SCIENCE SET
OPEN ACCESS PUBLISHERS

Review Article

Annals of Marine Science Research

Marine Parks as A Component in Remote Island Management and Conservation: The Examples of Australia's Sub-Antarctic Territories (The Heard Island and Macquarie Island Groups)

Patrick Hamilton Armstrong*, & Vivian L. Forbes

School of Social Science, The University of Western Australia, Nedlands, 6009, Western Australia

***Corresponding author:** Patrick Hamilton Armstrong, School of Social Science, The University of Western Australia, Nedlands, 6009, Western Australia.

Submitted: 25 February 2025 **Accepted:** 03 March 2025 **Published:** 10 March 2025

Citation: *Armstrong, P. H., & Forbes, V. L. (2025). Marine Parks as A Component in Remote Island Management and Conservation: The Examples of Australia's Sub-Antarctic Territories (The Heard Island and Macquarie Island Groups). A of Mar Sci Res, 2(2), 01-10.*

Abstract

Increasing emphasis is being placed internationally on the management and conservation of the biological resources of the oceans. In the case of remote islands, because of the often-intimate ecological connections between the biological resources of the terrestrial environment, and those of the surrounding ocean it is important that the management of the two be considered together. This is particularly important in the case of sub-Antarctic islands, which constitute breeding stations for vast quantities of wildlife, particularly seals, penguins and other seabirds. Thus, a myriad of food-chains leads from the surrounding ocean towards the land. Despite devasting despoliation, particularly though unregulated sealing from about 1820 until the middle years of the twentieth century, and the effects of the introduction of exotic organisms (such as cats and rabbits) until more recently, some of these islands still represent relatively pristine environments of great scientific and conservation significance. This paper compares efforts to combine the management of the ocean resources with those of the delicate island ecosystems, particularly through the development of marine parks, on two of Australia's sub-Antarctic archipelagos - the Heard and Macdonald Islands group in the southern Indian Ocean, and Macquarie Island, south of New Zealand. The two archipelagos have very different legal and sovereignty histories. The terrestrial conservation arrangements of Macquarie Island developed from those of the State of Tasmania, while those of the Heard Island group have, since its transfer from United Kingdom sovereignty, been an Australian Commonwealth (i.e., Federal) responsibility. The legal arrangements for the conservation of the marine area (outside the contiguous zone) are the domain of the Commonwealth, which has expanded its protection of the resources of the oceans surrounding both remote territories through the development of marine parks in the years since 2000. While monitoring of the marine parks around Macquarie is not too difficult – partly as the result of the island having a permanent scientific base - that of the region around Heard Island, which has no permanent population, is more problematic.

Keywords: Marine Parks, Australia, Sub-Antarctic Islands, Sovereignty, Conservation, Ecological Links

Introduction

This study examines the concept of marine parks as a component in the remote island management and conservation of the two groups of islands in the Southern Ocean, namely the Heard and Macdonald Islands, and the Macquarie Island groups. In particular emphasis is placed on the complementary nature of marine and terrestrial conservation, and the need for the two components of the remote island ecosystems to be conserved and managed as integrated wholes.

Position, Discovery and Sovereignty

Reputedly first having its position described accurately by Captain Heard of the *Oriental* on 25 November 1853, Heard Island is the main island of a small archipelago in the Southern Ocean; the position of the mid-point of the island is 53° 05' S; 73°30'E (Figure 3). It is thus just south of the Antarctic convergence. The island is approximately 34km wide and 48km long, the main axis lying north-west to south-east. Shag Rock and a group of tiny islets lie 12km to the north and the rocky, cliff-

bound McDonald islands 42km to the west. The main island is a complex ice-capped volcanic feature about 2,700m elevation and according to some estimates about 40 million years old. The island is about 250M (440km) southeast of Iles Kerguelen and about 2,120M (4,100km) southwest of Cape Leeuwin, Western Australia. Although there had been extensive sealing on the island since the 1820s (see Figures 1 and 2), no country claimed jurisdiction until the 1920s, despite a half-hearted and unofficial flag-raising by a Captain Anton of the *Mangaroo* in March 1910. In October 1926, the British Colonial Office issued a licence to a South African company for whaling and sealing on the islands, requiring the British flag to be displayed 'on occasion'. The decline in seal numbers and the world-wide depression led to a reduction in demand for raw materials, and the licence being terminated in March 1934.

