MANAGEMENT FRAMEWORKS FOR THE NEW ZEALAND SUB-ANTARCTIC ISLANDS

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Roberts, A.D. 2007 (23:xi): Management frameworks for the New Zealand sub-Antarctic islands. *Papers and Proceedings of the Royal Society of Tasmania* 141(1): 29–32. https://doi.org/10.26749/rstpp.141.1.29 ISSN 0080-4703. Department of Conservation, PO Box 743, Invercargill, New Zealand. Email: aroberts@doc.govt.nz

The five island groups known as the New Zealand sub-Antarctic islands — Antipodes Islands, Auckland Islands, Bounty Islands, Campbell Island and Snares Islands — are perhaps better regarded as cool temperate although they share many features and many management issues with islands south of the Antarctic Convergence. The Snares and Bounty islands have granitic substrates; the Antipodes, Auckland and Campbell islands are of volcanic origin. Marine mammals and seabirds are important components of the fauna. Terrestrial flora and invertebrate fauna show high levels of endemism. Several species of alien vertebrates have been successfully eradicated. The islands are managed by the New Zealand Department of Conservation as National Nature Reserves, and together are recognised as a World Heritage Site.
Key Words: sub-Antarctic islands, cool temperate, Antipodes Islands, Auckland Islands, Bounty Islands, Campbell Island, Snares Islands, World Heritage Site, alien species removal.

The New Zealand sub-Antarctic islands are located south of New Zealand in the Pacific sector of the Southern Ocean. Although these islands are not truly sub-Antarctic but more correctly cool temperate, they share many features and many common management issues with islands south of the Antarctic Convergence. The New Zealand sub-Antarctic islands are mid-latitude islands lying between 47° and 53°S, between the subtropical convergence (which swings as far north as the Chatham Islands (44°S)) and the Antarctic Convergence (which sits around the latitude of Macquarie Island (54°S)). The islands are more heavily vegetated than most of the other Southern Ocean islands, but share elements of both the flora and fauna of the sub-Antarctic islands. They have faunas rich and diverse in albatross, penguins and marine mammals.

Circulation in the western Pacific sector of the Southern Ocean is influenced by the New Zealand continental shelf which forms a shallow platform interrupting the westerly flow of the Southern Ocean currents. Additional influences on circulation include the Solander Trench, the Macquarie Ridge and the action of the deep ocean currents that move along the southern edge of the Campbell and Bounty plateaux. The number of seamounts across the shelf indicates a history of volcanism near the edge of the Australian and Pacific plates (Kennedy & Hayward 1993).

SNARES ISLANDS

At 48°02'S, 166°35'E this small group is the most northerly of these islands, just 200 km southwest of the South Island of New Zealand. The group comprises ten islands, totalling 328 ha. The largest, North-East Island, covers 280 ha. The base rock is ancient granite set down about 100 MY BP (Kennedy & Hayward 1993). The mean temperature is about 11°C and annual precipitation is estimated at about 1200 mm.

There is a cover of woody vegetation of tree daisy *Olearia lyallii* Hook. and other components of shrub-type forest. The Snares Islands are the least modified island group in New Zealand, with no history of settlement, and no introduction of any pest species. There are several endemic bird species (penguin, snipe, passerines) on the Snares (Peat 2003).

There is evidence of Polynesian visitation in the pre-European period (Peat 2003). European discovery was in 1791.

AUCKLAND ISLANDS

The Auckland Islands form the largest group amongst the New Zealand sub-Antarctic islands. They are 460 km south of the South Island of New Zealand at 50°44'S; 166°05'E. There are more than 10 islands in the group totalling 62 560 ha, with the largest being Auckland Island at 50 990 ha. The islands are the remnants of two former volcanoes that were active around 10 MY BP (Kennedy & Hayward 1993). The mean annual temperature is around 11°C, with annual rainfall estimated at 1000–1500 mm.

