

Impact of the Madrid Protocol on the Environment of Deception Island

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ABSTRACT

This article summarises the history of human activity on Deception Island and its impact on the environment, and details various attempts to manage current and expected activity levels. In particular, the application of the Protocol on Environmental Protection to the Antarctic Treaty is detailed. Although scientific activities on Deception Island today are minimal, sea-based tourist visitation is increasing at a great rate. Strategic management of this Antarctic island must be a priority if environmental impacts are to be successfully minimised as per the intention of the Madrid Protocol's Article 3. Though the tourism industry is becoming increasingly regulated through the application of the ATS and other initiatives, the potential for greater than minimal or transitory environmental impacts remains and with it the need for response planning. These issues are currently under consideration by the Committee for Environmental Protection and due for discussion at the next Antarctic Treaty Consultative Meeting in Baltimore, United States, in 2009.

INTRODUCTION

Deception Island (62°57'S, 60°38'W) is an active volcano in the South Shetland Islands. Its topography is unique; ringed by cliffs in a horseshoe shape with a narrow entry on the south-east side known as Neptune's Bellows, it is one of the very few places in the world where vessels can sail directly into the sheltered centre of a large flooded restless caldera, Port Foster. Measuring 15km diameter with land area of 98.5km², barren slopes and ash-layered glaciers, its highest point (539m) is Mt. Pond (Downie, 2007). Deception Island has both freshwater and geothermal springs, the latter of which steam the seawater beaches in Pendulum Cove and Port Foster enough to kill plankton (Stonehouse, 2002).



Illustration 1: Deception Island's unique flooded caldera, viewed from the south.

Furthermore, Deception Island has the only geothermal lake in the Antarctic (Kroner Lake) (Downie, 2007). The island's polar maritime climate ranges in temperature from -28°C to +11°C, with a mean annual temperature of -3°C (Downie, 2007). The sparse flora on unheated ground includes lichen and bryophyte (moss) communities typical of the maritime climate, but near geothermal vents grow unique thermophilic communities, featuring bryophyte turf at 25-45°C, mixing with marchantiophytes (liverworts) within a few centimetres of these vents where temperatures reach 90-95°C. Many of these remarkable bryophytes are unknown or very rare elsewhere in the Antarctic (Smith, 2005). Deception Island also features the largest known stand of *Colobanthus quitensis*, Antarctic pearlwort, one of only two flowering plants in the Antarctic



Illustration 2: Steaming shores of Port Foster.

early November (Smith Jr., 2002) and this marine community demonstrates a gradient of biodiversity from 2 species present at Fumarole Bay near the centre to 35 species near Neptune's Bellows, considered to reflect a post-eruption recovery trend which may number up to 300 when including nematodes identified to species level (Barnes *et al.*, 2008). Nine seabird species breed on the island including petrels, the Antarctic Cormorant, Greater Sheathbill, skuas, gulls and terns (Bó & Copello, 2001), and the world's largest colony of chinstrap penguins breeds at Baily Head (Downie, 2007).

As an island of several firsts in Antarctic history, Deception Island's uniqueness is underscored. British and American sealers visited in 1820, leading to establishment of the first US sealing base at Pendulum Cove that same year. The first scientific expedition to Antarctica (HMS *Chanticleer* led by British Captain Henry Foster) visited in 1829, and the island was the subject of the first accurately surveyed map of an Antarctic landmass in 1842.

(Annex to Measure 3, 2005; Downie, 2007). Ice cover is visible on Port Foster from late July to

Chilean-Norwegian whaling activities commenced in the early 20th century, making the transition from whale factory boat at anchorage to shore-based whaling station in 1912 with the issue of a license to Hektor Whaling Co. by the Falkland Island Dependencies (FIDs) Government, production peaking at 140,000 barrels/summer and abandoned in the Depression's April 1931 price slump. These are the most significant whaling remains in the Antarctic (Annex to Measure 3, 2005). The first powered flight in Antarctica took off from an improvised ash runway at Whalers Bay in 1928.