Figure 1: Hunting Elephant Seals at Northeast Point, Heard Island in 1887. Sketch by H. W. Elliott, After Captain H. C. Chester. In the Public Domain.

On Christmas Eve 1947, Group Captain Stuart Campbell, leading the first Australian expedition, acknowledging the pre-existing 'sovereign right of His Majesty (George VI)', declared that 'His Majesty's Government in the Commonwealth of Australia intends forthwith to continue the occupation of the islands and to administer them as Australian territories'. This was confirmed by an exchange of letters between the two governments on 19 December 1950. Australia's claim has been undisputed ever since. Armstrong, 1992 gives a summary of early history and of the sovereignty of the territory [1]. The need for formal management and government of the Territory was acknowledged by the Australian Commonwealth Parliament in the *Heard Island and McDonald Islands Act 1953,* section 5 of which provides that the law of the Australian Capital Territory applies.

Figure 2: Removing Blubber from Elephant Seals at Southwest Beach, Heard Island, 1887. Sketch by H W Elliott, After Captain H C Chester. In the Public Domain.

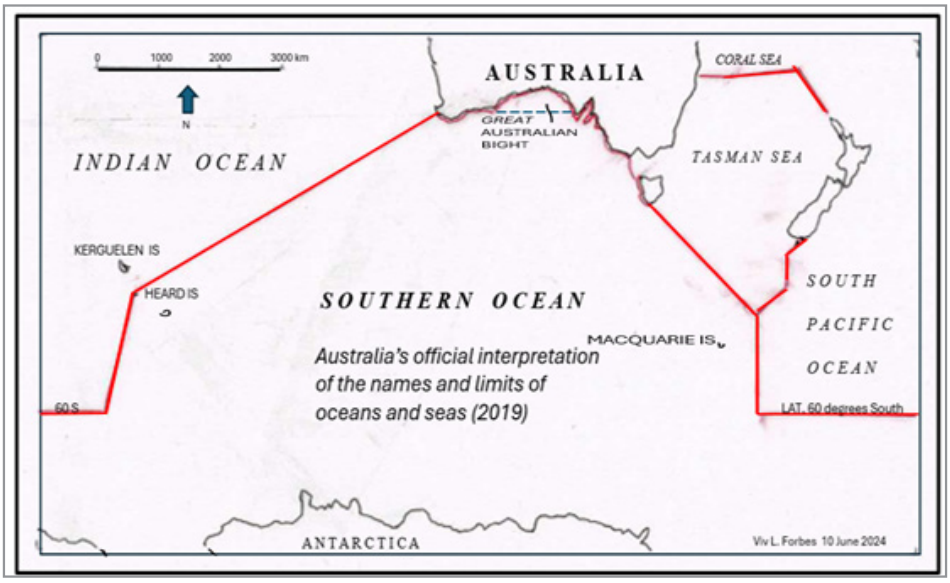

Figure 3: The Southern Ocean: Australia's Official Interpretation, 2019.

The International Hydrographic Organization (IHO) proposed the name "Southern Ocean" for the whole area south of Lat. 60º S in 2004.

Macquarie Island is in the Southern Ocean at 54° 37.8'S, 158° 51.6'E, north of the Convergence, (although this is not a fixed line, but a zone that fluctuates in its position to some extent) (Figure 3). The rectangular island has a broadly north-south axis, and is 35km long and 5km wide. In the vicinity are, to the north, the Judge and Clerk Islets and Bishop and Clerk Islets to the south. Discovery of the island is attributed to Captain Frederick Hasselborough of the Perseverance. He sighted the island on 11 July 1810 during a sealing voyage out of Sydney. It is possible, however, that he could have been preceded by Polynesians or other earlier voyagers, as Hasselborough recorded seeing a wreck 'of ancient design' on the island. He claimed the island for Britain, and named the place after the then Governor of New South Wales, Lachlan Macquarie; it was thus initially attached to the colony of New South Wales. In 1880, by Letters Patent of Queen Victoria, 'Macquarrie Island (sic) lying south-east of the … island of Tasmania' was effectively created a dependency of the Colony of Tasmania (Hobart Town Gazette 26 October 1880, pp 1057-1059). In 1890, the government of the Colony of New Zealand, campaigned vigorously for the transfer of the island to its authority. After some debate this was not agreed, neither was it consented to by Westminster.