There is a significant level of endemism in the indigenous flora and fauna. The island has elements of a Pacific biota: rata forest (*Meterosideros umbellata* Cav.), parakeets (*Cyanoramphus* spp.) and rails (*Rallus* spp.) as well as sub-Antarctic elements: megaherbs (*Pleurophyllum* spp. *Stilbocarpa* spp.), albatrosses (*Diomeda* spp.) and penguins (*Eudyptes* spp.).

There is also evidence of brief settlement by Polynesians around c.700 Y BP (Anderson 2006). European discovery occurred in 1806. The Auckland Islands have had some history of modifications through whaling, farming and the introduction of various pests (many of which have now been removed (Brown 2002, Torr 2002). Planning is under way for removal of feral pigs and cats.

CAMPBELL ISLAND

At 52°33'S, 169°10'E, Campbell Island is the southernmost of the New Zealand sub-Antarctic islands, being some 700 km south of New Zealand's South Island. The main island covers 11 330 ha and there are about six very small outliers. The island was volcanic, active about 6–11 MY BP (Kennedy & Hayward 1993). Mean annual temperature is 6°C, average annual precipitation is 1360 mm, and there is severe gale wind on at least 100 days annually.

The island has much in common with other sub-Antarctic islands, with some stunted shrubby vegetation, but is mostly covered in tussock (*Poa litorosa* Cheeseman) grassland. There is a number of endemic species including six albatross species — *Thalassarche impavida* Matthews, 1912, *T. chrysostoma* (Forster, 1785), *T melanophrys* (Temminck, 1828), *Diomedea epomophora* Richdale, 1952, *D. antipodensis* Robertson & Warham, 1992, *Phoebetria palpebrata* (Forster, 1785) — that breed on site (Peat 2003). The megaherbs (*Pleurophyllum* spp. *Stilbocarpa* spp., *Anisotome* spp. and *Bulbinella*) are spectacular.

European discovery was in 1810. The island has been farmed and burning had taken place although all animal pests (cattle, sheep, rats, cats) have now been removed (Brown 2002, McClelland & Tyree 2002).

ANTIPODES ISLANDS

The Antipodes Islands are the most distant from New Zealand being 850 km southeast of the South Island of New Zealand. They are located at 49°41'S; 178°45'E. The main island covers 2025 ha and together with several smaller islands and islets the area of the whole group is 2097 ha. The island was a former volcano last active less than 1 MY BP (Kennedy & Hayward 1993). Temperature is estimated at 8°C and the annual rainfall at 1000–1500 mm. Levels of endemism amongst flora and fauna are high (Peat 2003).

European discovery was in 1800. There has been little modification to the environment apart from the accidental introduction of mice (*Mus musculus* Linnaeus, 1758).

BOUNTY ISLANDS

The Bounty Islands are the most northern of the New Zealand Sub-Antarctic islands located at 47°45'S and 179°05'E. They are 700 km east-southeast of the South Island of New Zealand. The group comprises 20 very small islands totalling some 135 ha, remnants of granite outcrops that were laid down c.180 MY BP (Kennedy & Hayward 1993). Mean annual temperature is estimated at 10°C.

The islands are not vegetated and the fauna is dominated by albatross and penguins species (Peat 2003). European discovery was in 1788.

MANAGEMENT FRAMEWORKS

The framework for the sub-Antarctic islands administered by New Zealand is established via the New Zealand legislative system. The islands are administered by the Department of Conservation (DOC), the government agency responsible for the conservation of natural and historic heritage as well as providing for recreation on conservation lands. DOC administers 24 statutes and various regulations. Key statutes are: the Conservation Act 1987, National Parks Act 1970, Reserves Act 1977, Wildlife Act 1953 (all found at www.doc.govt.nz).

