admiralty Bay, King George Island, South Shetland islands, pp 68-73

Final Report of the Twelfth Antarctic Treaty Special Consultative Meeting**.** The Haque**,** 11-15 September 2000 Management Plan for Site of Special Scientific Interest No.34. (ASPA 151) Lions Rump, King George Island, South Shetland Islands, pp 95-102

APPENDIX A

Preliminary plant checklist from adjacent ice-free areas to Admiralty Bay, King George Island

ANGIOSPERMAE

POACEAE
Deschampsia antarctica Desv.

CARYOPHYLLACEAE
Colobanthus quitensis (Kunth) Bartl.

MOSSES

AMBLYSTEGIACEAE
Orthotheciella varia (Hedw.) Ochyra
Sanionia uncinata (Hedw.) Loeske
S. georgico-uncinata (Mull Hal..) Ochyra & Hedenas
Warnstorfia laculosa (Müll. Hal.) Ochyra & Matteri
Warnstorfia sarmentosa (Wahlenb.) Hedenäs

ANDREAEACEAE
Andreaea depressinervis Card.
Andreaea gainii Card.
Andreaea regularis Muell.

BARTRAMIACEAE
Bartramia patens Brid.
Conostomum magellanicum Sull.

BRACHYTHECIACEAE
Brachythecium austrosalebrosum (Müll. Hal.) Kindb.
Brachythecium glaciale B.S.G.

BRYACEAE
Bryum amblyodon Müll. Hal.
Bryum argenteum Hedw.
Bryum orbiculatifolium Card. et Broth.
Bryum pallescens Schleich. ex Schwaegr.
Bryum pseudotriquetrum (Hedw.) Schwaegr.
Pohlia cruda (Hedw.) Lindb.
Pohlia drummondii (Müll. Hal.) A. L. Andrews in Grout
Pohlia nutans (Hedw.) Lindb.
Pohlia wahlenbergii (Web. Et Mohr.) Andrews

DICRANACEAE
Anisothecium cardotii (R. Br. ter.) Ochyra
Chorisodontium aciphyllum (Hook. f. et. Wills.) Broth.
Kiaeria pumila (Mitt. in Hook. f.) Ochyra – very rare.

DITRICHACEAE
Ceratodon purpureus (Hedw.) Brid.
Distichum capillaceum (Hedw.) B.S.G.
Ditrichum hyalinum (Mitt.) Kuntze
Ditrichum lewis-smithii Ochyra

ENCALYPTACEAE
Encalypta rhaptocarpa Schwaegr.

GRIMMIACEAE
Grimmia reflexidens Müll. Hal.
Racomitrium sudeticum (Funck) Bruch & Schimp. in BSG.
Schistidium amblyophyllum (Müll. Hal.) Ochyra & Hertel
Schistidium antactici (Card.) L. I. Savicz & Smirnova
Schistidium cupulare (Müll. Hal.) Ochyra
Schistidium falcatum (Hook. f. at Wils.) B. Bremer
Schistidium halinae Ochyra
Schistidium occultum (Müll. Hal.) Ochyra & Matteri
Schistidium rivulare (Brid.) Pobp.
Schistidium steerei Ochyra
Schistidium urnulaceum (Müll. Hal.) B. G. Bell.

HYPNACEAE
Hypnum revolutum (Mitt.) Lindb.
Platydictya jungermannioides (Brid.) Crum

MEESIACEAE
Meesia uliginosa Hedw.

ORTHOTRICHACEAE
Muelleriella crassifolia (Hook. f. et Wils.) Dus.

POLYTRICHACEAE
Polytrichastrum alpinum (Hedw.) G. L. Smith
Polytrichum strictum Brid.
Polytrichum juniperinum Hedw.
Polytrichum piliferum Hedw.

POTTIACEAE
Dydimodon gelidus Card.
Hennediella antarctica (Angstr.) Ochyra & Matteri
Hennediella heimii (Hedw.) Zand.
Stegonia latifolia (Schwaegr. in Schult.) Vent in Broth.
Syntrichia filaris (Müll. Hal.) Zand.
Syntrichia princeps (De Not.) Mitt.
Syntrichia saxicola (Card.) Zand.

SELIGERACEAE
Dicranoweisia brevipes (Müll. Hal.) Card..
Dicranoweisia crispula (Hredw.) Milde
Dicranoweisia grimmiaceae (Müll. Hal.) Broth.

