

# Management Plan for

## Antarctic Specially Protected Area (ASPA) No. 139

### BISCOE POINT, ANVERS ISLAND, PALMER ARCHIPELAGO

#### Introduction

The Biscoe Point Antarctic Specially Protected Area is located near the south-west coast of Anvers Island, in the Palmer Archipelago, Antarctic Peninsula, at 64°48'40"S, 63°46'27"W. Approximate area: 0.59 km<sup>2</sup>. The primary reason for the designation of the Area is its extensive vegetation communities, soils and terrestrial ecology. The Area contains the most extensive stands of Antarctic hair grass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*) in the Anvers Island region, as well as numerous species of mosses and lichens. The Area is a breeding site for several bird species, including Adélie (*Pygoscelis adeliae*) and gentoo (*P. papua*) penguins, brown (*Stercorarius lonnbergi*), south polar (*S. maccormicki*) and hybrid skuas, which have been the subject of long-term monitoring and ecological research. Furthermore, the long history of protection of the Area makes it a valuable reference site for comparative studies and long-term monitoring.

The Area was proposed by the United States of America and adopted through Recommendation XII-8 [1985, Site of Special Scientific Interest (SSSI) No. 20]; date of expiry was extended by Resolution 3 (1996) and through Measure 2 (2000); and the Area was renamed and renumbered by Decision 1 (2002). The boundary of the Area was revised through Measure 2 (2004) to remove its marine component, and following the collapse of the ice ramp joining the island to Anvers Island. A revised Management Plan was adopted through Measure 7 (2010).

The Area is situated within Environment E – Antarctic Peninsula, Alexander and other islands based on the Environmental Domains Analysis for Antarctica and within Region 3 – Northwest Antarctic Peninsula based on the Antarctic Conservation Biogeographic Regions. Biscoe Point lies within Antarctic Specially Managed Area No.7 Southwest Anvers Island and Palmer Basin.

#### 1. Description of values to be protected

Biscoe Point (64°48'47"S, 63°47'41"W, 0.59 km<sup>2</sup>), Anvers Island, Palmer Archipelago, Antarctic Peninsula, was designated on the grounds that the “Site contains a large (approximately 5000 m<sup>2</sup>) but discontinuous stand of the two native vascular plants, Antarctic hair grass (*Deschampsia antarctica*) and, less commonly, Antarctic pearlwort (*Colobanthus quitensis*). A relatively well developed loam occurs beneath closed swards of the grass and contains a rich biota, including the apterous midge *Belgica antarctica*. Long-term research programs could be jeopardised by interference from nearby Palmer Station and from tourist ships.”

The present management plan reaffirms the exceptional ecological and scientific values associated with the rich flora and invertebrate fauna within the Area. In addition, it is noted that the first observation of *C. quitensis* growing south of 60°S was made at Biscoe Point, reported by Jean-Baptiste Charcot from the Expédition Antarctiques Française in 1903-05. The island on which Biscoe Point lies contains the most extensive communities of *D. antarctica* and *C. quitensis* in the Anvers Island vicinity, and they are of unusual abundance for this latitude. The abundance is much greater than previously described, with almost half of the island of Biscoe Point, and much of the ice-free area of the peninsula to the north, possessing significant stands of vegetation. The communities extend over a large proportion of the available ice-free ground, with a discontinuous cover of *D. antarctica*, *C. quitensis* and bryophytes and lichens of several species varying in density over an area of approximately 250,000 m<sup>2</sup>. One stand of mosses in the prominent valley on the northern side of the main island extends almost continuously for 150 m along the valley floor, covering an

area of approximately 6500 m<sup>2</sup>. Individual, near-continuous stands of *D. antarctica* and *C. quitensis* reach a similar size, both on the main island and, to a lesser extent, on the promontory to the north.

Several plant community studies were in progress when the Area was designated in 1985. Although these studies were discontinued soon after site designation, botanical research at the site has continued. For example, *D. antarctica* and *C. quitensis* seeds have been collected from Biscoe Point for plant studies examining the influence of climate change and enhanced UV-B radiation (Day, pers. comm. 1999). Biscoe Point was valuable for these studies because of the amount and quality of seeds available within the Area. Cores containing plant material and soils have been collected within the Area to investigate carbon and nitrogen fluxes within the ecosystem and to evaluate the influence of increased temperature and precipitation on the ecosystem (Park *et al.*, 2007, Day *et al.*, 2009). In addition, Biscoe Point is one of the few low-lying vegetated sites that has not yet been substantially damaged by Antarctic fur seals, and as such the Area has been identified as a potential control site for assessing Antarctic fur seal impacts on vegetation and soils in this region. While recent expansion of the gentoo penguin colony has resulted in damage to and loss of some vegetation surrounding nest sites, these are relatively small compared to the overall vegetation cover at Biscoe Point, and the vegetation values of the Area are not considered to have been significantly compromised.

Biscoe Point is also valuable for ornithological research. Research into seabird ecology and long-term monitoring studies are being conducted on Adélie (*Pygoscelis adeliae*) and gentoo (*P. papua*) penguin colonies, as well as brown (*Stercorarius lonnbergi*) and hybrid skuas (Patterson-Fraser, pers. comm. 2010). The gentoo penguin colony became established at Biscoe Point around 1992 and, as a recently founded colony, is of particular value for monitoring long-term ecological changes to the local bird population structure and dynamics (Fraser, pers. comm., 1999). The Adélie penguin colony is valuable for long-term monitoring and comparison with other colonies in Arthur Harbor that are subjected to higher levels of human influence. In this respect, the fact that the Area has been protected from significant human use, and that use allowed has been regulated by permit, for such a long period of time is of particular value. The Adélie penguin colony is one of the oldest in the southern Anvers Island region (more than 700 years), and as such is valuable for paleoecological studies. The site is also the only site in the region where brown (*S. lonnbergi*), south polar (*S. maccormicki*) and hybrid skuas are known to occur annually.

Until recently, Biscoe Point was on a peninsula joined to Anvers Island by an ice ramp extending from the adjacent glacier. The ice ramp disappeared as the glacier retreated, and a narrow channel now separates Anvers Island from the island on which Biscoe Point lies. The original boundary of the Area was of geometric shape and extended to include a separate ice-free promontory 300 m to the north of this island, and also included the intervening marine environment. The Area is now defined to include all land above the low tide water level of the main island on which Biscoe Point is situated (0.48 km<sup>2</sup>), all offshore islets and rocks within 100 m of the shore of the main island, and most of the predominantly ice-free promontory 300 m to the north (0.1 km<sup>2</sup>). The marine component is now excluded from the Area because of the lack of information on its values. The Area in total is now approximately 0.59 km<sup>2</sup>.

In summary, the Area at Biscoe Point therefore has high value for its outstanding:

- examples of vegetation communities, soils and associated terrestrial ecology;
- ornithological interest, with several of the resident breeding bird species and associated paleoecological features possessing unusual properties, and which are the subject of long-term studies; and
- utility as a reference site for comparative studies and monitoring.

In order to protect the values of the Area, it is important that visitation continues to remain low and be carefully managed.

