Management Plan

for Antarctic Specially Protected Area No. 101 TAYLOR ROOKERY, MAC.ROBERTSON LAND

Introduction

Taylor Rookery is an emperor penguin (*Aptenodytes forsteri*) colony located on the east side of Taylor Glacier, Mac.Robertson Land (67°27'S; 60°51'E, Map A). The site was originally designated as Specially Protected Area No. 1, through Recommendation IV-I (1966), after a proposal by Australia. A management plan for the Area was adopted under Recommendation XVII-2 (1992). In accordance with Decision 1 (2002) the site was redesignated and renumbered as Antarctic Specially Protected Area (ASPA) No. 101. Revised ASPA management plans were adopted under Measure 2 (2005) and Measure 1 (2010). Taylor Rookery is designated as an ASPA to protect the largest known colony of emperor penguins located entirely on land.

1. Description of values to be protected

Of the 48 currently known emperor penguin colonies around Antarctica, the first land-based colony was only discovered at Emperor Island, Dion Islands, Antarctic Peninsula (67°52'S, 68°43'W) in 1948. About 150 breeding pairs occupied the island, but since the 1970s the population decreased and comprised only 22 pairs in 1999. No emperor penguins have been sighted at the Dion Islands since 2009 and the colony is likely to have become extinct. The colony at Taylor Glacier was the second land-based colony to be discovered, in October 1954. This colony is entirely land-based throughout the breeding season. Because of this uncommon characteristic this colony was designated as a Specially Protected Area in 1966, as was Emperor Island. A third land-based colony with about 250 pairs was discovered in Amundsen Bay, East Antarctica, in 1999.

The emperor penguin colony at Taylor Glacier is the largest known land-based colony (Map B) and as such is of outstanding scientific importance. The Australian Antarctic program has monitored the population at the Taylor Glacier colony, intermittently from 1957 to 1987, and annually since 1988. Photographic censuses have resulted in counts with high levels of accuracy. The number of adults at the colony averaged about 3680 breeding pairs in the early years. In the 1988-2010 period, the population averaged 2930 pairs or 20.5% less than earlier years. From 2011-2014, a further drop of 12% occurred (unpublished data). The reasons for this decrease are unknown. Similar long term records are available only for two other emperor penguin colonies, near Dumont d'Urville (Pointe Géologie Archipelago, ASPA 120, 66°40'S, 140°01'E), and at Haswell Island (ASPA 127, 66°31'S, 93°00'E), where both colonies decreased by about 50% in the 1970s. Population data are also available for a number of colonies in the Ross Sea region. However, the records of the latter are not continuous and do not include counts of the colonies in winter.

Each year the Australian Antarctic program makes no more than three visits, at different times of year, to Taylor Glacier. The colony is ideal for census work as it is surrounded by small rocky hills which make it possible to observe the penguins without entering the breeding area. Thus, human disturbance to the colony, especially since 1988, has been very low and direct human interference can be excluded as a potential factor influencing the health of this population.

2. Aims and Objectives

Management of Taylor Rookery aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance;
- allow research on the ecosystem and physical environment, particularly on the avifauna, provided it is for compelling reasons which cannot be served elsewhere;
- minimise the possibility of introduction of pathogens which may cause disease in bird populations within the Area;
- minimise the possibility of introduction of alien plants, animals and microbes to the Area;
- allow for the gathering of data on the population status of the emperor penguin colony on a regular basis and in a sustainable manner; and
- allow visits for management purposes in support of the aims of the management plan.

3. Management Activities

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

- visits shall be made to the Area as necessary (preferably not less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure that management activities are adequate: and
- the Management Plan shall be reviewed at least every five years and updated as required.

4. Period of Designation

Designated for an indefinite period.

5. Maps

Map A: Antarctic Specially Protected Area No. 101, Taylor Rookery, Mawson Coast, Mac.Robertson Land, East Antarctica. The inset map indicates the location in relation to the Antarctic continent.

Map B: Antarctic Specially Protected Area No. 101, Taylor Rookery: Topography and Emperor Penguin Colony.

Map C: Antarctic Specially Protected Area No. 101, Taylor Rookery: Vehicle and Helicopter Approach and Landing Site.

Map D: Antarctic Specially Protected Area No. 101, Taylor Rookery: ASPA Boundary Points All map specifications: Horizontal Datum: WGS84; Vertical Datum: Mean Sea Level

6. Description of the Area

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

The Taylor Rookery ASPA consists of the whole of the northernmost rock exposure on the east side of

Taylor Glacier, Mac.Robertson Land (67°27′ 14″S, 60°53′ 0″E, Map B). Boundary coordinates for the Area are provided at Appendix 1 and are shown on Map D. The Area boundary follows the coastline (at the low tide mark) from a point at the north-western corner of the Area at 67°27′4.9″S, 60°52′58.2″E (boundary point 1), in a roughly south-easterly direction to boundary point 6 (67°27′27.8″S, 60°53′7.7″E). The boundary then continues in a westerly and then northerly direction (roughly following the limit of the ice free area) to boundary point 22 (67°27′18″S, 60°52′50.2″E) then follows the ice cliff north to boundary point 23 (67°27′5.3″S, 60°52′57.1″E) and then joins back to boundary point 1. There are no boundary markers delimiting the site.

The emperor penguin colony is located on a low lying rock outcrop in the south-west corner of a bay formed by Taylor Glacier to the west, the polar ice cap to the south and the islands of the Colbeck Archipelago to the east. The Area is surrounded by fast ice to the north and east. The Area is some 90 kilometres west of Mawson station. There is ice-free terrain adjacent to the glacier on the western boundary and to the south the rock rises steeply to meet the ice of the plateau. The rock itself forms a horseshoe around a central flat area of exposed rock and moraine. This area is covered with snow in winter and is occupied by the emperor penguins. A couple of small melt lakes form in late spring and a small stream exits to the north-east. The sides of the horseshoe are rounded ridges of rock which are bare and smoothed by ice. Otherwise the terrain is rough and dissected with cracks and fissures. The average height of the ridges is about 30 metres.

