Management Plan for

Antarctic Specially Protected Area (ASPA) No. 149

CAPE SHIRREFF AND SAN TELMO ISLAND, LIVINGSTON ISLAND, SOUTH SHETLAND ISLANDS

Introduction

The Cape Shirreff Antarctic Specially Protected Area (ASPA) is situated on the northern coast of Livingston Island, South Shetland Islands, at 62°27'30"S, 60°47'17"W, and is approximately 9.7 km^2 in area. The primary reason for designation of the Area is to protect the biota present within the Area, in particular the large and diverse seabird and pinniped populations which are the subject of long-term scientific research and monitoring. Krill fishing is carried out within the foraging range of these species. Cape Shirreff is thus a key site for ecosystem monitoring, which helps to meet the objectives of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). The Area contains the largest Antarctic fur seal (*Arctocephalus gazella*) breeding colony in the Antarctic Peninsula region and is the most southerly colony where fur seal reproduction, demography and diet can be monitored. Palynoflora discovered within the Area are of significant scientific interest. The Area also contains numerous items of historical and archaeological value, mostly associated with sealing activities in the 19th Century. The Area was originally designated following proposals by Chile and the United States of America and adopted through Recommendation IV-11 [1966, Specially Protected Area (SPA) No. 11]. The Area was re-designated as Site of Special Scientific Interest (SSSI) No. 32 through Recommendation XV-7 (1989). The Area was designated as CCAMLR Ecosystem Monitoring Program (CEMP) Site No. 2 through CCAMLR Conservation Measure 82/XIII (1994); protection was continued by Conservation Measure (CM) 91/02 (2004) and boundaries were extended through Measure 2 (2005) to include a larger marine component and to incorporate plant fossil sites. Conservation Measure 91-02 was lapsed in November 2009 and protection of Cape Shirreff continues as ASPA No. 149 (SC-CCAMLR-XXVIII, Annex 4, para 5.29). The Management Plan was revised through Measure 7 (2011) and Measure 7 (2016).

The Area lies within 'Environment E – Antarctic Peninsula, Alexander and other islands and 'Environment G – Antarctic Peninsula offshore islands, as defined in the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)). Under the Antarctic Conservation Biogeographic Regions classification (Resolution 3 (2017)) the Area lies within ACBR3 – Northwest Antarctic Peninsula.

1. Description of values to be protected

Cape Shirreff (62°27'30"S, 60°47'17"W, a peninsula of approximately 3.1 km^2), Livingston Island, South Shetland Islands, was originally designated as Specially Protected Area (SPA) No. 11 through Recommendation IV-11 (1966). In the light of results from the first complete census of Pinnipedia carried out in the South Shetland Islands (Aguayo & Torres 1966), Chile considered special protection for the site was needed. Formal proposal of the SPA was made by the United States (U.S.). The Area included the ice-free ground of the Cape Shirreff peninsula north of the Livingston Island ice cap margin. Values protected under the original designation included the diversity of plant and animal life, many invertebrates, a substantial population of southern elephant seals (*Mirounga leonina*) and a small colony of Antarctic fur seals (*Arctocephalus gazella*).

Following designation, the size of the Cape Shirreff Antarctic fur seal colony increased to a level at which biological research could be undertaken without threatening continued colony growth. A survey of the South Shetland Islands and the Antarctic Peninsula identified Cape

Shirreff – San Telmo Island as the most suitable site to monitor Antarctic fur seal colonies potentially affected by fisheries around the South Shetland Islands. In order to accommodate the monitoring program, the SPA was redesignated as Site of Special Scientific Interest (SSSI) No. 32 through Recommendation XV-7 (1989) following a joint proposal by Chile, the United Kingdom and the United States. Designation was on the grounds that the "presence of both Antarctic fur seal and penguin colonies, and of krill fisheries within the foraging ranges of these species, make this a critical site for inclusion in the ecosystem monitoring network being established to help meet the objectives of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). The purpose of the designation is to allow planned research and monitoring to proceed, while avoiding or reducing, to the greatest extent possible, other activities which could interfere with or affect the results of the research and monitoring program or alter the natural features of the Site". The boundaries were enlarged to include San Telmo Island and associated nearby islets. Following a proposal prepared by Chile and the United States, the Area was subsequently designated as CCAMLR Ecosystem Monitoring Program (CEMP) Site No. 2 through CCAMLR Conservation Measure 82/XIII (1994), with boundaries identical to SSSI No. 32. Protection of Cape Shirreff as a CCAMLR Ecosystem Monitoring Program (CEMP) was continued by Conservation Measure (CM) 91/02 (2004).

The boundaries of the Area were further enlarged through Measure 2 (2005) to include a larger marine component and to incorporate two new sites where plant fossils were discovered in 2001 (Map 3). The designated Area (9.7 km2) comprises the entire Cape Shirreff peninsula north of the Livingston Island permanent ice cap, the adjacent part of the Livingston Island permanent ice cap where the fossil discoveries were made in 2001, the San Telmo Island group, and the surrounding and intervening marine area enclosed within 100 m of the coast of the Cape Shirreff peninsula and of the outer islets of the San Telmo Island group. The boundary extends from the San Telmo Island group to the south of Mercury Bluff.

Conservation Measure 91-02 lapsed in November 2009, with the protection of Cape Shirreff continuing under the Management Plan for ASPA No. 149 (SC-CCAMLR-XXVIII, Annex 4, para 5.29). The change was made with the aim of harmonizing protection under both CCAMLR and the Protocol on Environmental Protection to the Antarctic Treaty (The Protocol) and to eliminate any potential duplication in management requirements and procedures.

The current Management Plan reaffirms the exceptional scientific and monitoring values associated with the large and diverse populations of seabirds and pinnipeds which breed within the Area, and in particular those of the Antarctic fur seal colony. The Antarctic fur seal colony is the largest in the Antarctic Peninsula region and is the most southerly that is large enough to study growth, survival, diet, and reproduction parameters. The last complete census of Cape Shirreff and San Telmo Island estimated the total population at 5,727 individuals (Krause & Hinke 2021). Monitoring of the Antarctic fur seal colony began in 1965 (Aguayo and Torres 1966, 1967) and seasonal data are available from 1991, making this one of the longest continuous Antarctic fur seal monitoring programs. As part of the CCAMLR Ecosystem Monitoring Program (CEMP), monitoring was established to detect and avoid possible adverse effects of fisheries on dependant species such as pinnipeds and seabirds, as well as target species such as Antarctic krill (*Euphausia superba*). Long-term studies are assessing and monitoring the survival, feeding ecology, growth, condition, reproduction, behavior, vital rates, abundance, and population genetics of pinnipeds and seabirds that breed within the Area. Data from these studies will be evaluated in context with environmental and other biological data and fisheries statistics to help identify possible cause-effect relationships between fisheries and pinniped and seabird populations.

In 2001/02 imprints of megaflora were discovered in rocks incorporated within moraines of the Livingston Island glacier (Palma-Heldt et al. 2004; 2007) (Map 2). The fossiliferous rocks were found to contain two distinct palynological assemblages, indicative of different time periods and climatic conditions, and formed part of a study into the geological history of Antarctica and Gondwana. Studies of microbial research were carried out within the Area in 2009/10, to assess the influence of microhabitats on microbial diversity and metabolic capacity (INACH 2010).

The original values of the area considered for special protection, including floral and faunal communities, all remain present at Cape Shirreff. Regular research and monitoring has focused largely on the land-breeding vertebrate community. However, future research to assess extant floral and invertebrate communities would provide a welcome update on the state of these specially protected values.

The Area contains a number of pre-1958 human artifacts. Historic Site & Monument (HSM) No.59, a rock cairn commemorating those who died when the Spanish ship San Telmo sank in the Drake Passage in 1819, lies within the Area. The wreck of the *San Telmo*, the last position of which was recorded near Livingston Island, is recognized as HSM No.95 (Measure 2 (2021)). Remnants of a 19th Century sealing community also can be found within the Area. A human skull and two femurs, possibly associated with historic sealing activities, were collected at Yamana Beach (Torres 1992; Contantinsecu & Torres 1995; Torres 1999).

2. Aims and objectives

Management at Cape Shirreff aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human presence, disturbance and sampling within the Area;
- avoid activities that would harm or interfere with CEMP research and monitoring activities;
- allow scientific research associated with the CEMP on the ecosystem and physical environment in the Area;
- allow other scientific research within the Area provided it is for compelling reasons which cannot be served elsewhere and provided it will not compromise the values for which the Area is protected;
- allow archaeological and historical research and measures for artifact protection, while protecting the historic artifacts present within the Area from unnecessary destruction, disturbance, or removal;
- minimize the possibility of introduction of alien plants, animals and microbes to the Area;
- minimize the possibility of the introduction of pathogens that may cause disease in faunal populations within the Area; and
- allow visits for management purposes in support of the aims of the Management Plan.

