Management Plan

for Antarctic Specially Protected Area No. 133 HARMONY POINT, NELSON ISLAND, SOUTH SHETLAND ISLANDS

Introduction

This Area was originally designated as Site of Special Scientific Interest No. 14 under ATCM Recommendation XIII-8 (1985), following a proposal by Argentina, considering that the Area constitutes an excellent example of bird communities and terrestrial ecosystems of the maritime Antarctic in the South Shetland Islands region, and allows for long-term research without damage or interference.

In 1997, the Management Plan was adapted to the requirements of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty, and approved by Measure 3 (1997). A second revised Management Plan was approved through Measure 2 (2005). The latest version constitutes the revision of the Management Plan approved by Measure 7 (2012) and was the third revision since the entry into force of Annex V.

The original reasons for its designation are still valid and in recent years further reasons have made it even more significant. One of the central issues relates to the problems and threats associated with human activities. Based on global drivers (climate change, changes in ocean conditions, etc.), it has been established that the northern area of the Antarctic Peninsula where ASPA 133 is located is suffering the consequences of these drivers, showing glacier retreat, sea ice loss, ocean acidification and warming, among others (Morley *et al*. 2020). Anthropic disturbance could endanger the long-term studies carried out there, especially at times that coincide with the reproductive periods of the fauna in the area. The main global drivers are tourism, pollution, and the risks of introducing non-native species (Morley *et al*. 2020). The presence of man-made debris in ASPA No. 133 has recently been assessed, having found mainly plastics and other waste (Finger *et al*. 2021).

Currently, there is a need to increase the volume of studies related to the numbers and reproduction of seabirds and mammals, since they have the potential to be used as ecological indicators of processes on a global scale and of the environmental quality of ecosystems (Costa *et al*., 2019; Croxall *et al*., 1998). In this regard, the geographical location of ASPA No. 133 is crucial for this type of study and other comparative studies between its fauna and that of other Antarctic areas. Climatic and oceanographic variability have been shown to have effects on seabird populations, generally with profound consequences, such as reduced breeding success and alterations in the mating cycles of some species (Chambers *et al*. 2011; Krüger *et al*., 2018; Warwick-Evans *et al*., 2021). The Antarctic Peninsula region is one of the places on the planet where the greatest effects of global climate change have been observed, notably the direct impact on the formation and duration of sea ice and the consequent effects on the entire food chain (Morley *et al*., 2020; Turner *et al*., 2009). Recent studies indicate that the drivers of change in ocean ecosystems are causing, in the western region of the Antarctic Peninsula, increased temperatures, the loss of sea ice and increased potential for invasion by other species, among other impacts (Morley *et al*., 2020). Some authors point out that the region of Harmony Point has undergone some of the greatest changes. Stability in the positive phase of the SAM (Southern Annular Mode) has had an impact on winds, water movement and the extent of sea ice (Stammerjohn *et al*., 2008; Thompson and Solomon, 2002), and has repercussions for Antarctic flora and fauna.

In this context, ASPA No. 133 is an area that has suffered little disturbance, which allows comparative studies with populations that inhabit areas of frequent human disturbance (accumulation of refuse, pollution, tourism and fishing; Woehler *et al*., 2001, Patterson *et al*., 2008). In recent years, the numbers of several stocks that inhabit the ASPA, have remained stable, as is the case of giant petrels, although the current size of the stock shows much lower values than previous decades (Krüger, 2019). It is also important to study in the ASPA the impacts of processes such as the increase in temperature, which has direct consequences in the increase of ice-free areas and the resulting formation of soils that are important in the dynamics of the area and the formation of bodies of water.

Its designation as an ASPA ensures that current long-term research programmes will not be adversely affected by accidental human interference, destruction of vegetation and soil, pollution of bodies of water, and disturbance of birds, especially in seasons coinciding with breeding periods. Among the scientific investigations carried out in ASPA No. 133 are the research activities carried out by Chile in the Area, including the projects "Marine Protected Areas: Monitoring of oceanographic conditions, top predators and benthic habitats in the western Antarctic Peninsula", by researchers from the Chilean Antarctic Institute, and "Molecular Migration Route of Emerging Viruses: The role of *Chionis albus* as a reservoir in the transport of viruses with zoonotic risk to the southern cone", led by researchers from the University of Chile.

1. Description of values to be protected

The values to be protected in the Area continue to be associated with the composition and biological diversity of this site. Harmony Point is a promontory with an ice-free area located on the west coast of Nelson Island in the South Shetland Islands. It has an undulating topography that rises to 40 metres above sea level, with numerous streams and abundant vegetation. The closest permanent scientific station is Great Wall (CHN), a year-round facility with capacity for 40 people located on King George Island, 16 km northeast of Harmony Point (COMNAP, Antarctic facilities).

The ice-free areas are home to important breeding colonies of 12 species of birds, including one of the largest colonies of chinstrap penguins (*Pygoscelis antarctica*) in Antarctica (Silva *et al.*, 1998). There is also a large colony of giant petrels *(Macronectes giganteus*), a species that is highly sensitive to human disturbance, and a large colony of gentoo penguins (*Pygoscelis papua*). The importance of the ASPA for birds is proved by the fact that it has been designated Important Bird Area (IBA ANT) No 049.

The Area has abundant vegetation, developed on various types of soils, particularly characterised by the presence of extensive moss carpets, as well as lichens and fungi. The presence of two species of vascular plants, *Deschampsia antarctica* and *Colobanthus quitensis* has also been reported in the Area (Harris *et al.*, 2015): while the former is more abundant and broadly distributed, the latter, according to some authors, is not found on the island (Rodrígues *et al.*, 2019). Taking into account that vegetation is an important factor in soil formation, protection of the Area ensures the possibility to conduct research related to the soils and flora present in the area.

Although Antarctica is considered one of the few uncontaminated areas of our planet because it is relatively isolated and distant from large industrial and urban centres, there is evidence of an excessive presence of pollutants in the north of the peninsula in the recent detection of substances associated with human activity in places that should be considered intact (Olalla *et al.*, 2020).

For all the above reasons, its particular geographical location in the Northwest of the Antarctic peninsula gives this ASPA and the numerous scientific research programmes that are developed in the area a crucial importance in order to explain, at least partially, alterations in the Antarctic ecosystems as a result of climate change and/or human disturbance.

According to Morgan *et al.* (2007) ASPA No. 133 represents the environmental domain "Environment Domain E – Antarctic Peninsula and Alexander Island Main Ice Fields" and, according to Terauds *et al.* (2012) the area is in the "Northwest of the Antarctic Peninsula" biogeographic region. Additionally, according to the "Important Bird Areas in Antarctica 2015" (Harris *et al.* 2015), Harmony Point, Nelson Island, constitutes IBA ANT049.

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2. Aims and objectives

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

3. Management activities

The following management activities will be carried out to protect the values of the area:

- Personnel authorised to enter the ASPA will be instructed on the particular conditions of the Management Plan.
- Collection of samples will be limited to the minimum required for approved scientific research plans.
- All signs, as well as other structures constructed in the Area for scientific or management purposes, must be adequately secured and maintained in good condition.
- Given the presence of important colonies of seabirds adjacent to the areas travelled by scientists and support staff, trails leading to research sites may be marked to limit circulation to such trails, preferably those previously travelled or marked.
- Movement will be restricted to sectors without vegetation, avoiding proximity to fauna except when the scientific projects so require and if the corresponding harmful interference permits have been obtained.
- Distances from fauna must be respected, except when the scientific projects require otherwise and providing the relevant permits have been issued.

- In accordance with the requirements of Annex III to the Protocol on Environmental Protection to the Antarctic Treaty, any equipment or material abandoned or no longer used must be removed providing its removal does not adversely affect the environment.
- All those responsible for aircraft operating in the area must be informed of the location, limits and restrictions that apply to entry and overflight of the area.
- Preventive measures will be implemented to avoid the introduction of non-native species
- In accordance with Resolution 5 (2019), all researchers visiting the ASPA will be reminded of the prohibition on using personal care products that contain plastic microbeads.
- The Management Plan must be reviewed not less than once every five years and updated if necessary.
- The necessary visits will be made (at least once every five years) to determine whether the Area continues to serve the purposes for which it was designated and to ensure that management and maintenance measures are adequate.

National Antarctic programmes operating in the region must consult with each other to ensure the implementation of the above provisions.

4. Period of designation

Designation is for an indefinite period.

5. Maps

The following maps are included as Annexes at the end of the Management Plan:

- Map 1: General location of Nelson Island and ASPA No. 133 in the Northern Region of the Antarctic Peninsula.
- Map 2: General location of ASPA No. 133 on Nelson Island.
- Map 3: Specific location of ASPA No. 133 on Nelson Island.
- Map 4: Gurruchaga Shelter Area (ARG) in Harmony Point
- Map 5: Finger Point Area.

6. Description of the Area

6(i) Geographical coordinates and boundaries

The Area is located on the west coast of Nelson Island (62°18'S; 59°14'W), between King George Island, to the northeast, and Robert Island, to the southwest, and includes Harmony Point and Finger Point, the ice-covered sector and the adjacent maritime area, as shown on Map 3.