## 2. Aims and Objectives

Management at Biscoe Point aims to:

- Avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance and sampling in the Area;

- Allow scientific research on the ecosystem and physical environment in the Area provided it is for compelling reasons which cannot be served elsewhere and that will not compromise the values for which the Area is protected;
- Allow visits for educational and outreach purposes (such as documentary reporting (visual, audio or written) or the production of educational resources or services) provided such activities are for compelling reasons that cannot be served elsewhere and will not compromise the values for which the Area is protected;
- Minimize the possibility of introduction of alien plants, animals and microbes to the Area;
- Minimize the possibility of the introduction of pathogens that may cause disease in faunal populations within the Area; and
- Allow visits for management purposes in support of the aims of the management plan.

### 3. Management activities

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

- Signs showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently, and copies of this management plan, including maps of the Area, shall be made available at Palmer Station (US) on Anvers Island and at Yelcho Station (Chile) on Doumer Island;
- Copies of this management plan shall be made available to all vessels and aircraft visiting the Area and/or operating in the vicinity of Palmer Station, and all personnel (national program staff, field expeditions, tourist expedition leaders, pilots and ship captains) operating in the vicinity of, accessing or flying over the Area, shall be informed by their national program, tour operator or appropriate national authority of the location, boundaries and restrictions applying to entry and overflight within the Area;
- National programs shall take steps to ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- Markers, signs or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer required;
- National Antarctic programs operating in the Area should maintain a record of all new markers, signs and structures erected within the Area;
- Visits shall be made as necessary (at least once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.

### 4. Period of designation

Designated for an indefinite period.

### 5. Maps and photographs

**Map 1:** ASPA No. 139 Biscoe Point, Arthur Harbor, Anvers Island, showing the location of nearby stations (Palmer Station, US; Yelcho Station, Chile; Port Lockroy Historic Site and Monument No. 61, UK), the boundary of Antarctic Specially Managed Area No. 7 Southwest Anvers Island and Palmer Basin, and the location of nearby protected areas.

Projection: Lambert Conformal Conic; Central Meridian: 64° 00' W; Standard parallels: 64° 40' S, 65° 00' S; Latitude of Origin: 66° 00' S; Spheroid and horizontal datum: WGS84; Contour interval: Land – 250 m, Marine – 200 m.

Data sources: coastline & topography SCAR Antarctic Digital Database v4.1 (2005); Bathymetry: IBCSO v.1 (2013); Protected areas: ERA (Jul 2013); Stations: COMNAP (May 2013).

Inset: the location of Anvers Island and the Palmer Archipelago in relation to the Antarctic Peninsula.

**Map 2:** ASPA No. 139 Biscoe Point – Physical features, boundaries and access guidelines.

Projection: Lambert Conformal Conic; Central Meridian: 63° 46' W; Standard parallels: 64° 48' S; 64° 50' S; Latitude of Origin: 65° 00' S; Spheroid and horizontal datum: WGS84; Vertical datum: mean sea level; Contour interval: 5 m. The coastline of the island on which Biscoe Point lies is digitized from an orthophoto (Nov 2009) estimated as accurate to  $\pm 1$  m (ERA, 2010). The peninsula to the north of Biscoe Point, several offshore islands and Anvers Island are also derived from the recent orthophoto and a georeferenced WorldView-2 image (16 Jan 2012) (Imagery © 2012 Digital Globe; NGA Commercial Imagery Program). Penguin colonies and other features: orthophoto (Nov 2009) and GPS survey (ERA 2001).

**Map 3:** ASPA No. 139 Biscoe Point – Penguin colonies, approximate vegetation extent, and known contaminated sites.

Map specifications as for Map 2. Contamination: partial survey (Feb 2001); Vegetation: estimated from air and ground photos.

## 6. Description of the Area

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

#### *General description*

Biscoe Point (64°48'47" S, 63°47'41" W) is at the western extremity of a small island (0.48 km<sup>2</sup>), located close to the southern coast of Anvers Island (2700 km<sup>2</sup>) about 6 km south of Mount William (1515 m), in the region west of the Antarctic Peninsula known as the Palmer Archipelago (Map 1). Until recently, this island was joined to Anvers Island by an ice ramp extending from the adjacent southward-flowing glacier, and many maps (now incorrectly) show Biscoe Point as lying on a peninsula. A narrow, permanent, marine channel of approximately 50 m in width now separates the island on which Biscoe Point lies from Anvers Island. This mostly ice-free island lies south-east of Biscoe Bay and to the north of Bismarck Strait. A smaller extent of mostly ice-free land about 300 m to the north remains joined as a peninsula to Anvers Island by an ice ramp.

The island on which Biscoe Point lies is approximately 1.8 km long in an east-west direction and of up to about 450 m in width (Map 2). Topography consists of a series of low-lying hills, with the main east-west oriented ridge rising to a maximum altitude of about 24 m. A small ice cap that previously rose to 12 m at the eastern end of the island no longer exists. The coastline is irregular and generally rocky, studded by offshore islets and rocks, and pitted by numerous bays. A number of the more sheltered bays harbor gentle and accessible gravel beaches. The unnamed promontory to the north is approximately 750 m in length (east-west) by 150 m wide and is of similar character, although of lower topography.

Palmer Station (US) is located 13.8 km north-west of the Area at Arthur Harbor, Yelcho Station (Chile) is located approximately 12 km to the southeast at Doumer Island, while 'Base A' (UK, Historic Site No. 61) is located at Port Lockroy, Goudier Island (off Wiencke Island) approximately 13 km to the east (Map 1).

#### *Boundaries*

The original boundary of the Area was of geometric shape to include the land associated with Biscoe Point, the separate ice-free promontory 300 m to the north, and also the intervening islands and marine environment. A recent detailed review revealed little information to substantiate special values associated with the local marine environment. The marine area is not the subject of current or planned scientific studies, nor is it being subjected to specific pressures or threats requiring management. For these reasons, the boundary was revised to exclude the marine environment. The Area is now defined to include all land above the low tide water level of the main island on which Biscoe Point is situated (0.48 km<sup>2</sup>), all offshore islets and rocks within 100 m of the shore of this main island, and most of the predominantly ice-free promontory 300 m to the north (0.1 km<sup>2</sup>) (Map 2). The landward (eastern) boundary on the northern promontory bisects the peninsula at the point where it protrudes from Anvers Island, distinguished by a small bay cutting into the glacier in the south and a

similar, although less pronounced, coastline feature in the north. The total area including the main island and the northern promontory is approximately 0.59 km<sup>2</sup>.

### *Climate*

No meteorological data are available for Biscoe Point, although data are available for Palmer Station (US), where conditions are expected to be broadly similar. Longer-term data available for Palmer Station show regional temperatures to be relatively mild because of local oceanographic conditions and because of the frequent and persistent cloud cover in the Arthur Harbor region (Lowry 1975). Annual average air temperatures recorded at Palmer Station during the period 1974 to 2012 show a distinct warming trend, although also demonstrate significant inter-annual variability. The annual average temperature for the years 2010-12 was -1.34° C. The minimum annual average temperature recorded was -4.51° C in 1980. The minimum temperature recorded over that period was -26° C (Aug 1995) and the maximum is 11.6° C (Mar 2010).

Between 1990 and 2012 the average annual precipitation was 64 cm and snowfall averaged 342 cm. Storms and precipitation at Palmer Station are frequent, with winds being persistent but generally light to moderate in strength, prevailing from the north-east. Cloud cover is frequent and extensive, often with a ceiling of less than 300 m.

