UK Overseas Territories and Crown Dependencies: 2011 Biodiversity snapshot.

British Antarctic Territory: Appendices.

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This section includes a series of appendices that provide additional information relating to that provided in the British Antarctic Territory chapter of the publication: UK Overseas Territories and Crown Dependencies: 2011 Biodiversity snapshot.

All information relating to British Antarctic Territory is available at http://jncc.defra.gov.uk/page-5746

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APPENDIX 1: MULTILATERAL ENVIRONMENTAL AGREEMENTS

The Protocol on Environmental Protection to the Antarctic Treaty (known as the **Environmental Protocol)** was adopted in 1991 and came into force in 1998. The Protocol provides a framework for the comprehensive environmental protection of Antarctica. As a result, a whole series of protective mechanisms have been put in place to preserve the biodiversity and natural heritage of the Antarctic by limiting as much as possible the impacts of human activities, which include scientific research and tourism. The Environmental Protocol commits the Parties to "*the comprehensive protection of the Antarctic environment and dependent and associated ecosystems and designates Antarctica as a natural reserve, devoted to peace and science*" An essential element of this is the banning of all mineral extraction within the Treaty area, except for scientific purposes.

Annex II to the Environmental Protocol gives specific protection to the region's flora and fauna. It prohibits (except with a permit) the removal or interference with native species. In addition to this it bans the deliberate introduction of non-native species including soil and micro-organisms (except in accordance with a permit), and provides a mechanism to give further protection to species considered endangered [currently extended only the Ross Seal (*Ommatophoca rossii*)].

Annex V allows for the designation of protected areas in order to enhance the protection of specific regions within Antarctica and thus the BAT. Areas designated as Antarctic Specially Protected Areas (ASPAs) are created to protect particularly vulnerable regions, areas of special scientific interest or protect a zone for future study. It is prohibited to enter an ASPA without a permit. Other areas with a lesser need of protection but where activities pose risks of mutual interference or cumulative environmental impacts can be designated as Antarctic Specially Managed Areas (ASMAs); a permit is not required to enter these areas, but a copy of the management plan is essential.

To ensure that human activity does not damage the continent a number of other measures are required under the Protocol. All activities with a more than minor or transitory impact require an Environmental Impact Assessment (EIA) to measure what level of impact the proposed activity would have on the environment and whether the activity was important enough to justify that level of effect. There are also stringent rules to prevent marine pollution and deal with waste disposal.

The UK implements the requirements of the Environmental Protocol into domestic law via the provision of the Antarctic Act 1994 and associated Regulations.

UK ratification of ACAP has been extended to the BAT and a management plan has been drawn up to ensure compliance with ACAP requirements. (Status – green) The Southern Giant petrel is the only species covered by ACAP that breeds in the BAT.

APPENDIX 2: SPECIES DIVERSITY

Terrestrial biodiversity in the BAT is very limited (Convey, 2007); there are no terrestrial mammals or trees and only two flowering plants the Antarctic hair grass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*). There is considerable invertebrate endemism both in the BAT and across Antarctica (Pugh and Convey 2008). The dominant plant cover consists of low-growing cryptogams and microorganisms including mosses, lichens, fungi and hepatics plants, found on ground which is ice-free during the summer months. There are only two higher insect species. One flightless midge (the chironomid *Belgica antarctica*) is endemic to the Antarctic Peninsula and South Shetland Islands, while the second (another chironomid, *Parochlus steinenii*, is Antarctica's only winged insect, occurring on the South Shetland Islands, South Georgia and in Tierra del Fuego). While diversity is low, in these locations population densities can be very high, and certainly comparable with those of these groups in temperate and tropical environments. Elsewhere, the terrestrial fauna is dominated by a few species of micro-arthropods which are found most commonly in vegetated areas.

In contrast with terrestrial ecosystems, marine diversity is particularly rich with several species of marine birds that forage in the nearshore and offshore waters and use ice-free islands and coastal areas as nesting grounds. A number of species breed on the Peninsula or on the offshore islands; these include the Emperor penguin (*Aptenodytes forsteri*) (in very small numbers), the Adélie penguin (*Pygoscelis adeliae*), chinstrap penguin (*Pygoscelis antarctica*), the gentoo penguin (*Pygoscelis papua*) and the macaroni penguin (*Eudyptes chrysolophus*) (again in very small numbers) as well as the snow petrel (*Pagodroma nivea*), cape petrel (*Daption capense*), Antarctic Petrel (*Thalassoica antarctica*), Antarctic fulmar (*Fulmarus glacialoides*), Wilson's (*Oceanites oceanicus*) and black-bellied storm petrels (*Fregetta tropica*), Antarctic prion (*Pachyptila vittata*) and southern giant petrel (*Macronectes giganteus*). Sheathbills (*Chionis alba*) are common scavengers of bird and seal breeding and moulting areas. Although penguins are the species most often associated with these territories, the most common birds are actually Procellariidae (petrels, prions, fulmars). Several species of whale and seal also take advantage of the fish and plankton-rich waters. The once heavily exploited whale populations are slowly growing again, however, several remain threatened, including the Blue whale (*Balaenoptera musculus*) and the Humpback whale (*Megaptera novaeangliae*).