6(ii) Natural features

From a geomorphological point of view, Harmony Point presents three well-defined units: an andesitic plateau, coastal and platform outcrops, and paleo-beaches. The plateau reaches 40 metres above sea level and is covered by debris resulting from the action of erosive agents on andesite rocks, with extensive development of lichen and moss communities. There are three successive levels of elevated paleo-beaches between the coast and the glacier. The paleo-beaches are defined by accumulations of boulders of variable height in some cases, and soil development in another. Temporary lagoons and small streams are observed in the irregularities of the terrain. Isolated andesite rocks and ancient nunataks can be seen beyond the limits of the glacier, which shows that the glacier covered Harmony Point in the past.

Weather

Long-term meteorological data is not available for the site since there is no permanent weather station installed. Due to its location in the South Shetland Islands, we can say that the area has the cold oceanic climate characteristic of maritime Antarctica, with frequent summer rains and a moderate thermal amplitude, and a cold and humid morphoclimatic system of a cryoval nature. These climate parameters facilitate the occurrence of periglacial processes and the presence of an active layer that is usually saturated in summer.

There is no weather station at the site, but Rodrigues *et al.* (2019) point out that the nearest station is 17 km to the north on the Fildes Peninsula. The average annual temperature there is -1.6 °C and the average annual rainfall is 630 mm. These authors indicate that a well drilled in 1985 in the polar cap of Nelson Island revealed a temperature of -1.5 °C at a depth of 10 m, which would be close to the average annual air temperature at that time (Ren, 1990). Pervasive permafrost at elevations above 26 m may imply a colder climate in ice-free areas. Records indicate that the abundance of ventifacts in rock outcrops suggests that wind is an important geomorphic agent on the island.

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

One of the effects of climate change observed in ASPA No. 133 is the increased surface of the lakes associated with the melting of glaciers. Marginal ice lakes, which are part of the paraglacial system, can occur in direct contact with a glacier front and can be dammed by recession moraines. Furthermore, it has been suggested that glaciofluvial channels feed these marginal lakes. According to Shridhar *et al*. (2015), proglacial lakes serve as an indicator of local climate change through modified hydrological flow regimes and trapped sediments.

Da Rosa *et al*. (2021) studied the expansion of these lakes on King George Island and Nelson Island between 1986 and 2020. They found that both lakes with marginal ice (lakes in contact with glaciers) and those not in contact with glaciers have been expanding since 1986 in the coastal environments of both islands. The results show that the lakes experienced an area increase of 732% (from 0.18 km^2 to 1.39 km^2) between 1986 and 2020. Most lake expansions occurred at glacial fronts and can be attributed to the melting of glacial fronts and subsequent glacial retreat.

The authors have determined that from 1989 to 2020, Nelson Island showed a glacial area loss of 12 km^2, 8.4% of the total area in 1989. Marine glaciers have retreated in recent decades, some have changed their calving fronts to glaciers ending in lakes, and there are new ice-free land areas and marginal ice lakes. During the periods of 1989–2003 and 2003–2020, there was an increase in lake area of 0.103 km^2 (an increase by 190% of the total area from 0.054 in 1989), and 0.135 km^2 (86% of the total area of 0.157 in 2003), respectively.

Geology and Soils

The geology of Nelson Island, according to Manfroi *et al*. (2015), as in other South Shetland Islands, consists mainly of andesitic and intrusive lavas, with some thin layers of volcanoclastic sediments. Fildes Strait separates southern Nelson Island from King George Island, where other Upper Cretaceous rock layers are exposed. Paleontological studies have shown that the fossil-bearing levels are restricted to the northeastern part of the island and occur in an isolated outcrop at Rip Point, on the coast of Fildes Strait, approximately 1.0 km north of Brazil's Crulls Hut (62°14'19" S; 58°59'0" W).

Nelson Island has an ice cap that is a remnant of a larger ice cap that once covered the entire southern Shetland Islands. It is geologically composed of an andesite core surrounded by pillow lavas, tuffs and agglomerates (Smellie *et al*., 1984). Nelson Island was extensively glaciated during the Last Glacial Maximum, around 16 kyr B.P. The island has been subject to postglacial cryoplanation, resulting in successive uplifted marine terraces, separated by scarps, and felsenmeers on cores of strong rock (mainly igneous andesites).

In regards to the area's geology, according to Smellie *et al*. (1984), the Harmony Point area is dominated by basaltic lavas with a thickness that varies between 4 and 20 m (Figure 1). According to these authors, the most common clastic rocks are non-stratified fine to coarse grained lapillistones. Thin-bedded volcanic mudstones and fine volcanic sandstones occur locally at Harmony Point. At this location they form beds that are 0.5–20 cm thick (including a 1 cm thick coal seam) that are locally disrupted and show cross-bedding, washout structures and normal grading.

Rodrigues *et al*. (2019) mention that Nelson Island has a total area of 165 km^2 with only 5% (8 km^2) of the island being ice-free. The authors mention that the soils and landforms on Nelson Island remain some of the least studied in the South Shetland archipelago, despite the fact that it is one of the oldest ice-free areas and is highly vegetated. The soils of Harmony Point vary according to the interaction between the terrain, the parent material and the vegetation. The soils are mostly shallow, rocky and cryoturbid, both dystrophic and eutrophic (*op. cit*.).

These same authors determined that the presence of continuous permafrost below 30 cm in soils above 26 m of elevation proves the importance of cryopedogenesis in soil formation in this area. Soils with humic (umbric) A horizons are very common, indicating long-term stabilisation and humification of organic matter. Chemical weathering is effective on the ground and at the umbric horizon, due to landscape stability and plant cover. Furthermore, ornithogenesis and the formation of umbric horizons is widespread, corroborating the importance of phosphatisation as a soil-forming process in this part of Antarctica, which occurs in no other areas of Maritime Antarctica and East Antarctica (*op. cit*.).

In relation to the processes of cryoturbation and phosphatisation, both are key processes for soil formation at Harmony Point, and well-developed ornithogenic soils with a high degree of weathering and clay-enriched phosphate B horizons are common. On the other hand, soils without bird activity are coarse-grained and contain primary minerals even in the clay fraction, revealing poor chemical weathering, despite active physical weathering (Rodrigues *et al*. 2019).

The main pedogenetic processes observed in this area are marked phosphating, melanisation due to the accumulation of organic matter, and cryoturbation. Soil development varies from poorly developed, shallow, stony, cryoturbated soils to well-developed, organic-rich phosphate soils with colours ranging from grey to brown. The mineralogical composition of the clay fraction contains secondary minerals, indicating the active role of chemical weathering. Ornithogenic soils have mature phosphate minerals such as vivianite and taranakite, as well as poorly crystalline leucophosphite. Intensively cryoturbated soils are underlain by permafrost and are classified as typical haploturbels; polygonal soils are widespread on the cryoplanated plateau. Phosphatisation is a dominant soil-forming process in this area and is associated with past and present guano accumulation by nesting birds and has led to the development of deeper ornithogenic haplorthels. Ornithogenic soils occur at different topographic levels on the cryoplanated platform and marine terraces. High P concentrations can be used as an indicator of past nesting bird activities, with far-reaching implications, especially with regard to plant growth and microbial activity and diversity (Rodrigues *et al*. 2019).

According to Rodrigues *et al*. (2019) two landscape domains are recognised in Harmony Point, the coastal and upper platforms, with their respective landscape units (Figure 2). The coastal landscape occurs between sea level and the slope that limits the higher elevated marine terrace. Above that, extending inland to the edge of the glacier and the paraglacial area, are the upper platforms (cryoplanated surface and felsenmeers) (*op cit.*). The coastal domain is made up of rocky cliffs, the current sand and gravel beaches, raised marine terraces and volcanic piles, which form resistant intrusive bodies (microgabbros) or dikes of basaltic lava.

Regarding the soils, Rodrigues *et al*. (2019) indicate that its colour is greatly influenced by the composition of the original material. Soils developed from a mixture of tuffs, andesitic basalts, and andesites show greyish to dark green colours. These andesitic rocks are typically greyish/greenish due to hydrothermal alteration processes and chloritisation during crystallisation (Moura *et al*., 2012). Poorly drained areas show strong greyish colours, while the more evolved and deeper soils, especially ornithogenic ones, show reddish-yellow colours, revealing an advanced degree of weathering.

Five soil orders have been recognised in the Area to date, according to the taxonomic system of *Soil Taxonomy* (1999): Histosols (*Hidric Cryfibrists*), Entisols (*Lithic Criorthents*), Spodosols (*Oxiaquic Humicryods*), Mollisols (*Lithic Haplocryolls*) and Inceptisols (*Lithic Eutrocryepts* and *Histic Cryaquepts*). Rodrigues *et al*. (2019) have carried out the latest soil classification at Harmony Point (Figure 3).