The Area also has a raised beach which is typical of several found along the coast of Mac.Robertson Land. The beach is composed of locally derived pebbles, cobbles and boulders between 1 cm and 1 m across. It slopes upwards from the shoreline to a well defined platform several metres broad and 3 to 6 m above sea level. The Area is readily defined by its natural features.

Climate

Limited data exist for the meteorology of the Area. Conditions are probably similar to those of the Mawson station area, approximately 90 km to the east, where the mean monthly temperatures range from +0.1°C in January to -18.8°C in August, with extreme temperatures ranging from +10.6°C to -36.0°C. The mean annual wind speed is 10.9 m per second with frequent prolonged periods of strong south-easterly katabatic winds from the ice cap with mean wind speeds over 25 m per second and gusts often exceeding 50 m per second.

Local sections of the coast vary in their exposure to strong winds and it is possible that slightly lower mean wind speed may exist at Taylor Rookery. Other characteristics of the weather are high cloudiness throughout the year, very low humidity, low precipitation and frequent periods of strong winds, drifting snow and low visibility associated with the passage of major low pressure systems.

Environmental Domains and Antarctic Conservation Biogeographic Regions

Based on the Environmental Domains Analysis for Antarctica (Resolution 3(2008)) Taylor Rookery is located within Environment D *East Antarctic coastal geologic*. Based on the Antarctic Conservation Biogeographic Regions (Resolution 6 (2012)) Taylor Rookery is not assigned to a Biogeographic Region.

Geology and Soils

The rocks at Taylor Rookery are metamorphic and probably formed from ancient metamorphic sedimentary rocks. They are mapped as garnet-biotite-quartz-felspar gneiss, granite and migmatite. The metamorphic rocks are intruded by charnockite which has yielded an isotopic age of 100 million years, thus defining a minimum age for the metamorphic rocks. Numerous shear zones intersect the banded metamorphic rocks and there are recognised traces of an old erosion surface at about 60 m altitude.

Vegetation

The flora of Taylor Rookery consists of at least ten species of lichen (Table 1) and an unknown number of terrestrial and freshwater algae. No mosses have been recorded from the Area. Twenty six species of lichen and three species of moss can be found in the region, 20 of which are found on nearby Chapman Ridge and 16 from Cape Bruce on the western side of Taylor Glacier. The rock types are not conducive to colonization by lichens. Most of the lichens occurring at Taylor Rookery grow on the higher outcrops at the southern end where weathering is least.

Lichens	
Pseudephebe minuscula	Lecidea phillipsiana
Buellia frigida	Physcia caesia
Caloplaca citrina	Xanthoria elegans
Candelariella flava	Xanthoria mawsonii
Rhizoplaca melanophthalma	Lecanora expectans

Table 1. Plants recorded from Taylor Rookery.

Birds

Emperor penguins

The breeding site of the emperor penguins is a north-facing amphitheatre formed by the tongue of the Taylor Glacier to the west and rocky hills to the east. The penguins occupy the areas that are level, and are covered with snow for most of the breeding season.

First hatchlings were observed in mid July which suggests mid May as the onset of laying. Fledglings depart the colony from mid December to mid January, usually leaving during the day when the weather is the warmest and the katabatic wind has subsided. Adult birds and fledglings generally head in N–NE towards a polynya 60-70 km from the colony. The fast ice extent reduces to approximately 25 km by mid January. The polynya appears to be a permanent feature of the Mawson Coast.

Following the commencement of the ongoing monitoring program in 1988, up to about 2010 the penguins occupied the southern part of the Area. In recent years, they have moved to the northern part where they now spend the winter. In 2014 they were observed for the first time occupying the fast ice outside the Area (as early as October). The ongoing monitoring program will help determine whether this is a recurring behaviour; if so, changes to the Area management arrangements may be required.

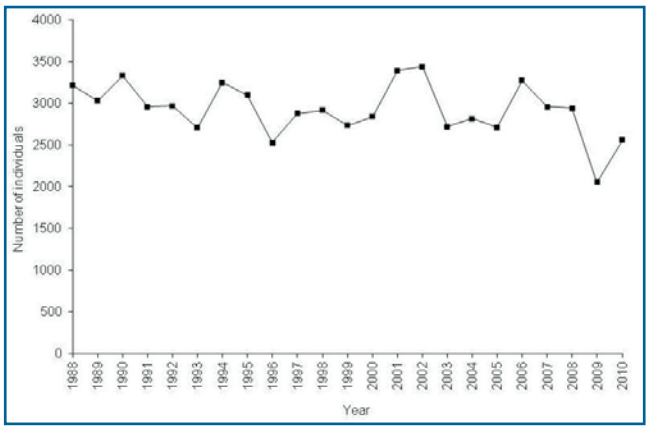

Figure 1. Numbers of adult emperor penguins present in the colony during winter at Taylor Glacier, 1988– 2010. Source: Robertson et al. (2014)

Skuas

Skuas are often observed near the penguin colony. It is not known whether these birds breed in this location.

6(ii) Access to the Area

Travel to the Area may be by vehicle over sea ice, which is generally only possible during the period 1 May to 25 December, or by aircraft, in accordance with section 7(ii) of this plan.

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

Two automated cameras were set up within the Area in 2013 on the rocky ridges surrounding the breeding area of the penguins (see Map B for camera locations – 67°27'10.8"S, 60°53'6"E and 67°27'18.0"S, 60°52'55.2"E . A four-berth refuge is located in the Colbeck Archipelago, approximately five kilometres to the north-east of the Area (see Map A – 67°26'17.9"S, 60°59'23.6"E). Mawson station (67°36'S, 62°53'E) is approximately 90 kilometres to the east.