The constitutional and legal position of the two island groups is thus different. The Heard Island group is an external territory of the Commonwealth of Australia, Macquarie Island is part of the State of Tasmania (it is included in Huon Valley Council local authority area). The former now has no permanent population, the latter has a permanent scientific base permanently staffed by some 20-40 scientists: Tasmanian statutes apply.

Environment and Ecology

Although both island groups experience what could be described as a sub-Antarctic climate, and there are some similarities in their ecology, the geologies and physical geographies of the two islands are very different.

Heard Island is dominated by Big Ben (a more-or-less conical active volcano, the summit of which is Mawson's Peak) and is largely covered by glaciers: some past estimates have stated that 70 per cent of the island's surface was glaciated, a further two per cent snow-covered. Between 1947 and 2004, however, the glaciated area of Heard Island shrank by around 29 per cent [2]. The McDonald Islands are much lower. Most of the volcanic rocks are from 400,000 to 100,000 years old although there are parasitic cones on the flanks of Heard Island, to which a date of around 15,000 years has been attributed. Basaltic lavas, trachytes and trachyandesites are present, along with some older pillow lavas. There has been considerable volcanic activity on both Heard Island and McDonald Island in the last six decades, some of it picked up by satellite imagery. The topography of the latter has been transformed since the 1980s. The most recent activity was in mid-2023 [3-5].

Because of the extreme environment (cold temperatures, wind, salt spray) the vegetation of Heard Island is relatively restricted: for the most part a low, tundra-like community made up of a dozen vascular plants: amongst the most conspicuous of which is *Azorella selago* a plant that grows into 'cushions' up to 60cm high. In addition, there are 44 moss and 12 liverwort species, and around 30 species of lichens. Two common plant communities are 'Cushion carpet' and 'mossy feldmark'. There are a few dozen species of invertebrate.

The biodiversity of adjacent McDonald Island appears to be even poorer (5 species of vascular plants) and much of the vegetation that formerly existed appears to have been exterminated by recent volcanic activity.

It is significant that there appear to be no exotic plant species naturalised on Heard Island. The few vertebrate and invertebrate species that were accidentally or deliberately brought in during the use of the island as an Australian scientific base 1947-1955 (for example, clothes moths, a few sheep, a rat) appear not

to have survived the abandonment of the island in the 1950s, with the possible exception of a species of earthworm. Turner, Scott and Rozefelds, give a review of the vascular plant biodiversity on Heard Island, together with the role of long-distance dispersal [6].

Terrestrial ecosystems in the Heard Island archipelago therefore have a very low biodiversity, low biological productivity and thus low biomass per unit area. Few plants are more than a metre high [7].

The amount of human disturbance on Heard Island is now as low as almost anywhere on the planet (outside parts of the mainland of Antarctica), and strenuous efforts are now made to maintain the island's pristine environment.

Macquarie Island has a very different geology and topography. It is the exposed crest of the submarine Macquarie Ridge, which stretches approximately north-south for thousands of kilometres south of New Zealand. It was raised to its present position - where the Indo-Australian tectonic plate meets the Pacific plate. It is the only place on earth where rocks from deep in the earth's mantle (some 6km below the ocean floor) are exposed above sea-level. These include ultrabasic and ultramafic rocks such as troclotite. There are also examples of pillow basalts and other extrusive rocks [8]. The island mainly consists of a low plateau, surrounded by steep slopes and cliffs 200 – 350m high; the highest point is Mount Hamilton at 433m: there are no glaciers.

Some 45 species of vascular plants occur, of which about four are endemic (found nowhere else); 79 species of moss have been recorded. The vegetation communities comprise a mosaic of feldmark, open tussock grassland, and cushion moorland on the windswept plateau. The cushion plant *Azorella macquariensis* is a dominant species. As on Heard Island the vegetation is low: there are no woody plants [7]. There are about 300 species of invertebrates on the Island, including an endemic flightless wasp and several spiders. The biological productivity is probably higher. There is a higher biodiversity, together with a higher degree of endemism, as the island has never been completely glaciated – overwhelmed by glaciers – although some small glaciers may have accumulated in hollows [9]. Thus, colonisation by long distance dispersal and to some extent speciation – the evolution of new species - has continued for longer than on Heard, although there are biological similarities. Food-webs on Macquarie are more complex.