Flora

Vegetation in the Antarctic environment is restricted to ice-free areas, mainly on the Antarctic islands and in the coastal areas of continental regions. These plant communities are predominantly cryptogamic and the length of their growing season depends on climate, latitude and relief. The availability of liquid water is the most critical factor for the development of plant communities in Antarctica. Such liquid water is available during some months when the snow melts and when it rains in summer, or when moisture can be absorbed directly from the air. According to da Fonseca *et al*. (2021) between 2016 and 2021 on Nelson Island the surface in which algae were recorded went from 0.67 to 1.11 km^2, for lichens it went from 1.60 to 2.17 km^2 and for mosses from 0.02 to 0.11 km^2, which indicates a gradual increase in the area occupied by vegetation, surely associated with environmental changes and the increase in the ice-free area in the area due to the retreat of the glacier.

In general, the vegetation of Harmony Point can be said to be made up of a variety of plant communities, dominated by bryophytes and lichens, similar to those of King George Island (Pereira). *et al*. 2007). The most common mosses are *Sanionia uncinata* and *Polytrichastrum alpinum* (Ochyra, 1998). Among the vascular plants, the grass *Deschampsia antarctica* is rare and *Colobanthus quitensis* has not been reported on the island in recent years. In the Area there are extensive areas covered by rich and diverse communities of bryophytes and lichens (which are being classified), dominated mainly by *Usnea fasciata* and by *Himantormia lugubris*, while *D. Antarctica* and *C. quitensis* present less development, especially in sectors less affected by recent anthropic disturbance or breeding activities. Moss turf subformations are found in humid sites protected from the wind, while subformations dominated by lichens appear in sectors with high wind exposure (Figure 4).

The vegetation cover at the different levels of the marine terrace corresponds to their age. The oldest (and highest) are covered with carpets of *Sanionia uncinata* and patches of *Polytrichastrum alpinum turves* in drier areas, while *Sanionia georgicouncinata* and *Warnsdorf* spp., occur in the more humid sectors, occasionally associated with *Bryum* spp., and rarely with *Brachythecium autrosalebrosum*. The intermediate level of the terrace is normally covered by crustose/fruticose lichens, mainly by the dominant *Acarospora macrocyclus* and *Caloplaca* spp. The most recent marine terrace (first level) is covered mainly by formations of *Prasiola crispa* at certain points, associated with vagrant bird guano.

The vegetation of the higher areas basically consists of nitrophobic species that are highly resistant to wind exposure and drying out. The main formation is a dense carpet of muscular lichen *Himantormia lugubris*, in close association with mosses *Andreaea gainii* and *A. depressinervis*, but occasionally attached to other carpet-forming mosses. Other muscular lichens are also very common, particularly *Ochrolechia frigida*, *Psoroma hypnorum* and *Cladonia* spp. The formations of *Andreaea* spp., are sometimes lichen-free, forming dark brown to black cushions covering exposed rock as a primary coloniser. *Usnea aurantiacotra* is sterile on low hills above plateaus, associated with mosses and other lichens on rocky outcrops (Rodrigues *et al*. 2019) (see Figure 4).

The depressions are surrounded mainly by a dense carpet of mosses, common with a marginal strip (up to 50 cm long) of *Bryum* spp., and/or *B. austrosalebrosum* around flooded areas. Further away, with water-saturated soils, there is a carpet of moss made up of *Warnsdorfia sarmentosa*, partially parasitised by muscular lichens, such as *Cystocoleus niger* or *O. frigida*. As long as the surrounding areas are better drained and drier, they are dominated by *S. uncinata*. In shallow pools where birds are occasional visitors and some guano is deposited, the waters are colonised by the algae *Prasiola crispa* (Rodrigues *et al*., 2019) (see Figure 4).

The area is frequently used as a nesting area by birds (giant petrels and skuas, especially), resulting in guano-enriched soils and mixed vegetation. Soils with a high content in organic matter present an abundant mixed vegetation, consisting of lichens, such as *Usnea* spp., *Sphaerophorus globosus* and *Stereocaulon* spp., and mosses such as *S. uncinata* and *Chorisodontium acyphyllum*. These areas are covered mainly by saxicolous lichen species, without any clear pattern. In some felsenmeers where vertical to subvertical rock walls form below the nests, the rock surfaces are covered by *Umbilicaria* spp. and *Usnea* spp., associated with *Lecidea* spp. and *Buellia* spp. On more stable rock surfaces, other encrusting lichens are common, particularly *Rhizoplaca* spp., *Lecidea* spp., *Carbonea* spp., and *Buellia* spp., with occasional presence of *Rhizocarpon geographicum* in guano-free areas. Wherever water-saturated soil accumulates, there can also be a thick moss bank of *Sanionia* spp., *Polytrichum juniperinum* and *P. piliferum* (Rodrigues *et al*. 2019) (see Figure 4).

One of the important discoveries of recent years was the confirmation of the presence of *Hygrolembidium isophyllum* at Harmony Point (Putzke *et al.*, 2020) during a survey carried out in the summer of 2019, where a large population of this species was found. The population is 200 m north of the Gurruchaga Shelter and is located within Antarctic Specially Protected Area No 133. The findings reinforce the need to protect this area, as this species is very rare in Antarctica. A small lake nearby and the snow deposits that supply it with meltwater, in addition to the low incidence of wind, are abiotic factors that could be influencing the occurrence of the species in the area (Putzke *et al.*, 2020).

Fauna

The area is home to breeding colonies for 12 species, which at the time of the previous renewal numbered 3 347 pairs of gentoo penguins (*Pygoscelis papua*), 89 685 pairs of chinstrap penguins (*Pygoscelis antarctica*), 479 pairs of cape petrel (*Daption capense*), 69 pairs of blue-eyed shag (*Leucocarbo bransfieldensis*), 144 pairs of snowy sheatbill (*Chionis alba*), 71 pairs of skuas (*Stercorarius antarctica*, 61 and *S. maccormicki*, 11), 128 pairs of kelp gulls (*Larus dominicanus*) and 746 pairs of giant petrels *(Macronectes giganteus*).

The ice-free area at Harmony Point supports a wide range of birds, including one of the largest colonies of chinstrap penguins in the Antarctic Peninsula region, with approximately 90 000 pairs present in 1995/96 (Silva *et al.*, 1998). In 1995/96, 3347 breeding pairs of gentoo penguins and 69 breeding pairs of blue-eyed shag (*Leucocarbo bransfieldensis*) (Oosthuizen *et al.*, 2020. N. Coria (*Pers. Comm.*, 2010) reported 395 pairs of southern giant petrels *(Macronectes giganteus*) breeding in 2009/10, compared to 485 pairs recorded in 2004/05. Silva *et al.* (1998) reported 479 pairs of cape petrels (*Daption capense*), 144 pairs of snowy sheatbills (*Chionis albus*), 61 pairs of brown skua (*Stercorarius antarctica*), 128 pairs of kelp gulls (*Larus dominicanus*), 173 pairs of Antarctic terns (*Sterna vittata*), and a total of about 1 000 pairs of Wilson's storm-petrel (*Oceanites oceanicus*) and black-bellied storm-petrel (*Fregetta tropica*) at Harmony Point in 1995/96 (Harris *et al.*, 2015). Most of the bird colonies are distributed along the northwestern and southern coasts of Harmony Point. Colonies of giant petrel are found around the Gurruchaga Shelter. Figure 5 represents a map with the location of the colonies according to Silva *et al.* (1998).

A declining trend has been reported in Antarctica for many of the colonies of blue-eyed shag (*Leucocarbo bransfieldensis*) (Casaux and Barrera-Oro, 2015). These authors detected negative trends in the number of breeding pairs of this species in the colonies on Nelson Island (Figure 6). According to these authors, the number of breeding pairs of Antarctic shags in the two colonies on Nelson Island have shown a downward trend during the sampling periods. The Punta Duthoit colony (eastern sector of Nelson Island) was monitored for almost 15 consecutive years (except in 1991), for a total period of 19 years. The time series at Harmony Point was not that long due to logistical limitations, reaching approximately 10 years. In both colonies, the number of breeding pairs decreased from the late 1980s to 2004, then stabilised around the lower values. These authors recorded a parallel decrease in the abundance of the two fish species exploited in Potter Cove (King George Island) and that of the Antarctic shag (*L. bransfieldensis*) on Nelson Island, locations which are close to one another in the South Shetland Islands (Casaux and Barrera-Oro, 2015). Oosthuizen *et al.* (2020) indicate that the blue-eyed shag nests in a single, segregated colony on the north coast of Harmony Point and that most of the nests are located on three promontories that face the sea, with steep slopes that prevent easy access on foot. In December 2018, the authors recorded through images captured with a DJI Phantom 4 Advanced unmanned aerial vehicle a total of 69 reproductive pairs of *L. bransfieldensis*, whose nests were located between 10 and 20 metres above sea level, oriented mainly towards the southeast.