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

ASPA No. 102 Rookery Islands, Mac.Robertson Land (67°36'36" S and 62°32'01" E) is located approximately 80 kilometres east of Taylor Rookery (see Map A).

6(v) Special zones within the Area

There are no special zones within 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 only for compelling scientific reasons that cannot be served elsewhere, in particular for scientific study of the avifauna and ecosystem of the Area, or for essential management purposes consistent with plan objectives, such as inspection, management or review;
- the actions permitted will not jeopardise the values of the Area;
- the actions permitted are in accordance with the management plan;
- the permit, or an authorised copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the permit;
- the permit shall be issued for a finite period; and
- the appropriate national authority shall be notified of any activities or measures undertaken that were not included in the authorised permit.

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

Whenever possible, vehicle access to the Area should be from sea ice to the east of Colbeck Archipelago, to avoid crossing the penguin's pathways from the rookery to the sea (see Map B). Vehicle entry to the Area is prohibited. Vehicles used for transport to the Area are to be left outside the Area, to the east, and entry to the Area must be by foot. The approach route for vehicles is marked on Map C.

The following conditions apply to the use of aircraft:

- disturbance of the colony by aircraft shall be avoided at all times;
- overflights of the colony are prohibited, except where essential for scientific or management purposes. Such overflights are to be at an altitude of no less than 930 m (3050 ft) for single-engine helicopters and fixed-wing aircraft, and no less than 1500 m (5000 ft) for twin-engine helicopters;
- fixed wing aircraft are not permitted to land inside the Area;
- fixed wing aircraft used to approach the Area shall not land or take off within 930 m (3050 ft) or fly within 750 m (2500 ft) of the colony;
- helicopters shall approach the Area from the east over the sea ice and preferably, where sea ice conditions permit, land outside the Area at the point marked "H" on Map C (60°53'32.5"E, 67°27'6.1"S), with access to the Area being by foot;
- when landing outside the Area, single-engine helicopters should not land or take off within 930 m (3050 ft) or fly within 750 m of the colony, and twin-engine helicopters should not land, take off or fly within 1500 m (5000 ft) of the colony;
- if landing inside the Area is essential due to unsuitable sea ice conditions, only singled-engine helicopters may land in the north-east of the Area at the point marked "H" on Map C (60°53'17.8"E, 67°27'6.8"S), where a headland to the south obscures the colony from view and noise;
- single-engine helicopters approaching to land in the Area should fly at the lowest safe height over the sea ice to avoid disturbing the colony; and
- refuelling of aircrafts is not permitted within the Area.

There are no marked pedestrian routes within the Area. Unless disturbance is authorised by permit, pedestrians should keep well away from the colony area (at least 50 m) and give way to departing and arriving penguins. Pedestrians moving in and around the Area should avoid crossing the access routes of the birds if possible, or cross quickly without obstructing penguin traffic.

7(iii) Activities which are or may be conducted within the Area, including restrictions on time and place

Penguins may be in the Area in most months, and are particularly sensitive to disturbance during the following periods:

- from mid-May to mid-July, when they are incubating eggs; and
- from mid-July to mid-September, when adults are brooding chicks.

The Area may be accessed to conduct censuses of the emperor penguin colony. The colony is ideal for census work because it can be done without any disturbance to the birds. The best vantage point for viewing and photographing the penguins in winter are the rocky headlands that run adjacent to Taylor Glacier, on the western side of the colony, and on the eastern side of the Area. The ideal time for a census of adults is from 22 June to 5 July, since during this time most birds present are incubating males, each representing one breeding pair.

Other activities which may be conducted in the Area:

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

7(iv) Installation, modification or removal of structures

No new structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit. Scientific markers and equipment must be secured and maintained in good condition, clearly identifying the permitting country, name of principal investigator and year of installation. All such items should be made of materials that pose minimum risk of harm to fauna and flora or of contamination of the Area.

A condition of the permit shall be that equipment associated with the approved activity shall be removed on or before completion of the activity. Details of markers and equipment temporarily left in situ (GPS locations, description, tags, etc. and expected removal date) shall be reported to the permitting authority.

Temporary field huts, if permitted, should be placed well away from the penguin colony at the point to the north-east of the Area, where a headland to the south obscures the colony from view.

7(v) Location of field camps

A four-berth refuge is located in the Colbeck Archipelago, approximately 5 kilometres to the north-east of the Area (60°59'23.6"E, 67°26'17.9"S).

Camping is permitted within the Area and should be well away from the penguin colony, preferably at the point to the north-east of the Area where a headland to the south obscures the colony from view (as indicated on Map B).

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

- No poultry products, including dried food containing egg powder, are to be taken into the Area.
- No depots of food or other supplies are to be left within the Area beyond the season for which they are required.
- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. The highest level 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) into the Area.
- To the maximum extent practicable, clothing, footwear and other equipment used or brought into the Area (including backpacks, carry-bags and other equipment) shall be thoroughly cleaned before entering and after leaving the Area.
- Boots and sampling/research equipment and markers that come into contact with the ground shall be disinfected or cleaned with hot water and bleach before entering and after visiting the Area to help prevent accidental introductions of animals, plant material, micro-organisms and non-sterile soil into the Area. Cleaning should be undertaken either at the refuge hut or on station.
- Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (CEP 2011), and in the Environmental Code of Conduct for terrestrial scientific field research in Antarctica (SCAR 2009).
- No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio- nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in a permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted.
- Fuel is not to be stored in the Area unless required for essential purposes connected with the activity for which the permit has been granted. All such fuel shall be removed at the conclusion of the permitted activity. Permanent fuel depots are not permitted.
- All material introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so as to minimise the risk of environment impacts.