The use of the island by sealers over a substantial period resulted in the introduction of rabbits, cats, mice and rats. Rabbits (*Oryctolagus cuniculus*) were introduced to many islands, partly in the hope that they might provide a source of food for shipwrecked mariners. Armstrong reviewed the introduction of rabbits to remote islands) [10]. Cats (*Felis catus*) were apparently introduced in 1818: they devastated the sea-bird colonies (see below). Rats and mice apparently appeared later. A programme to eliminate cats continued from 1974 to 2002 [11]. However, the removal of the cats allowed rabbit numbers to explode – they reached their peak in numbers in the 1980s – one estimate was that there were 200,000 on the island; the effect on the vegetation was very severe and rabbits (along with rats and mice) were removed in the period 2011-2014 by hunters, and by baiting from the air. Four introduced species of plants then apparently disappeared without human agency. In 2014, Macquarie Island was declared 'pest free', apart from a number of invertebrates, the elimination of which was deemed impossible.

The presence of so many alien mammals on the island until very recently substantially disrupted the natural food-web, and nutrient pathways – the routes of elements such as nitrogen, phosphorus, iron and calcium - through the ecosystem.

Nutrient Pathways from Sea to Land

The principle component of the animal biomass on both Heard Island and Macquarie comprises seabirds (particularly penguins) and the seals that breed on the islands.

Reliable estimates of numbers are difficult to come by, particularly for Heard Island, which is particularly a centre for macaroni penguins (*Eudyptes chrysolophus*). The Island holds a massive colony of this species, estimated at around 2 million! This represents 21 per cent, of the total world macaroni penguin population (Australian Antarctic Program, various websites).

King penguins (*Apenodytes patagonicus*) and gentoo penguins (*Pygoscelis papua*) are also present on Heard Island, although in smaller numbers. However, a 1987 survey estimated 16,600 breeding pairs of gentoo penguins (Australian Antarctic Program). In addition, since the late 1940s, breeding populations of king penguins have increased exponentially, doubling every five or so years. The current breeding population estimate is 60,000 pairs, with at least another 45,000 non-breeding birds present on the island during the 2003–04 summer.

It is thus probable that Heard Island likely supports a population of well over 2 million penguins in total.

Macquarie Island supports the world's largest breeding population of royal penguins (*Eudyptes schelegeli*) estimated at over 850,000 breeding pairs. King penguins are represented by an estimated 150,000-170,000 breeding pairs (UNESCO World Heritage Centre - Macquarie Island website). There are also large numbers of gentoo, and also southern rockhopper penguins (*Eudyptes chryocome*), There is certainly a population of at least one million penguins in the breeding season on Macquarie Island (Australian Antarctic Program, and World Heritage Centre: various websites).

When it is noted that there are several dozen other species of seabirds breeding on the two island groups (petrels, albatrosses, gulls, skuas, cormorants) it will be appreciated that the avian biomass is very considerable.

Macquarie Island is also teeming with seals! The estimated total number reaches up to 100,000 seals according to the Australian Antarctic Program (Australian Antarctic Program - Macquarie Island environment). Southern elephant seals (*Mirounga leonina*) can weigh several tonnes. There are said to be over 80,000 individuals on Macquarie Island, at certain times of the year (Wikipedia - Macquarie Island). Several fur seal species also breed on Macquarie Island, including Antarctic fur seals (*Arctocepalus gazella*), subantarctic fur seals (*A. tropicalis*) and New Zealand fur seals (*A. forsteri*), although their numbers are much lower than the elephant seals (Macquarie Island environment - Australian Antarctic Program websites).

There have been few recent estimates of the breeding population of seals on Heard Island, or the MacDonalds: populations

were virtually extinguished by sealers (see above). However, recovery has been spectacular and several species breed in very substantial numbers (many thousands), and numbers appear to be increasing.

Because the very large populations of seabirds and seals, although living in or on the ocean for long periods of time, have to come to land to breed, there is a substantial flow of nutrients from the ocean towards the land. Both categories of vertebrates obtain food from fish and krill offshore. Nestlings defaecate near the nest site (guano), and many young birds die, some through predation from skuas. Egg-shells crumble into the soil, eventually releasing calcium. The afterbirths of seals are rich in iron, phosphorus and nitrogen. The decomposition products of these processes pass, in due course from the soil into the vegetation. There is of course a return movement of some of these elements back towards the sea through leaching and the action of temporary and more permanent streams. Weathering of rocks supplements biological flows. The combination of volcanic activity, glacial action and meltwater streams on Heard Island probably enriches the adjoining ocean considerably.