As one of the disputed territories of the Antarctic Peninsula, geopolitical tensions have played out on Deception Island. The secret British wartime Operation Tabarin based itself in the abandoned Hektor whaling station in 1944 (Downie, 2007), the Argentinians established Decepción Station right across the harbour at Fumarole Bay three years later, and the Chileans established Pedro Aguirre Cerda station in Pendulum Cove in 1955 (Joyner & Ewing, 1991). At one point the British tore down Argentine and Chilean huts in response to Argentinian marines firing over the heads of a British party near Hope Bay in 1952 (Vicuña, 1986, cited in Joyner & Ewing, 1991). The Chilean base was destroyed by volcanic eruption in 1967 (Joyner & Ewing, 1991), while further eruptions in 1969 and 1970 destroyed many other installations by fire and mudslide and changed the shoreline, creating a new islet (Stonehouse, 2002) and offering unique opportunities to study Antarctic colonisation processes.

Studies of floral, faunal and soil microalgal recovery after these eruptions make the island one of the best-studied marine sites in the Southern Ocean for biodiversity (Barnes *et al.*, 2008; Fernani *et al.*, 2007). Current research has a vulcanology and marine benthic focus and is summer-only at Fumarole Bay's Argentine and Spanish (Gabriele de Castilla) bases (Downie, 2007). Although the volcanic hazard has been assessed as no less safe than since 1820 (Roobol, 1982), the Chilean programme never returned to its burnt-out station, nor did the British Antarctic Survey.

In 1966 the environmentalist Lars-Eric Lindblad pioneered modern ship-based Antarctic tourism combining sight-seeing with educational lectures (Stonehouse, 2002). Since then, ship-borne tourist visitation to Deception Island has increased to 25,146 people in the 2007/2008 season – the most-visited Antarctic site by tourists



Illustration 3: Deception Island's topography

(IAATO, 2008).

Human visitation to Deception Island impacts on the natural environment, affecting wilderness, aesthetic, scientific, historic and tourism values. With the 1991 signing of the Protocol on Environmental Protection to the Antarctic Treaty (The Madrid Protocol), a host of regulatory frameworks were established to protect the environment and minimise impacts on these values. This article aims to first summarise the Madrid Protocol and annexes, and their subsequent application to Deception Island. The next section considers typical impacts of human activities on Deception Island, and whether they are adequately addressed through the current regulatory framework, highlighting recent and current issues of concern. Finally, current considerations within the Antarctic community to investigate or address these concerns will be reviewed and commented on.

The Madrid Protocol

The Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol) was signed in 1991, with 27 Articles and 6 technical Annexes designating Antarctica as a

“natural reserve devoted to peace and science”, obliging Parties to protect the “Antarctic environment plus dependent and associated” ecosystems for all lands, ice shelves, islands and seas in the area south of 60° latitude (with some extensions), and fundamentally consider environmental protection in the “planning and conduct of all activities”. Concepts of “intrinsic value” such as wilderness, aesthetic, and scientific values, were introduced, with interpretation of these concepts to take place at the State level prior to ratification of the protocol in its domestic law.

This meant major new requirements for parties to the Antarctic Treaty: to undertake Environmental Impact Assessments (EIAs) with these values in mind, *prior* to undertaking planned activities. Contingency planning for emergencies, clean up of contaminated sites, inspections, cooperation and transparency were all required, along with an explicit ban on mining. Very importantly, a Committee for Environmental Protection was established to consider items and report recommendations to the Antarctic

Treaty Consultative Meeting (ATCM). Advisory only, the committee was envisaged to be non-political, but has since been more political than scientific on many subjects (Walton, 2007). The Protocol also made provision for dispute settlement and addition of further annexes - elaborations for applying principles of the Protocol's various articles. Six annexes now exist.

Annex I defines three tiers of EIA, while Annex II concerns the Conservation of Antarctic Flora and Fauna, based on and superseding Agreed Measures then twenty years old by simplifying and modernising them (Harris, 2007). Annex III concerns waste management and disposal, and Annex IV the prevention of marine pollution. Annex V came into force in May 2002, and defined Antarctic Specially Protected Areas (ASPAs) to protect discrete areas of outstanding environmental, scientific, historic, aesthetic or wilderness value(s), and Antarctic Specially Managed Areas (ASMAs) targeted to assist planning and coordination of multiple activities in an area, to avoid possible conflicts, improve cooperation between Parties and/or minimise environmental impacts. Annex VI was adopted in 2005 at ATCM XXVIII in Stockholm and tries to elaborate rules and procedures to liability.