These patterns are expected to be broadly similar at Biscoe Point, although the Area will have minor climatic differences as a result of local geography.

### *Geology and soils*

Specific descriptions are not available of the geology of island on which Biscoe Point lies, or of the peninsula to the north. However, the bedrock appears to be composed mainly of gabbros and adamellites of Late Cretaceous to Early Tertiary age belonging to the Andean Intrusive Suite, which dominate the composition of southeastern Anvers Island (Hooper, 1958). Gabbro is a dark, coarse-grained plutonic rock that is mineralogically similar to basalt, and which is composed mainly of calcium-rich plagioclase feldspar and pyroxene. Adamellite is a granitic rock composed of 10-50% quartz and which contains plagioclase feldspar. A fine mineral soil is present on the gentle terrain, although precise soil characteristics have yet to be described. A relatively well-developed, loamy soil is associated with the closed swards of *Deschampsia*. Cores extracted in the south of the island, close to the Adélie penguin colony, consisted of an organic horizon, overlying a sandy loam glacial drift or bedrock (Day *et al.* 2009).

### *Freshwater habitat*

A number of small seasonal streams and ponds are present on the island on which Biscoe Point lies, although they have not been scientifically described. A small pond (perhaps the largest, at approximately 30 m x 8 m) and stream occur in a valley on the southern side of the principal ridge of the island, 50 m NE of the southern small boat landing site (Map 2). The presence of a long rubber hose suggests that at one time visitors may have collected fresh water from this site. The hose was removed in 2009-10 and disposed of at Palmer Station. Another freshwater pond of similar size (approximately 25 m x 6 m) is found in the prominent east-west trending valley on the northern side of the island. A small associated stream drains this pond to the west. A series of small ponds appear present in satellite imagery (mid-Jan 2012) at the eastern end of the island, nestled in depressions where a small ice cap previously existed. The freshwater environment has thus far escaped significant disturbance from seals. Some ponds near the gentoo penguin colony are frequented by washing / bathing penguins, and as a result have become locally enriched by nutrients (Patterson-Fraser pers. comm. 2014). Information on the hydrology of the separate promontory to the north is not available.

### *Vegetation*

The most significant aspect of the vegetation at Biscoe Point is the abundance and reproductive success of the two native Antarctic flowering plants, the Antarctic hair grass *Deschampsia antarctica* and Antarctic pearlwort *Colobanthus quitensis*. The communities of *D. antarctica* and *C. quitensis* at Biscoe Point are the most extensive in the Anvers Island vicinity and are considered particularly abundant for such a southerly location (Greene and Holtom 1971; Komárková 1983, 1984; Komárková, Poncet and Poncet 1985). The first observation of *C. quitensis* growing south of 60°S was made near Biscoe Point, recorded (as *C. crassifolius*) by the biologist Turquet on Jean-Baptiste Charcot's Expédition Antarctiques Française (1903-05). More recently, seeds from both flowering plants within the Area have been collected for propagation in studies on the effects of climate change and UV-B exposure on these species being conducted out of Palmer Station (Day, pers. comm., 1999; Xiong, 2000). In January 2004, cores of plant material and soils were collected from Biscoe Point and were used in multi-year experiments into the tundra ecosystem. The cores were used in combination with precipitation and surface runoff samples to measure pools and fluxes of carbon and nitrogen within the Biscoe Point ecosystem and to evaluate the role of nitrogen inputs from the nearby penguin colony (Park *et al.*, 2007). Cores were also used in climate manipulation experiments at Palmer Station, which investigated the influence of increased temperature and precipitation on plant productivity and the abundance of the springtail *Cryptopygus* (Day *et al.*, 2009).

The abundance of *D. antarctica* and *C. quitensis* is much greater than previously described, and almost half of the island on which Biscoe Point lies, and much of the ice-free area of the peninsula to the north, possess significant stands of these species and a wide range of bryophytes and lichens. The approximate distribution of the most substantial stands of vegetation on the main island has been estimated from air and ground photography (Map 3). The distribution illustrated in Map 3 is intended as a general guide to the main areas of vegetation cover, rather than as a definitive description, and is not based on a precise ground survey. However, it does serve to indicate the scale of the vegetated communities, which comprise a discontinuous cover of varied composition and density over an area of approximately 250,000 m<sup>2</sup>. Komárková (1983) noted a discontinuous stand of *D. antarctica* and *C. quitensis* reaching approximately 5000 m<sup>2</sup> on the main island. One particularly extensive stand of mosses in the principal valley on the northern side of the main island extends almost continuously for 240 m along the valley floor, occupying an area of approximately 8000 m<sup>2</sup> (Harris, 2001). Stands of lesser extent are present elsewhere on the island and on the separate promontory 300 m to the north. Colonization has been observed occurring on recently deglaciated material.

Mosses tend to dominate on valley floors, close to streams and ponds, and in moist depressions. Mosses specifically recorded at Biscoe Point include *Bryum pseudotriquetrum* and *Sanionia uncinata* (Park *et al.*, 2007). On valley sides, mixed communities of moss and *C. quitensis* are frequent on lower north-facing slopes, with an increasing prevalence of *D. antarctica* with elevation. Mixed *D. antarctica* and *C. quitensis* communities are particularly prolific on northern slopes between 10-20 m, while *D. antarctica* tends to be more frequent on the higher exposed sites above 20 m. Mosses and lichens are frequently co-dominants or subordinate taxa. In some habitats *C. quitensis* may occur in small patches alone. Plant communities are commonly found on snow-free benches below the ridgelines on which Adélie and gentoo penguins nest (Park and Day, 2007). Patches of dead vascular plants of up to 20 m<sup>2</sup> have been observed within the Area, believed to result from the effects of desiccation, flooding and frost during some summers (Komárková, Poncet and Poncet 1985).

Unlike many other low-lying coastal sites in the region, the vegetation at Biscoe Point does not appear to have been severely affected by the recent substantial increase in numbers of Antarctic fur seals (*Arctocephalus gazella*). As such, the Area has been identified as a potential control site for assessing Antarctic fur seal impacts on vegetation and soil (Day, pers. comm., 1999). Expansion of the gentoo penguin colony has resulted in local damage to areas of vegetation where the birds are concentrated and building nests (Patterson-Fraser pers. comm. 2014). These sites are relatively small compared to the overall area of vegetation cover at Biscoe Point, and the vegetation values of the Area are not considered to have been significantly compromised as a result.

*Invertebrates, bacteria and fungi*

The apterous midge *Belgica antarctica* has been observed associated with the well-developed loam and closed swards of grass. Cores collected at Biscoe Point contained several species of microarthropod, including several species or genera of Acari, one species of Diptera and three species of Collembola. The springtail *Cryptopygus antarcticus* was the most abundant microarthropod (Day *et al.*, 2009) No further information is available on the invertebrate assemblages in the Area, although in view of the well-developed plant communities a rich invertebrate fauna might be expected. There is no information available on local bacterial or fungal communities.