ALGAE

MACROSCOPIC CONTINENTAL ALGAE
Prasiola crispa (Lightfoot) Menegh

MICROSCOPIC CONTINENTAL ALGAE
Bacillariophyceae
Coscinodiscales
Orthoseira cf. *dendroteres* (Ehrenberg) Crawford

Naviculales
Amphora veneta Kützing
Achnanthes lanceolata (Brébisson) Grunow
Achnanthes marginulata Grunow
Caloneis cf. *silicula* (Ehrenberg) Cleve
Caloneis cf. *schumanniana* (Grunov) Cleve
Cocconeis sp.,
Fragilaria bidens Heiberg
Fragilaria capucina Desmazieres
Fragilaria construens f. *binodis* (Ehrenberg) Hustedt
Fragilaria pinnata Ehrenberg
Gomphonema parvulum (Kützing) Kützing
Hantzschia amphioxys (Ehrenberg) Grunow
Luticola muticopsis (Van Heurck) D. G. Mann
Luticola mutica var. *ventricosa (*Kützing) Cleve et Grunow
Navicula cf. *bryophila* Petersen
Navicula elginensis (Gregory) Ralfs
Navicula glaciei Van Heurck,
Navicula phyllepta Kützing
Nitzschia agnita Hustedt
Nitzschia cf. *fontifuga* Cholnoky
Nitzschia frustulum (Kützing) Grunow
Nitzschia gracilis Hantzsch
Nitzschia homburgiensis Lange-Bertalot
Nitzschia cf. *hybrida* Grunow
Nitzschia inconspicua Grunow
Nitzschia perminuta (Grunow) M. Pergallo
Opephora olsenii Moeller
Pinnularia borealis Ehrenberg
Pinnularia ignobilis (Krasske) Cleve-Euler
Pinnularia microstauron (Ehrenberg) Cleve
Stauroneis cf. *anceps* Ehrenberg
Stauroneis cf. *simulans* (Donkin) R. Ross.

MACOSCOPIC FUNGI
Omphalina antarctica Sing.
Galerina moelleri Bas.

LICHENS AND LICHENICOLOUS FUNGI
Acarospora macrocyclos Vain.
Alectoria minuscula – Lindsay
Arthopyrenia maritima Øvstedal
Arthrorhaphis citrinella (Ach.) Poelt
Austrolecia antarctica Hertel
Bacidia stipata Lamb
Biatorella antarctica Murray
Bryonora castanea (Hepp) Poelt
Bryoria chalybeiformis (L.) Brodo et D. Hawksw.
Buellia anisomera Vain.
Buellia augusta Vain.
Buellia cladocarpiza Lamb
Buellia coniops (Wahlenb. in Ach.) Th. Fr.
Buellia granulosa (Darb.) Dodge
Buellia latemarginata Darb.
Buellia papillata (Sommerf.) Tuck.

Buellia perlata (Hue) Darb.
Buellia pycnogonoides Darb.
Buellia russa (Hue) Darb.
Buellia subpedicillata (Hue) Darb.
Caloplaca amniospila
Caloplaca athallina Darb.
Caloplaca buelliae Olech & Søchting
Caloplaca cirrochrooides (Vain.) Zahlbr.
Caloplaca citrina (Hoffm.) Th. Fr.
Caloplaca iomma Olech & Søchting
Caloplaca millegrana
Caloplaca psoromatis Olech & Søchting
Caloplaca regalis (Vain.) Zahlbr.
Caloplaca siphonospora Olech & Søchting
Caloplaca sublobulata (Vain.) Zahlbr.
Caloplaca tetraspora (Nyl.) H. Oliv.
Caloplaca tiroliensis Zahlbr.
Candelaria murrayi (Dodge) Poelt
Candelariella hallettensis (Murray) Øvstedal
Candelariella vitellina (Hoffm.) Müll. Arg.
Carbonea vorticosa (Flörke) Hertel
Catapyrenium daedaleum (Kremp.) Stein
Catapyrenium lachneum (Ach.) R. Sant.
Catillaria corymbosa (Hue) Lamb
Cladonia cariosa (Ach.) Spreng.
Cladonia furcata (Huds.) Schrader
Cladonia phyllophora Ehrh. ex Hoffm.
Cladonia pyxidata (L.) Hoffm.
Coelocaulon aculeatum (Schreber) Link
Coelocaulon epiphorellum (Nyl. in Crombie) Kärnef.
Cystocoleus ebeneus (Dillwyn) Thwaites
Dermatocarpon intestiniforme (Körb.) Hasse
Haematomma erythroma (Nyl.) Zahlbr.
Himantormia lugubris (Hue) Lamb
Hypogymnia lugubris (Pers.) Krog
Hypogymnia lububris (Pers.) Krog f. *compactior* (Zahlbr.) D. C. Linds.
Japewia tornoensis (Nyl.) Tønsberg
Lecania brialmontii (Vain.) Zahlbr.
Lecania gerlachei (Vain.) Zahlbr.
Lecanora dispersa (Pers.) Sommerf.
Lecanora expectans Darb.
Lecanora physciella (Darb.) Hertel
Lecanora polytropa (Hoffm.) Rabenh.
Lecidea assimilata Nyl.
Lecidea atrobrunnea (Ramond ex Lam. et DC.) Schaer.
Lecidea lapicida (Ach.) Ach.
Lecidea sarcogynoides Körb.
Lecidea sciatrapha Hue
Lecidella aff. *carpathica* Körb. –
Lecidella stigmatea (Ach.) Hertel and Leuckert
Lecidella wulfenii (Hepp) Körb.
Leptogium puberulum Hue
Massalongia carnosa (Dicks.) Körb.
Mastodia tesselata Auct.
Megaspora verrucosa (Ach.) Hafellner
Microglaena antarctica Lamb
Ochrolechia frigida (Sw.) Lynge