3. Management activities

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

- Notices showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently at the following locations, where copies of this Management Plan and maps of the Area shall also be made available:
    1. Guillermo Mann (Chile) and Cape Shirreff Field Camp (United States), Cape Shirreff, Livingston Island;
    2. Saint Kliment Ohridski Station (Bulgaria), Hurd Peninsula, Livingston Island;
    3. Arturo Prat Station (Chile), Discovery Bay/Chile Bay, Greenwich Island;
    4. Base Juan Carlos I (Spain), Hurd Peninsula, Livingston Island;
    5. Julio Escudero Station (Chile), Fildes Peninsula, King George Island; and
    6. Eduardo Frei Station (Chile), Fildes Peninsula, King George Island.
- A sign showing the location and boundaries of the Area with clear statements of entry restrictions should be placed at Módulo Beach, Cape Shirreff, to help avoid inadvertent entry;

- Copies of this Management Plan shall be made available to all vessels and aircraft visiting the Area, and the appropriate national authority shall inform all personnel operating in the vicinity of, accessing or flying over the Area, of the location, boundaries and restrictions applying to entry and overflight within the Area;
- National programs shall take steps to ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- Markers, signs or other structures should not be installed within the Area except for essential scientific or management purposes. If installed, they shall be recorded, secured and maintained in good condition and removed when no longer required by the responsible National Antarctic program;
- Visits shall be made as necessary (no less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate;
- National Antarctic programs operating in the region shall consult together for the purpose of ensuring that the above provisions are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: ASPA No. 149 Cape Shirreff and San Telmo Island: regional overview. Map specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 62°00'S; 2nd 63°00'S; Central Meridian: 60°45'W; Latitude of Origin: 62°00'S; Spheroid: WGS84; Horizontal accuracy: < ±100 m. Bathymetric contour interval 50 m and 200 m; vertical accuracy unknown. Data sources: land features from SCAR Antarctic Digital Database v7.2 (2020); bathymetry supplied by the U.S. Antarctic Marine Living Resources (U.S. AMLR) Program, NOAA (2002) and IBCSO (v1.0 2013) (http://ibcso.org).

Inset: location of Map 1 in relation to the South Shetland Islands and the Antarctic Peninsula.

Map 2: ASPA No. 149 Cape Shirreff and San Telmo Island: access. Map specifications as per Map 1, except the vertical contour interval is 20 m and the horizontal accuracy is expected to be greater than ±5 m. Data source: from digital data supplied by Instituto Antártico Chileno (INACH) (2002) (Torres *et al.* 2001), except small boat landing sites supplied by M. Goebel (Dec 2015).

Map 3: ASPA No. 149 Cape Shirreff and San Telmo Island: wildlife and human features. Map specifications and data sources as per Map 2 with the exception of the vertical contour interval, which is 5 m. Seal tracking station and HSM: D. Krause (2021). Walking routes and fauna: INACH, updated by M. Goebel and D. Krause (Dec 2015).

6. Description of the Area

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

Overview

Cape Shirreff (62°27'30"S 60°47'17"W) is situated on the northern coast of Livingston Island, the second largest of the South Shetland Islands, between Barclay Bay and Hero Bay (Map 1). The cape lies at the northern extremity of an ice-free peninsula of low-lying, hilly relief. To the west of the peninsula lies Shirreff Cove, to the east Black Point, and to the south lies the permanent ice cap of Livingston Island. The peninsula has an area of approximately 3.1 km^2, being 2.6 km from north to south and ranging from 0.5 to 1.5 km from east to west. The interior of the peninsula comprises a series of raised beaches and both rounded and steep-sided hills, rising to a high point at Toqui Hill (82 m) in the central northern part of the peninsula. The western coast is formed by almost continuous cliffs 10 to 15 m high, while the eastern coast has extensive sand and gravel beaches.

A small group of low-lying, rocky islets lie approximately 1200 m west of the Cape Shirreff peninsula, forming the western enclosure of Shirreff Cove. San Telmo Island, the largest of the group, is 950 m in length, up to 200 m in width, and of approximately 0.1 km^2 in area. There is a sand and pebble beach on the southeastern coast of San Telmo Island, separated from a sand beach to the north by two irregular cliffs and narrow pebble beaches.

Boundaries and coordinates

The designated Area comprises the entire Cape Shirreff peninsula north of the permanent Livingston Island ice cap, the San Telmo Island group, and the surrounding and intervening marine area (Map 2). The marine boundary encloses an area that extends 100 m from, and parallel to, the outer coastline of the Cape Shirreff peninsula and the San Telmo Island group. In the north, the marine boundary extends from the northwestern extremity of the Cape Shirreff peninsula to the southwest for 1.4 km to the San Telmo Island group, enclosing the intervening sea within Shirreff Cove. The western boundary extends southwards for 1.8 km from 62°28'S to a small island near 62°29'S, passing around the western shore of this small island and proceeding a further 1.2 km south-east to the shore of Livingston Island at 62°29'30"S, which is approximately 300 m south of Mercury Bluff. From this point on the coast, the southern boundary extends approximately 300 m due east to 60°49'W, from where it proceeds in a northeasterly direction parallel to the coast for approximately 2 km to the ice sheet margin at 60°47'W. The southern boundary then extends due east for 600 m to the eastern coast. The eastern boundary is marine, following the eastern coastline 100 m from the shore. The boundary encompasses an area of 9.7 km^2 (Map 2).

Climate

Meteorological records for Cape Shirreff have been collected for a number of years by Chilean and U.S. scientists and are currently recorded by instruments mounted on the Cape Shirreff Field Camp buildings. During recent summer seasons (Nov – Feb inclusive, 2005/06 to 2009/10) the mean air temperature recorded at Cape Shirreff was 1.84ºC (U.S. AMLR Program data, 2005-2010). The maximum air temperature recorded during this period was 19.9ºC and the minimum was -8.1ºC. Wind speed averaged 5.36 m/s and the maximum recorded wind speed reached 20.1 m/s. Wind direction over the data collection period was predominantly from the west, followed by WNW and ENE. Meteorological data are available for two recent winters, with mean daily temperature for Jun-Aug 2007 of -6.7ºC with a minimum of -20.6ºC and a maximum of +0.9ºC, and a mean daily temperature for Jun-Sep 2009 of -5.8ºC with a minimum of -15.2ºC and a maximum of +1.9ºC.

Geology, geomorphology and soils

Cape Shirreff is composed of porphyritic basaltic lavas and minor volcanic breccias of approximately 450 m in thickness (Smellie *et al*. 1996). The rocks at Cape Shirreff are deformed into open folds, which trend in a NW-SE direction, and subvertical axial surfaces that are intruded by numerous dykes. A rock sample obtained from the southern side of Cape Shirreff was identified as fresh olivine basalt and was composed of approximately 4% olivine and 10% plagioclase phenocrysts in a groundmass of plagioclase, clinopyroxene and opaque oxide. Rock samples at Cape Shirreff have been K-Ar dated as of late Cretaceous age with a minimum age of 90.2± 5.6 million years old (Smellie *et al*. 1996). The volcanic sequences at Cape Shirreff form part of a broader group of relatively fresh basalt and andesite lavas covering eastern-central Livingston Island that are similar to basalts found on Byers Peninsula.

The Cape Shirreff peninsula is predominantly a raised marine platform, 46 to 53 m above sea level, (Bonner & Smith 1985). The bedrock is largely covered by weathered rock and glacial deposits. Two lower platforms, covered with rounded water-worn pebbles, occur at elevations of approximately 7-9 m and 12-15 m above Mean Sea Level (MSL) (Hobbs 1968).

There is little information on the soils of Cape Shirreff. They are mainly fine, highly porous, ash and scoria. The soils support a sparse vegetation and are enriched by bird and seal colonies which inhabit the Area.

Paleontology

A fossilized wood specimen belonging to the Araucariaceae family (*Araucarioxylon* sp.) was recorded from Cape Shirreff (Torres 1993). It is similar to fossils found at Byers Peninsula (ASPA No. 126), a site with rich fossil flora and fauna 20 km to the southwest. Several fossil specimens have also been found at the northern extremity of the Cape Shirreff peninsula. In 2001/02 fossiliferous rocks of two different ages were discovered incorporated within frontal and lateral moraines of the Livingston Island permanent ice cap (Map 3). Study of the palynomorphs found within the moraines identified two distinct palynological assemblages, arbitrarily named 'Type A' and 'B' (Palma-Held *et al*. 2004, 2007). The 'Type A' association was dominated by Pteridophyta, mainly Cyatheaceae and Gleicheniaceae, and by *Podocarpidites* spp. and also contained *Myrtaceidites eugenioides* and epiphyllous fungal spores. The assemblage is believed to be indicative of warm and humid conditions of Early Cretaceous in age (Palma-Heldt *et al*. 2007). The 'Type B' assemblage was characterized by a subantarctic flora with *Nothofagidites*, *Araucariacites australis*, *Podocarpidites otagoensis, P. marwickii*, *Proteacidites parvus* and also epiphyllous fungal spores, which indicate a cold and humid temperate climate (Palma-Heldt *et al*. 2007). The age of the assemblage is estimated to be Late Cretaceous-Paleogene (Palma-Heldt *et al*. 2004; Leppe *et al*. 2003). Palynological investigations were undertaken at Cape Shirreff in order to investigate the evolution of the southern Pacific margin of Gondwana and to develop a model of the Mesozoic-Cenozoic evolution of the Antarctic Peninsula. It has been noted that other fossils may be revealed by further recession of the Livingston Island permanent ice cap (D. Torres, A. Aguayo and J. Acevedo, pers. comm. 2010).

Streams and lakes

There is one permanent lake ('Lago Oculto') on Cape Shirreff, located north and at the base of Toqui Hill (Map 3). The lake is ~2-3 m deep and 12 m long at full capacity, diminishing in size after February (Torres 1995). Moss banks grow on surrounding slopes. There are also several ephemeral ponds and streams on the peninsula, fed by snow-melt, especially in January and February. The largest of the streams is found draining southwestern slopes toward the coast at Yamana Beach.

Vegetation and invertebrates

Although a comprehensive survey of the vegetation communities at Cape Shirreff has not been undertaken, Cape Shirreff appears to be less well vegetated than many other sites in the South Shetland Islands. Observations to date have recorded one grass, five species of moss, six of lichen, one fungi and one nitrophilous macroalgae (Torres 1995).