### Breeding birds and mammals

At least six species of birds breed on the island on which Biscoe Point lies. An Adélie penguin (*Pygoscelis adeliae*) colony is located on the ridge of a promontory on the south side of the island, above a narrow cove on the southern coast (Map 3). Numbers at this colony have declined from around 3000 in the 1980s to around 500-600 in recent years (Table 1). A gentoo penguin (*Pygoscelis papua*) colony was discovered on slopes on the northern side of this cove, on the southern side of the main island ridge, in 1992-93 (Fraser, pers. comm., 1999) (Map 3) and gentoo numbers have increased significantly in recent years with 3197 breeding pairs in the 2012-13 season (Patterson-Fraser, pers. comm. 2010, 2014; Ducklow *et al.*, 2013) (Table 1).

**Table 1.** Numbers of breeding Adélie (*Pygoscelis adeliae*) and gentoo (*Pygoscelis papua*) penguins on the island on which Biscoe Point lies 1971-2012.

Year	<i>Pygoscelis adeliae</i>			<i>Pygoscelis papua</i>		
	Breeding pairs	Count type <sup>1</sup>	Source	Breeding pairs	Count type <sup>1</sup>	Source
1971-72	3020	N3	2	0	N3	2
1983-84	3440	C3	3	0	C3	3
1984-85	2754	N1	3	0	N1	3
1986-87	3000	N4	4			
...						
1994-95				14	N1	5
1995-96				33	N1	5
1996-97	1801	N1	5	45	N1	5
1997-98				56	N1	5
1998-99				26	N1	5
1999-2000	1665	N1	5	149	N1	5
2000-01	1335	N1	5	296	N1	5
2001-02	692	N1	5	288	N1	5
2002-03	1025	N1	5	639	N1	5
2009-10	594	N1	6	2401	N1	6
2010-11	539	N1	7	2404	N1	7
2011-12	567	N1	7	3081	N1	7
2012-13	522	N1	7	3197	N1	7

1. N = Nest, C = Chick, A = Adults; 1 = < ± 5%, 2 = ± 5-10%, 3 = ± 10-15%, 4 = ± 25-50% (classification after Woehler, 1993)
2. Müller-Schwarze and Müller-Schwarze, 1975
3. Parmelee and Parmelee, 1987
4. Poncet and Poncet 1987 (note: the number of 3500 given in Woehler (1993) appears to be in error).
5. Fraser data supplied February 2003, based on multiple published and unpublished sources.
6. Patterson-Fraser data supplied March 2010 based on census at time of peak egg presence.
7. Ducklow *et al.* 2013.

The Adélie penguin colonies are some of the oldest in the region (more than 700 years), and have been the subject of paleoecological studies (Emslie, 2001), while the gentoo penguin colony is considered particularly interesting because it has been recently established (Fraser, pers. comm., 1999). Long-term studies are being conducted on the population structure and dynamics of the penguin colonies within the Area, which make a useful comparison with other colonies in Arthur Harbor that are subjected to higher levels of human influence (Fraser, pers. comm., 1999). The pattern of a decline in the Adélie penguin breeding population at Biscoe Point and increasing gentoo penguin breeding population is consistent with recent observations of colonies at

nearby Palmer Station (Ducklow *et al.* 2013) and elsewhere in the Antarctic Peninsula region (Hinke *et al.* 2007, Carlini *et al.* 2009).

South polar skuas (*Stercorarius maccormicki*) and brown skuas (*S. lonnbergi*) breed within the Area annually, and hybrids also occur. On the island on which Biscoe Point lies, 132 pairs of south polar skuas and one pair of brown skuas were counted on 26-27 February 2001 (Harris, 2001). Concurrently, 15 pairs of south polar skuas, usually with one or two chicks, were counted on the promontory 300 m to the north. Kelp gulls (*Larus dominicanus*) and Antarctic terns (*Sterna vittata*) breed within the Area (Fraser, pers. comm., 2000), although data on numbers are not available. Information on other bird species that breed within the Area, or that transiently visit, is not available.

Small numbers of non-breeding Antarctic fur seals (*Arctocephalus gazella*) (several counted on the island in late-February 2001 – Harris, 2001), Weddell seals (*Leptonychotes weddellii*) and southern elephant seals (*Mirounga leonina*) have been observed on beaches in summer. Despite the presence of beaches and terrain suitable for haul-out, relatively few seals are typically observed within the Area. This may be a result of the observed frequent persistence of dense brash ice originating from glaciers calving from nearby Anvers Island (Fraser, pers. comm., 1999). Further information on numbers and breeding status, or on other seal species, is not available. No information is available on the local marine environment.

#### *Human activities and impact*

Human activity within the Area appears to have been minimal, but few details have been recorded. The first documented human activity in the vicinity of Biscoe Point occurred over 150 years ago, when John Biscoe, Royal Navy, entered the bay now named after him on 21 February 1832. Biscoe recorded a landing on Anvers Island, probably near Biscoe Point, to take formal possession for the United Kingdom of what he believed to be part of the mainland of Antarctica (Hattersley-Smith, 1991). The next recorded visit to Biscoe Point was in 1903-05, when Turquet made observations of *C. quitensis* at the site on the Première Expédition Antarctiques Française led by Charcot.

More recently, formal plots for plant studies were established on the island near Biscoe Point in 1982 (Komárková, 1983), although the long-term research originally planned was discontinued soon thereafter. Komárková used welding rods inserted into the soil to mark study sites. A partial survey accurately mapped the positions ( $\pm 2$  m) of 44 welding rods found in soils and vegetation during a systematic search made on the northeastern side of the island in February 2001 (Map 3) (Harris, 2001). The rods were located in an area of some of the richest vegetation on the island, and distributed over an area of at least 8000 m<sup>2</sup>. In general, they had been inserted into soil or vegetation with chemically coated ends downwards. Contaminants from the rods appeared to kill all vegetation up to 20 cm from where the rods lay. Numerous rods have been found in previous seasons, possibly numbering in the hundreds (Fraser, Patterson, Day: pers. comms., 1999-2002). Additional welding rods were found on and near the beach during the 2009-10 season, which were collected and disposed of at Palmer Station (Patterson-Fraser, pers. comm., 2010). The Area is not considered suitable as a reference site for measuring chemical contamination, because there remains uncertainty over contaminant types and concentrations, which sites have been affected, and the extent to which contaminants may have moved through soil, water and biological systems.

Fraser (pers. comm., 2001) also reported markers made of lead present in the gentoo penguin colony. In addition, seaborne litter (mostly wood) may be found on beaches. A rubber hose (15 m long, ~15 cm diameter) was removed from a small valley near the southern small boat landing site in 2009-10.

Recent scientific studies within the Area have focused on monitoring the breeding status of penguins and skuas. The Area has also been used for the collection of seeds of *Deschampsia* and *Colobanthus* and cores of soil and plant material for ecological research in the Palmer Station region. Permits have been required to visit the Area since the site was specially protected in 1985.

#### *6(ii) Access to the Area*



Access to the Area may be made by small boat, by aircraft or across sea ice by vehicle or on foot. Particular routes have not been designated for small boat access to the Area. Overflight, preferred helicopter access routes and aircraft landing restrictions apply within the Area, the specific conditions for which are set out in Section 7(ii) below. The designated Helicopter Access Zone that applies around the Area is described in Section 6(v) and 7(ii) below.