II.Measures

Ochrolechia parella (L.) A. Massal.
Pannaria hookeri (Borrer ex Sm.) Nyl.
Parmelia saxatilis (L.) Ach.
Physcia caesia (Hoffm.) Fürnr.
Physcia dubia (Hoffm.) Lettau
Physcia cf. *wainioi* Räs.
Physconia muscigena (Ach.) Poelt
Placopsis contortuplicata Lamb
Poeltidea perusta (Nyl.) Hertel et Hafellner
Polyblastia gothica Th. Fr.
Porpidia albocaerulescens (Wulfen) Hertel et Knoph
Porpidia crustulata (Ach.) Hertel et knoph
Pseudephebe minuscula (Nyl. ex Arnold) Brodo et D. Hawksw.
Pseudephebe pubescens (L.) Choisy
Pseudevernia pubescens
Psoroma hypnorum (Vahl) Gray
Ramalina terebrata Hook et Tayl.
Rhizocarpon geminatum Körb.
Rhizocarpon geographicum (L.) DC.
Rhizocarpon polycarpon (Hepp) Th. Fr.
Rhizoplaca aspidophora (Vain.) Redón
Rhizoplaca melanophthalma (DC. in Lam. et DC.) Leuck. et Poelt
Rinodina deceptionis Lamb
Rinodina mniaraea (Ach.) Körb.
Rinodina petermanii (Hue) Darb.
Rinodina turfacea (Wahlenb.) Körb.
Sphaeorophorus fragilis (L.) Pers.
Sphaeorophorus globosus (Hudson) Vain.
Sphaeorophorus cfr. *melanocarpus* (Sw.) DC.
Staurothele gelida (Hook & Tayl.) Lamb
Stereocaulon alpinum Laurer ex Funck
Stereocaulon glabrum (Müll. Arg.) Vain.
Tephromela atra (Hudson) Hafellner
Thelocarpon cyaneum Olech et Alstrup
Tremolecia atrata (Ach.) Hertel
Umbilicaria aprina Nyl.
Umbilicaria cfr. *cristata* Dodge et Baker
Umbilicaria decussata (Vill.) Zahlbr. –
Umbilicaria propagulifera (Vain.) Llano
Umbilicaria rufidula (Hue) Filson
Usnea acromelana Stirton
Usnea antarctica Du Rietz
Usnea aurantiaco-atra (Jacq.) Bory
Verrucaria ceuthocarpa Wahlenb.
Verrucaria cylindrophora Vain.
Verrucaria dispartita Vain.
Verrucaria elaeoplaca Vain.
Verrucaria psycrophila Lamb
Verrucaria tesselatula Nyl.
Xanthoria candelaria (L.) Th. Fr. –
Xanthoria elegans (Link.) Th. Fr.

APPENDIX B

Fauna recorded at Admiralty Bay, King George Island

Birds recorded at Admiralty Bay

Breeding species:

Pygoscelis adeliae
Pygoscelis papua
Pygoscelis antarctica
Macronectes giganteus
Daption capense
Oceanites oceanicus
Fregetta tropica
Phalacrocorax bransfieldensis
Chionis alba
Catharacta maccormicki
Catharacta lonnbergi
Larus dominicanus
Sterna vittata

Non-breeding

Frequent:

Eudyptes chrysolophus
Fulmarus glacialoides
Pagodroma nivea
Sterna paradisaea

Sporadic:

Aptenodytes patagonicus
Aptenodytes forsteri
Edyptes chrysocome
*Spheniscus magellanicus**
Talassarche melanophris
*Phoebetria fusca**
*Phoebetria palpebrata**
Thalassoica Antarctica
Halobaena caerulea
*Pachyptila desolata**
Bubulcus ibis
Cygnus melanocoryphus
*Anas sibilatrix**
Anas georgica
Calidris fuscicollis
*Steganopus tricolor**
*Catharacta chilensis**

II.Measures

Pinnipeds recorded at Admiralty Bay:

Mirounga leonina
Lobodon carcinophagus,
Leptonychotes weddelli,
Hydrurga leptonyx,
Arctocephalus gazella,
Ommatophoca rossi *

* - only one visit.