Application of the Madrid Protocol to Deception Island

As part of the Antarctic, Deception Island is a natural reserve. The protocol commits the treaty Parties to comprehensively protect the island's environment and 'dependent and associated' ecosystems (Article 2), wilderness, aesthetic and scientific values, and to consider these for *all activities* (Article 3). This applies to tourism and non-governmental activities as well as governmental. Area designation (*Annex 5*) enables this protection to take place, providing the key framework for general management of the island.

Designation in the Historic Sites & Monuments (HSM) list enables protection of *specific places and items*; designation as an Antarctic Specially Protected Area (ASPA) enables protection of *intrinsic values* (marine area inclusion subject to approval by the Convention on Conservation of Antarctic Marine Living Resources (CCAMLR)); and designation as an Antarctic Specially Managed Area (ASMA) enables *multiple uses* of an area to help planning, coordination and cooperation, avoid conflicts, and minimise environmental impacts.

To this end, the remains of the Norwegian Hector whaling station at Whalers Bay, considered the most significant whaling remains in the Antarctic, are listed as HSM 71 in ATCM Measure 4 (1995) based on a Chilean-Norwegian proposal, and the site expanded in 2003 by ATCM Measure 3 (2003) (DIMG, 2005d). The remains of the Chilean Station at Pendulum Cove are listed as HSM 76. ASPA 140 was created to designate sites of unique botanical importance on Deception Island, including five coastal sites around Port Foster, adopted in 1985 under Recommendation XIII-8 ATCM XIII, and 11 sub-sites elsewhere added in 2002 after an extensive botanical survey of the island (DIMG, 2005b). Geothermal Kroner Lake is protected in such a way for its high biodiversity (Izaguirre *et al.*, 2006). ASPA 145 was created to protect two sites of exceptional ecological interest on the caldera seabed subject to long-term scientific study of recolonisation and biodiversity after volcanic eruption, adopted in 1987 under Recommendation XIV-5 ATCM XIV, after a proposal by Chile (DIMG, 2005c).

These piecemeal proposals gave legal protection to different parts of the island, but no coherent strategy had been formulated for protecting the whole island, so in 2000 an integrated strategy was agreed by Argentina, Chile, Norway, Spain and the UK, to propose the island as an ASMA. In 2002, USA, IAATO and ASOC joined the working group which produced a Management Package for conservation and protection of the environment, managing science, tourism and conservation demands, and safeguarding people while there (DIMG, 2005a). Deception Island was formally adopted as ASMA 4 in 2005 under ATCM XXVIII Measure 3. It is interesting that ASMA 4 uses different terminology for values protected than that used in the Protocol's Article 3. Instead of 'wilderness', 'aesthetic', and 'scientific', ASMA 4 lists 'natural', 'historic', 'educational' and 'tourism'. While natural could be taken to mean wilderness, the latter three terms effectively dedicate this area of the Antarctic to conservation, education and tourism, which contravenes the Protocol's Article 2 designation of Antarctica as a natural reserve *devoted to peace and science*. A Management Group was formed (IP 19, ATCM XXIX) for the ASMA 4 Management Plan to oversee its implementation. The Plan includes a Code of Conduct for Visitors to Deception Island, as well as the recently revamped Site Guidelines for Whalers Bay (WP 56, DIMG, 2008b), now consistent with guidelines for

other sites. It should be noted that the origin of site guidelines stems from IAATO, which prepared visitor guidelines adopted in 1994 at the ATCM in Kyoto as *Recommendation XVIII-1*.

The recent history of the development of Deception Island management reflects Article 6 very well, which encourages cooperation, consultation and transparency to collectively protect the environment and avoid cumulative impacts. In a report to the ATCM XXXI, the Deception Island Management Group noted its success in resolving previously reported conflicts between science and tourism (IP 19, DIMG, 2008a).