The seasonal cycle of sea ice formation in the Palmer area is highly variable, with sea ice formation beginning between March and May. For the period 1979 to 2004, the seasonal duration of sea ice in the Palmer area varied between five and 12 months (Stammerjohn *et al.*, 2008). Dense brash ice is frequently found in the vicinity of the island and originates from calving glaciers on Anvers Island, which may impede small boat access.

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

No structures or instruments are known to be present within the Area. A permanent survey marker, consisting of a 5/8" stainless steel threaded rod, was installed on the island on which Biscoe Point lies by the USGS on 31 January 1999. The marker, named BIS1, is located at 64°48'40.12"S, 63°46'26.42"W at an elevation of 23 m (Maps 2 & 3). It is sited approximately midway along the principal ridgeline of the island, about 100 m north of the southern small boat landing site. The marker is set in bedrock and marked by a red plastic survey cap.

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

The nearest protected areas to Biscoe Point are: Litchfield Island (ASPA No. 113) which is 16 km west of the Area in Arthur Harbor; South Bay (ASPA No. 146), which is approximately 12 km to the southeast at Doumer Island (Map 1).

*6(v) Special zones within the Area*

An Helicopter Access Zone (Maps 2 and 3) has been defined within the Management Plan for Antarctic Specially Managed Area No. 7, which applies to aircraft accessing the designated landing sites within the Area. The Helicopter Access Zone extends in northwesterly and northeasterly directions from the designated landing sites out to a distance of 2000 feet (610 m) from the edges of known bird colony breeding locations within the Area.

**7. Permit conditions**

*7(i) General permit conditions*

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit to enter the Area are that:

- It is issued for scientific research, and in particular for research on the terrestrial ecosystem and fauna in the Area;
- It is issued for compelling educational or outreach reasons that cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted will not jeopardize the ecological, scientific, or educational values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the 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 Permit shall be issued for a finite period;

- the Permit, or a copy, shall be carried when in the Area.

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

Access to the Area shall be by small boat, by aircraft, or over sea ice by vehicle or on foot. When access over sea ice is viable, there are no special restrictions on the locations where vehicle or foot access may be made, although vehicles are prohibited from being taken on land.

*Foot access and movement within the Area*

Movement on land within the Area shall be on foot. All people in aircraft, boats, or vehicles are prohibited from moving on foot beyond the immediate vicinity of their landing or access site unless specifically authorised by Permit.

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

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

Visitors should move carefully so as to minimize disturbance to flora, fauna, soils, and water bodies. Pedestrians should walk on snow or rocky terrain if practical, but taking care not to damage lichens. Pedestrians should walk around the penguin colonies and should not enter sub-groups of nesting penguins unless required for research or management purposes. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

*Small boat access*

The recommended landing sites for small boats are at either of the following locations (Maps 2 & 3):

- 1) on the beach on the northern shore of the elongated cove on the southern coast of the island, which is the site most likely to be free of sea ice;
- 2) on the beach in the small cove mid-way along the northern coast of the island, adjacent to the designated camp and helicopter landing sites.

Access by small boat at other locations around the coast is allowed, provided this is consistent with the purposes for which a Permit has been granted.

*Aircraft access and overflight*

Restrictions on aircraft operations apply during the period between 01 October and 15 April inclusive, when aircraft shall operate and land within the Area according to strict observance of the following conditions:

- 1) Overflight of the Area below 2000 ft (~610 m) is prohibited outside of the Helicopter Access Zone (Map 2), except when specifically permitted for purposes allowed for by the Management Plan. It is recommended that aircraft maintain a 2000 ft (~610 m) horizontal separation distance from the edges of bird colonies breeding within the Area as shown in Map 2, unless accessing the designated landing sites through the Helicopter Access Zone;
- 2) Helicopter landing is permitted at two designated sites (Map 2), the first (A) on the main island on which Biscoe Point lies, and the second (B) on the separate promontory 300 m further to the north. The landing sites with their coordinates are described as follows:
  - (A) 64°48.59' S, 63°46.82' W – on beach gravels a few meters above sea level 35 m east of the beach on the eastern shore of a small cove on the northern coast of the island. A small tidal pool of about 25

m in diameter is located 30 m east of the landing site; and

(B) 64°48.37' S, 63°46.40' W – on the lower (western) slopes of a ridge, which may be snow-covered, extending from Anvers Island towards the northern promontory. Care should be exercised on snow slopes extending east and up-slope on Anvers Island, which are likely to be crevassed .

- 3) Aircraft landing within the Area should approach within the Helicopter Access Zone to the maximum extent practicable. The Helicopter Access Zone allows access from the north and west, from the region of Biscoe Bay, to landing site (A), and from the north and east to landing site (B) (Map 2). The Helicopter Access Zone extends over the open water between landing sites (A) and (B).
- 4) Use of smoke grenades to indicate wind direction is prohibited within the Area unless absolutely necessary for safety, and any grenades used should be retrieved.

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

- Scientific research that will not jeopardize the ecosystem or values of the Area;
- Activities with educational and / or outreach purposes that cannot be served elsewhere;
- Essential management activities, including monitoring and inspection.

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

- No structures are to be erected within the Area except as specified in a permit and, with the exception of permanent survey markers and signs, permanent structures or installations are prohibited;
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator, year of installation and date of expected removal. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination or damage to the values of the Area;
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to flora and fauna, preferably avoiding the main breeding season (01 Oct – 31 Mar);
- Removal of specific structures / equipment for which the permit has expired shall be the responsibility of the authority which granted the original Permit, and shall be a condition of the permit.

*7(v) Location of field camps*

Temporary camping is allowed within the Area at the designated site located approximately 50 m north-east of helicopter landing site (A), on the northern coast of the main island on which Biscoe Point lies. The camp site is located on beach gravels and rocky ground a few meters above sea level, immediately north of a transient tidal pool, and is separated from the sea further to the north by a low rocky ridge of about 8 m. When necessary for essential purposes specified in the Permit, temporary camping is allowed on the separate peninsula 300 m to the north, although a specific camping site has not been determined. Camping on surfaces with significant vegetation cover is prohibited.

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

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

- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);

- Visitors shall ensure that sampling equipment and markers brought into the Area are clean. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including backpacks, carry-bags and other equipment) shall be thoroughly cleaned before entering the Area. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (CEP 2011), and in the Environmental Code of Conduct for terrestrial scientific field research in Antarctica (SCAR 2009);
- All poultry brought into and not consumed or used within the Area, including all parts, products and / or wastes of poultry, shall be removed from the Area or disposed of by incineration or equivalent means that eliminates risks to native flora and fauna;
- No herbicides or pesticides shall be brought into the Area;
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted;
- Fuel, food, chemicals and other materials are not to be stored in the Area, unless specifically authorized by permit and shall be stored and handled in a way that minimizes the risk of their accidental introduction into the environment;
- All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of their introduction into the environment is minimized;
- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

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

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

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

- Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs. This includes biological samples and rock specimens.
- Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed from any part of the Area, unless the impact of removal is likely to be greater than leaving the material *in situ*. If this is the case the appropriate authority should be notified.
- The appropriate national authority should be notified of any items removed from the Area that were not introduced by the permit holder.

*7(ix) Disposal of waste*

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

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

Permits may be granted to enter the Area to:

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

- 3) carry out protective measures;
- 4) carry out research or management in a manner that avoids interference with long-term research and monitoring activities or possible duplication of effort. Persons planning new projects within the Area should consult with established programs working within the Area, such as those of the US, before initiating the work.