APPENDIX C

Code of Conduct for Visitors

1. Introduction

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

2. General Guidelines

- Leaders of tourist and non-governmental expeditions wishing to visit Arctowski, Ferraz or Machu Picchu stations should contact the Department of Antarctic Biology, Polish Academy of Sciences (02-141 Warsaw, Poland, Ustrzycka), the Comissão Interministerial para os Recursos do Mar (Ministério da Marinha, Esplanada dos Ministérios, 70055-900, Brasília, DF, Brazil), or the Instituto Antártico Peruano – INANPE (Jr. Ucayali 259, Lima – Perú) respectively, well in advance of the planned visit to make the necessary arrangements. This does not preclude visits in emergency situations.
- The State Party responsible for tour operators should ensure that tour operators, their staff, tourists and other visitors are fully informed of, and comply with, the provisions of this Management Plan.
- Expedition Leaders of cruise ships and Masters of national programme support vessels are encouraged to exchange itineraries in order to avoid two ships unintentionally converging on a site simultaneously.
- For commercial cruise operators, no more than 100 passengers may be ashore at a site at any time, accompanied by a minimum of one member of the expedition staff for every 20 passengers.
- Members of non-governmental and tourist expeditions visiting Arctowski and Ferraz stations should use the routes shown in Fig. 5.A and B. These routes give the opportunity to observe wildlife and the station installations, while minimizing disturbance to station activities and the environment, and avoiding habitat degradation.
- In order to avoid environmental impact, disturbance of wildlife and interference with on-going scientific research, landing at or entering of the special zones listed in section 6.2 should not take place, except in emergencies.
- All movement on land should be undertaken carefully to minimize disturbance to animals, soil and vegetated areas, or disturb scientific equipment. The visitor should:
    - avoid walking on vegetation such as moss or lichen.
    - maintain an appropriate distance from birds or seals which is safe and does not cause them disturbance. As a general rule, maintain a distance of 5 metres. Where practicable, keep at least 15 metres away from fur seals.
    - wash boots and clean clothes, bags, tripods and walking sticks before landing, in order to prevent biological introductions.
    - not leave any litter.
    - not take biological or geological souvenirs or disturb artefacts.
    - not write or draw graffiti on any man-made structure or natural surface.
    - not touch or disturb scientific instruments or markers.
    - not touch or disturb field depots or other equipment stored by National Antarctic Programmes.