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

Taking of or harmful interference with native flora and fauna is prohibited, except in accordance with a permit. Where taking or harmful interference with animals is involved this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

Ornithological research on the breeding birds present within the Area shall be limited to activities that are non-invasive and non-disruptive. If the capture of individuals is required, capture should occur outside the Area if at all possible to reduce disturbance to the colony.

7(viii) Collection and removal of anything not brought into the Area by the permit holder

Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs.

Material of human origin likely to compromise the values of the Area, and which was not brought into the Area by the permit holder or otherwise authorised, may be removed unless the impact of the removal is likely to be greater than leaving the material in situ. If such material is found the permit issuing authority shall be notified, if possible while the field party is still within the Area.

7(ix) Disposal of waste

All wastes, including all human wastes, shall be removed from the Area. Wastes from field parties shall be stored in such a manner to prevent scavenging by wildlife (e.g. skuas) until such time as the wastes can be disposed or removed. Wastes are to be removed no later than the departure of the field party. Human wastes and grey water may be disposed into the sea well outside the Area.

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

Permits may be granted to enter the Area to:

- carry out biological monitoring and Area inspection activities, which may involve the collection of samples for analysis or review;
- erect or maintain scientific equipment and structures, and signposts; or
- carry out other protective measures.

Any specific sites of long-term monitoring shall be appropriately marked and a GPS position obtained for lodgement with the Antarctic Data Directory System through the appropriate national authority.

Visitors shall take special precautions against the introduction of alien organisms to the Area. Of particular concern are pathogenic, microbial or vegetation introductions sourced from soils, flora or fauna at other Antarctic sites, including research stations, or from regions outside Antarctica. To minimise the risk of introductions, before entering the Area visitors shall thoroughly clean footwear and any equipment to be used in the Area, particularly sampling equipment and markers.

7(xi) Requirements for reports

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such visit reports should include, as applicable, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

A copy of the report should be forwarded to the Party responsible for development of the Management Plan (Australia) to assist in management of the Area, and the monitoring of bird populations.

8. Supporting Documentation

Barbraud, C., Gavrilo M, Mizin, Y. and Weimerskirch, W. (2011) Comparison of emperor penguin declines between Pointe Géologie and Haswell Island over the past 50 years. *Antarctica Science* 23: 461- 468.

Budd, G.M. (1961): The biotopes of emperor penguin rookeries. *Emu* 61:171-189.

Budd, G.M. (1962): Population studies in rookeries of the emperor penguin *Aptenodytes forsteri. Proceedings of the Zoological Society, London* 139: 365-388.

Crohn, P.W. (1959): A contribution to the geology and glaciology of the western part of the Australian Antarctic Territory. *Bulletin of the Bureau of Mineral Resources, Geology and Geophysics, Australia*, No. 32.

Filson, R.B. (1966): The lichens and mosses of Mac. Robertson Land. Melbourne: Department of External Affairs, Australia (Antarctic Division).

Fretwell, P.T. and Trathen, P.N. (2009): Penguins from space: faecal stains reveal the location of emperor penguin colonies. *Global Ecology and Biogeography* 18:543-552.

Fretwell, P.T., LaRue, M.A., Morin, P., Kooyman, G.L., Wienecke, B., et al. (2012) An emperor penguin population estimate: the first global, synoptic survey of a species from space. PLoS ONE 7(4): e33751. doi:10.1371/journal.pone.0033751

Horne, R.S.C. (1983): The distribution of penguin breeding colonies on the Australian Antarctic Territory, Heard Island, the McDonald Islands and Macquarie Island. *ANARE Research Notes* No. 9.

Kato, A. and Ichikawa, H. (1999) Breeding status of Adélie and Emperor penguins in the Mt Riisser- Larsen area, Amundsen Bay. Polar Bioscience 12: 36-39.

Kirkwood, R. and Robertson, G. (1997): Seasonal change in the foraging ecology of emperor penguins on the Mawson Coast, Antarctica. *Marine Ecology Progress Series* 156: 205-223.

Kirkwood, R. and Robertson, G. (1997): The energy assimilation efficiency of emperor penguins,

Aptenodytes forsteri, fed a diet of Antarctic krill, *Euphausia superba*. *Physiological Zoology* 70: 27-32.

Kirkwood, R. and Robertson, G. (1997): The foraging ecology of female emperor penguins in winter.

Ecological Monographs 67: 155-176.

Kirkwood, R. and Robertson, G. (1999): The occurrence and purpose of huddling by Emperor penguins during foraging trips. *Emu* 99: 40-45.

Lee J.E. and Chown S.L. 2009: Breaching the dispersal barrier to invasion: quantification and management.

Ecological Applications **19**: 1944-1959.

Longton, R. E. (1988): Biology of polar bryophytes and lichens, Cambridge University Press, Cambridge, pp. 307-309.

Melick, D. R., Hovenden, M. J. and Seppelt, R. D. (1994): Phytogeography of bryophyte and lichen vegetation in the Windmill Islands, Wilkes Land, Continental Antarctica. *Vegetation* 111: 71-87.

Morgan, F., Barker, G., Briggs, C. Price, R. and Keys, H (2007): Environmental Domains of Antarctica,

Landcare Research New Zealand Ltd

Øvstedal, D. O. and Lewis Smith, R. I. (2001): Lichens of Antarctica and South Georgia: A guide to their identification and ecology, Cambridge University Press, Cambridge.

Robertson, G. (1990): Huddles. *Australian Geographic* 20: 76-94.

Robertson, G. (1992): Population size and breeding success of emperor penguins *Aptenodytes forsteri* at the Auster and Taylor Glacier Colonies, Mawson Coast, Antarctica. *Emu*. 92: 62-71.