Human interference during the sealing period, and in the case of Macquarie Island, for some time after, disrupted food chains and therefore nutrient flows. The enormous reduction of seal numbers, as elephant seals were slaughtered for oil, and other species for their fur, massively reduced the biomass: even penguins were sometimes killed for their oil. The killing of seabirds by the introduced cats on Macquarie meant that guano flows were reduced. The removal of the cats allowed rabbit (and other rodent) numbers to surge. Vegetation was in places eaten out, and bare soil (often crumbly peat) was exposed. Nutrients were deflected from the vegetation into rabbit biomass and there must also have been considerable loss through soil and peat erosion. It is only within the last decade or so that something akin to the pre-human-exploitation set of ecological relationships could be restored to Macquarie Island.

Terrestrial Conservation

The principle Commonwealth statute on the management of conservation and biodiversity in Australia is the *Environment Protection and Biodiversity Conservation Act, 1999,* section 5 of which reads:

'This Act extends to each external Territory.'

It thus is clearly applicable to the Heard and McDonald Islands.

In addition, the Governor-General has the power to issue specific Ordinances relating to the territory. An example is the Migratory Birds (*Amendment*) Ordinance 1982, which seeks to apply certain international agreements to the territory, and the *Environmental Protection and Management Ordinance 1987*, the purpose of which is 'to protect the environment and indigenous wildlife of the Territory', the 'environment' being defined as including (under section 4 of the Ordinance):

- *(a) ecosystems and their constituent parts; ...*
- *(b) natural and physical resources; ...*
- *(c) the qualities and characteristics of locations, places and areas; ...*
- *(d) heritage value of places and things; and the social, economic and cultural aspects of a thing mentioned in paragraph (a), (b), (c) or (d).'*

Almost anything that might interfere with the environment, thus defined, including taking any organism, rock or soil from the territory requires a permit, and if no permit has been granted is prohibited, quite severe criminal penalties can be imposed. Introducing living or dead organisms is similarly prohibited. Indeed, the Ordinance effectively disallows any landing in the territory without a permit.

In addition, the archipelago was added to the Australian National Heritage List in 2007. This list was created by an amendment to the 1999 *Commonwealth Biodiversity Act,* in 2003.

The legal protection of the terrestrial environment is fairly complete. Enforcement in a Territory that has no (official or legal) population is another matter.

Macquarie Island, as part of the State of Tasmania is subject to Tasmanian statutory surveillance and administration. In 1933, Tasmania declared the island a 'wildlife sanctuary' under the Tasmanian *Animals and Birds Protection Act 1928* (section 23) and, in 1972, it was made a State Reserve under the Tasmanian *National Parks and Wildlife Act 1970* (section 14).

As the name implies, the whole thrust of the 1928 Act (as originally framed) was on the 'protection' of 'animals' (terrestrial vertebrates seem to be implied) and birds. Plants are not included, and the idea of habitats and ecosystems needing protection was not considered at the time. The emphasis was on the prohibition of hunting of certain species and certain other destructive activities rather than active conservation and management. The 1970 statute, which effectively replaced the earlier Act, included both flora and fauna and appealed for more to modern ideas of habitat and ecosystem management. It is regularly updated. A Tasmanian state ranger is stationed on the Island [12].

Marine Conservation and Management

Thus, for both these Australian sub-Antarctic territories, although their legal histories had been quite different, by the end of the twentieth century they had substantial legal protection of their terrestrial environments, and in the case of Macquarie Island very stringent procedures for near-absolute protection. In the case of Heard and McDonald Islands, since the abandonment of the scientific base in the mid-1950s, the enforcement of the quite complex protective legal apparatus has been more uncertain. The archipelago is seldom visited by any government or official authority.

However, as has been shown above, most intimate and important links exist between the terrestrial plant and animal communities and the surrounding ocean ecosystems, and it is only more recently that the islands' surrounding marine environments have been given appropriate protection. There is now a realisation that the terrestrial ecosystems, and those of the surrounding oceans are intimately linked and so should be managed together in an integrated way.

The management and protection of the waters surrounding the Australian continent and the offshore islands (near and distant) under Australian jurisdiction is a complex task. Geoscience Australia, a Federal Authority, plays a major role in the delineation of Australia's maritime boundaries. The delineation of these boundaries has economic, environmental, political and strategic implications. This is evident in the map prepared by the Austra-

lian Hydrographic Office for the Australian Defence Department of the 'Southern Ocean' in 2019, as partially depicted in Figure 3.