Figure 1: Location of ASMA Nº 1 in King George Island, Antartic Peninsula

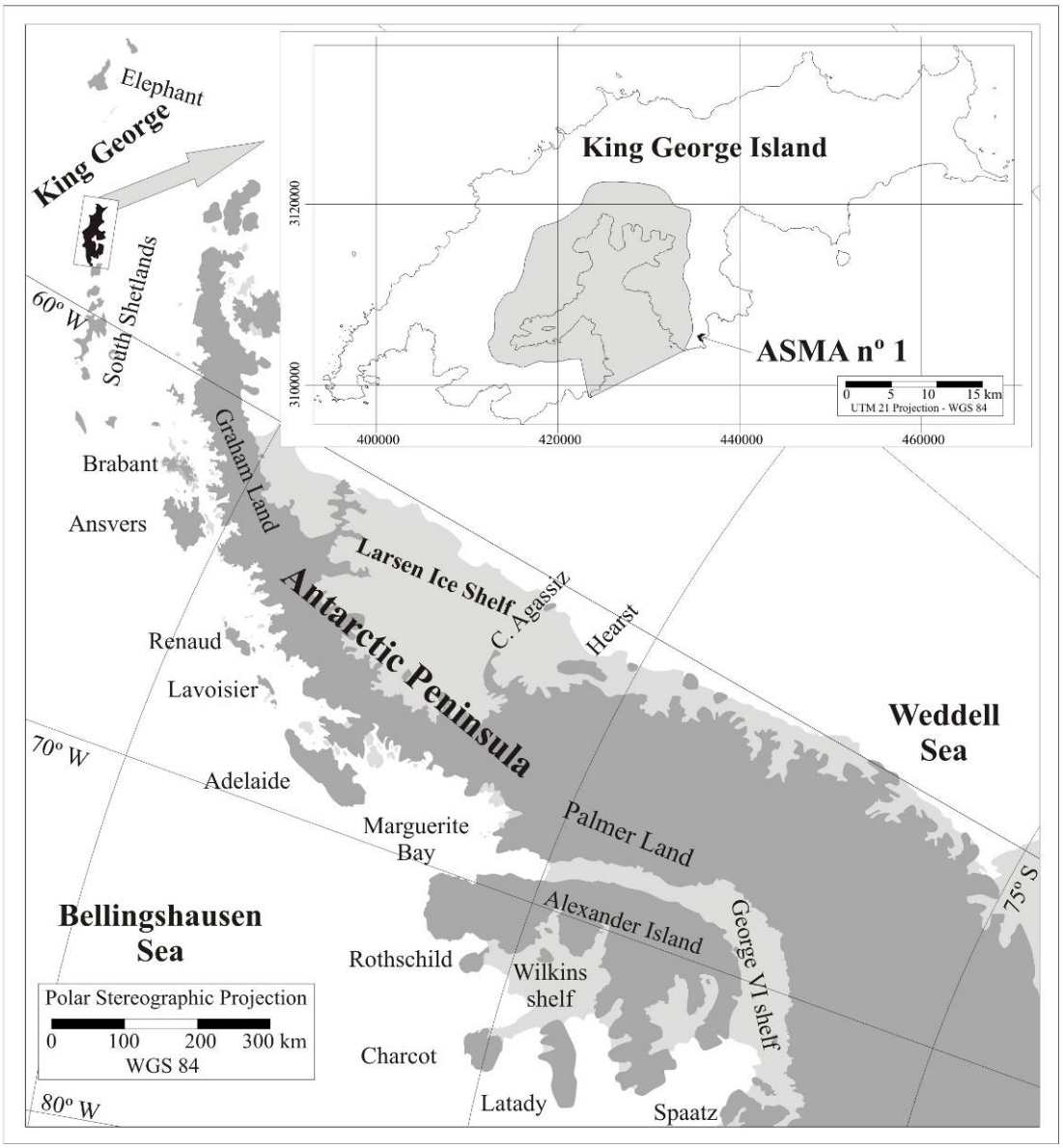

Figure 2: Admiralty Bay Antartic Specially Managed Area - ASMA Nº 1

Figure 3: Location of minor and/or semi-permanent structures and anchorage sites

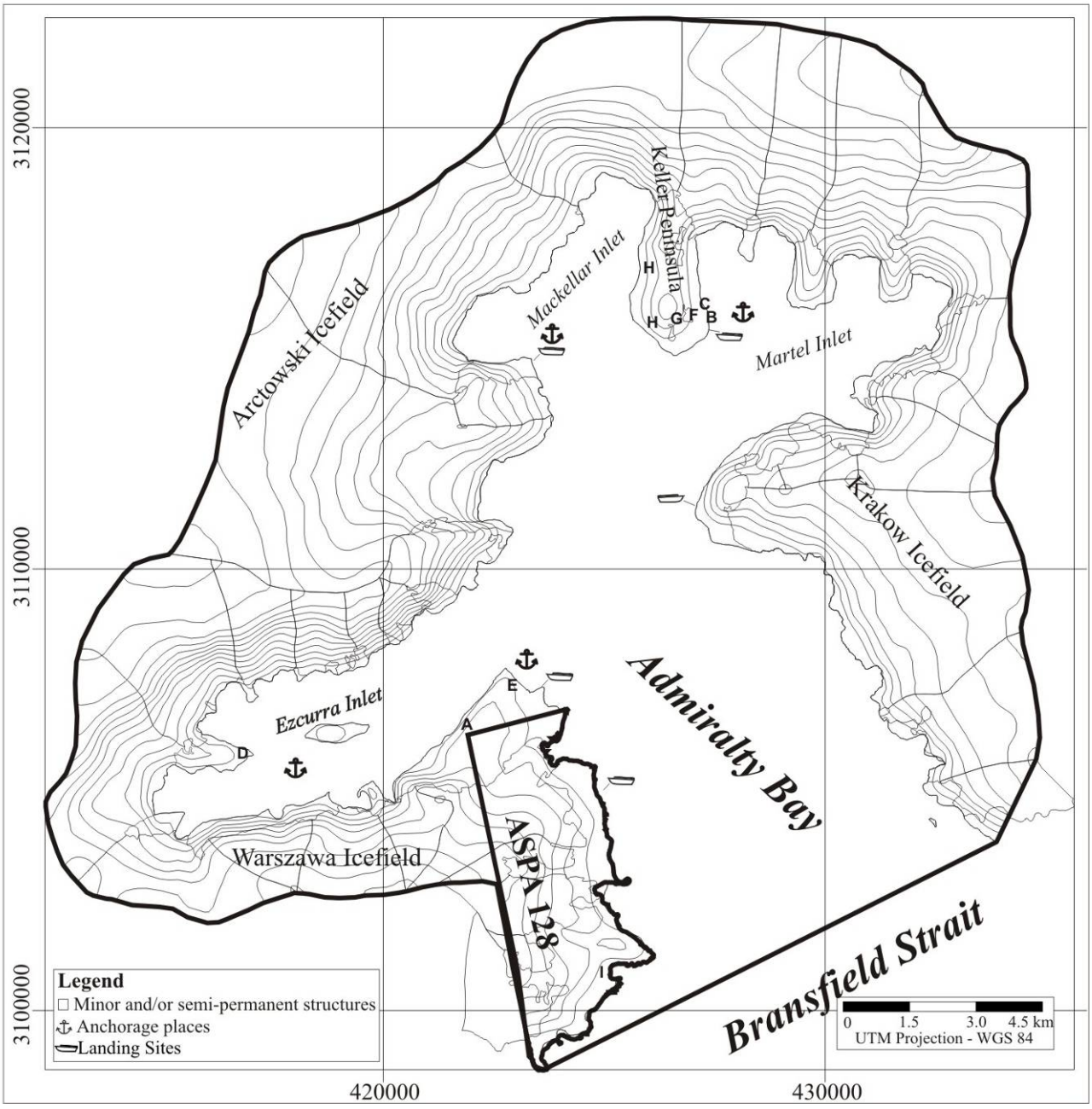