Robertson, G. (1994): The foraging ecology of emperor penguins (*Aptenodytes forsteri*) at two Mawson Coast Colonies, Antarctica. *PhD Thesis, University of Tasmania.*

Robertson, G. (1995): The foraging ecology of emperor penguins *Aptenodytes forsteri* at two Mawson Coast colonies, Antarctica. *ANARE Reports* 138, 139.

Robertson, G. and Newgrain, K. (1992): Efficacy of the tritiated water and 22Na turnover methods in estimating food and energy intake by Emperor penguins *Aptenodytes forsteri. Physiological Zoology* 65:933- 951.

Robertson, G., Wienecke, B., Emmerson, L., and Fraser, A.D. (2014). Long-term trends in the population size and breeding success of emperor penguins at the Taylor Glacier colony, Antarctica. Polar Biology 37: 251-259.

Robertson, G., Williams, R. Green, K. and Robertson, L. (1994): Diet composition of emperor penguin chicks *Aptenodytes forsteri* at two Mawson Coast colonies, Antarctica. *Ibis 136: 19-31*

Schwerdtfeger, W. (1970): The climate of the Antarctic. In: *Climates of the Polar Regions (ed. S. Orvig)*, pp. 253-355.

Schwerdtfeger, W. (1984): Weather and climate of the Antarctic. In: *Climates of the Polar Regions (ed. S. Orvig*), p. 261.

Streten, N.A. (1990): A review of the climate of Mawson – a representative strong wind site in East Antarctica. *Antarctic Science* 2: 79-89.

Trail, D.S. (1970): ANARE 1961 Geological traverses on the Mac.Robertson Land and Kemp Land Coast. Bulletin of the Bureau of Mineral Resources, Geology and Geophysics, Australia, No. 135.

Trail, D.S., McLeod, I.R., Cook, P.J. and Wallis, G.R. (1967): Geological investigations by the Australian National Antarctic Research Expeditions 1965. *Bulletin of the Bureau of Mineral Resources, Geology and Geophysics, Australia,* No. 118.

Trathan, P.N., Fretwell, P.T. and Stonehouse, B. (2011) First recorded loss of an emperor penguin colony in the recent period of Antarctic regional warming: implications for other colonies. *PLoS ONE* 6:e14738.

Whinam J, Chilcott N. and Bergstrom D.M. 2005: Subantarctic hitchhikers: expeditioners as vectors for the introduction of alien organisms. *Biological Conservation* **121**: 207-219.

Wienecke, B., Kirkwood, R. and Robertson, G. (2004): Pre-moult foraging trips and moult locations of emperor penguins at the Mawson Coast. *Polar Biology* 27: 83-91.

Wienecke, B. C. and Robertson, G. (1997): Foraging space of emperor penguins *Aptenodytes forsteri* in Antarctic shelf waters in winter. *Marine Ecology Progress Series* 159: 249-263.

Wienecke, B., Robertson, G., Kirkwood and R., Lawton, K. (2007): Extreme dives by free-ranging emperor penguins. *Polar Biology* 30:133-142.

Wienecke, B., Kirkwood, R. and Robertson, G. (2004): Pre-moult foraging trips and moult locations of emperor penguins at the Mawson Coast. *Polar Biology* 27: 83-91.

Wienecke, B. (2009): Emperor penguin colonies in the Australian Antarctic Territory: how many are there?

Polar Record 45:304-312.

Wienecke, B. (2009): The history of the discovery of emperor penguin colonies, 1902-2004. *Polar Record*

46: 271-276.

Willing, R.L. (1958): Australian discoveries of Emperor penguin rookeries in Antarctica during 1954-57.

Nature, London, 182: 1393-1394.

Appendix 1: Taylor Rookery, Antarctic Specially Protected Area No 101, boundary coordinates

Boundary Point	Latitude (S)	Longitude (E)	Boundary Point	Latitude (S)	Longitude (E)
1	67°27′4.9″	60°52′58.2″	13	67°27′27.4″	60°52′51.5″
2	67°27′17.1″	60°53′29.5″	14	67°27′27.9″	60°52′49.3″
3	67°27′17.7″	60°53′31.0″	15	67°27′28.7″	60°52′48.8″
4	67°27′21.6″	60°53′27.5″	16	67°27′28.9″	60°52′47.7″
5	67°27′22.4″	60°53′19.3″	17	67°27′28.9″	60°52′46.5″
6	67°27′27.8″	60°53′7.7″	18	67°27′28.3″	60°52′46.0″
7	67°27′29.1″	60°53′4.9″	19	67°27′24.9″	60°52′45.4″
8	67°27′29.8″	60°53′2.6″	20	67°27′20.7″	60°52′50.1″
9	67°27′30.1″	60°53′0.5″	21	67°27′19.3″	60°52′49.9″
10	67°27′29.8″	60°52′57.1″	22	67°27′18.0″	60°52′50.2″
11	67°27′29.3″	60°52′55.5″	Follows ice cliff north		
12	67°27′28.0″	60°52′54.6″	23	67°27′5.3″	60°52′57.1″