The absence of permanent inhabitants, both on the islands and on the continent of Antarctica, means that direct pressure on biodiversity is relatively limited compared with most parts of the world although the increase in the number of stations is adding to such pressures. However, as in other regions, fishing poses a threat to marine birds, and particularly to albatrosses. The Antarctic Peninsula region and surrounding islands play host to 95% of all tourist visitors to the continent. Tourist numbers have risen significantly in the past decade (there were some 13,600 visitors in 2001/2002 and over 36,000 in 2009/2010 of whom over 21,000 visitors landed). Antarctic Treaty Parties and the International Association of Antarctica Tour Operators (IAATO) work closely to promote safe and environmentally responsible tourism in Antarctica and have introduced a series of measures and guidelines to limit negative impacts. Tourist activities tend to be concentrated around the areas with the most interesting biodiversity, and where the need to protect wildlife and vegetation is greatest. Trathan et al 2008 demonstrate the low impacts that regulated tourism has on

breeding gentoo penguins at one of the most frequently visited sites on the Peninsula, Goudier Island, Port Lockroy.

APPENDIX 3: THREATS

Invasive species

Although many of the sub-Antarctic Islands have been impacted by invasive species, to date Antarctica has remained largely protected. However the Antarctic Treaty Consultative Meeting (ATCM) and CEP fully recognise the threats posed by invasive alien species to the Antarctic environment and as a result this issue has been give the highest level of priority on the CEP's five year workplan. Parties have been working to introduce a range of practical measures and biosecurity controls to minimise the risk of such introductions and/or intra-regional transfer of non-native species as well as guidelines on control, containment and/or eradication.

Following reports in 2009 of the presence of a vascular plant species new to Antarctica (*Nassauvia magellanica*) at Whalers Bay, Deception Island, in January 2010 UK scientists visited the site to assess the colonisation status of the reported plant species and subsequently removed all vegetative material.

Climate change

The Antarctic Peninsula has experienced one of the highest rates of warming in the last 50 years, when compared with the rest of Antarctica or even the rest of the world (Turner *et al.* 2005). For example, the air temperature at Vernadsky Station has risen by 2.5°C. On the west coast, the rate of warming has been more limited in summer and spring than in winter and autumn, but the number of days with temperatures above 0°C has risen by 74 % (IPCC, 2007). These changes have not left the physical environments unscathed: the ice sheets have shrunk by more than 14,000 km² since 1974, 87% of measured glaciers are retreating and seasonal snowfall has diminished.

Rising air temperatures are almost certain to continue in the future and lead to ice and snow retreat, thereby paving the way for plants to grow. However, it is difficult to assess the direct impacts that climate change will have on the fauna and flora of the British Antarctic Territory because other influences are compounding this such as, for example, increasing exposure to ultra-violet rays (due to the hole in the ozone layer) and seasonal drought (Convey 2006).

Phytoplankton play a crucial role in the global carbon cycle because they account for approximately half of global photosynthesis (Behrenfeld *et al.* 2006). They sequester a considerable quantity of CO_2 which is then transformed into organic material that is the basis of secondary production in the oceans. Several recent studies indicate that climate change, and in particular changes in thermohaline circulation, could seriously affect phytoplankton biomass throughout the world. Reductions in Antarctic seasonal sea ice in some regions could also reduce the production of phytoplankton that within/develop below sea ice. This reduction could have important consequences for krill which are one of the key components of the Southern Ocean foodchain/ecosystems.

Climate change is likely to change the availability and abundance of food for cetaceans. Whales, in particular, have a highly specialized diet. Krill, a zooplankton that closely resembles the shrimp, is the main food source for several species of large whale. It is concentrated in very localized geographical areas of the Polar oceans, and only found in highly specialized environmental conditions. By causing reductions in seasonal sea-ice and thereby a decline in phytoplankton, climate change could affect the abundance and distribution of krill, thereby having very serious consequences on the reproductive and survival capacity of cetaceans.

The numbers of salps (zooplankton) have increased dramatically in the Southern Ocean whilst Antarctic krill abundance has declined over recent decades (see Atkinson *et al*. 2004). These changes are likely to have significant impacts on species distribution and abundance. Reductions in krill and increases in salps appear to be intimately linked to a decrease in the duration and surface area of sea-ice.

In the last few decades, scientists have observed a reduction in the population of krill, and the ice-dependent krill predator, the Adélie penguin, while at the same time populations of the less ice-dependent krill predator, the chinstrap penguin have also decreased (Forcada and Trathan 2009).

Warming also leads to changes in the solubility of CO_2 in the ocean, leading to increased ocean acidification. Plankton with calcium-based skeletal structures will be directly

threatened by acidification of the oceans (Orr *et al*., 2005). Continued acidification of the water will also have negative impacts on the cold-water corals. Recent research strongly suggests that if current rates of Southern Ocean acidification continue unabated, it is unlikely that pteropods will survive beyond 2100. Deterioration on this scale of pteropod populations, a very important link in the marine food chain, would have potential consequences higher up the food chain.

The Antarctic Peninsula is therefore unique in its vulnerability to climate change, because of the extent of the warming that has occurred. Long term monitoring of the ecosystems and physical environments of the region are therefore paramount.

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