According to Krüger (2019) the observations of the last two decades seem to indicate that the populations of some species of the southern giant petrel *(Macronectes giganteus*) at Harmony Point have decreased. According to this author, 746 pairs were counted in 1995/96 (Silva *et al.* 1998), compared to 485 pairs recorded in 2005 (ACAP 2010) and 395 pairs in 2009 (Harris *et al.* 2015). Silva *et al.* (1998) mentioned that the distribution of flying seabird colonies coincided with that of previous mapping studies. In this work, the authors counted a total of 481 active nests and point out that the largest colony was located on the north coast. Small scattered breeding groups (< 30 nests) and isolated nests were found in the higher inland area and on the southern shores. Nest distribution was similar to that of previous studies, with the exception of one colony recorded in previous studies that currently had no nests, and one new colony that was not recorded in previous studies. The number of nests had decreased over practically the entire area, with the exception of the large colony on the north coast (Figure 7).

Krüger (2019) notes that there are few areas in the Western Antarctic Peninsula where southern giant petrels breed in large numbers, and Harmony Point, with more than 450 nests, is one of such areas. The apparent increase in population at Harmony Point in 1997 (746, Silva *et al.*, 1998), compared to 1965 (417; Araya and Aravena, 1965) and 1989 (494; Favero *et al.*, 1991) was attributed to the closure of the area to tourist activity in 1988, implying the effectiveness of the protection measures established for the site (Silva *et al.*, 1998). However, since then the population appears to have declined to its numbers before protection and may be fluctuating around 450 pairs (Harris *et al.*, 2015 and references therein). The changes in the populations of *Macronectes giganteus* elsewhere were attributed to interactions with fishing (Quintana *et al.*, 2006; Krüger *et al.*, 2017), to changes in food sources (Bruyn *et al.*, 2007), the intense human disturbance near the colonies and the influence of climate/weather (Krüger *et al.*, 2012; Schulz *et al.*, 2014; Petry *et al.*, 2016). Giant petrels are very sensitive to constant human presence and local declines in colonies in places such as King George Island (Sander *et al.*, 2005; Petry *et al.*, 2016) and Penguin Island (Harris *et al.*, 2015), in the South Shetland Islands, where human presence is intense due to research stations and tourism (Bender *et al.*, 2016), seem to support that view. However, the causes of the fluctuation at Harmony Point have yet to be properly evaluated. For example, chinstrap penguins (*Pygoscelis antarcticus*) and papuan penguins (*P. papua*), which are potential inland food sources for giant petrels (penguin remains found in >90% of diet samples and may influence population dynamics, according to Bruyn *et al.*, 2007; Bezerra *et al.*, 2015), are numerous at Harmony Point (Silva *et al.*, 1998). The lowest population count for this site was 395 pairs in 2009. This coincides with a strong El Niño effect (Lee *et al.*, 2010), which could also have been responsible for the lower reproductive success on Elephant Island (Schulz *et al.*, 2014; Petry *et al.*, 2018).

The importance of ASPA 133 for the conservation of Antarctic seabirds is relevant, being recognised as an Important Antarctic Bird Area, with the designation IBA ANT 049 (Figure 8).

Regarding marine mammals, three species are usually found in the Area: Weddell seals (*Leptonychotes weddelli*), southern elephant seals (*Mirounga leonina*) and Antarctic fur seals (*Arctocephalus gazella*). Occasionally, crabeater seals (*Lobodon carcinophaga*) have also been spotted. The number of mammals in the Area is variable, with maximum sightings of fur seals, Weddell seals and elephant seals of 320, 550 and 100, respectively. The Weddell seal usually breeds in the area, with significant numbers, which can reach 60 females with pups for a season. Calvings of fur and elephant seals have also been recorded, although in much smaller numbers.

6(iii) Access to the Area

The area should preferably be entered by sea. To access by sea, the landing area is located on the east coast of the Gurruchaga Shelter, about 200 metres to the north in the area near the Glacier (see Map 4), on a protected beach of boulders generally without a significant presence of fauna. There is an alternative landing area on the coast just in front of the shelter, but its use is not recommended because a giant petrel nesting area must be crossed to get to the shelter from there. During access to the area, care must be taken not to circulate over areas of vegetation.

Access to the navigation lighthouse located at the west end of Harmony Point is by disembarking to the south of the lighthouse (see Map 3). Both this access and the entrance to Finger Point will be carried out only by sea (see Map 5).

Access by air will only be allowed when there are no means of access by sea, and in the event of an emergency that puts people's lives at risk. In order not to interfere with the breeding settlements of birds near the shelter, particularly giant petrels, small planes are allowed to land over the Nelson Island glacier (see Map 3), taking into account that flying over Harmony Point or Finger Point, or between them, over Harmony Cove, is not permitted on the approach routes. For the approach, the structures indicated in Map 3 should be used. During the manoeuvres, please take into account that planes must not fly over the ice-free area of the Area to avoid disturbing the bird colonies. Aircraft landing must be carried out following the provisions of Resolution 2 (2004), Guidelines for the Operation of Aircraft near Concentrations of Birds.

If absolutely necessary, helicopters may be allowed to land on the ice-free areas of Harmony Point at one of the two possible sites indicated on Map 4. For this, the provisions of the "Guidelines for the Operation of Aircraft near Concentrations of Birds" (Resolution 2, 2004) will be observed as a minimum standard, except in cases of emergency or air safety, to ensure that there is no taking of or harmful interference with the fauna and flora of the area.

The National Antarctic Programme in charge of the activities carried out may use the heliport located to the west of the deposit a single time, only to evacuate historical waste or waste generated during the summer. This task can only be carried out at the end of the campaign, and not before March to ensure that the bird species are not in the critical period for raising chicks. Once this task has been completed, there will be no helicopter access to the area, except in the event of a life-threatening emergency.

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

Located within the Area are structures that remain inside the Area year-round.

Shelters: Within the Area there is the "Gurruchaga" Shelter (ARG), used as accommodation by the research teams that visit the Area, and a storage shed, which have approximate surfaces of 30 m^2 and 12 m^2, respectively. The facilities are only used during spring and summer, with a maximum capacity for 4 people (see section 7(ix) on *Disposal of Waste*).

Beacons: There is a Chilean radio beacon for navigation at the western end of Harmony Point, and another Argentine radio beacon at Finger Point.

Marker boards: A sign warning of the beginning of the Protected Area is located on the sandy beach in front of the shelter. Another sign installed in the shelter indicates its name and ownership.

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

- ASPA No. 112, Coppermine Peninsula, Robert Island, South Shetland Islands, approximately 30 km to the southwest.
- ASPA 125, Fildes Peninsula, King George Island, South Shetland Islands, 23 km north-northeast.
- ASPA No. 128, West Coast of Admiralty Bay, King George Island, South Shetland Islands, approximately 45 km east-northeast.
- ASPA No. 132, Potter Peninsula, King George Island, South Shetland Islands, approximately 30 km east-northeast.
- ASPA 150, Ardley Peninsula (Ardley Island), King George Island, South Shetland Islands, about 19 km northeast.
- ASPA 171, Narebski Point, Barton Peninsula, King George Island, about 25 km northeast of Harmony Point.

6(vi) Restricted Areas within the Area

There are no restricted areas within the Protected Area.

7. Permit conditions

7(i) General permit conditions

Entry to the Area is prohibited except under a permit issued by appropriate national Authorities. The conditions for the granting of permits are that: .

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

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

Within the ASPA, all movements will be carried out exclusively on foot.

The circulation of land vehicles in the Area is prohibited.

The area closest to the coast that lacks vegetation should be used for any movements.

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

- Scientific research activities that cannot be carried out in other places and that do not endanger the Area's ecosystem.
- Essential management activities, including monitoring.
- Activities aimed at the promotion of scientific activity, within the framework of the National Antarctic Programmes.
- If access to certain nesting sites for birds and mammal colonies is deemed necessary for scientific or conservation reasons, it could include greater restrictions between late October and early December. This period is considered especially sensitive because it coincides with the egg-laying peaks of nesting birds in the Area.
- The use of RPAs will not be allowed within the limits of the ASPA, unless previously analysed case by case during the environmental impact assessment process. They may only be used when stated in the entry permit and under the conditions established therein. During the analysis and authorisation process, all Antarctic Treaty directives in force will be taken into account.

7(iv) Installation, modification or removal of structures

- No additional structures may be built nor equipment installed within the ASPA, except for essential scientific or management activities and with proper permits.
- Any scientific equipment installed in the Area, as well as any research marking, must be approved by permit and clearly labelled, indicating the country, name of the main researcher, and year of installation.
- Any element to be installed must be of such a nature as to present a minimum risk of contamination in the Area, or of causing damage to vegetation or disturbance to fauna.
- Research markings must not remain after the permit expires. If any specific project cannot be completed within the authorised period and the material cannot be withdrawn, it shall be recorded in the Post-Visit Report and request an extension permitting its permanence in the Area.