Patches of Antarctic hairgrass (*Deschampsia antarctica*) can be found in some valleys, often growing with mosses. Mosses are predominantly found inland from the coast. In a valley running northwest from Half Moon Beach, there is a moderately well-developed wet moss carpet of *Warnstorfia laculosa* (=*Calliergidium austro*-stramineum, also =*Calliergon sarmentosum*) (Bonner 1989, in Heap 1994). In areas with better drainage, *Sanionia uncinata* (=*Drepanocladus uncinatus*) and *Polytrichastrum alpinum* (=*Polytrichum alpinum*) are found. The raised beach areas and some higher plateaus have extensive stands of the foliose nitrophilous macroalga *Prasiola crispa*, which is characteristic of areas enriched by animal excreta and has been observed to replace moss-lichen associations damaged by fur seals (Bonner 1989, in Heap 1994).

The six lichen species thus far described at Cape Shirreff are Caloplaca spp, *Umbilicaria antarctica*, *Usnea antarctica*, *U. fasciata*, *Xanthoria candelaria* and *X. elegans*. The fruticose species *Umbilicaria antarctica*, *Usnea antarctica* and *U. fasciata* form dense growths on cliff faces and on the tops of steep rocks (Bonner 1989, in Heap 1994). The bright yellow and orange crustose lichens *Caloplaca* spp, *Xanthoria candelaria* and *X. elegans* are common beneath bird

colonies and are also present with the fruticose species. The identity of the single recorded fungal species is unknown.

The invertebrate fauna at Cape Shirreff has not been described.

Microbial ecology

Field studies of the microbial ecology at Cape Shirreff were carried out 11-21 January 2010 and results were compared with the bacterial communities present at Fildes Peninsula, King George Island. The study aimed to evaluate the influence of the different microhabitats on the biodiversity and metabolic capacities of bacterial communities found at Cape Shirreff and Fildes Peninsula (INACH, 2010).

Breeding birds

The avifauna of Cape Shirreff is diverse, with ten species known to breed within the Area, and several non-breeding species present. Chinstrap (*Pygoscelis antarcticus*) and gentoo (*P. papua*) penguins breed within the Area; Adélie penguins (*P. adeliae*) have not been observed to breed on Cape Shirreff or San Telmo Island, although are widely distributed throughout the region. Both chinstrap and gentoo penguins are found in small colonies on the northeastern and northwestern coasts of Cape Shirreff peninsula (Map 3). Data have been collected on the chinstrap and gentoo penguin colonies every summer season since 1996/97, including reproductive success, demography, diet, foraging and diving behaviour (e.g. Hinke *et al*. 2007; Polito *et al*. 2015). Chinstrap and gentoo penguins at Cape Shirreff have been tagged with telemetry devices episodically since 2005 to study their over-winter behaviours (e.g, Hinke & Trivelpiece 2011, Hinke *et al*. 2015, Hinke *et al*. 2017).

Data available on penguin numbers are presented in Table 1 (see Section 8). In 2019/20 there were 17 active breeding sub-colonies at Cape Shirreff, with a total of 708 gentoo and 2179 chinstrap penguin nests (U.S. AMLR unpublished data). Since regular census work started in 1997/98, the numbers of chinstrap penguins at Cape Shirreff have declined by 71.5%, whilst gentoo abundance has declined by 12.5% (Table 1 (Section 8)). The differing magnitude in trends in chinstrap and gentoo populations at Cape Shirreff have been attributed to the higher winter juvenile mortality rate experienced by chinstrap penguins (Hinke *et al*. 2007) and a greater flexibility in feeding patterns exhibited by gentoo penguins (Miller *et al.* 2009).

In general, the chinstrap penguins nest on higher escarpments at Cape Shirreff, although they are also found breeding on small promontories near the shore. Gentoo penguins tend to breed on more gentle slopes and rounded promontories. During the period of chick rearing, foraging by both species of penguin is confined to the shelf region, approximately 20 to 30km offshore from Cape Shirreff (Miller & Trivelpiece 2007). Research on the use of unmanned aerial systems to aid in estimating penguin abundance and colony distribution, initiated in 2010/11 (Goebel *et al*. 2015), remains under development.

Several other species breed within the Area (Map 3), although data on numbers are patchy. Kelp gulls (*Larus dominicanus)* and brown skuas (*Catharacta antarctica*) nest in abundance along the entire coastline of the Area. Kelp gull census work began in 2000/01 and data indicate stable chick production, averaging 29 ± 14 (sd) chicks per year (U.S. AMLR, unpublished data). The number of breeding pairs of brown skuas has nearly doubled from 16 in 1997/98 to 29 in 2019/20 (U.S. AMLR, unpublished data). Over that time, average annual reproductive success of brown skuas has averaged 0.54 ± 0.25 (sd) fledglings/pair but exhibits a negative trend (U.S. AMLR, unpublished data).

Historically, sheathbills (*Chionis alba*) nested in two places: one pair was recorded nesting on the western coast of the Cape Shirreff peninsula; a second pair was observed breeding among rocks at the northern beach on San Telmo Island, near an Antarctic fur seal breeding site (Torres, pers. comm. 2002). Antarctic terns (*Sterna vittata*) breed in several locations, which vary from year to year. Since 1990/91 a small colony of approximately 11 pairs of Antarctic shag (*Leucocarbo atriceps bransfieldensis*) have nested on Yeco Rocks, on the western coast of

the peninsula (Torres 1995). Cape petrels (*Daption capense*) breed on cliffs on the western coast of the Area; 14 pairs were recorded in January 1993, nine in January 1994, three in January 1995 and eight in 1999. Wilson's storm petrel (*Oceanites oceanicus*) also breed on the western coast of the Area. Black-bellied storm petrel (*Fregetta tropica*) have been observed to breed near the field camp on the eastern coast. Updates on breeding activity for these species are currently unavailable.

Other bird species recorded but not breeding within the Area include macaroni penguin (*Eudyptes chrysolophus*), king penguin (*Aptenodytes patagonicus*), emperor penguin (*Aptenodytes forsteri*), snow petrel (*Pagodroma nivea*), white-rumped sandpiper (*Calidris fuscicollis*), black-necked swan (*Cygnus melanocoryphus*), and the cattle egret *Bubulcus ibis* (Torres 1995; Olavarría *et al.* 1999). Additional bird species recorded as foraging close to Cape Shirreff include the black-browed albatross (*Thalassarche melanophris*) and gray-headed albatross (*T. chrysostoma*), although neither species has yet been recorded within the Area (Cox *et al*. 2009). A large number of non-breeding southern giant petrels (*Macronectes giganteus*) frequent the Area in the summer, but a report of a breeding colony on the peninsula (Bonner 1989, in Heap 1994) is incorrect (Torres, pers. comm. 2002).

Breeding mammals

Cape Shirreff (including San Telmo Island) is presently the site of the largest known breeding colony of the Antarctic fur seal in the Antarctic Peninsula region. Antarctic fur seals were once abundant throughout the South Shetland Islands but were hunted to local extinction between 1820 and 1824. The next observation of Antarctic fur seals at Cape Shirreff was on 14 January 1958, when 27 animals were recorded, including seven juveniles (Tufft 1958). The following season, on 31 January 1959, a group of seven adult males, one female and one live male pup were recorded, along with one dead male pup (O'Gorman, 1961) (Table 2, Figure 1 (see Section 8)). A second female arrived three days later, and, by mid-March, 32 Antarctic fur seals were present. The Cape Shirreff and San Telmo colony continued to grow until its recent peak in 2002, when 8,577 pups were born (Goebel *et al.* 2003) (Table 2, Figure 1 (Section 8)). The total population at that time is estimated to be between 21,190 and 35,165 individuals depending on a conservative (Hucke-Gaete *et al.* 2004) or a more widely-used (Payne 1979) conversion rate, respectively. That peak was an order of magnitude lower than pre-exploitation population levels in the area (Hucke-Gaete *et al.* 2004), and has given way to a rapid population decrease of over 87% since 2007 (Krause & Hinke 2021; Krause *et al.* 2022). Although it remains the largest Antarctic fur seal breeding center in the Antarctic Peninsula, the breeding population is precariously low and further study is needed to identify the minimum sustainable population level.

Antarctic fur seal breeding sites at Cape Shirreff are concentrated around the coastline of the northern half of the peninsula (Map 3). At San Telmo Island, breeding is concentrated on sandy beaches at the southern and central sections of the island (Krause pers. comm. 2021). Long-term monitoring of Antarctic fur seals has been carried at Cape Shirreff since 1991, with the primary objective of studying breeding success in relation to prey availability, environmental variability and human impacts (Osman *et al*. 2004). Researchers have studied various aspects of the fur seal colony, including pup production, predation, growth, female attendance behavior, seal diet, and foraging behavior (Goebel *et al*. 2014). Genetic analysis to investigate the recolonization of Antarctic fur seals at Cape Shirreff from the putative source population at South Georgia indicated highly significant genetic differentiation (Bonin *et al.* 2013; Paijamans *et al.* 2020), which emphasizes the importance of the genetic diversity within the Cape Shirreff population (Bonin *et al.* 2013; Krause *et al.* 2022). The Antarctic fur seal colony at Cape Shirreff has also been used to study the genetic analysis of twin pups, which are rare among pinnipeds (Bonin *et al*. 2012).

A number of extremely rare color patterns in fur seal pups have been recorded within the Area. Antarctic fur seals with pie-bald or light colorings were documented for the first time and an albino Weddell seal (*Leptonychotes weddellii*) represented the first confirmed case of albinism in Weddell, leopard (*Hydrurga leptonyx*), Ross (*Ommatophoca rossii*) or crabeater seals (*Lobodon carcinophagus*) (Acevedo *et al.* 2009a, 2009b). In December 2005 an adult male

subantarctic fur seal was observed among Antarctic fur seals at Cape Sherriff, which is more than 4000 km from the nearest subantarctic fur seal breeding colony (Torres *et al*. 2012).

Growth rates of fur seal pups within the Area have been studied in relation to sex, breeding season and maternal foraging and attendance (Vargas *et al*. 2009; McDonald *et al*. 2012a, 2012b). Studies on population dynamics indicate that the Cape Shirreff and San Telmo colony is likely being reduced by both worsening prey availability and predation of pups by leopard seals (*Hydrurga leptonyx*) (Schwarz *et al.* 2013; Krause *et al.* 2020; Krause *et al.* 2022).