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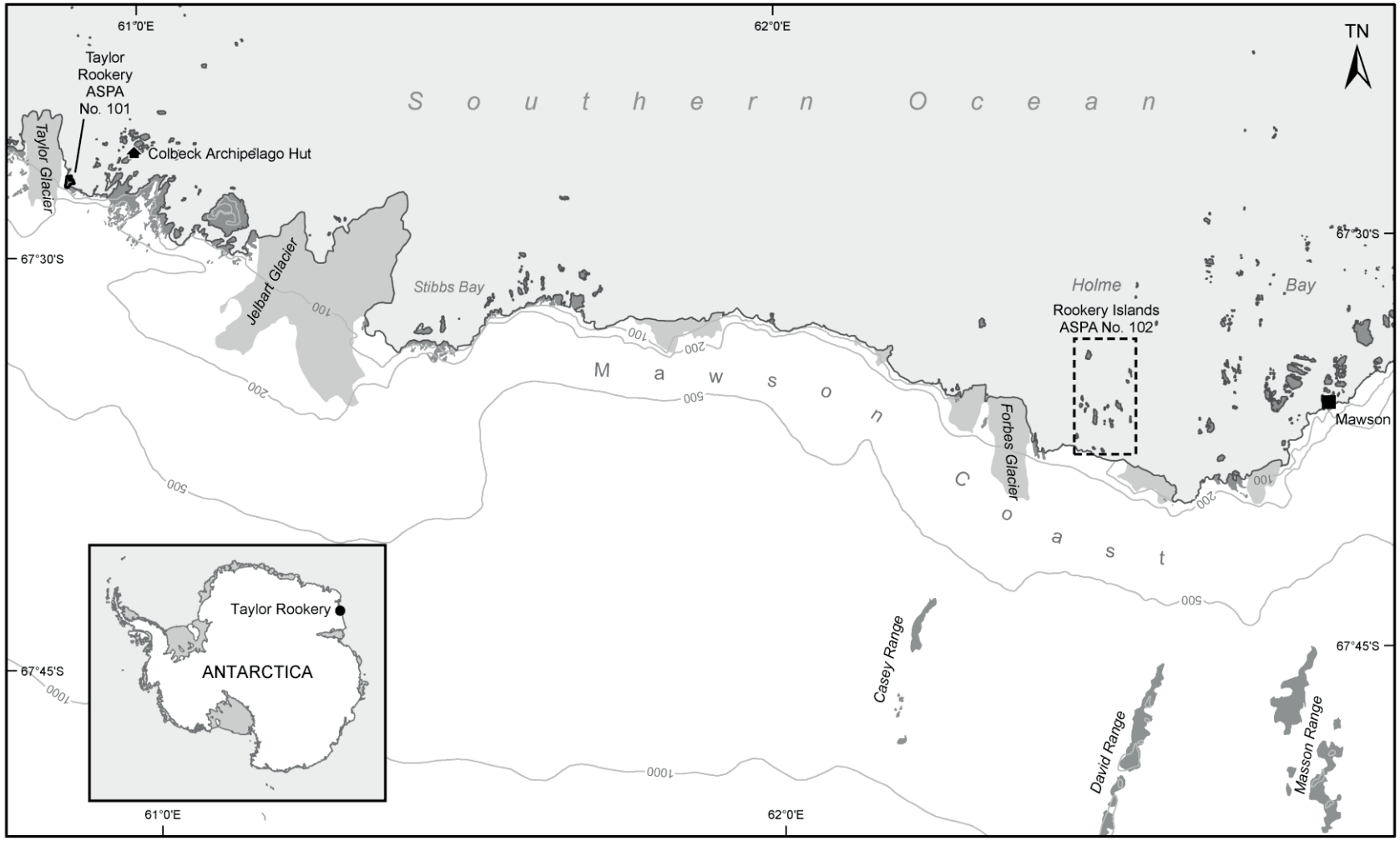
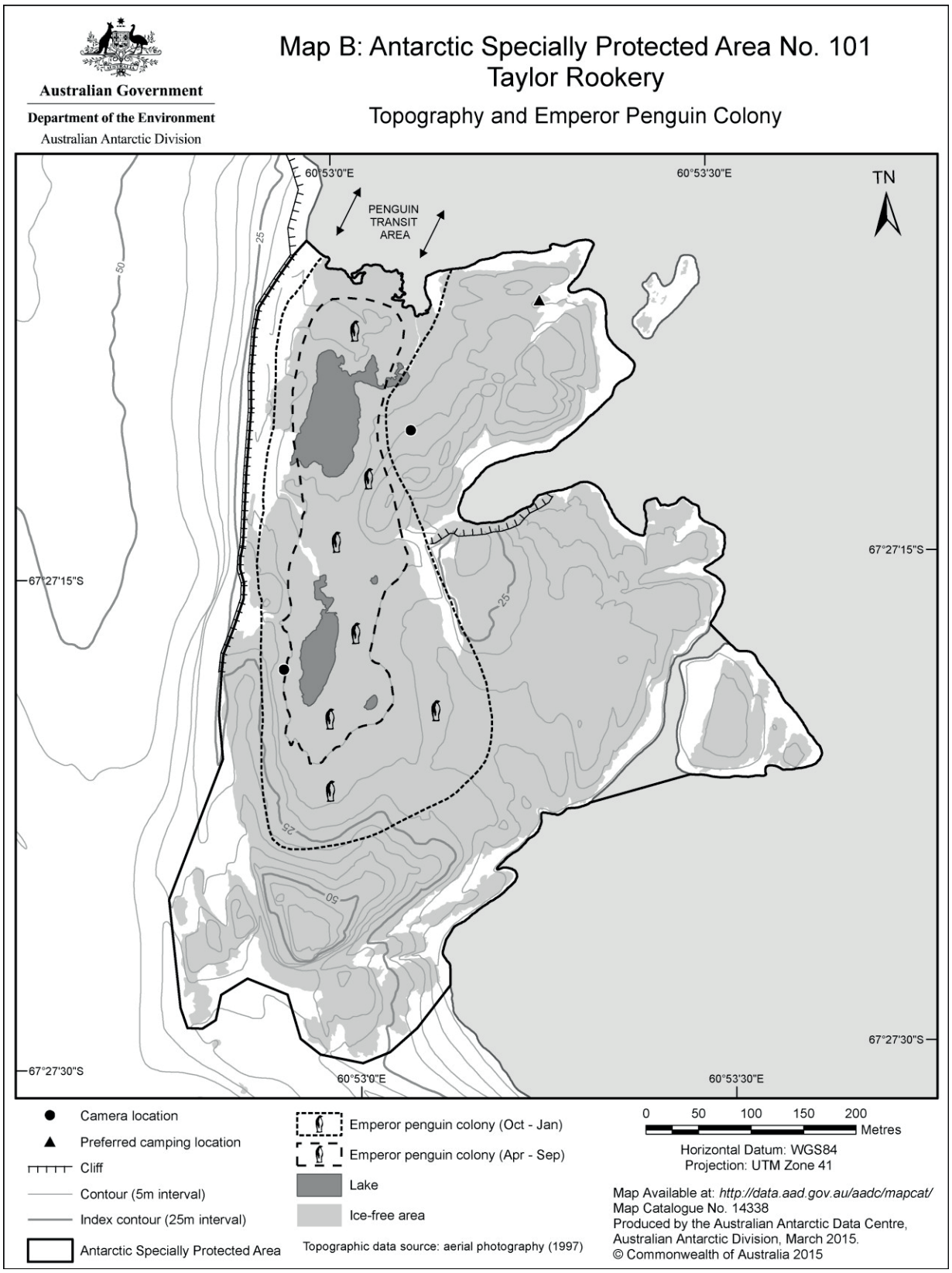
Map A: Antarctic Specially Protected Area No 101, Taylor Rookery, Mawson Coast, Mac.Robertson Land, East Antarctica