Maritime Zones

The primary undertaking for maritime boundary determination is the delineation and proclamation of the Territorial Sea Baseline (TSB; the datum) from which the outer limits of the nation's various maritime zones are computed/measured. The TSB comprises several components including normal baseline along the actual coast, straight baselines between headlands, and bay and river closing lines. These straight baselines and their terminal points were gazetted on 9 February 1983 in the *Commonwealth of Australia Gazette* No. S 29. At the same time, a proclamation adopted the low-water level known as Lowest Astronomical Tide (LAT) as the datum upon which the territorial sea baseline aligns along the coast, termed the Normal Baseline. The remainder of the TSB – Straight baselines – are delineated across river mouths, bays, and areas of deeply indented coastline or where their fringing islands along the coast. Waters on the landward side of the TSB are the Internal Waters for the purpose of domestic and international laws. The TSB used to determine Coastal Waters does not include low tide elevations (LTE) greater than 3M from the coastline or islands.

In the context of Australia, the maritime zones include the 3-nautical mile (M) limit of Coastal Waters, the 12-M limit of the Territorial Sea, the 24-M limit of the Contiguous Zone, the 200-M limit of the Australian Exclusive Economic Zone (AEEZ). The outer limit of the extended (legal) continental shelf is sometimes based on a constraint line lying 350M beyond the TSB in accord with the provisions of the *United Nations Law of the Sea Convention* 1982 (the 1982 Convention) which Australia ratified on 5 October 1994. The 1982 Convention entered into force on 16 November 1994.

Domestically, the *Seas and Submerged Lands Act* 1973, affirms Commonwealth sovereignty over the Territorial Sea and certain Commonwealth rights (and obligations) in respect of the Contiguous Zone, the AEEZ and Continental Shelf (natural and extended/outer). Section 4 of the Act declares that the Act applies to all territories. [Additionally, the 1979 *Offshore Constitutional Settlement* (OCS) was an agreement between the Commonwealth and the (Australian) States, which provides the basis for an agreed division of powers in relation to Coastal Waters and relative to certain other matters including the regulation of shipping and navigation, offshore hydrocarbon exploration, crimes at sea and fisheries. A range of legislation gives effect to the OCS at Commonwealth level. The principal legislation implementing the OCS (*Coastal Water* (*State Powers*) *Act* 1980, *Coastal Waters (State Title) Act* 1980 entered into force between January 1982 and February 1983].

While Coastal Waters out to 3M are the responsibility of each Australian State, the Territorial Sea limit (3 to 12M), and the ocean beyond this limit out to 200 nautical miles (which includes the Contiguous Zone) is under the authority of the Commonwealth, that is, the Federal Government. In the case of Macquarie Island, therefore, the inshore waters – the marine environment within 3M of the shore is managed by Tasmania, the waters beyond 3M are the responsibility of the Commonwealth.

Ideally, conservation of the terrestrial environment (living and non-living), the inshore waters, and the surrounding ocean should be managed within a single framework.

Figures 4 and 5 illustrate the combination of normal and straight baselines employed to the encompass the Macquarie Island Group and the Heard Island and McDonald Island Group, respectively. Each of the Island Groups have the suite of maritime zones, namely Territorial Sea, Contiguous Zone, an EEZ and an Extended (legal) Continental Shelf in accordance with Australian and international laws.