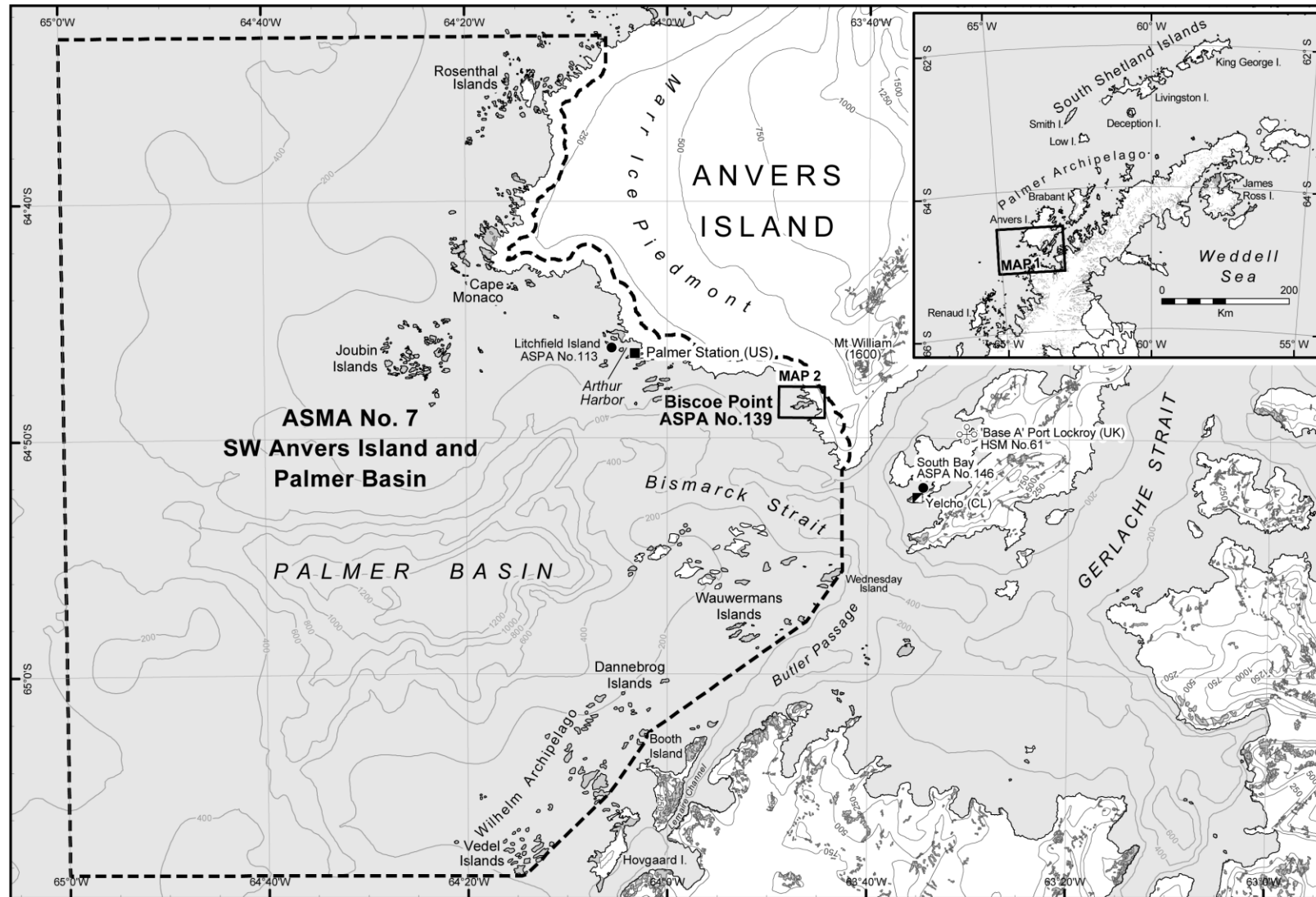
#### 7(xi) Requirements for reports

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

### 8. Supporting documentation

- Baker, K.S. 1996. Palmer LTER: Palmer Station air temperature 1974 to 1996. *Antarctic Journal of the United States* **31** (2): 162-64.
- Carlini, AR, NR Coria, MM Santos, J Negrete, M a. Juares, and G a. Daneri. 2009. Responses of *Pygoscelis adeliae* and *P. papua* populations to environmental changes at Isla 25 de Mayo (King George Island). *Polar Biology* **32** (10) (May 16): 1427–33.
- Day, T.A., Ruhland, C.T., Strauss, S., Park, J-H., Krieg, M.L., Krna, M.A., and Bryant, D.M. 2009. Response of plants and the dominant microarthropod *Cryptopygus antarcticus*, to warming and contrasting precipitation regimes in Antarctic tundra. *Global Change Biology* **15**: 1640-1651.
- Ducklow, H.W., W.R. Fraser, M.P. Meredith, S.E. Stammerjohn, S.C. Doney, D.G. Martinson, S.F. Saille, O.M. Schofield, D.K. Steinberg, H.J. Venables, and Amsler, C.D. 2013. West Antarctic Peninsula: An ice-dependent coastal marine ecosystem in transition. *Oceanography* **26**(3):190–203.
- Emslie, S.D., Fraser, W., Smith, R.C. and Walker, W. 1998. Abandoned penguin colonies and environmental change in the Palmer Station area, Anvers Island, Antarctic Peninsula. *Antarctic Science* **10**(3): 257-268.
- Emslie, S.D. 2001. Radiocarbon dates from abandoned penguin colonies in the Antarctic Peninsula region. *Antarctic Science* **13**(3):289-295.
- ERA. 2010. Biscoe Point Orthophoto 2010. Digital orthophotograph of Biscoe Point and adjacent areas of coast on Anvers Island. Ground pixel resolution 8 cm and horizontal / vertical accuracy of  $\pm 1$  m. MSL heights, 5 m<sup>2</sup> DTM. Aerial photography acquired by BAS on 29 Nov 2009 BAS/4/10. Unpublished data, Environmental Research & Assessment, Cambridge.
- Greene, D.M. and Holtom, A. 1971. Studies in *Colobanthus quitensis* (Kunth) Bartl. and *Deschampsia antarctica* Desv.: III. Distribution, habitats and performance in the Antarctic botanical zone. *British Antarctic Survey Bulletin* **26**: 1-29.
- Harris, C.M. 2001. Revision of management plans for Antarctic protected areas originally proposed by the United States of America and the United Kingdom: Field visit report. Internal report for the National Science Foundation, US, and the Foreign and Commonwealth Office, UK. Environmental Research & Assessment, Cambridge.
- Hattersley-Smith, M.A. 1991. The history of place-names in the British Antarctic Territory. *British Antarctic Survey Scientific Reports* **113** (Part 1).
- Hinke, JT, K Salwicka, SG Trivelpiece, GM Watters, and WZ Trivelpiece. 2007. Divergent responses of *Pygoscelis* penguins reveal a common environmental driver. *Oecologia* **153** (4) (October): 845–55.
- Hooper, P.R. 1958. Progress report on the geology of Anvers Island. Unpublished report, British Antarctic Survey Archives Ref AD6/2/1957/G3.
- Hooper, P.R. 1962. The petrology of Anvers Island and adjacent islands. *FIDS Scientific Reports* **34**.
- Komárková, V. 1983. Plant communities of the Antarctic Peninsula near Palmer Station. *Antarctic Journal of the United States* **18**: 216-218.