Probably as a result of drastic reductions in their preferred ice habitat within the Antarctic Peninsula region (Forcada *et al.* 2012), the numbers of summer-resident leopard seals have substantially increased at Cape Shirreff and San Telmo in recent decades (Krause *et al.* 2015). As such a comprehensive research program conducted by both INACH and U.S. AMLR researchers has revealed important ecological connections between this apex predator and other species breeding at Cape Shirreff. Monitoring of leopard seal predation on the Antarctic fur seal pup population was initiated in 2000/01 and was expanded during the 2003/04 Antarctic season (Vera *et al*. 2004). Leopard seals hauling out at Cape Shirreff have been fitted with HD video cameras, GPS and time-depth recorders to monitor their foraging range, and hunting strategies (Krause *et al.* 2015). While no more than two leopard seals were seen foraging concurrently before 1996 (Boveng *et al.* 1998), their numbers rose rapidly between 1998 and 2011 (Vera *et al.* 2005; Goebel *et al.* 2014). Between 2011 and 2020 the maximum number of leopard seals observed foraging concurrently at Cape Shirreff averaged 20 (range = 11 to 41). Fur seal pups appear to be preferentially targeted by large, adult female leopard seals who use specialized hunting tactics to achieve high rates (> 92%) of prey capture success (Hiruki *et al.* 1999; Krause *et al.* 2015). Between 2013 and 2017 Antarctic fur seal pups alone contributed an estimated 21.3 – 37.6% of female leopard seal summer diets (Krause *et al.* 2020). High leopard seal density, focused feeding on fur seal pups, and the associated intraspecific competition (Krause *et al.* 2016), including kleptoparasitism and food caching behavior (Krause & Rogers 2019), have significantly elevated rates of pup mortality at Cape Shirreff. In addition to fur seal pups, leopard seals regularly consumed brush-tailed penguins, and two species of demersal fish (*Gobionotothen gibberifrons and Notothenia coriiceps)* (Krause *et al.* 2020).

A small number of southern elephant seals breed in October on several eastern beaches (U.S. AMLR, pers. comm. 2000; Torres, pers. comm. 2002). On 2 Nov 1999 34 pups were counted on beaches south of Condor Hill (U.S. AMLR, unpublished data). Since that time a majority of pups have been born near Playa Media Luna, and between 2009 and 2017 the annual pup production has ranged widely from 58 in 2016 to a low of 17 in 2017 (U.S. AMLR, unpublished data). Groups of non-breeding southern elephant seals also haul out regularly at Cape Shirreff to rest and molt. Since 2009, weekly censuses found over 200 individuals hauled out concurrently at some point every year (U.S. AMLR, unpublished data). The foraging behavior of southern elephant seals has been studied using satellite tracking of animals tagged at Cape Shirreff and analyzed in relation to the physical properties of the water column (Huckstadt *et al*. 2006; Goebel *et al.* 2009). Seals were found to forage as far afield as the Amundsen Sea and one animal was observed travelling 4,700 km due west of the Antarctic Peninsula.

Crabeater seals have been observed hauling out at Cape Shirreff throughout the study period. The maximum number observed was 8 during the 2017/18 season. While the vast majority of individuals observed are non-resident , crabeater seals have been observed both pupping and copulating on land, a rare behaviour, in 2015 and 2017 (U.S. AMLR, unpublished data). Weddell seals are also regular residents at Cape Shirreff, including a small number of breeding females. The highest number of Weddell seal pups born was 6 in 2017, and the highest number of concurrently hauled out adult and juvenile individuals was 48 during the 2010/11 season (Goebel et al. 2014; U.S. AMLR, unpublished data).

DNA samples are frequently collected from four seal species at Cape Shirreff and stored in the Southwest Fisheries Science Center DNA archives (Goebel *et al.* 2009). During the 2009/10, 2010/11, 2011/12, and 2014/15 summer seasons, researchers deployed archival tags on

Antarctic fur seals, along with Weddell seals and leopard seals, to monitor their behavior over the winter period (Goebel *et al*. 2014; Hinke *et al.* 2017). Unoccupied aerial system (UAS) surveys have been conducted every season since 2011/12, and have been shown to be robust to Antarctic conditions, as accurate as traditional ground methods for counting and measuring seabirds and pinnipeds (Goebel *et al.* 2015; Krause *et al.* 2017), and often less invasive than traditional ground methods (Krause *et al.* 2021).

Humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalus*), minke (*Balaenoptera bonaerensis*) and killer (*Orcinus orca*) whales have been observed in the offshore area immediately to the north-east of the Area (Cox *et al*. 2009; U.S. AMLR, unpublished data). A stranded Southern Right whale (*Eubalaena australis*) was found at 'Papua Beach' in 1997/98 (Torres *et al*. 1998).

Marine environment and ecosystem

The seafloor surrounding the Cape Shirreff peninsula slopes relatively gently from the coast, reaching depths of 50 m approximately 2-3 km from the shore and 100 m at about 6-11 km (Map 1). This relatively shallow and broad submarine ridge extends to the NW for about 24 km before dropping more steeply at the continental shelf edge. The ridge is about 20 km in width and flanked on either side by canyons reaching depths of around 300-400 m. There is abundant macroalgae present in the intertidal zone. The limpet *Nacella concinna* is common, as elsewhere in the South Shetland Islands.

The waters offshore from Cape Shirreff have been identified as one of three areas of consistently high krill biomass density in the South Shetland Islands area, although absolute krill populations fluctuate significantly over time (Hewitt *et al*. 2004; Reiss *et al*. 2008). The spatial distribution, demography, density and size of krill and krill swarms have been studied in the nearshore region at Cape Shirreff, using small scale acoustic surveys and Autonomous Underwater Vehicles (AUV) (Warren *et al*. 2005; Reiss *et al*. 2008; Reiss *et al.* 2021). Acoustic surveys of the nearshore environment indicate that krill in this area are most abundant to the south and SE of Cape Shirreff and at the margins of the two submarine canyons, which are believed to be a source of nutrient-rich water that may increase productivity in the nearshore area surrounding Cape Shirreff (Warren *et al.* 2006, 2007). Nearshore net tows indicated that the organisms identified in acoustic surveys were primarily the euphausiids, *Euphausia superba*, *Thysanoessa macrura* and *Euphausia frigida*, and may also include chaetognaths, salps, siphonophores, larval fish, myctophids and amphipods (Warren *et al.* 2007).

The nearshore environment surrounding Cape Shirreff has been identified as a primary feeding ground for penguins resident at the site, particularly during the breeding season when chick provisioning limits foraging range (Cox *et al*. 2009). Fur seals and penguins at Cape Shirreff depend strongly upon krill for prey. Predator foraging ranges are known to overlap with areas of commercial krill fisheries (Hinke *et al*. 2017) and changes in the abundance of both predators and krill have been linked to climatic change (Hinke *et al*. 2007; Trivelpiece *et al*. 2011). Research at Cape Shirreff therefore aims to monitor krill abundance in combination with predator populations and breeding success, in order to assess the potential effects of commercial fishing (e.g., Watters *et al*. 2020), as well as environmental variability and climatic change on the ecosystem.

Numerous studies of the marine environment have been conducted in the region offshore from Cape Shirreff as part of research carried out within the U.S. AMLR survey grid, including both summer (Reiss *et al*. 2008) and winter surveys (Reiss *et al*. 2017). These studies include investigations into various aspects of the marine environment, including physical oceanography, environmental conditions, phytoplankton distribution and productivity, krill distribution and biomass and the distribution and density of seabirds and marine mammals (U.S. AMLR 2008, 2009). Currently, at-seas studies include annual deployments of a mooring array, that spans two cross-shelf marine canyons and the shallow shelf in between, remotely-piloted glider surveys (Reiss *et al.* 2021), and episodic surveys based on the U.S. AMLR survey grid by fishing vessels and National Antarctic programs. These studies continue to provide data for assessing ecosystem response to climate change and fishing in the vicinity of Cape Shirreff.

Historical features

Following discovery of the South Shetland Islands in 1819, intensive sealing at Cape Shirreff between 1820 and 1824 exterminated almost the entire local populations of Antarctic fur seals and southern elephant seals (Bonner 1968; Smith & Simpson 1987). In January 1821, 60–75 British sealers were recorded living ashore at Cape Shirreff and 95,000 skins were taken during the 1821/22 season (O'Gorman 1963). Evidence of the sealers' occupation remains, with ruins of at least one sealers' hut in the northwestern region of the peninsula and remains of sealer's settlements recorded on a number of the beaches (D. Torres, A. Aquayo and J. Acevedo, pers. comm. 2010). The shoreline of several bays is also littered with timbers and sections of wrecked sealers' vessels. Other evidence of sealing activity includes the remains of stoves, pieces of glass bottles, a wooden harpoon, and a handcrafted bone figure (Torres & Aguayo 1993). Fildes (1821) reported that sealers found spars and an anchor stock from the Spanish ship San Telmo on Half Moon Beach around the time she was lost. The ship sank in the Drake Passage at around 62°S 70°W on 4 September 1819, with 644 persons aboard (Headland 1989; Pinochet de la Barra 1991). These were possibly the first people to die in Antarctica, and the event remains the greatest single loss of life yet to occur south of 60°S. A cairn has been erected on the northwestern coast of Cape Shirreff peninsula to commemorate the loss, which is designated as Historic Monument No. 59 (Map 3). The *San Telmo* wreck is recognized as HSM No.95 (Measure 2 (2021)), although the wreck location remains unknown.