Station
Contour (metres)
Ice-free area
Ice shelf, ice tongue
Rookery Islands ASPA No. 102 The islands within this area
Taylor Rookery ASPA No. 101

0 5 10 15 20 Kilometres
Horizontal Datum: WGS84
Projection: UTM Zone 41

Map Available at: *http://data.aad.gov.au/aadc/mapcat/*
Map Catalogue No. 14350
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, March 2015.


Australian Government
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Australian Antarctic Division
Map B: Antarctic Specially Protected Area No. 101
Taylor Rookery
Topography and Emperor Penguin Colony
60°53'0"E
60°53'30"E
TN
PENGUIN
TRANSIT
AREA
67°27'15"S
67°27'30"S
Camera location
Preferred camping location
Cliff
Contour (5m interval)
Index contour (25m interval)
Antarctic Specially Protected Area
Emperor penguin colony (Oct - Jan)
Emperor penguin colony (Apr - Sep)
Lake
Ice-free area
Topographic data source: aerial photography (1997)
0 50 100 150 200
Metres
Horizontal Datum: WGS84
Projection: UTM Zone 41
Map Available at: http://data.aad.gov.au/aadc/mapcat/
Map Catalogue No. 14338
Produced by the Australian Antarctic Data Centre,
Australian Antarctic Division, March 2015.