- Komárková, V. 1984. Studies of plant communities of the Antarctic Peninsula near Palmer Station. *Antarctic Journal of the United States* **19**: 180-182.
- Komárková, V, Poncet, S and Poncet, J. 1985. Two native Antarctic vascular plants, *Deschampsia antarctica* and *Colobanthus quitensis*: a new southernmost locality and other localities in the Antarctic Peninsula area. *Arctic and Alpine Research* **17**(4): 401-416.
- Müller-Schwarze, C. and Müller-Schwarze, D. 1975. A survey of twenty-four rookeries of pygoscelid penguins in the Antarctic Peninsula region. In *The biology of penguins*, Stonehouse, B. (ed). Macmillan Press, London.
- National Science Foundation, Office of Polar Programs, 1999. Palmer Station. OPP World Wide Web site address <http://www.nsf.gov/od/opp/support/palmerst.htm>
- Park, J-H. and Day, T.A. 2007. Temperature response of CO<sub>2</sub> exchange and dissolved organic carbon release in a maritime Antarctic tundra ecosystem. *Polar Biology* **30**: 1535–1544. DOI 10.1007/s00300-007-0314-y.
- Park, J-H., Day, T.A., Strauss, S., and Ruhland, C.T. 2007. Biogeochemical pools and fluxes of carbon and nitrogen in a maritime tundra near penguin colonies along the Antarctic Peninsula. *Polar Biology* **30**:199–207.
- Parmelee, D.F. and Parmelee, J.M. 1987. Revised penguin numbers and distribution for Anvers Island, Antarctica. *British Antarctic Survey Bulletin* **76**: 65-73.
- Poncet, S. and Poncet, J. 1987. Censuses of penguin populations of the Antarctic Peninsula, 1983-87. *British Antarctic Survey Bulletin* **77**: 109-129.
- Rundle, A.S. 1968. Snow accumulation and ice movement on the Anvers Island ice cap, Antarctica: a study of mass balance. *Proceedings of the ISAGE Symposium, Hanover, USA, 3-7 September, 1968*: 377-390.
- Sanchez, R. and Fraser, W. 2001. *Biscoe Point Orthobase*. Digital orthophotograph of island on which Biscoe Point lies, 6 cm pixel resolution and horizontal / vertical accuracy of  $\pm 2$  m. Geoid heights, 3 m<sup>2</sup> DTM, derived contour interval: 2 m. Data on CD-ROM and accompanied by USGS Open File Report 99-402 "GPS and GIS-based data collection and image mapping in the Antarctic Peninsula". Science and Applications Center, Mapping Applications Center. Reston, USGS.
- Smith, R.I.L. 1996. Terrestrial and freshwater biotic components of the western Antarctic Peninsula. In Ross, R.M., Hofmann, E.E and Quetin, L.B. (eds). Foundations for ecological research west of the Antarctic Peninsula. *Antarctic Research Series* **70**: 15-59.
- Smith, R.I.L. and Corner, R.W.M. 1973. Vegetation of the Arthur Harbour – Argentine Islands region of the Antarctic Peninsula. *British Antarctic Survey Bulletin* **33 & 34**: 89-122.
- Stammerjohn, S.E., Martinson, D.G., Smith, R.C. and Iannuzzi, R.A. 2008. Sea ice in the western Antarctic Peninsula region: Spatio-temporal variability from ecological and climate change perspectives. *Deep-Sea Research II* **55**: 2041– 2058.
- Woehler, E.J. (ed) 1993. *The distribution and abundance of Antarctic and sub-Antarctic penguins*. SCAR, Cambridge.
- Xiong, F.S., Mueller, E.C. and Day, T.A. 2000. Photosynthetic and respiratory acclimation and growth response of Antarctic vascular plants to contrasting temperature regimes. *American Journal of Botany* **87**: 700-710.



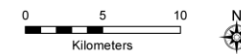
**Map 1: ASPA No. 139 Biscoe Point, Anvers Island**

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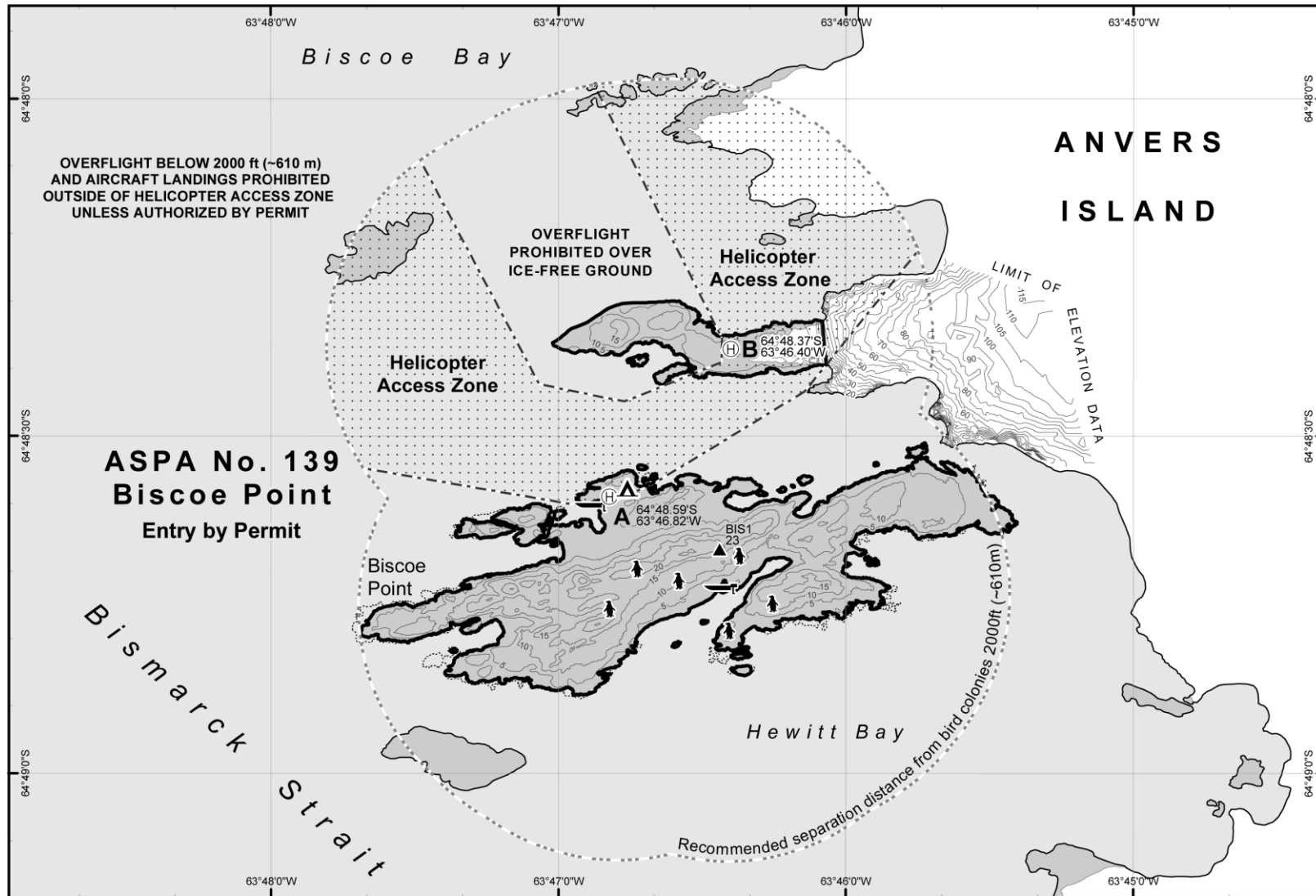