Figure 4: Location of Zones of Scientific and/or Ecological Interest

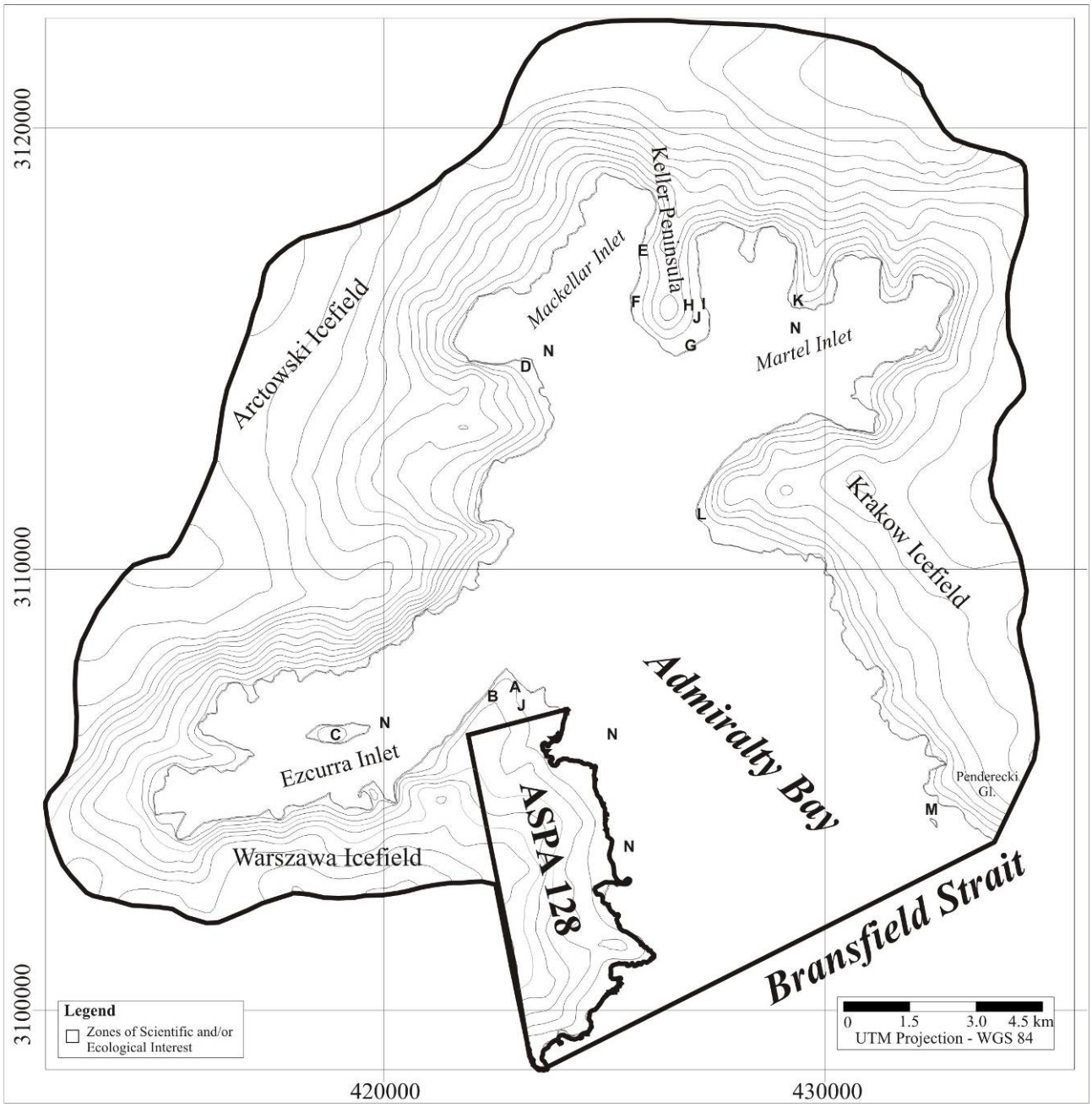

Figure 5A: Tour Routes - Comandante Ferraz Station

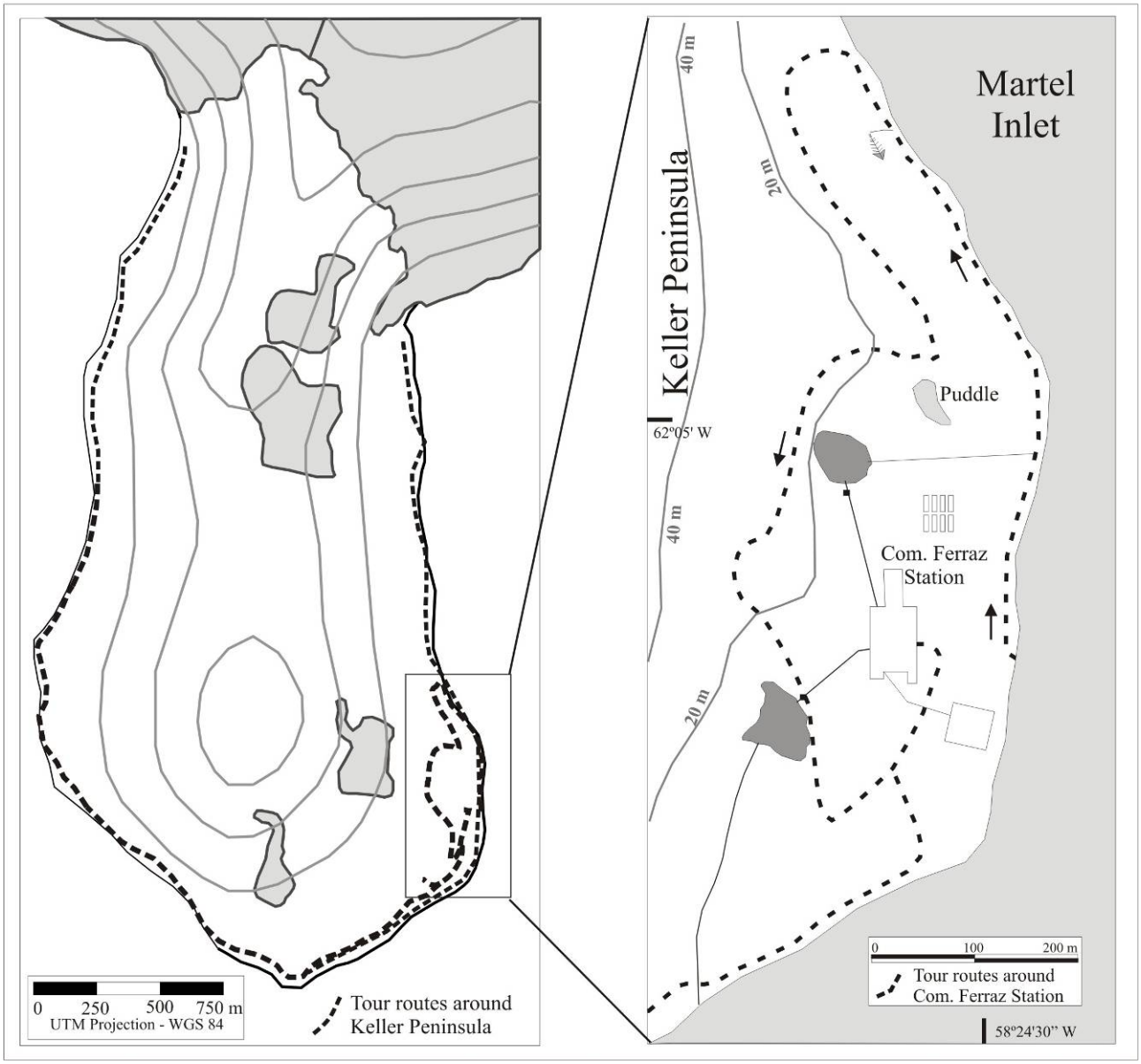

Figure 5B: Facilities Zone - Comandante Ferraz Station

1. Disembarkation point
2. Old whaling boat
3. Fuel tanks
4. Assembled whale skeleton
5. Site of former Base "G" (UK)
6. "Spanish tower"
7. Geomagnetism - VHF unit
8. North lake and water pump
9. Crosses and graves
10. South lake and water pump
11. Ruins of old British radiosonde
12. Meteorological Unit
13. Old buildings
14. Helicopter pad
15. Chemistry lad
16. Main station complex
17. Refuge 1