Figure 4: TSB for Macquarie Island

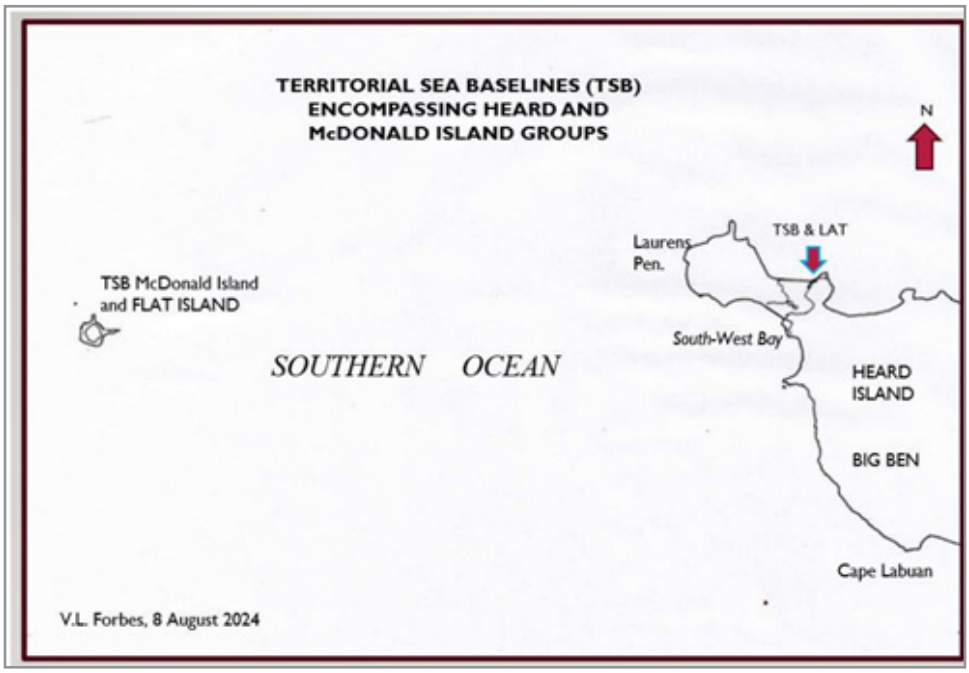

Figure 5: TSB (normal and straight) for the Heard Island and McDonald Is.

A continental shelf boundary between Kerguelen Island (under French sovereignty) and the Heard Island and McDonald Islands (Australia), comprising two terminal points and six turning points, was delimited on 4 January 1982, which entered into force in 1983. (Forbes, 1995) Southward of the continental shelf (maritime) boundary Australia claims a 200-M EEZ limit which was originally termed an Australian Fishing Zone (AFZ). Likewise, a continental shelf boundary between Australia and New Zealand northeast of Macquarie Island was delimited in 2004 (Figure 6(a) & (b)).

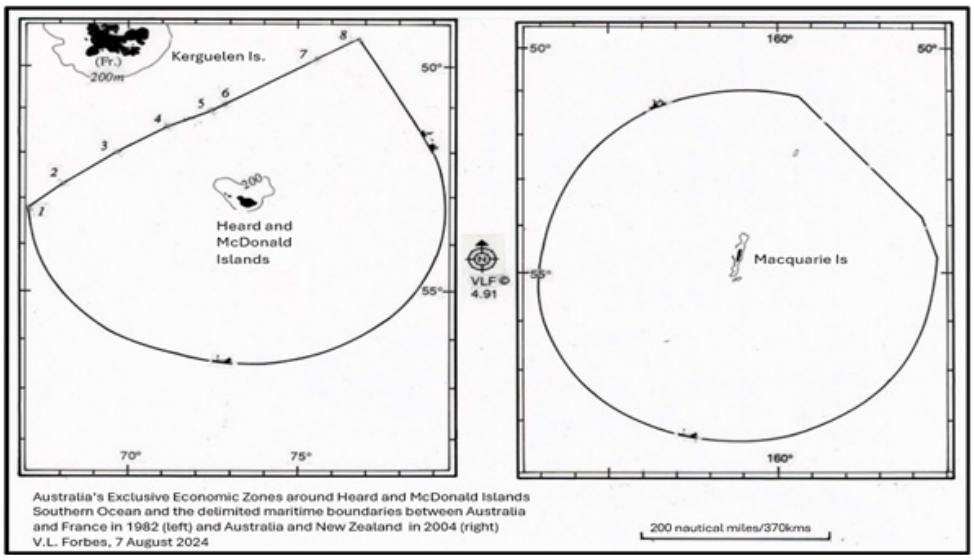

Figure 6(a) and (b): The Maritime Boundaries and Limits of AEEZ in the Vicinity of Heard & McDonald Islands (left) and Macquarie Island Groups (right). (Source: V.L. Forbes, Maritime Boundaries of the Indian Ocean, Singapore, 1995.)

Natural and Extended Continental Shelf

The natural continental shelf – generally the 200-metre isobath limit – is the area of the seabed and its substratum which extends beyond the territorial sea to a distance of 200M from the TSB and beyond that distance to the outer edge of the continental margin as defined in Article 76 of the 1982 Convention. The continental shelf is largely coextensive with the EEZ within 200M from the TSB. Australia submitted details of its claim to an *extended outer (legal) continental shelf limit* to the UN Commission on the Limits of the Continental Shelf (CLCS) on 15

November 2004. The submission contained the information on the proposed outer limits of the continental shelf of Australia beyond 200M from the Australian TSB.