7(v) Location of field camps

- Parties using the Area will normally have the Gurruchaga Shelter available. Use of the shelter for scientific purposes by personnel not belonging to the Argentine Antarctic Programme must be coordinated previously with the latter. If tents are needed to be installed, these must be located immediately next to said shelter. Other sites should not be used for this purpose in order to limit human impact. Due to the presence of abundant flora and fauna, a total of four is established as the adequate number of people that can inhabit the shelter, in addition to a camp of approximately six people.
- Not considered within this limit is the installation of tents with instruments or scientific material, or those used as an observation base, which must be removed as soon as the activity concludes.

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

- The deliberate introduction of live animals or plant material is not allowed. All reasonable precautions must be taken against the unintentional introduction of foreign species into the area. It should be noted that foreign species are most often and most effectively introduced by humans. Clothing (pockets, boots, Velcro fasteners on clothing) and personal equipment (bags, backpacks, camera bags, tripods), as well as scientific instruments and work tools can carry insect larvae, seeds, propagules, etc. For more information, see the Non-native Species Manual. Revision 2019 - CPA2011"
- Uncooked farm products may not be introduced.
- No herbicides or pesticides may be brought into the Area. Any other chemical product, which must be introduced with the corresponding permit, will have to be removed from the Area at the end of the activity. The use and type of chemical products must be documented in the best possible way for the knowledge of future researchers.
- Fuel, food, and other materials must not be deposited within the Area unless they are essential to the activity authorised in the corresponding permit, and as long as they are accumulated inside or close to the shelter. The fuels used in the Gurruchaga Shelter must be handled in accordance with the procedures duly established by the National Antarctic Programme involved in the activity.

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

- Any taking or harmful interference is prohibited, except in accordance with a Permit. When an activity involves taking or harmful interference, it must be consistent with the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica*, as a standard minimum and with the *SCAR Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica*.
- Information on any taking and harmful interference must be duly exchanged through the Antarctic Treaty Information Exchange System, as established in Article 10.1 of Annex V to the Madrid Protocol.
- Researchers taking samples of flora or fauna of any kind in the Area must ensure that they are familiar with previous collections to minimise the risk of possible duplication. To do so, they should consult the Antarctic Treaty Electronic Information Exchange System (available at *https://eies.ats.aq/Login?ReturnUrl=%2F*) and/or contact the relevant National Antarctic Programmes.

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

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

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

7 (ix) Disposal of waste

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

The waste water from the kitchen of the Gurruchaga Shelter cannot be discharged to the adjacent land. It must therefore be collected in drums and subsequently evacuated from the ASPA at the end of the campaign.

Waste resulting from research activities in the Area may be temporarily stored next to the Gurruchaga Shelter, pending removal. Said storage must be carried out in accordance with the provisions of Annex III to the Madrid Protocol, marked as waste and duly closed to avoid accidental leaks. They will be removed when the group leaves, in conditions that ensure that they do not disperse or become accessible to the fauna. This waste will be collected by the Antarctic Programme that generates it, to be disposed of in accordance with Annex III of the Madrid Protocol.

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

Permits to enter the Area may be granted for biological monitoring and inspection activities, which may include the taking of samples of vegetation or animals for research purposes as well as the erection and maintenance of signs or any other management measure.

All structures and markings installed in the Area for scientific purposes, including signs, must be approved in the Permit and clearly identified by country, indicating the name of the main researcher and year of installation. Research markings and structures must be removed on or before the permit expiry date. If a project cannot be concluded within the time allowed, an extension must be requested authorising the permanence of any element in the Area.

7(xi) Reporting requirements

The Parties granting entry permits to ASPA No. 133 must ensure that the principal holder of each permit issued submits a report describing the activities carried out to the relevant authority. These reports must be submitted as soon as possible, within the deadlines established by the corresponding appropriate authorities. The reports should include the information indicated in the Visit Report Form, as provided in the stipulations of Resolution 2 (2011).

The Parties granting entry permits to ASPA No. 133 must keep a record of said activities, and submit summary descriptions of the activities carried out by the persons under their jurisdiction in the annual exchange of information. Wherever possible, the local authority should also forward a copy of the visit report to the proponent Parties, to assist in managing the Area and reviewing the Management Plan.

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

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Figure 1: Geological sketch map of Harmony Point, reproduced from Smellie et al (1984).

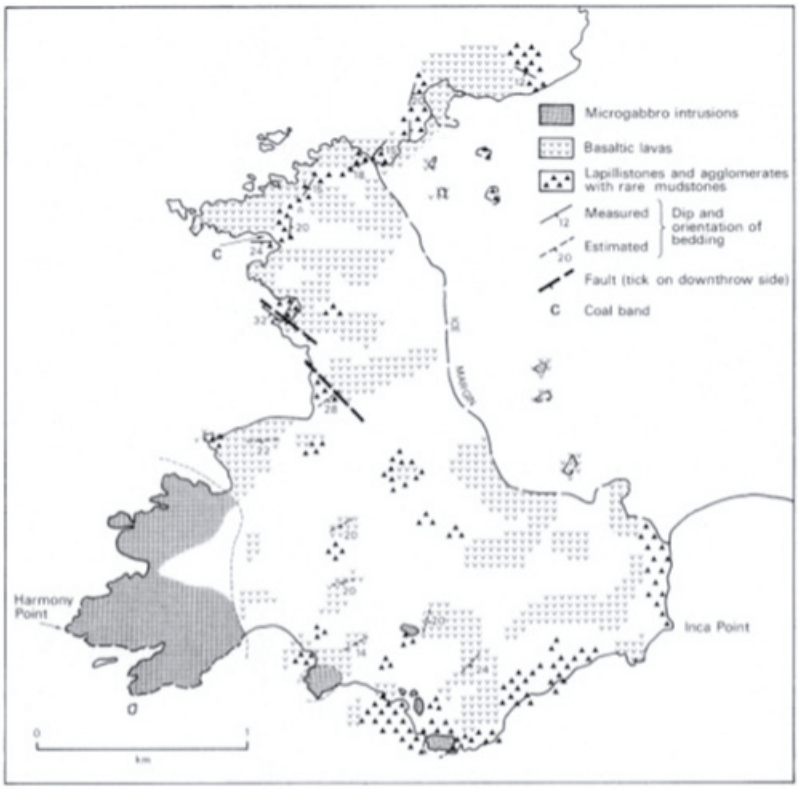


Figure 2: Map of geographic features of Harmony Point, Nelson Island, with the respective extensions in hectares (reproduced from Rodrigues et al., 2019).

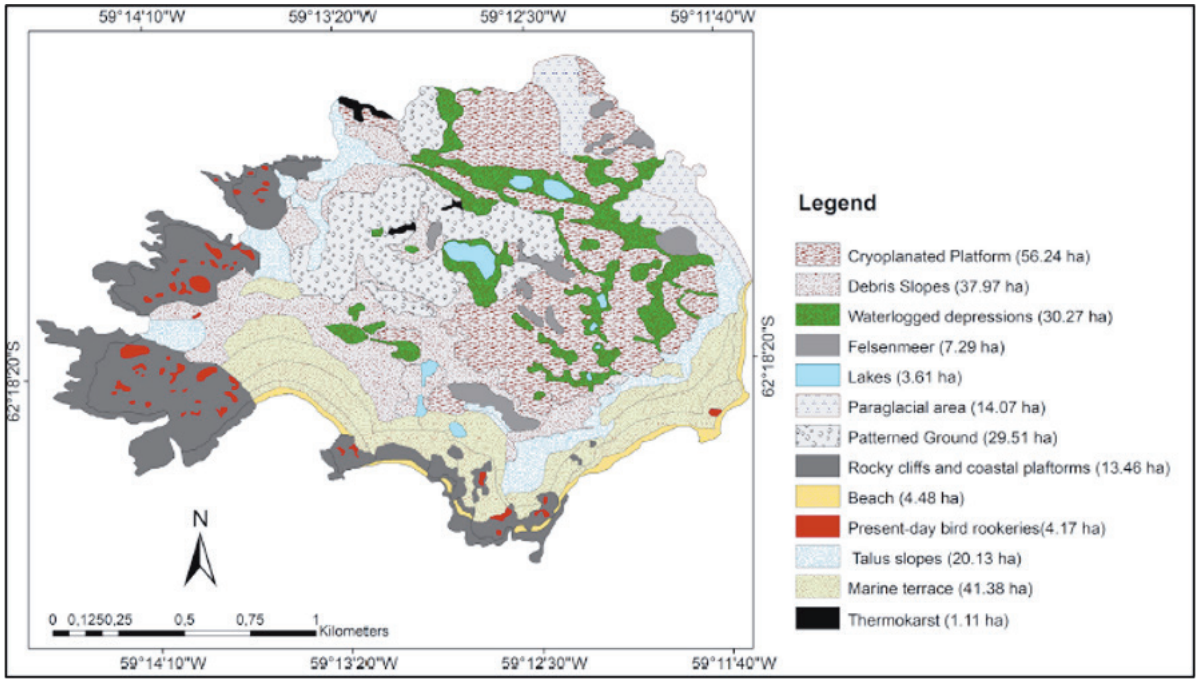


Figure 3: Soil map of Harmony Point, Nelson Island, with the respective extensions in hectares (reproduced from Rodrigues et al., 2019).