The remains of a camp were found close to the site of present camp facilities (Torres & Aguayo 1993). On the evidence of the script on items found at the site, the camp is believed to be of Russian origin and date from the 1940-50s, although its exact origins have yet to be determined. Items found include parts of an antenna, electrical wires, tools, boots, nails, battery cells, canned food, ammunition and a wooden box covered by a pyramid of stones. Several notes in Russian, dating from later visits, were found in this box (Torres 2007).

In January 1985 a human skull was found at Yamana Beach (Torres 1992), determined to be that of a young woman (Constantinescu and Torres 1995). In January 1987 part of a human femur was found on the ground surface nearby, inland from Yamana Beach. After a careful surface survey, no other remains were evident at that time. However, in January 1991, another part of a femur was found in close proximity to the site of the earlier (1987) find. In January 1993 an archaeological survey was carried out in the area, although no further human remains were found. The original samples were dated as from approximately 175 years BP, and it was hypothesised they belong to a single individual (Torres 1999).

Human activities / impacts

The modern era of human activity at Cape Shirreff has been largely confined to science. During the past three decades, the population of Antarctic fur seals in the South Shetland Islands grew to a level at which tagging and other research could be undertaken without threatening the existence and growth of the local population. Chilean studies on Cape Shirreff began in 1965 (Aguayo & Torres 1966, 1967), with a more intensive program initiated by Chilean scientists in 1982, including an ongoing Antarctic fur seal tagging program (Cattan *et al*. 1982; Torres 1984; Oliva *et al*. 1987). United States investigators have conducted pinniped and seabird surveys at Cape Shirreff and San Telmo Island since 1986/87 (Bengtson *et al*. 1990).

CEMP studies at Cape Shirreff began in the mid-1980s, initiated by Chilean and U.S. scientists. Cape Shirreff was designated as a CEMP Site in 1994 to protect the site from damage or disturbance that could adversely affect long-term CEMP monitoring. As part of the CEMP, long-term studies are assessing and monitoring the feeding ecology, growth and condition, reproductive success, behavior, vital rates, and abundance of pinnipeds and seabirds that breed in the Area. The results of these studies will be evaluated in context with environmental data, offshore sampling data, and fishery statistics to identify possible cause-effect relationships between krill fisheries and pinniped and seabird populations. Recent analyses using US AMLR time series of CEMP monitoring data (Watters *et al*. 2020) have revealed potentially negative

effects of locally high harvest rates of krill, particularly during years with poor environmental conditions.

Brucella and herpes virus antibodies were detected in tissue samples taken from Antarctic fur seals at Cape Shirreff over summer seasons from 1998-2001, and Brucella antibodies were also detected in Weddell seal tissue (Blank *et al*. 1999; Blank *et al*. 2001a & b). Studies on the mortality of Antarctic fur seal pups from diseases began in the 2003/04 Antarctic season (Torres & Valdenegro 2004). Enteropathogenic *Escherichia coli* (EPEC) has been recorded in swabs from Antarctic fur seals at Cape Shirreff, with two out of 33 pups sampled testing positive for the pathogen. The findings were the first reports of EPEC in Antarctic wildlife and in pinnipeds, and the effects of the pathogen on Antarctic wildlife is unknown (Hernandez *et al*. 2007).

Plastic rubbish was first reported at Cape Shirreff by Torres and Gajardo (1985), and marine debris monitoring studies have been carried out regularly since 1992 (Torres & Jorquera 1995). Debris remains an ongoing problem at the site, with over 1.5 tons of material removed from the area by Chilean scientists to date (D. Torres, A. Aquayo and J. Acevedo, pers. comm., 2010). Surveys yielded large numbers of articles, mostly made of plastic, but have also included vegetable waste from ships, metal oil drums, rifle shells and an antenna. For example, the 2000/01 season survey recorded a total of 1,774 articles, almost 98% of which were made of plastic and the remainder made of glass, metal and paper. It is significant that 34% of the plastic items found in 2000/01 were packing bands, representing approximately 589 bands. Of these, 40 were uncut and another 48 had been knotted into a loop. Several articles found in this survey were oiled, and some plastic articles were partially burnt. Antarctic fur seal entanglement in marine debris has been recorded frequently at Cape Shirreff (Torres 1990; Hucke-Gaete *et al*. 1997c, 2009), primarily in fishing equipment such as nylon ropes, net fragments and packing bands. Between 1987 – 2019 a total of 42 Antarctic fur seals were recorded with 'neck collars' from such debris (U.S. AMLR, unpublished data). Plastic fibers are also found in kelp gull and chinstrap penguin nests (Torres & Jorquera 1992), as well as those of sheathbills (Torres & Jorquera 1994). Recently a study to identify microplastics in seabird diet samples was initiated (J.Hinke, pers comm).

The waters surrounding Cape Shirreff represent an historically important fishing area for Antarctic krill. Catch data in CCAMLR Statistical subarea 48.1 for the Drake's Passage West small-scale management unit, which encompasses the foraging ranges of penguins and seals from Cape Shirreff, are publically available from 1994 (CCAMLR 2020a). Catches in the waters around Cape Shirreff have declined over time coincident with a shift in fishery operations from summer to winter in areas further south (Nicol & Foster 2016). Mean annual catches of krill in waters adjacent to Cape Shirreff were 24,510 tonnes from 1994 to 2000, 14,371 tonnes from 2001 to 2010, and 6,255 tonnes from 2011 to 2020. However, within the broader Statistical Area 48, catches have steadily increased to record levels, exceeding 450,000 tonnes in 2020. Catches in subarea 48.1 are currently capped at 155,000 tonnes and the fishery has been closed mid-season in nine of the last eleven seasons when catches have reached this level (CCAMLR 2020a).

Catches of finfish occurred historically in smaller quantities and included *Champsocephalus gunnari*, *Champsocephalus gunnari*, *Nototh*eniops *nybelini*, *Notothenia coriiceps*, *Notolepis* spp, *Notothenia gibberifrons*, *Notothenia neglecta*, *Notothenia rossii*, *Pseudochaenichthys georgianus* and *Chaenocephalus aceratus* (CCAMLR 2010). Currently, directed fishing for all finfish in Subarea 48.1 is prohibited except for scientific research permitted under CCAMLR Conservation Measure 24-01 (CCAMLR 2020b).

6(ii) Access to the Area

Access to the Area may be made by small boat, by aircraft or across sea ice by vehicle or on foot. Historically seasonal sea ice formation in the South Shetlands area generally began in early April and persisted until early December, although more recently the South Shetland Islands can be ice-free year round as a result of regional warming.

Air access is discouraged, and restrictions apply to routes and landing sites for the period 01 November – 31 March inclusive. Details of these restrictions are given in Section 7(ii) below, and of the Helicopter Access Zone in Section 6(v).

Two anchorages have been identified close to the Area (Map 2) and when access to the Area is made from the sea, small boats should land at one of the locations defined in Section 7(ii). Sea states are generally between 1 and 4 m, decreasing closer to shore or in lea of Cape Shirreff (Warren *et al*. 2006, 2007).

When sea-ice conditions allow, the Area may be accessed over sea ice on foot or by vehicle. However, vehicle use on land within the Area is restricted to the coastal zone between Módulo Beach and the Chilean / U.S. camp facilities and to following the access route shown on Map 3 to allow re-supply of the bird blind / emergency hut (see Section 7(ii) for more details).

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

A semi-permanent summer-only research camp has been established on the eastern coast of the Cape Shirreff peninsula, located at the base of Condor Hill (62°28.249'S, 60°46.283'W) (Map 3). Buildings for the camp remain *in situ* year-round. In 2021 the Cape Shirreff Field Camp (U.S.) consisted of four small buildings and an outhouse (Krause pers. comm. 2021). The camp 'Dr Guillermo Mann-Fischer' (Chile) is located around 50 m from the U.S. camp and comprised of a main hut, laboratory, store house, a fiberglass igloo, an outhouse and a defunct wind-powered generator tower (D. Torres, A. Aquayo and J. Acevedo, pers. comm., 2010)). The Chilean fiberglass igloo was originally installed in 1990/91, while the U.S. camp was established in 1996/97. Storage areas are also present, and tents are erected seasonally nearby as required. An All-Terrain Vehicle (ATV) shed, with secondary containment for summer use and winter storage of the ATV, was constructed at the U.S. camp in 2009/10. The site was selected to remain within the existing field camp footprint and to avoid interference with seal movements. A 'Weatherhaven' polar tent is stored at Cape Shirreff as additional accommodation for visiting scientists and is erected within 10 m of the south side of the U.S. camp when needed.

Two automatic weather stations are mounted on the exterior of existing buildings at Cape Shirreff. Two remote receiving stations used for seal tracking studies are stored within a box (90x60x100cm) located to the east of helicopter landing site 'A' on the northeastern slopes of Condor Hill and on the northern tip of Maderas Ridge (see Map 3).

A boundary sign, replaced in 2018, stating that the Area is protected and that access is prohibited is located at Módulo Beach, close to the Chilean and U.S. camps (Krause pers. comm. 2021). The boundaries of the Area are not otherwise marked.

The remains of a camp, believed to be of Russian origin, are present near the Chilean and U.S. camps. In other parts of the peninsula, sparse evidence may be found of 19th Century sealers' camps (Smith and Simpson 1987; Torres 1993; Stehberg and Lucero 1996). A cairn (Historic Monument No. 59) has been erected on Gaviota Hill on the northwestern coast to commemorate the loss of those aboard the *San Telmo* in 1819 (Map 3). In 1998/99 a 5x7 m bird observation / emergency hut (62°27.653'S, 60°47.404'W) was installed by U.S. scientists on the northern slopes of Enrique Hill above Bahamonde Beach, close to the penguin colonies (Map 3).

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

The nearest protected areas to Cape Shirreff are Byers Peninsula (ASPA No. 126), which lies about 20 km to the southwest; Port Foster (ASPA No. 145, Deception Island) and other parts of Deception Island (ASPA No. 140), which are approximately 30 km to the south; and 'Chile Bay' (Discovery Bay) (ASPA No. 144), which lies about 30 km to the east at Greenwich Island (Map 1).