- Coastline
- Contour (250 m)
- Isobath (200 m)
- Ice free ground
- Permanent ice
- Ocean
- Antarctic Specially Managed Area (ASMA) boundary
- Antarctic Specially Protected Area (ASPA)

- Station (year round)
- Station (seasonal)
- Historic Site & Monument (HSM)



Projection: Lambert Conic Conformal  
Spheroid and horizontal datum: WGS 84;  
Data sources: Bathymetry: IBCSO v.1 (2013) (<http://www.ibcso.org>);  
Topography: SCAR ADD v4.1 SQ19-20 (2005);  
Protected areas: ERA (Jul 2013); Stations: COMNAP (May 2013).

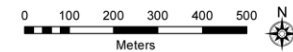


Map 2: ASPA No. 139 Biscoe Point - Physical features, boundaries and access guidelines

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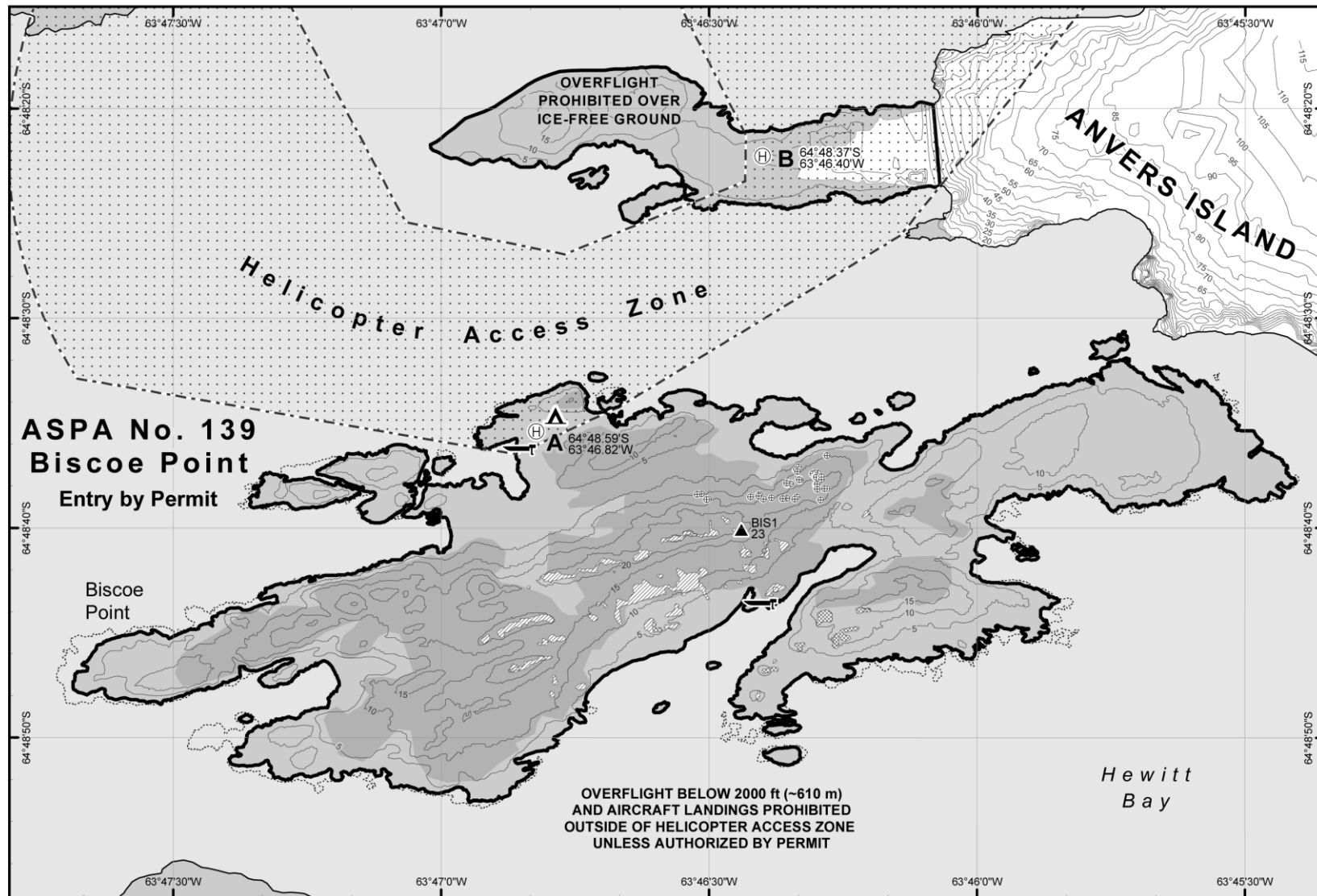


- Contour (5 m)
- Coastline
- ⋯ Offshore rock
- Ice free ground
- Permanent ice
- Ocean
- ▭ ASPA boundary
- ⋯ Recommended separation distance
- ▲ Penguin colony (approx.)
- ⊞ Helicopter Access Zone
- ⊞ Helicopter landing site
- ⊞ Small boat landing site
- ▲ Designated camp site
- ▲ Survey control (monumented)



Projection: Lambert Conic Conformal,  
 Spheroid and horizontal datum: WGS 84;  
 Data sources: Coastline: USGS orthophoto  
 (2001), ERA orthophoto (Nov 2009)  
 and georeferenced WV-2 image (© Jan 2012  
 Digital Globe; NSA Commercial Imagery Program);  
 Penguin colonies & other features: Orthophoto  
 (Nov 2009) & GPS survey (ERA 2001).



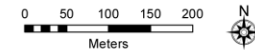


**Map 3: ASPA No. 139 Biscoe Point - Penguin colonies, approximate vegetation extent and known contaminated sites**

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- |               |                 |   |                         |                             |
|---------------|-----------------|---|-------------------------|-----------------------------|
| Contour (5 m) | Ice free ground | ASPA boundary                           | Helicopter Access Zone  | Designated camp site        |
| Coastline     | Permanent ice   | <i>Pygoscelis adeliae</i> (Nov 2009)    | Helicopter landing site | Survey control (monumented) |
| Offshore rock | Ocean           | <i>Pygoscelis papua</i> (Nov 2009)      | Small boat landing site | Contaminated site           |
|               |                 | Principal areas of vegetation (approx.) |                         |                             |



Projection: Lambert Conic Conformal,  
Spheroid and horizontal datum: WGS 84;  
Data sources: Coastline: USGS orthophoto  
(2001), ERA orthophoto (Nov 2009);  
Contamination: partial survey (Feb 2001);  
Penguin colonies & other features: Orthophoto  
(Nov 2009) & GPS survey (ERA 2001);  
Vegetation: estimated from air and ground photos.