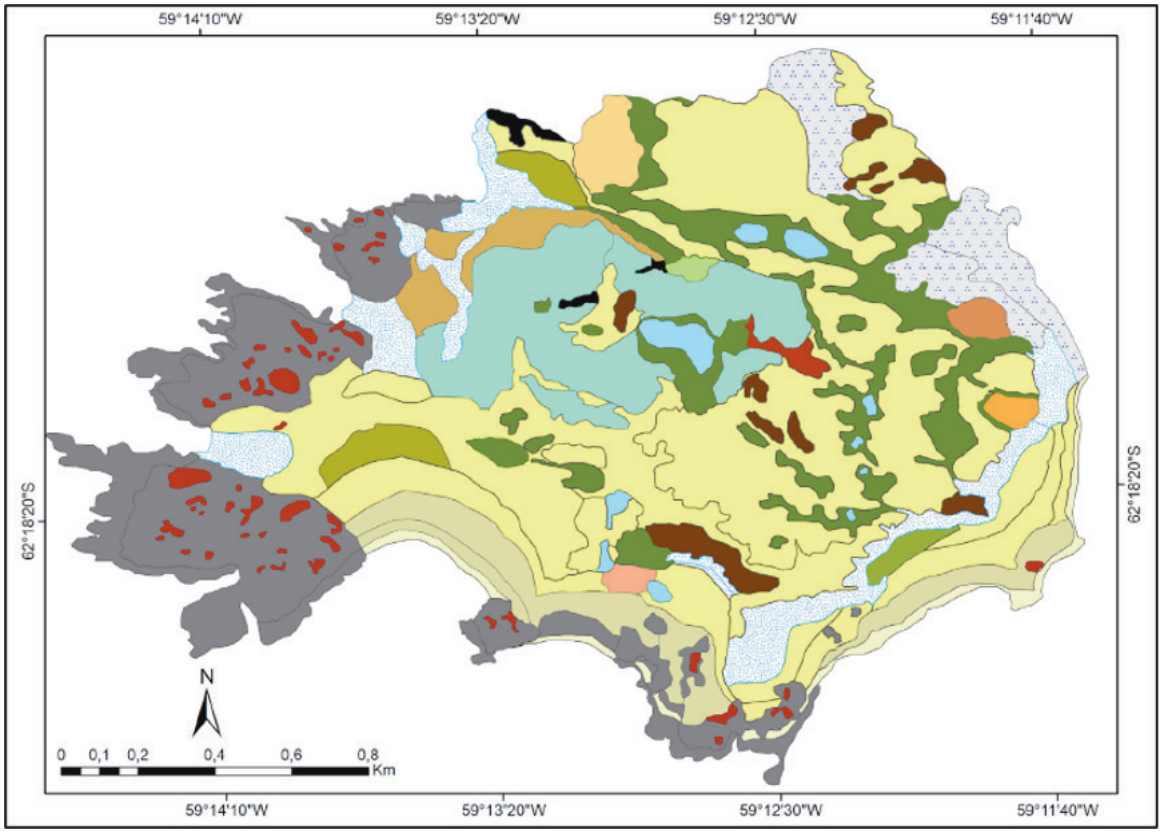


Figure 4: A block diagram illustrating the main landforms, according to landscape chronology, ranging from periglacial domains formed after glacial retreat (last 8 000 years), uplifted marine terraces (middle to late Holocene), the current beach and the volcanic stacks. Penguin colonies and rubble slopes are not represented in this diagram, although they are very representative in the southern part of Harmony Point (reproduced from Rodrigues et al., 2019).

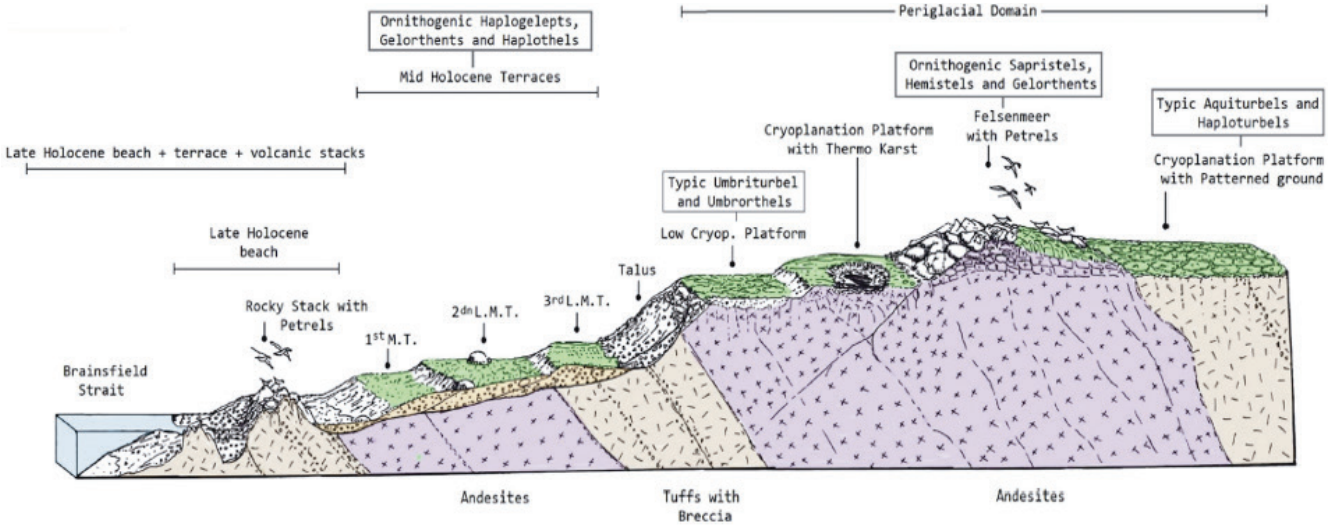


Figure 5: Distribution and abundance (in pairs) of the nesting species of Harmony Point, Nelson Island. Legend: GTP gentoo penguin, CHP chinstrap penguin, MG giant petrel, DC cape petrel, FT black-bellied storm-petrel, OO Wilson's storm-petrel, LD kelp gull, SV Antarctic tern, PHA blue-eyed shag, CA Antarctic pigeon. (Taken from Silva et al., 1998).

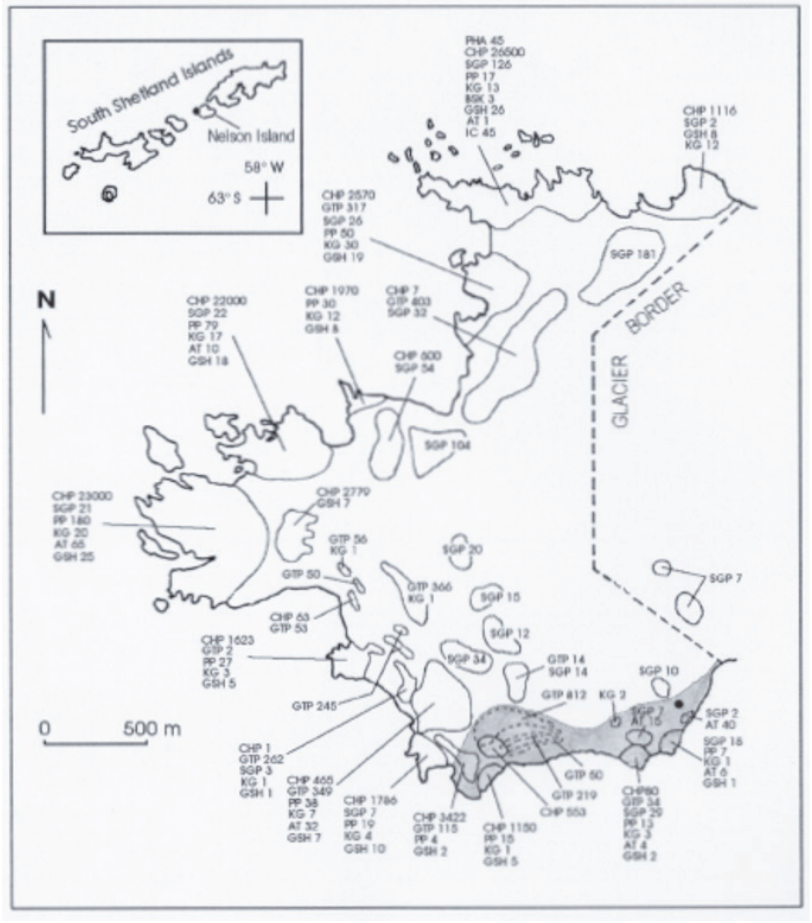


Figure 6: Population trends observed in Antarctic shag colonies at Harmony Point and Punta Duthoit, Nelson Island, South Shetland Islands (reproduced from Caseux and Barrera-Oro, 2015).