6(v) Special zones within the Area

A zone in the north and west of the Area is designated as a Restricted Zone, due to its high concentrations of wildlife. Restrictions apply to air access only and prohibit overflight below 2000 ft (~610m), unless specifically authorized by permit. The Restricted Zone is defined as the area north of 62°28'S (Map 2), and west of 60°48'W and north of 62°29'S.

A Helicopter Access Zone (Map 2) has been defined which applies to aircraft entering the Area and accessing the designated landing sites. The Helicopter Access Zone extends from the Livingston Island permanent ice cap northward following the main ridgeline of the peninsula for 1200 m (~ 0.65 n. mi.) towards Selknam Hill. The Helicopter Access Zone then extends east by 300 m (~0.15 n. mi) (to helicopter landing site 'B' at Ancho Pass and a further 400 m (~0.23 n. mi) east to the summit of Condor Hill at the helicopter landing site 'A'. The southern boundary of the Helicopter Access Zone is coincident with the southern boundary of the Area.

7. Terms and conditions for entry permits

7(i) General permit conditions

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

- It is issued for scientific purposes, in particular for research associated with the CEMP, or for compelling scientific, archaeological or historic purposes that cannot be served elsewhere, or for reasons essential to the management of the Area such as inspection, maintenance or review;
- the actions permitted are in accordance with this Management Plan;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental and scientific values of the Area;
- It is issued for compelling educational or outreach purposes that cannot be served elsewhere, and which do not conflict with the objectives of this Management Plan;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried within the Area.

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

Access to the Area shall be by small boat, by helicopter, on foot or by vehicle. Persons entering the Area may not move beyond the immediate vicinity of their landing site unless authorised by permit.

Foot access and movement within the Area

With the exception of the restricted use of vehicles described below, movement on land within the Area shall be on foot. Pilots, air, boat or vehicle crew, or other people in aircraft, boats, or vehicles are prohibited from moving on foot beyond the immediate vicinity of their landing site or the hut facilities unless specifically authorised by permit. Visitors should move carefully so as to minimize disturbance to flora, fauna, and soils, and should walk on snow or rocky terrain if practical, but taking care not to damage lichens. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize impacts.

Vehicle access and use

Access by vehicle over land may be made to the Area boundary. Access by vehicle over sea ice may be made to the shore within the Area. Vehicles are permitted to operate as follows:

- in the coastal zone between Módulo Beach and the Chilean / U.S. camp facilities (Map 3); and

- in support of annual re-supply of the bird blind / emergency hut following the designated route (see Map 3), which should be undertaken prior to 15 November in a given season and only if the entire route is snow-covered to a depth of at least 40 cm, to minimise the possibility of damage to underlying soil and vegetation (Felix & Raynolds 1989). A journey after 15 November should be considered carefully, due to potential disturbance to adult female fur seals, which tend to arrive around that time of the year. No more than two re-supply journeys by vehicle to the emergency hut are allowed per season. An inspection of the route should be undertaken when it is snow-free to check for any evidence that vehicle use has caused damage to soils or vegetation. Should any damage be observed, use of vehicles for the purpose of re-supply shall be suspended until such time as a review of this policy has been completed. As of 2021, the vehicle route between the main camp and the bird blind has never been used (Krause pers. comm. 2021).

The use of vehicles elsewhere within the Area is prohibited.

Boat access

Access by small boats should be at one of the following locations (Map 2):

1. the eastern coast of the peninsula at El Módulo Beach, 300 m north of the camp facilities, where a deep channel enables relatively easy access;
2. the northern end of Half Moon Beach, on the eastern coast of the peninsula;
3. the northern end of Yámana Beach, on the western coast (suitable at high tide only);
4. the north coast at Alcazar Beach near the bird blind / emergency hut;
5. the southern end of the northern beach on San Telmo Island.

Access by small boat at other locations around the coast is allowed, provided this is consistent with the purposes for which a permit has been granted. Two positions have been identified close to the Area for stationing support ships: 1,600 m north-east of the main camp facilities and approximately 800 m north of San Telmo Island (Map 2). Visitors should, where practicable, avoid landing where pinniped or seabird colonies are present on or near the coast.

Aircraft access and overflight

Due to the widespread presence of pinnipeds and seabirds over the Cape Shirreff peninsula during the breeding season (01 November – 31 March), access to the Area by aircraft in this period is strongly discouraged. Where possible and by preference, access should be by small boat. All restrictions on aircraft access and overflight apply between 01 November – 31 March inclusive, when aircraft shall operate and land within the Area according to strict observance of the following conditions:

1) It is recommended that aircraft maintain a horizontal and vertical separation distance 2000 ft (~610 m) from the Antarctic Specially Protected Area boundary (Map 2), unless accessing the designated landing sites through the Helicopter Access Zone or otherwise authorized by permit;
2) Overflight of the Restricted Zone is prohibited below 610 m (2,000 ft) unless authorized by permit. The Restricted Zone is defined as the area north of 62°28'S, or north of 62°29'S and west of 60°48'W (Map 2), and includes the areas of greatest wildlife concentration;
3) Helicopter landing is permitted at two designated sites (Map 2). The landing sites with their coordinates are described as follows:
4) **(A)** on a small area of flat ground, ~150 m northwest of the summit of Condor Hill (50 m, or ~150 ft) (62°28.257'S, 60°46.438'W), which is the preferred landing site for most purposes; and

   (B) on the wide flat area on Ancho Pass (25 m), situated between Condor Hill and Selknam Hill (62°28.269'S, 60°46.814'W).

5) Aircraft accessing the Area should follow the Helicopter Access Zone to the maximum extent practicable. The Helicopter Access Zone allows access from the south across the Livingston Island permanent ice cap and extends along the main ridgeline of the peninsula for 1,200 m (~ 0.65 n. mi.) towards Selknam Hill (elevation = 50 m, or ~150 ft). The Helicopter Access Zone then extends east by 300 m (~ 0.15 n. mi) to Ancho Pass, where helicopter landing site 'B' is situated, and a further 400 m (~0.23 n. mi) east to the summit of Condor Hill (elevation = 50 m, or ~150 ft), close to helicopter landing site 'A'. Aircraft should avoid overflight of the hut and beach areas on the eastern side of Condor Hill.
6) The preferred approaches to the Helicopter Access Zone are from the south across the Livingston Island permanent ice cap, from the southwest from the direction of Barclay Bay, and from the southeast from the direction of Hero Bay (Maps 1 and 2).
7) Weather with a low cloud ceiling often prevails at Cape Shirreff, particularly in the vicinity of the permanent ice cap, which can make snow/ice ground definition difficult to discern from the air. On-site personnel who may be advising on local conditions before aircraft approaches should be aware that a minimum cloud base of 150 m (500 ft) AMSL over the approach zone of the Livingston Island ice cap is necessary in order for access guidelines to be followed;
8) Overflight below 2000 ft (610 m) and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are prohibited except in accordance with a permit issued by an appropriate national authority. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

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

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

7(iv) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit;
- The principal camp facilities shall be limited to the area within 200 m of the existing Chilean and U.S. field camps (Map 3). Small temporary hides, blinds or screens may be constructed for the purpose of facilitating scientific study of the fauna;
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of harm to fauna, contamination, or of damage to the values of the Area;
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to flora and fauna, preferably avoiding the main breeding season (1 November – 31 March);
- Removal of specific structures, equipment, hides or markers for which the permit has expired shall be the responsibility of the authority which granted the original permit, and shall be a condition of the permit.

7(v) Location of field camps

Camping is permitted within 200 m of the facilities of the Chilean and U.S. field camps, on the eastern coast of the Cape Shirreff peninsula (Map 3). Temporary camping is permitted at the northern extremity of Yamana beach to support fieldwork on the San Telmo islets (Map 3). The U.S. bird observation hut on the northern slopes of Enrique Hill (62°27'41"S, 60°47'28"W) may be used for temporary overnight camping for research purposes, although should not be used as a semi-permanent camp. Camping is permitted on San Telmo Island when necessary for purposes consistent with plan objectives. The preferred camping location is at the southern end of the northern beach on the island. Camping is prohibited elsewhere within the Area.

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

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

- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);
- Visitors shall ensure that sampling equipment and / or markers are clean. To the maximum extent practicable, clothing, footwear and other equipment (including e.g. backpacks, carry-bags, tents, walking poles, tripods, etc.) shall be thoroughly cleaned prior to entry. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2019), and in the Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (*Resolution 5 (2018)*);
- Dressed poultry should be free of disease or infection before shipment to the Area and, if introduced to the Area for food, all parts and wastes of poultry shall be completely removed from the Area or treated, incinerated, or boiled long enough to kill any potentially infective bacteria or viruses;
- Herbicides or pesticides are prohibited from the Area;
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted;
- Fuel, food, and other materials shall not be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted. In general, all materials introduced shall be for a stated period only and shall be removed at or before the conclusion of that stated period;
- All materials shall be stored and handled so that risk of their introduction into the environment is minimized;
- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

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

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

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

- Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs. This includes biological samples and rock or soil specimens.
- Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed from any part of the Area, unless the impact of removal is likely to be greater than leaving the material *in situ.* If this is the case the appropriate authority should be notified and approval obtained.
- Material found that is likely to possess important archaeological, historic or heritage values should not be disturbed, damaged, removed or destroyed. Any such artifacts should be recorded and referred to the appropriate authority for a decision on conservation or removal. Relocation or removal of artifacts for the purposes of preservation, protection, or to re-establish historical accuracy is allowable by permit.
- The appropriate national authority should be notified of any items removed from the Area that were not introduced by the permit holder.