Each of the five island groups are National Nature Reserves under the Reserves Act. Nature Reserve status is the highest protective status possible under New Zealand law; the status "National" Nature Reserve means that the protective status can only be revoked by an Act of Parliament. The status of the New Zealand sub-Antarctic islands is consistent with most of the other islands around the southern ocean. The primary purpose of a nature reserve is protection and preservation of the natural features, species and environment. The Reserves Act also directs that the preservation of flora, fauna and ecological associations is accorded a higher level of value even than scientific interest or scientific research although science is still given high priority compared with recreational use. The boundary of the nature reserves is the spring tide mean low water mark. The five island nature reserves are together listed as a World Heritage Site (Peat *et al.* 1997) and under the International Union for the Conservation of Nature (IUCN) criteria, the islands would be regarded as strict nature reserves.

The Minister of Conservation (MOC) (as separate from the Department of Conservation) has a specific local government role under the Resource Management Act 1991. The MOC may place controls on any activity that might have an effect on the environment. The MOC has recently requested that the Department prepare a Regional Coastal Plan to cover marine activities within the tidal area and the territorial seas around each of the five islands.

The New Zealand government has a range of policy objectives for biodiversity protection and the objectives are agreed between four government agencies (Department of Conservation, Ministry of Environment, Ministry of Agriculture and Forestry, and Ministry of Fisheries).

The DOC has operational staff located in 50 management areas nationwide. The Southern Islands Area has staff based in both Invercargill (the southernmost city in New Zealand) and on Stewart Island (the southernmost populated island in New Zealand) and is responsible for the day-to-day management of the New Zealand sub-Antarctic islands. The Southern Islands Area covers Stewart Island (of which 92% is managed by DOC either as national park (85%) or other reserves) and a number of other nearby nature reserve islands and a marine reserve at Stewart Island as well as the five sub-Antarctic islands including a Marine Reserve and Marine Mammal Sanctuary at the Auckland Islands.

The Southern Islands Area has 26 full-time staff and a total annual operating budget (including salary, wages and operating) of NZ$2.4 million (2005) which covers management at both Stewart Island and the sub-Antarctic islands. No personnel are permanently based on any of the New Zealand sub-Antarctic islands. To visit the islands DOC staff use charter vessels (a 15-metre yacht and a 20-metre ex-fishing boat) and once every couple of years staff receive assistance from the Royal New Zealand Navy. In the 2006/07 summer there were six research expeditions, three management trips and three shorter research trips to the New Zealand sub-Antarctic.

CONSERVATION MANAGEMENT STRATEGY

Conservation Management Strategy Subantarctic Islands 1998–2008 (CMS) (Department of Conservation 1999) is the management planning document that guides the day-to-day management of the islands. The CMS was prepared for New Zealand's sub-Antarctic in 1998 and runs for a 10-year period. It is due to be reviewed in 2008. Four key management issues were identified during its preparation:

An island categorisation system was implemented and the system provided five different categories to assist island management by providing consistency (Atkinson 1990). It

is a nationally applied system but was particularly useful in the highly protected and high-value sub-Antarctic context. In the sub-Antarctic the two most protective categories — minimum impact and refuge — have been used. The Campbell Island setting illustrates this point: Dent Island (27 ha) has very important conservation value never having been modified by human influences, therefore it has been accorded minimum impact status. This status means that visits are tightly restricted, whereas Campbell Island (11 330 ha) as a refuge island is allowed a higher level of visitor use. In this context "visitor" means all persons visiting the island including management and research staff, rather than "visitor" just referring to tourists.

All visitor impacts are to be controlled on a precautionary basis. All visits to the islands pose some level of risk (such as pest incursion, oil spill, disturbance of wildlife breeding, etc.). Some of the more significant risks in terms of managing impact are visits by managers or researchers who might be undertaking pest control or significant scientific research, but there are also very considerable benefits from their visits. Therefore all visits are controlled through an entry permit system. *The Sub-Antarctic Island Research Strategy* (West 2005) identified priority research topics and is a means for assessing the benefits of research proposed for the sub-Antarctic. The *Research Strategy* was completed in 2003. The current research programme is mostly terrestrial in focus although there is an increasing focus on seabirds and marine mammals. Some marine research is being undertaken into describing the marine life with a focus on deep sea commercial fisheries research. There is also some work of more international significance in terms of plate tectonic investigations and climatological research.