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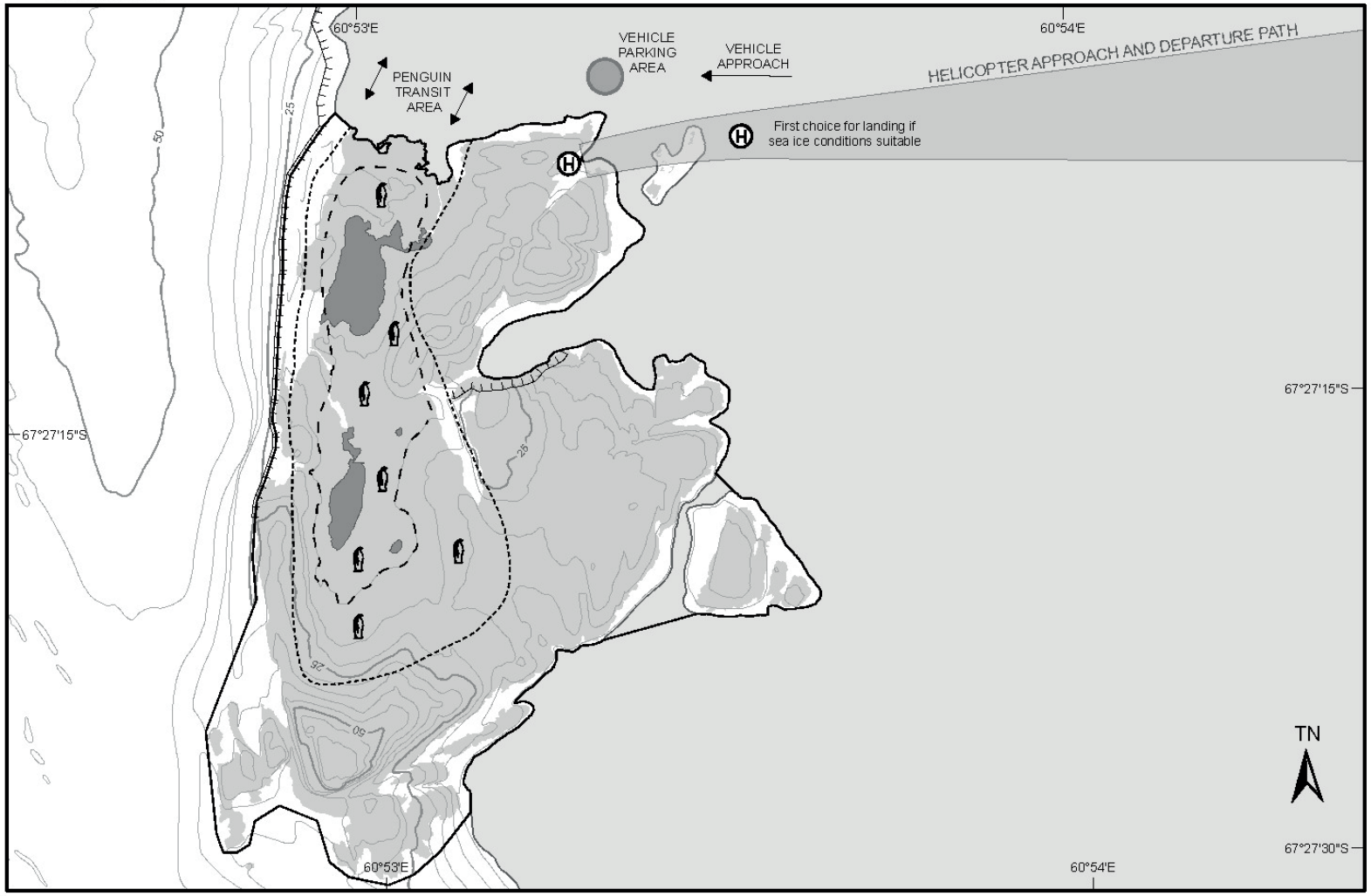
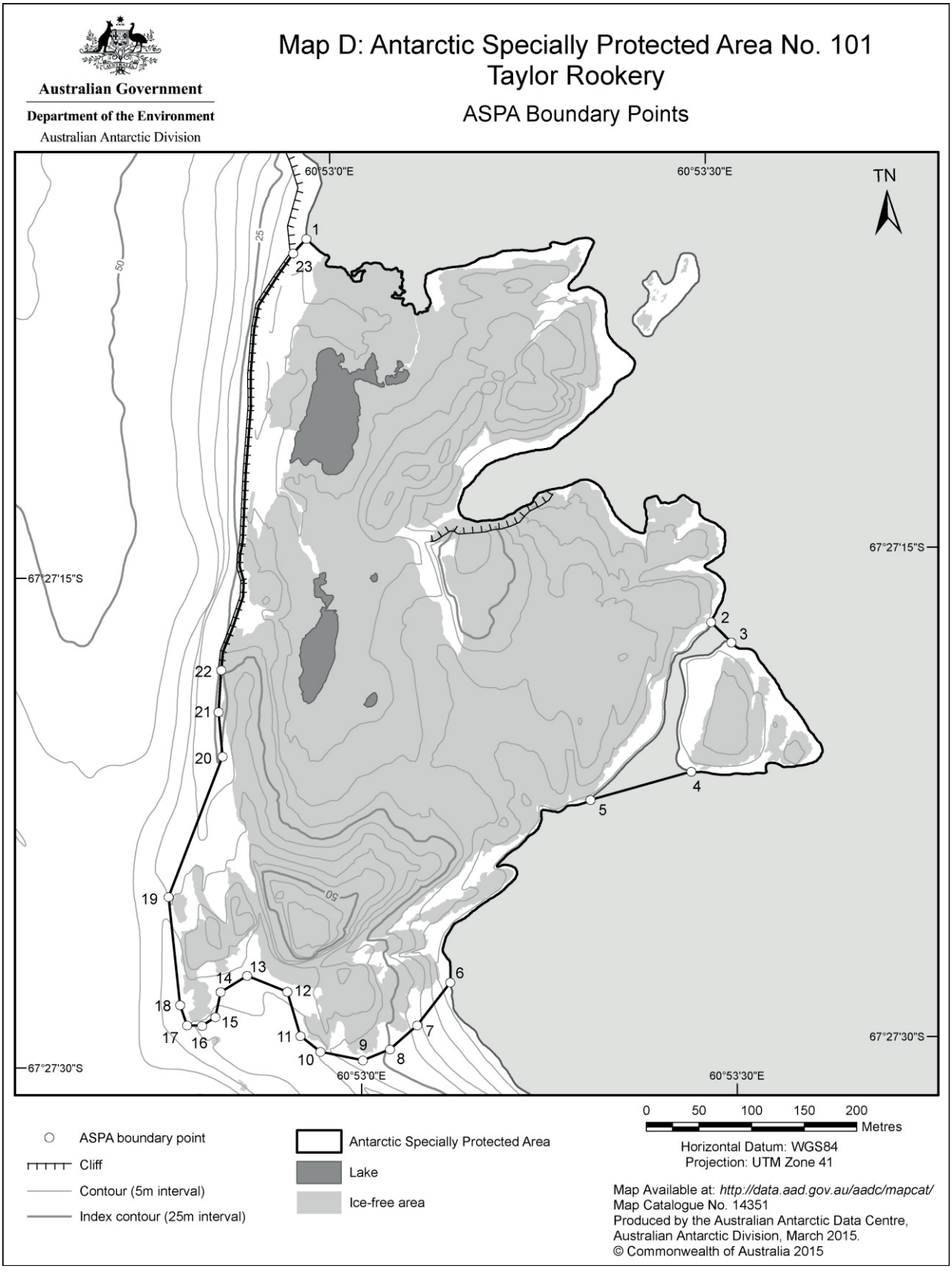
Map C: Antarctic Specially Protected Area No. 101, Taylor Rookery

Vehicle and Helicopter Approach and Landing Site



Map Available at: *http://data.aad.gov.au/aadc/mapcat/*
Map Catalogue No. 14339
Produced by the Australian Antarctic Data Centre,
Australian Antarctic Division, March 2015.


Australian Government
Department of the Environment
Australian Antarctic Division
Map D: Antarctic Specially Protected Area No. 101
Taylor Rookery
ASPA Boundary Points
60°53'0"E
60°53'30"E
TN
67°27'15"S
67°27'30"S
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
25
50
0 50 100 150 200
Metres
ASPA boundary point
Cliff
Contour (5m interval)
Index contour (25m interval)
Antarctic Specially Protected Area
Lake
Ice-free area
Horizontal Datum: WGS84
Projection: UTM Zone 41
Map Available at: http://data.aad.gov.au/aadc/mapcat/
Map Catalogue No. 14351
Produced by the Australian Antarctic Data Centre,
Australian Antarctic Division, March 2015.
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