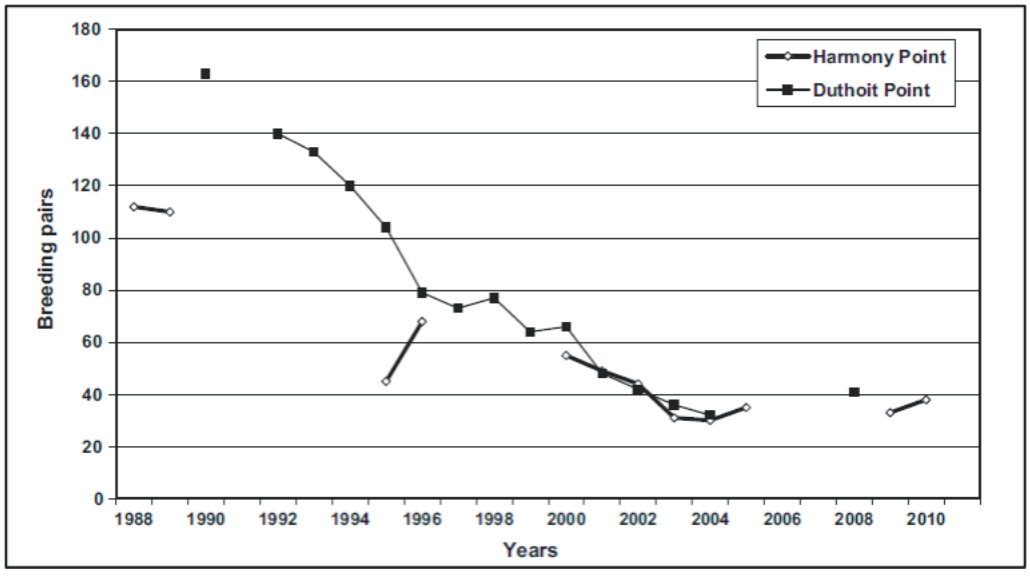


Figure 7: Number of active southern giant petrel (Macronectes giganteus) nests for each colony at Harmony Point in 1995/96 (Silva et al., 1998, dark grey area in circular plots) compared to counts made in 2018/19 (this study, white area in circular plots). Colony distribution (grey polygons) was adapted from Silva et al., (1998) (reproduced from Krüger, 2019).

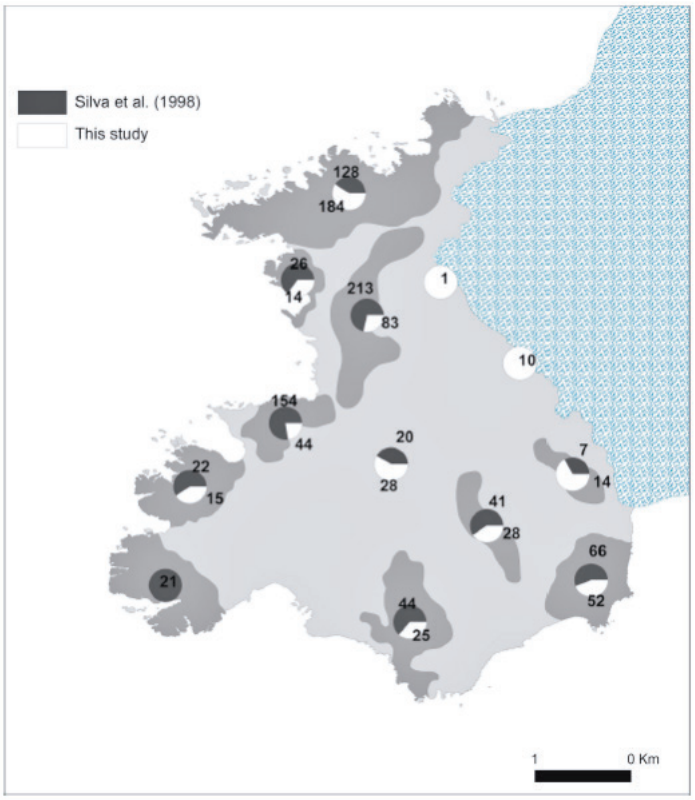
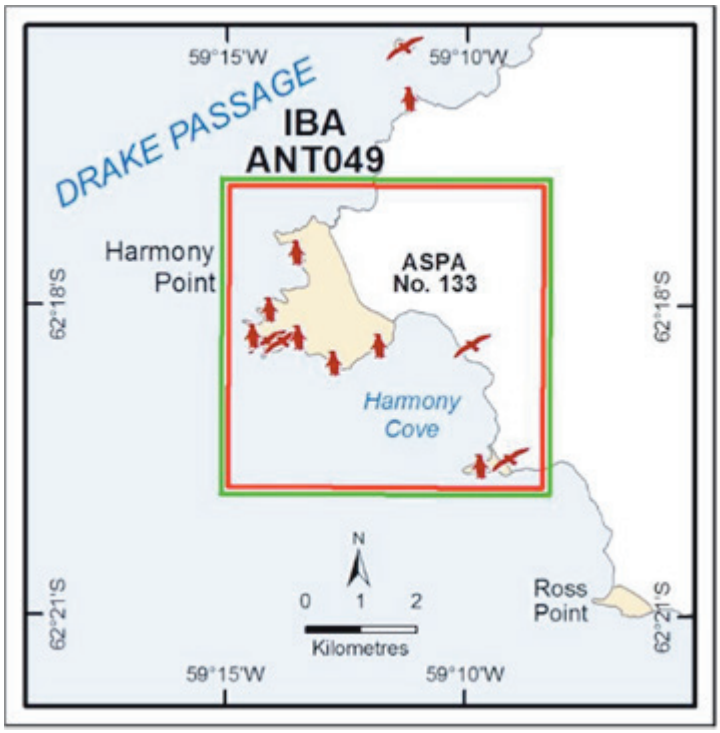
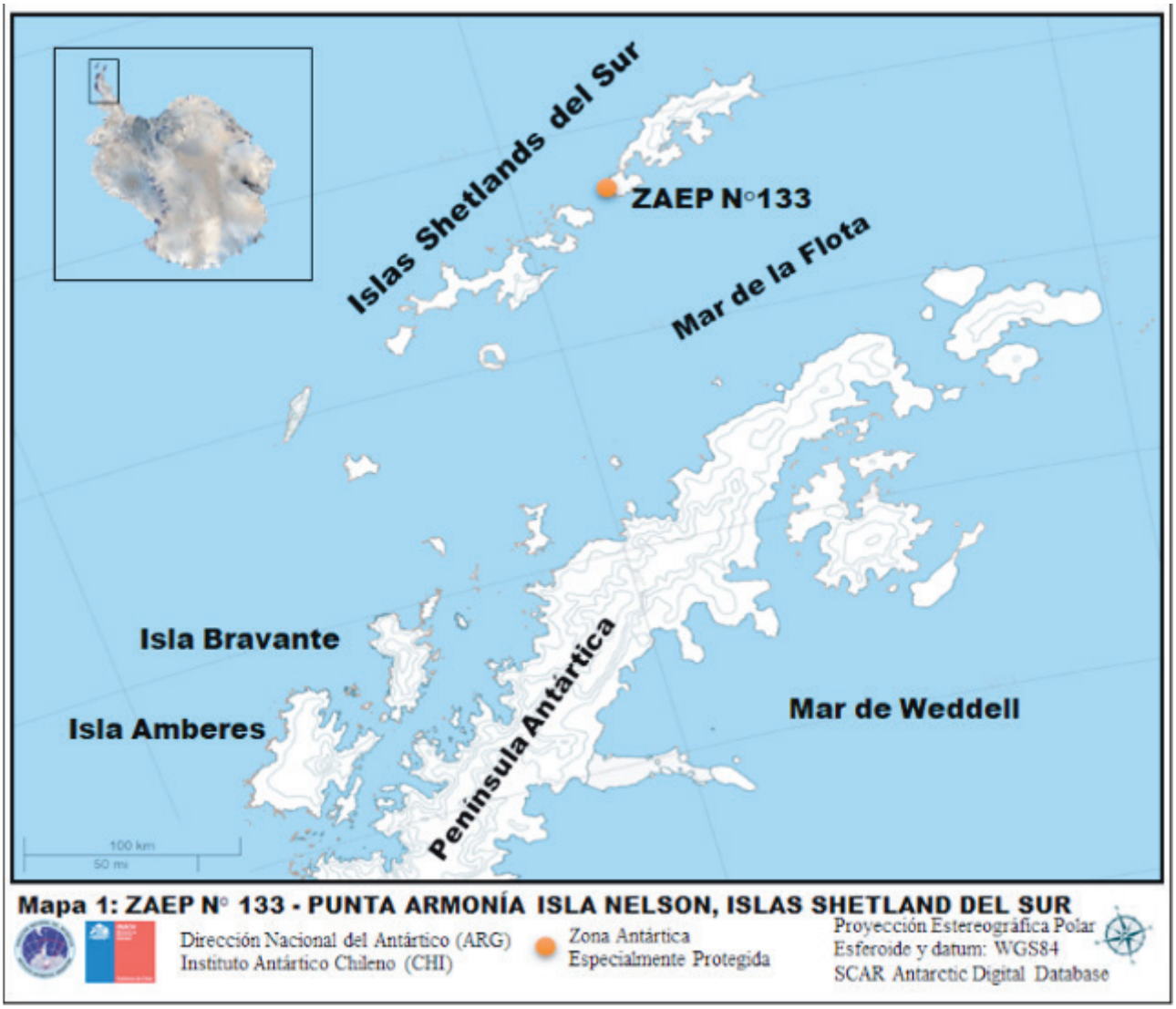