7(ix) Disposal of waste

All wastes shall be removed from the Area, except human wastes and domestic liquid wastes, which may be removed from the Area or disposed of into the sea.

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

Permits may be granted to enter the Area to:

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 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 are strongly encouraged to consult with established programs working within the Area, such as those of Chile or the United States, before initiating the work;
5) In view of the fact that geological sampling is both permanent and of cumulative impact, visitors removing geological samples from the Area shall complete a record describing the geological type, quantity and location of samples taken, which should, at a minimum, be deposited with their National Antarctic Data Centre or with the Antarctic Master Directory.

7(xi) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable after the visit has been completed in accordance with national procedures.
- Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Parties that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.
- Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures that might have exceptionally been undertaken, and / or of any materials released and not removed, that were not included in the authorized permit.

8. Supporting documentation

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Table 1: Chinstrap (*Pygoscelis antarcticus)* and gentoo (*P. papua*) penguin numbers at Cape Shirreff.

Year	Chinstrap (pairs)	Gentoo (pairs)	Source
1958	2000 (N3[1])	200-500 (N1[1])	Croxall and Kirkwood, 1979
1981	2164 (A4)	843 (A4)	Sallaberry and Schlatter, 1983 [2]
1987	5200 (A3)	300 (N4)	Woehler, 1993
1997	6907 (N1)	682 (N1)	Hucke-Gaete *et al.* 1997a
1997/98	7617 (N1)[a]	810 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
1998/99	7581 (N1)[a]	830 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
1999/00	7744 (N1)[a]	922 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2000/01	7212 (N1)[a]	975 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2001/02	6606 (N1)[a]	907 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2002/03	5809 (N1)[a]	722 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2003/04	5635 (N1)[a]	751 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2004/05	4907 (N1)[a]	818 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2005/06	4847 (N1)[a]	807 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2006/07	4543 (N1)[a]	781 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2007/08	3032 (N1)[a]	610 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2008/09	4026 (N1)[a]	879 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2009/10	4339 (N1)[a]	802(N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2010/11	4127 (N1)[a]	834 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2011/12	4100 (N1)[a]	829 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2012/13	4200 (N1)[a]	853 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2013/14	3582 (N1)[a]	839 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2014/15	3464 (N1)[a]	721 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2015/16	3325 (N1)[a]	655 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2016/17	3060 (N1)[a]	771 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2017/18	2449 (N1)[a]	705 (N1)[b]	[a]Hinke et al. 2019, [b]Watters et al. 2020
2018/19	2095 (N1)	674 (N1)	U.S. AMLR unpublished data
2019/20	2170 (N1)	708 (N1)	U.S. AMLR unpublished data

1. Alphanumeric code refers to the type of count, as in Woehler (1993).
2. Reported data did not specify species. It has been assumed that the higher number referred to chinstrap penguins. Data were reported as individuals, which have been halved to derive 'pairs' in the table.

Table 2. Census counts of live and dead Antarctic fur seal (*Arctocephalus gazella*) pups from Cape Shirreff and San Telmo Island (references available from U.S. AMLR).

Year (season ending)	Cape Shirreff	+/- SD	San Telmo Island
1959	2	NA	NA
1966	12	NA	NA
1971	27	NA	NA
1973	83	NA	218
1987	718	NA	1875
1992	2973	NA	2340
1993	3672	NA	2050
1994	3474	NA	2583
1995	4036	NA	2083
1996	4968	NA	2684
1997	5689	NA	3326
1998	4943	NA	2808
1999	5497	NA	NA
2000	5865	NA	2699
2001	5951	NA	2328
2002	6453	NA	2124
2003	5845	NA	NA
2004	6428	NA	NA
2005	6032	NA	NA
2006	5791	NA	NA
2007	6119	NA	NA
2008	4574	NA	1525
2009	4598	79	NA
2010	4007	80	NA
2011	3677	13	NA
2012	3328	79	NA
2013	2796	55	NA
2014	2306	21	NA
2015	2130	23	NA
2016	1681	24	NA
2017	1546	17	NA
2018	1267	29	NA
2019	1064	25	333
2020	860	11	NA

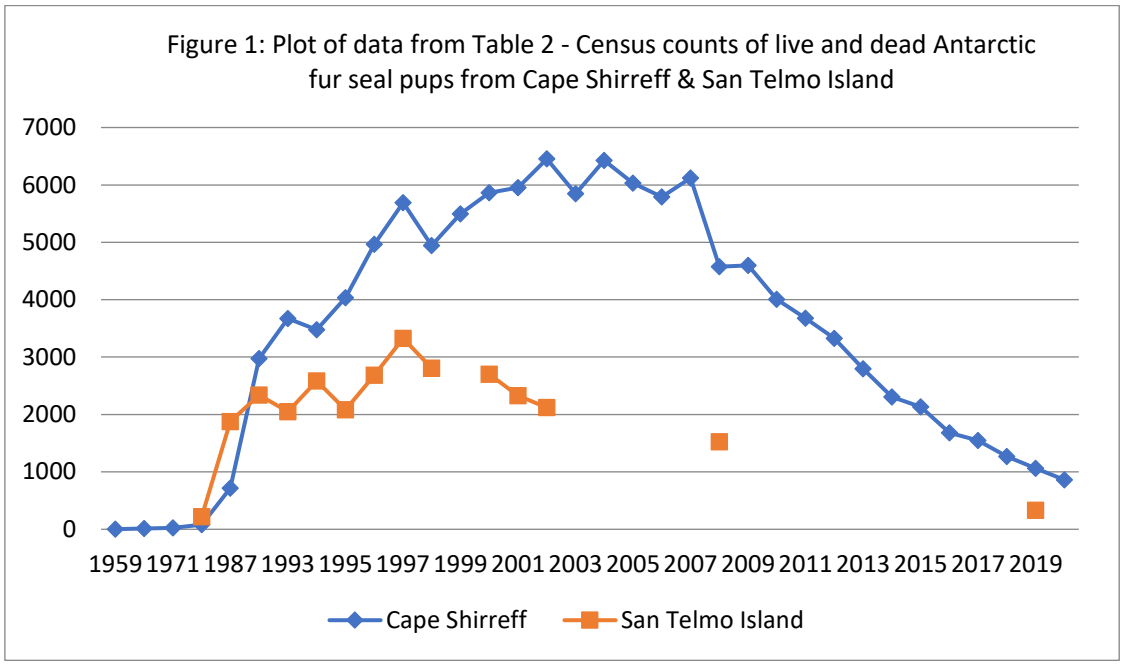
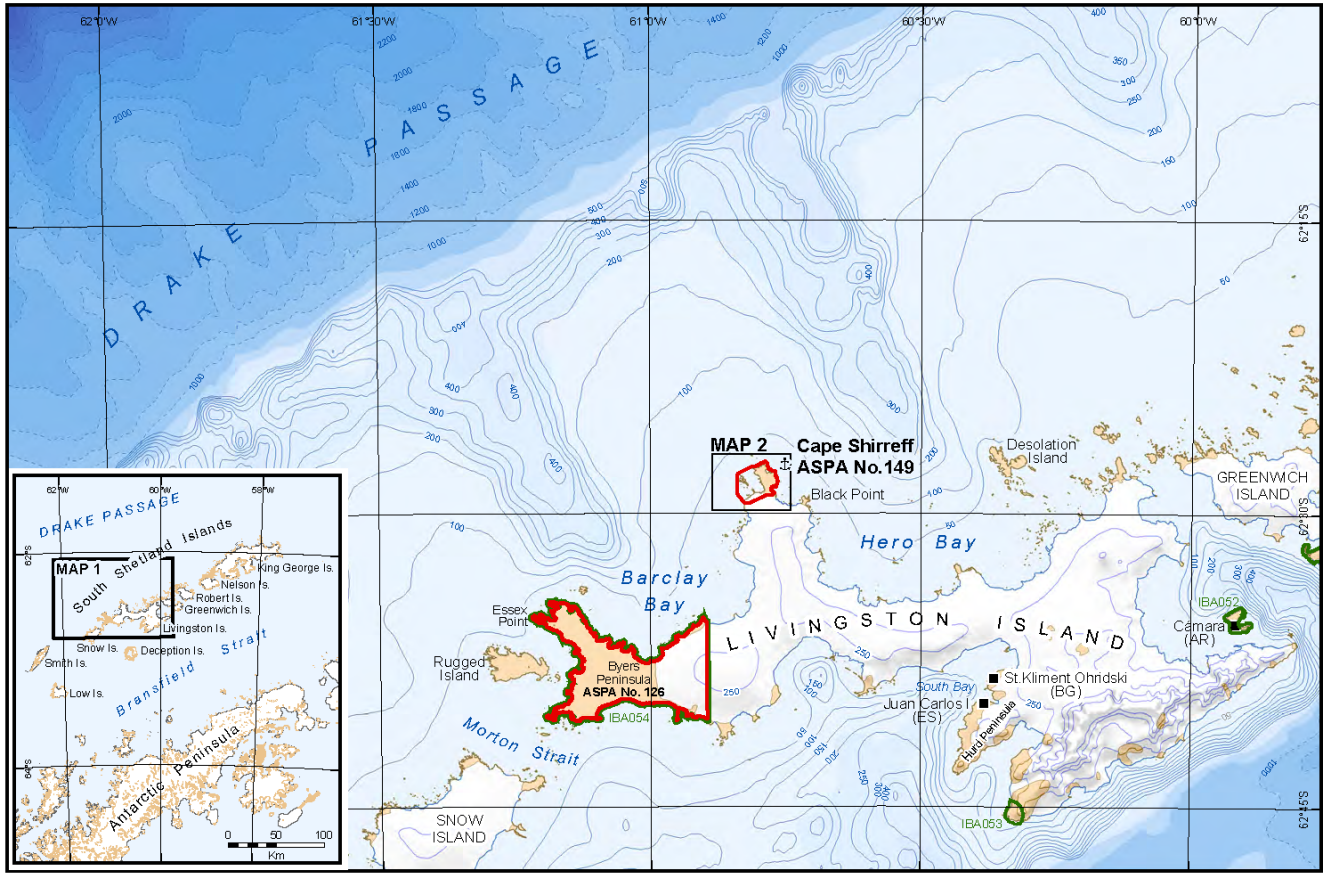