Management of specific activities on the island include Environmental Impact Assessments (EIAs) which must be prepared *prior* to all planned activities, considering their scope, cumulative impacts, safety, monitoring and accident response, in order to limit negative impacts and avoid adverse effects on the whole ecosystem (Article 3). The level of EIA should be prepared according to set procedures (*Annex 1*) based on whether activities will have less than, equal to or more than a minor or transitory impact on Deception Island's environment and dependent or associated ecosystems (Article 8), terms that are open to interpretation but subject to guidelines. IAATO requires its members to prepare EIAs for all their activities and recently the German operator Hapag-Lloyd prepared an Initial Environmental Evaluation (IEE, for activities with minor or transitory impacts) which covered 13 tourist cruises including activities at Deception Island.

Impacts of Human Activities on Deception Island

Whaling and sealing operations left litter still visible today - decaying stations, disintegrating oil tanks and piles of bleached whale bones. However, over time these and associated remains have come to have a historical value acknowledged



Illustration 4: Tour groups enjoying improvised thermal baths on the shores of Port Foster.

by the whaling station at Whalers Bay being designated Historic Sites and Monuments (HSM) 71. Impacts of human activities on this historic value include graffiti on the oil tanks and in the hangar.



Illustration 5: Graffiti on an oil tank at HSM 71, Whalers Bay, Deception Island.

Scientific impacts are much reduced since the eruptions, with summer-only stations at just one bay. Examples of scientific activities with minimal impact would include an autonomous weather station installed on a 200m ridge overlooking Port Foster to monitor conditions and photograph ice cover (Smith Jr., 2003).

Introduced species do not currently appear to be a major issue. Despite numerous ship visits and moderate marine temperatures, a recent marine study at Deception Island did not find any Non Indigenous Species (NIS) of algae (Barnes *et al.*, 2008). A previously long-established patch of Poa grass was smothered in the 1969 eruption and has not returned (Walton, 2007). However, historical human impact on biodiversity is evident in a number of Deception Island habitats which feature South American immigrant species – 14 invertebrate taxa have been introduced to the island's freshwater and terrestrial habitats since the eruptions (the database of Deception invertebrates contained only 57 invertebrate taxa) (Downie *et al.*, 2000).

Because Antarctic tourism is seasonal, visitor numbers peak over a two-month period impacting on both wilderness values which decrease the value of the visitor's wilderness experience, and environmental values – in a number of recognised ways. IAATO figures for the 2007-2008 austral summer show that by far the most common form of visitation to Deception Island is ship cruise (25,146 pax) with only a relatively small number (475 pax) making a small boat landing. Each visitation style, however, presents noted cumulative impacts and the risk of significant

impacts. There history of disturbance at Deception's geothermal beaches for the purpose of tourist 'hot pools' impacts on the marine flora and fauna found at the site. Rapidly increasing foot traffic from boat landings can perturb important thermophilic bryophyte and marchantiophyte communities (Smith, 2005). Additionally, the tourist season is breeding season for many birds, and the tourist walk from Baily Head to Whalers Bay interfaces with the Baily Head penguin rookery. Pedestrian activity can influence penguin breeding success, fledgling weight, juvenile survival, and heart rate (McClung *et al.* 2004).

The application of Annex VI regarding Liability Arising from Environmental Emergencies is not yet a powerful tool of protection as it is adopted but not yet in force. It has proven so far impossible to achieve consensus on all activities. , so in the event of an environmental emergency at Deception Island, liability remains unclear. Though the Deception Island Management Group have undertaken to coordinate and record activities and facilitate communication and information distribution (including educational materials) between working or visiting groups, it has only stated that it will monitor cumulative environmental impacts where practicable.

Is the Madrid Protocol serving its purpose to protect the environment of Deception Island?

It is one thing to have regulations, but to be fully effective, regulations require compliance which needs monitoring, and non-compliance leading to adverse impacts and effects on the ecosystem needs both remedial solutions and accountability, which requires appropriate jurisdiction. This is especially problematic for Deception Island's marine environment. The Prevention of Marine Pollution (*Annex 4*) designates south of 60°S a Special Area under the International Maritime Organisation, so that mandatory methods to prevent sea pollution are applied. These prohibit noxious discharge in any environmentally harmful concentrations or quantities, stipulates emergency preparedness and response. However it is impossible to fully monitor compliance of vessel operators, and for reasons of both lack of technology and monitoring it may be impossible to provide effective remedial solutions for the Deception Island environment despite swift response, or determine accountability for adverse environmental impacts and ecosystem effects such as may be caused by noxious substance spillage or

introduction of alien marine species through ballast water exchange.