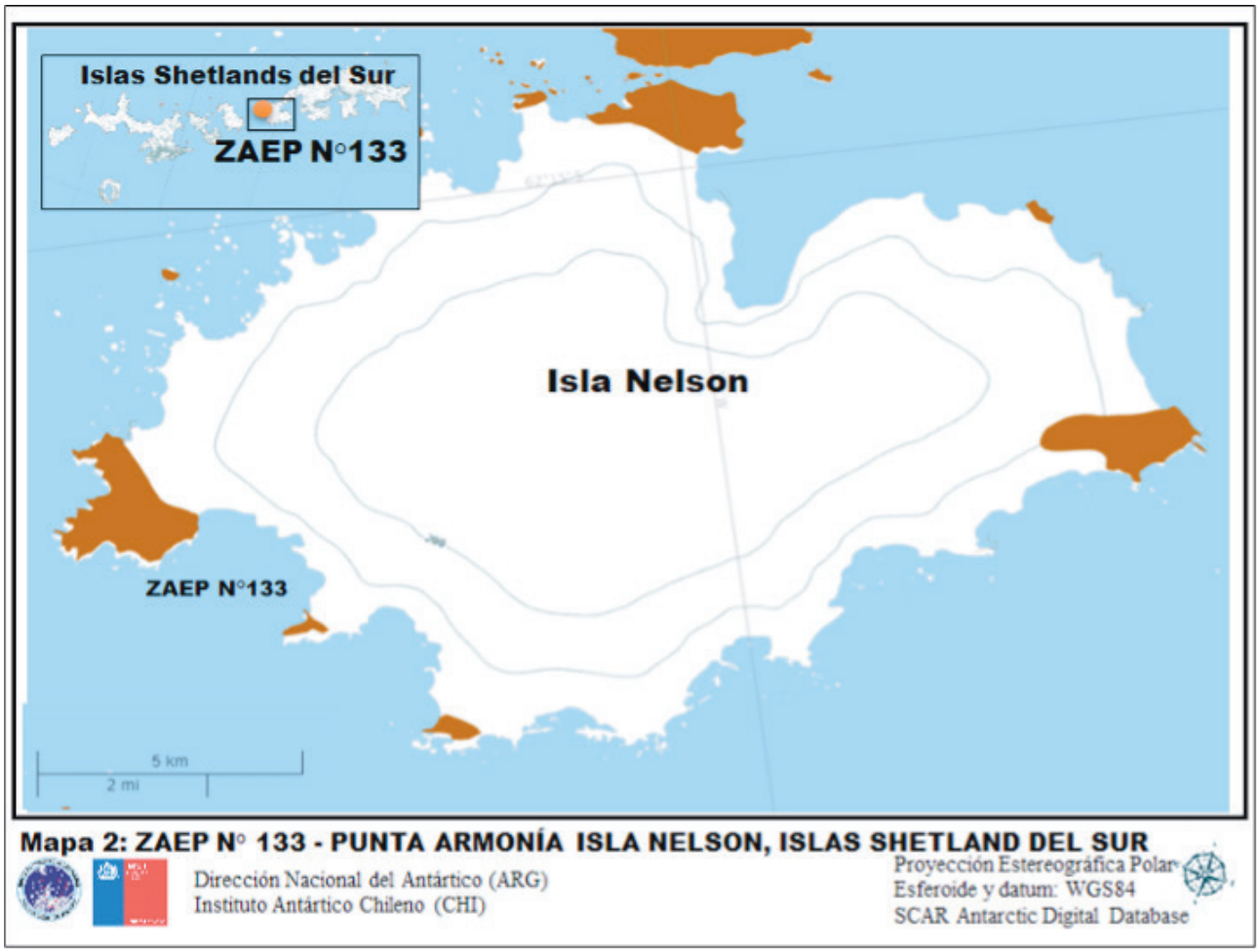
Figure 8: Location of Important Bird Area (IBA) No 049, whose position coincides with ASPA 133 Harmony Point.



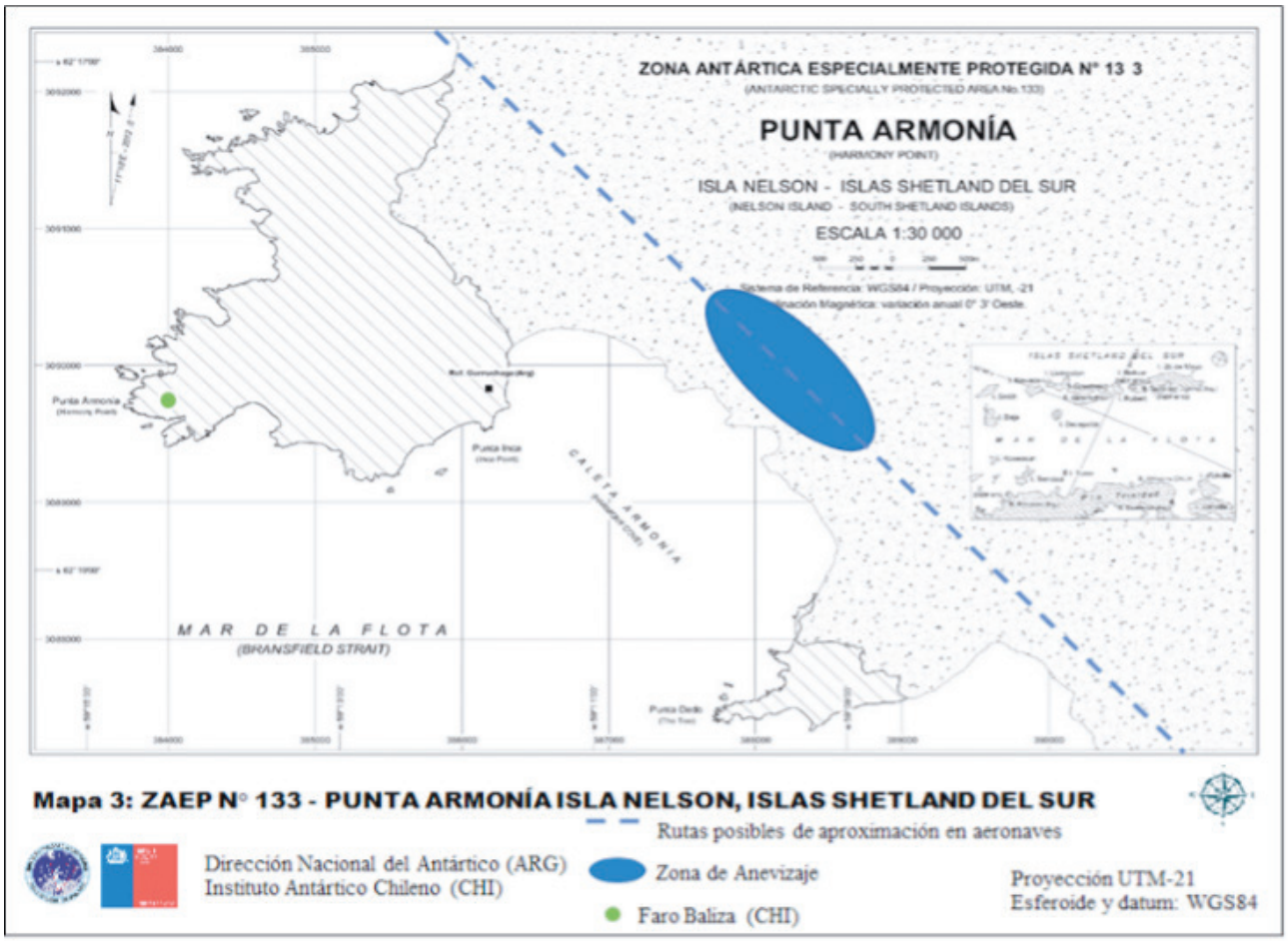
Map 1: Antarctic Specially Protected Area No. 133. Location of the ASPA in the Northern Region of the Antarctic Peninsula and in the South Shetland Islands, north of Fleet Sea/Bransfield Strait).



Map 2: Antarctic Specially Protected Area No. 133. General location of the ASPA on Nelson Island.



Map 3: Antarctic Specially Protected Area No. 133. Specific location of the ASPA on Nelson Island. Ice-free areas marked in continuous diagonal stripes. Areas covered by ice marked by dotted area.



Map 4: Antarctic Specially Protected Area No. 133. Specific location of important facilities and sites in the area occupied by the Gurruchaga Shelter (ARG), Harmony Point.

Map 5: Antarctic Specially Protected Area No. 133. Location of the landing area on Finger Point.