Figure 5C: Tour Routes - Henryk Arktowski Station

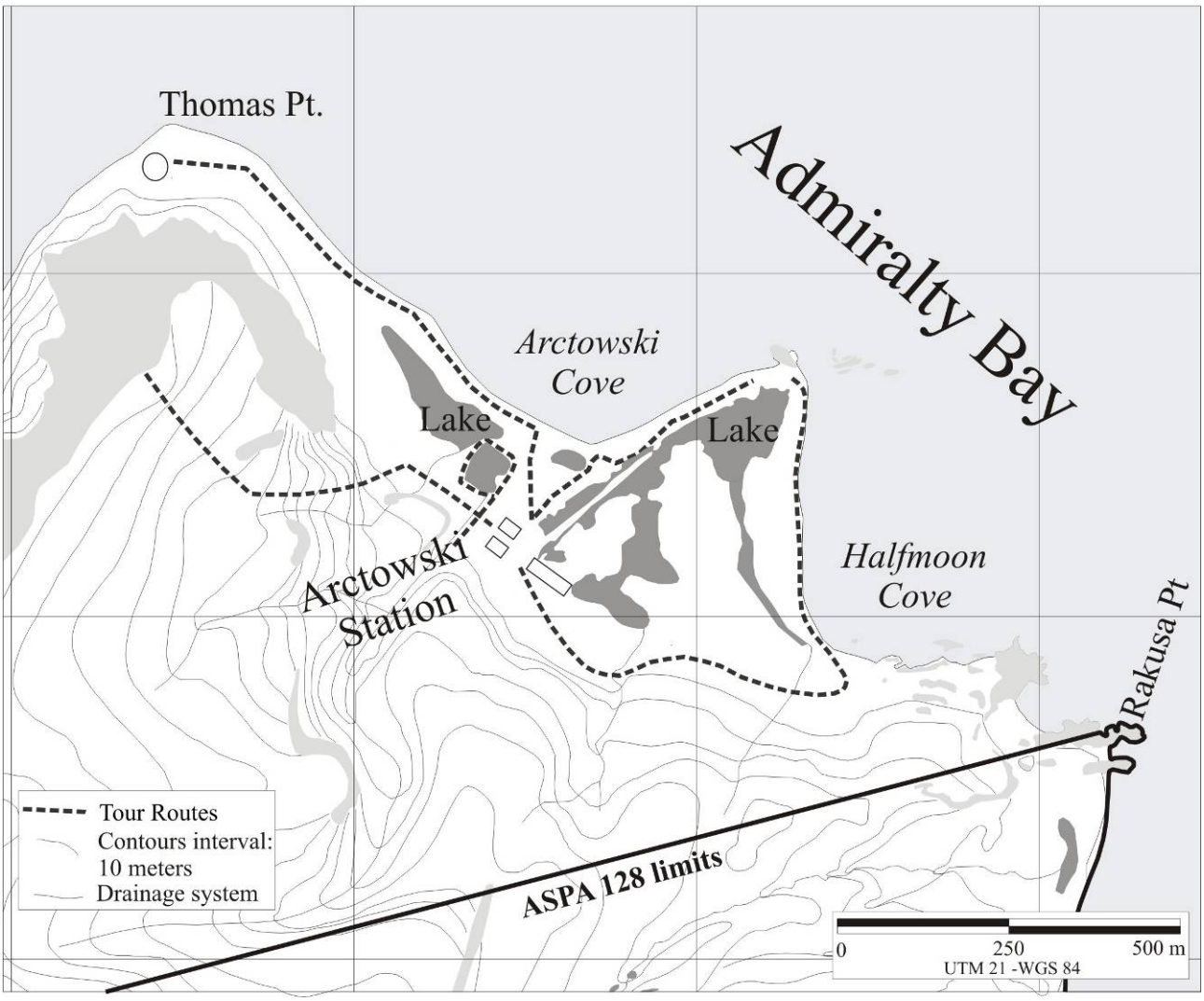

Figure 5D: Facilities Zone - Machu Picchu Station

1. Disembarkation point
2. Scientific Laboratory
3. Portable helicopter pad
4. Power House / Garage / Waste Management
5. Living quarters
6. Emergency refuge
7. Dining-room/ Kitchen
8. Flag
9. MST Radar

Figure 6: Flora (colonized areas) and Birds (occurrence sites)