Annex 4 on Marine Pollution applies rules regarding preventative measures, allowed concentrations of oily residues, emergency preparedness and response, yet also says that in cases of emergency the operator is exempt. Therefore there is essentially no integrated management solution for significant marine risks. The risk of marine pollution from oil leakage was highlighted recently with the grounding on 30 January 2007 of cruise vessel M/S Nordkapp on Deception Island. Faulty navigation during passage of Neptune's Bellows was reported by Norway as the cause in Information Paper 119 and Working Paper 37, submitted to the CEP.

There is definitely concern that there are limited techniques available to deal with oil leaks. In 1989 when the Argentine naval supply vessel, *Bahia Paraíso*, ran aground near the Antarctic Peninsula, 250,000 gallons of fuel oil leaked, causing considerable damage to the local environment. The response only consisted of oil-containment buoys, with studies of the impact on intertidal zones and bird habitats; the vessel remains underwater leaking oil (Joyner & Ewing, 1991). More recently (4 December 2008), the M/V *Ushuaia* ran aground at the entrance of Wilhelmina Bay near Cape Anna, with two diesel tanks punctured and spilled light marine oil. This was assessed to have minimal impact since the oil is very light and wind conditions would help disperse it (IAATO, 9 December 2008). The response was to refloat the vessel and monitor and report any pollution in the area, as the nature of these events leads to various impacts including on the intertidal zone and bird habitats, such as the nearby colony of chinstrap penguins.

If a spill occurred in the sheltered areas of the caldera it would be more problematic without the extra aid of wind dispersal to open waters. In a 2003 investigation COMNAP ranked the worst case scenario of a marine environmental emergency as the foundering of a ship in an environmentally sensitive coastal area, and assessed that neither clean-up nor restoration would be possible. Marine pollution risks cannot be removed or isolated without banning vessels from approaching the island from a considerable distance. Even where accountability could be determined, jurisdiction would be problematic, owing to a fundamental problem with the Madrid Protocol itself. The

intention to protect 'dependent and associated' ecosystems (*Article 2*) in the area of the Protocol (including all land, ice shelves, seas and islands south of 60°S) should therefore include the marine environment around Deception Island, not just within. Apart from bacteria, lichen, moss and one or two species of small insects on the continent, Antarctic biota depends on the highly productive marine ecosystem (Wood, 2003). The Deception Island Management Plan only covers the area of ASMA 4, which does not extend into the surrounding waters since they are covered by the Convention for Conservation of Marine Living Resources (CCAMLR) and not the Madrid Protocol. CCAMLR has the right of veto for inclusion marine areas in an ASPA. Pollution incidents are the jurisdiction of global maritime regime MARPOL. This nexus is a significant barrier to protection of the Deception Island environment.

Cumulative impacts on the marine environment are likely around Deception Island, which, along with Port Lockroy, carries the heaviest ship and visitor traffic load on the Antarctic Peninsula by far. Though individual ships may have a minor or transitory impact, collectively the impact may be significant, especially since the vessels are so concentrated in time and space (Wood, 2003). The EIA system does not provide a framework for assessing the collective cumulative impact of tourist vessel visitation to Deception Island according to its three-tier system.

Regarding the terrestrial environment of Deception Island and its caldera, the provisions of the Madrid Protocol for regulation and the Deception Island Management Plan for coordinating activities, communicating between Parties and IAATO, monitoring of cumulative impacts, providing site guidelines for codes of conduct and evacuation procedures in case of volcanic eruption, and revision of the management plan and site guidelines are likely to succeed in keeping environmental impact to a minor or transitory level. The Deception Island Management Plan includes response plans for cumulative impacts such as graffiti and rubbish, though it does not elaborate on prompt and effective response procedures to other negative impacts within ASMA 4. New Zealand proposed that all activity should have no more than a minor or transitory impact as a resolution at ATCM-XXX in Delhi (WP-13 *Environmental Impact of Tourism and Other Non-Governmental Activities in the Antarctic Treaty Area*), and IAATO fully endorses the proposal (IAATO Bylaws Article II,

Section E). Issues exist around the wording of EIA as outlined in the Protocol: the definition of 'minor or transitory', and the tipping point between this and 'significant changes'. Furthermore, changes are not always equivalent to adverse effects, and it can be difficult to determine whether a change was anthropogenic. IAATO have highlighted the 'importance of education to ensure continued good understanding and compliance' with site guidelines and to this end are developing an online field staff training and assessment programme. IAATO also highlighted the need for a single database for all tourism activities. Site guidelines need to include specifics like the distance to approach fauna and the number of people ashore or inside historic ASPAs, not only to protect the ASPA but to safeguard the visitor experience (CEP, 2008a).