The status of a potential plant pest species was clarified: the tree daisy species (*O. lyallii*) that was endemic to the Snares Islands 200 km south of New Zealand. It had arrived on the Auckland Islands within the past 200 years. Debate from botanists and island managers centred on whether it was a weed or not and whether it should be eradicated. The DOC used the CMS planning process to determine that the tree daisy could have got there via natural processes and there was no evidence that it had been directly introduced. The DOC has decided not to attempt to eradicate the tree daisy from the Auckland Islands and that its arrival should best be regarded as a naturally occurring colonisation event.

The CMS took a clear lead on the removal of pests from the islands and directed a pest eradication program. So far a range of pest species have been removed: cattle *Bos taurus* Linnaeus, 1758, rabbits *Oryctolagus cuniculus* Linnaeus, 1758, and mice *Mus musculus* from Enderby Island (710 ha); rabbits from Rose Island; goats *Capra hircus* Linnaeus, 1758 from Auckland Island (50 000 ha); as well as cattle, sheep *Ovis aries,* Linnaeus, 1758, cats *Felis catus* Linnaeus, 1758 and Norwegian rats *Rattus norvegicus* Berkenhout, 1769 from Campbell Island. The operation to eradicate Norwegian rats from the 11 330-ha Campbell Island required 120 tonnes of rodent bait, a team of 19 people, five helicopters which were flown from New Zealand, and six weeks of uncharacteristically good weather. The DOC has given the pest eradication work clear direction and priority, and a national advisory group of experts ensures that best practice and constant improvement occurs throughout the eradication programs nationwide (Cromarty *et al.* 2002). The only pests still to be removed are: mice from the Antipodes islands (2020 ha); and mice, cats and pigs *Sus scrofa* Linnaeus, 1758 from Auckland Island.

Other features of the management of the islands are links to threatened species recovery plans. Such activities include: monitoring of species populations; monitoring of species in conjunction with fisheries controls; and species reintroduction programs. There is a close focus on island biosecurity. An *Island Biosecurity Plan* (Agnew & Roberts 2004), which covers the DOC's island management operations across the southern portion of the South Island of New Zealand as well as the New Zealand sub-Antarctic islands is utilised and a stand-alone island quarantine store is established in Invercargill.

MANAGEMENT IN THE SURROUNDING SEAS

The management framework for the surrounding seas has the New Zealand Ministry of Fisheries responsible for fisheries quota management and in partnership with DOC for protected wildlife by-catch management and research issues. The DOC is responsible for marine reserves as well as marine mammal research and conservation issues, and the Ministry of Agriculture and Forestry (biosecurity section) is responsible for pest invasion matters, but at a national border level. Maritime New Zealand is responsible for marine pollution and oil spills within the 12-nautical-mile marine territorial limits.

The 12-mile territorial seas cover a large area around these islands, and by virtue of the far-flung nature of the islands establish quite a large 200-nautical-mile exclusive economic zone (EEZ). New Zealand's EEZ is 15 times its land area. There is a DOC-managed marine mammal sanctuary and marine reserve around the Auckland Islands extending out to the territorial waters. Currently marine protection for an area across the Campbell platform around the Campbell, Bounties and Antipodes islands is being investigated. The DOC expects a marine protection proposal to go to the Minister of Conservation and Minister of Fisheries for a sub-Antarctic Islands Marine Reserve by late 2008.

EXPECTATIONS FOR THE FUTURE

Removal of the last of the introduced animal pests is a priority, as is limitation of the impacts of human activities. Commercial fishing interactions with wildlife will continue, fishing pressure will continue as new species will be harvested. There will be exploration for gas and oil in the Great South Basin to the north and east of the islands. In all of that mixture these valuable sites will be managed for conservation purposes and along the way there is a considerable amount to be learned from each other as managers of remote oceanic islands.

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(accepted 24 September 2007)