Figure 1: Plot of data from Table 2 - Census counts of live and dead Antarctic fur seal pups from Cape Shirreff & San Telmo Island
7000
6000
5000
4000
3000
2000
1000
0
1959 1971 1987 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Cape Shirreff
San Telmo Island



Map 1: ASPA No.149 - Cape Shirreff & San Telmo Island - Regional overview

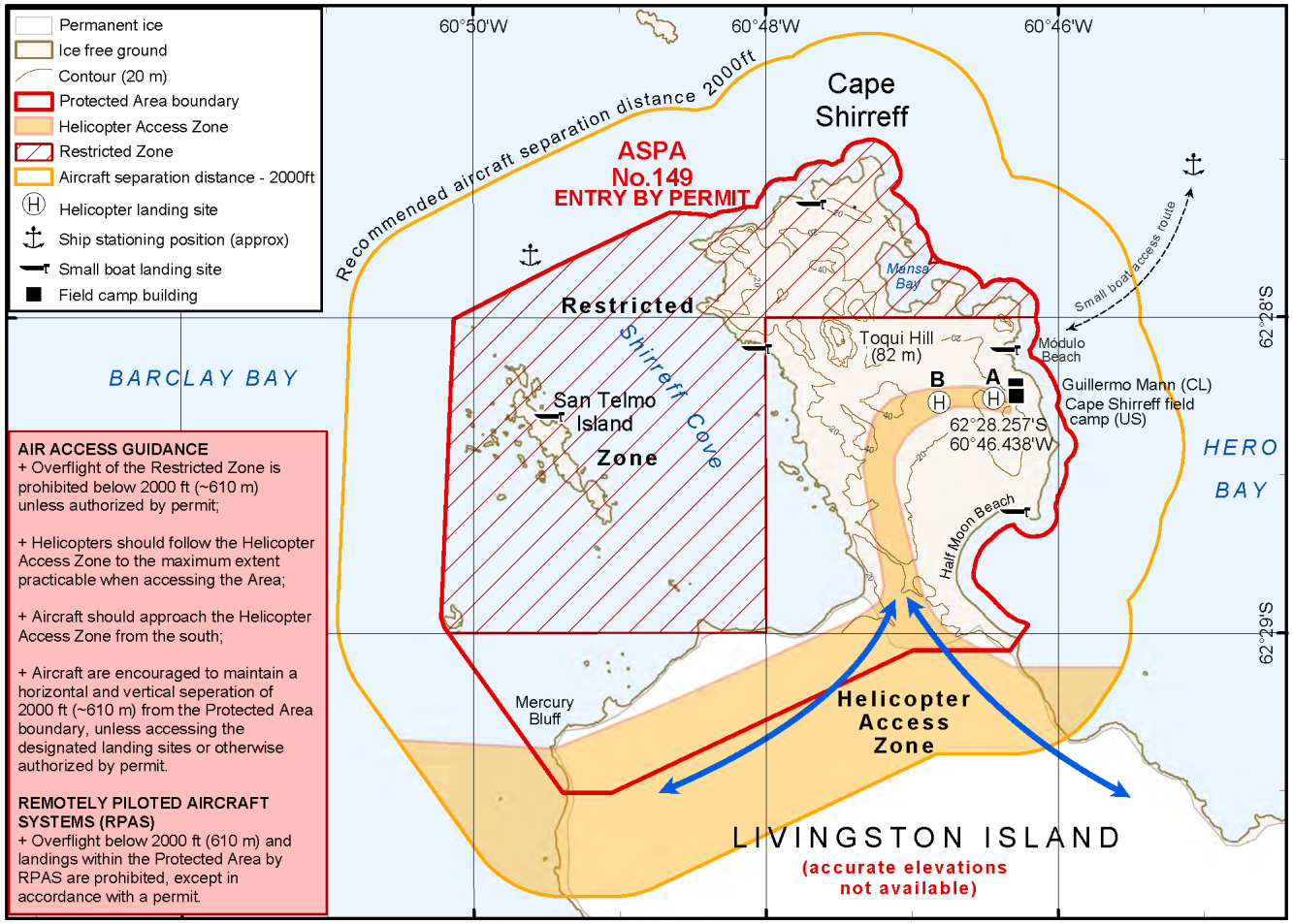
26 Jan 2022 (v3)
United States Antarctic Program / INACH
Environmental Research & Assessment

Permanent ice
Ice shelf
Ice-free ground
Contour (ice) - 250 m
Contour (rock) - 250 m
Bathymetry (50 m)
Bathymetry (200 m)
Antarctic Specially Protected Area (ASPA) boundary
Important Bird Area
Permanent Station
Ship stationing position (approx)

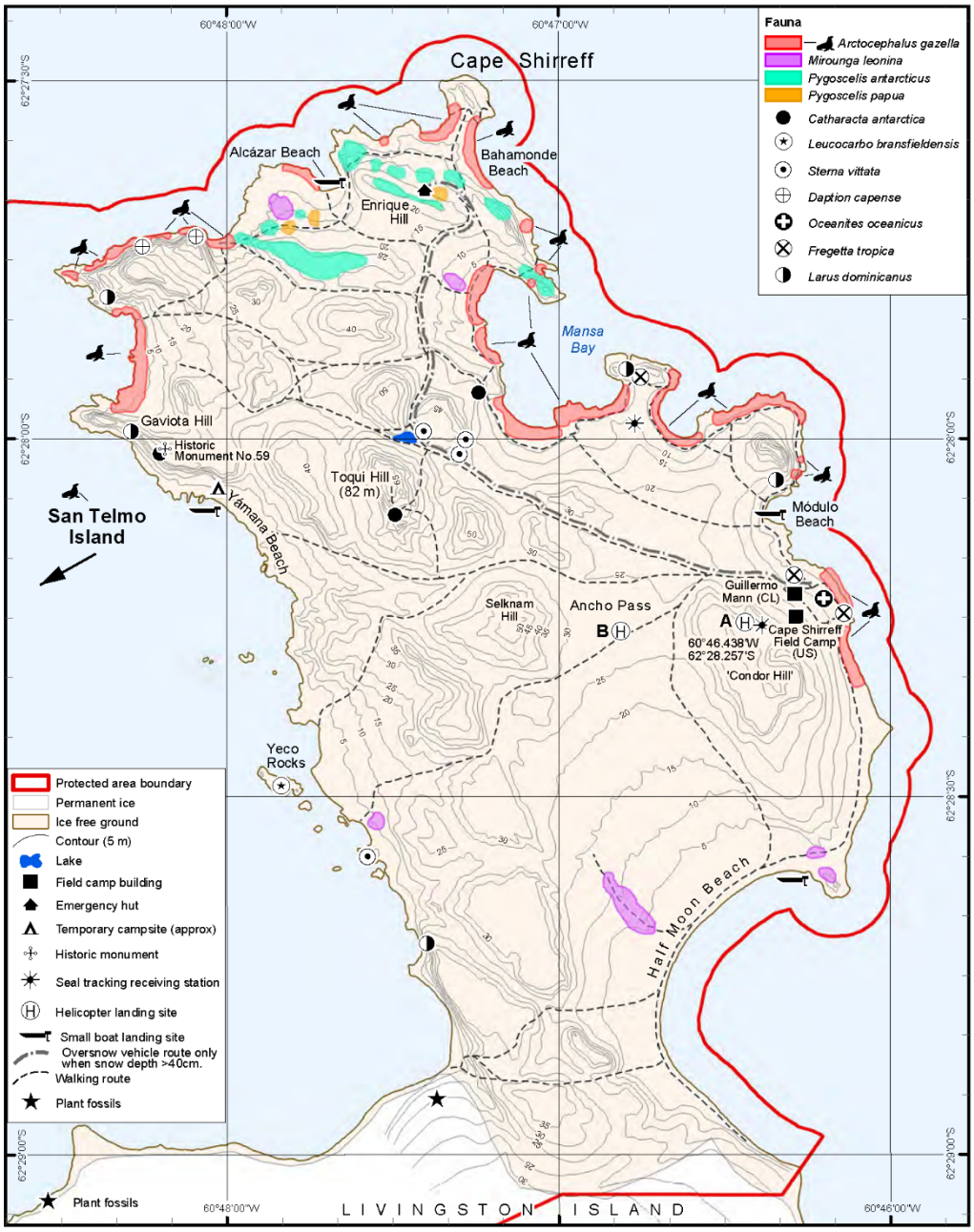
0 10 20
Kilometers

N

Projection: Lambert Conic Conformal
Spheroid and horizontal datum: WGS84
Data sources: Facilities: COMNAP (2021);
Topography: SCAR Antarctic Digital Database (v7.2-7.4, 2020-2022);
Hillshade derived from OSU RAMP 200 m DEM (v2).
Bathymetry: D. Demer & U.S. AMLR, NOAA, 2002 & IBCSO (v1 2013).



Map 2. ASPA No. 149 Cape Shirreff & San Telmo Island - access



Map 3: ASPA No. 149 - Cape Shirreff & San Telmo Island - wildlife & human features

28 Jan 2022 (v3)
United States Antarctic Program / INACH
Environmental Research & Assessment

Projection: Lambert Conformal Conic
Spheroid and horizontal datum: WGS84
Data sources: Seal tracking station & HSM: D.Krause (Dec 2015);
Walking routes, fauna: INACH, M.Goebel, D.Krause (2015);
All other data: Instituto Antártico Chileno (INACH).