This voluntary self-regulation in the interest of sustainable tourism is encouraging, and probably extends from the fact that "The mainstream industry recognised this prudential self-interest long before the drafting of the Protocol. A recognition which led the industry generally to exceed voluntarily the ATS requirements for environmental protection" (Herr, 1996b, 221). The Deception Island Management Plan does not elaborate on prompt and effective response procedures to negative impacts within ASMA 4 other than rubbish and graffiti, nor does it elaborate on enforcement, so accountability remains an issue, especially since not all operators are traceable to Parties or members of IAATO.

Addressing current issues of concern

It may well be prudent for the Deception Island Management Group to consider Baily Head for designation as an ASPA, to allow for increased regulation to lessen the risks of cumulative impact. ASOC has raised this issue. If the associated and dependent marine ecosystem surrounding Deception Island could be included in ASMA 4, regulation of activity in this area could be integrated into the Deception Island Management Plan, thus reducing risk. Failing this, if CCAMLR could be included in the Deception Island Management Group, coordination, communication of guidelines and regulation could be improved to improve sustainable protection of the Deception Island environment and its dependent and associated marine ecosystem for ongoing human activity.

Discussion by Parties in the report of CEP XI (2008) also indicated concern that the CEP is inherently weak in prioritising issues of importance, and

New Zealand has made an attempt to address this by introducing "*Improving the CEP's role in Advising the ATCM on the State of Antarctic Environments*" (WP 24, CEP 2008) including suggesting a five-year work plan, increasing engagement from Parties, Observers and experts, and making its advice to the ATCM more explicit. Some Parties stressed the workplan would need to remain flexible and US suggested dedicated sessions on particular issues could result in greater progress, and Britain suggested the CEP could 'take a proactive approach to deciding on the advice required by the ATCM'. The ATCPs are likely to discuss the issue of CEP responsiveness to issues in interessional discussion (CEP XI, 2008). If the CEP could become more responsive and dynamic this would be of benefit to the protection of Deception Island by ensuring priority issues will be addressed in a timely manner.

Regarding measuring and monitoring of cumulative impacts of pedestrian activity within ASMA 4, more complete measurements of environmental impacts are being undertaken, such as establishing baseline inventories to monitor changes in biodiversity (Downie *et al.*, 2000) and obtaining enough information for effective conservation actions to protect breeding birds (Bó & Copello, 2001). Wildlife responses to pedestrian activity (Knight & Gutzwiller, 1995), including monitoring changes in physiology, behaviour, reproductive success of penguins exposed to pedestrian activity, are being studied (Kriwoken & Rootes, 2000; Knight & Gutzwiller, 1995), and best management practices in ecotourism are being developed, such as recommendations to avoiding sensitive phases of breeding/moult, maintaining small visitor group size and observing minimum approach distances (Holmes *et al.*, 2008; Kriwoken & Rootes, 2000); these are valid approaches to managing this interaction.

In the future, management plans may include adoption of environmental audits (Kriwoken & Rootes, 2000). Where scientific impact data is known, it is possible to make proposals such as adding the communities of the unique thermophilic mosses and liverworts of Deception Island to a new ASPA under the Antarctic Treaty (Smith, 2005). Perhaps data could be gathered as to define the minimum area of a 'dependent and associated' marine ecosystem' regarding Deception Island, to support an approach to

CCAMLR proposing extending the Deception Island ASPAs and ASMA to further protect its unique biota.

Item 7, CEP X, New Delhi, India, 2007, Information Paper 108.

and the Development of Land-based Tourism Infrastructure in Antarctica: An IAATO Perspective, Item 7, ATCM XXXI, Kyiv, Ukraine, 2008, Information Paper 84.

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