The outer limit of Australia's extended continental shelf in the Kerguelen Plateau region encloses an area of 1,185,038km^2 beyond 200M from the TSB. The outer limit of the extended continental shelf is defined in small part by a line associated with the Australia-France Delimitation Treaty and in large part by 1,396 fixed points as prescribed by Article 76 of the 1982 Convention (Figure 6a).

The outer limit of Australia's extended continental shelf in the Macquarie Ridge region encloses an area of 81,719km^2 beyond 200M from the TSB. The outer limit is defined in small part by a line associated with the Australia-New Zealand Delimitation Treaty and in large part 402 fixed points in accordance with the provisions of Article 76 of the 1982 Convention.

First Designation of Marine Park

Following the clear identification of the marine boundaries, the Macquarie Island Marine Park was designated under the Commonwealth *National Parks and Conservation Act*, 1975, on 27 October 1999. It covered a surface area of 162,000km^2 with depths from 86m to over 6,000m. On 1 July 2023, after an extensive period of consultation, the marine park tripled in size to nearly 475,465 km^2. (Refer: Figure 7) The first phase of statutory consultation on the proposal to expand the marine park was held during mid-March 2023 (Parks Australia, 2023) [13]. The zoning enhances protection for millions of penguins, seals, and seabirds which have strong ecological links to the island. In particular it aims to ensure that the vast penguin colonies Island are not affected by introduced predators, or over-fishing.

The Macquarie Island Marine Park comprises an area in the Southern Ocean that is enclosed by the boundary of the outer limit of Australia's Exclusive Economic Zone (AEEZ) adjacent to Macquarie Island; and the boundary of the seaward limit of the Coastal Waters (CW) around Macquarie Island.

The MIMP is divided into the following sectors: The Sanctuary Zone which is assigned to IUCN category 1a strict nature reserve); the National Park Zone which is assigned to IUCN category II (national park); and the Habitat Protection Zone which is assigned to IUCN category IV (habitat/species management area) [13, 14].

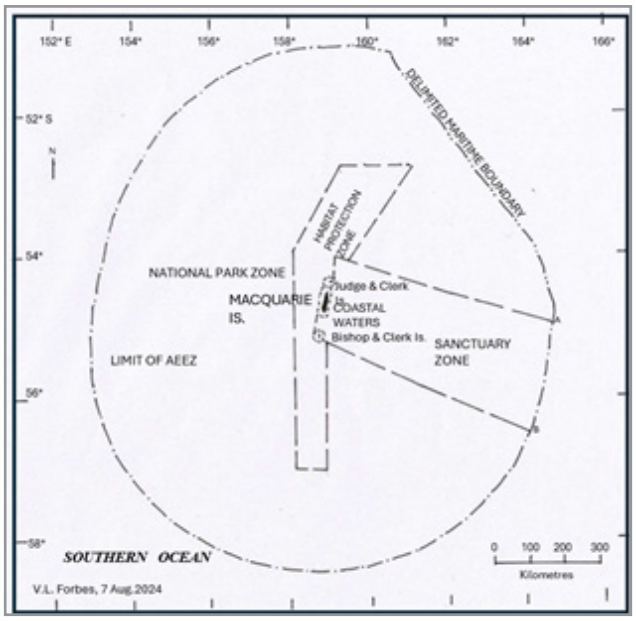

Figure 7: MIMP and the AEEZ.

Heard Island and McDonald Islands (HIMI) Marine Reserve

The Heard Island and the McDonald Islands (HIMI) have been listed on the Register of the National Estate and the existing HIMI Wilderness Reserve, comprising the terrestrial islands and waters to the limit of the 12M territorial Sea, was listed in 1997 as a World Heritage Area. The Wilderness Reserve is managed as an IUCN Category 1a (strict nature reserve) by the Australian Antarctic Division in accordance with provisions of the *Environment Protection and Management Ordinance* 1987 (the EPMO) made under the *Heard Island and McDonald Islands Act 1953* (see above).

The HIMI Marine Reserve was established in October 2002 and declared under Section 344 of the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). The Reserve was expanded on 28 March 2014 following a thorough scientific assessment of the region's conservation values and extensive consultation with key stakeholders [14].

The Reserve incorporates the existing Heard Island Wilderness Reserve with additional southern, western, central and northeastern representative segments of the AEEZ (comprising around 15.6 per cent of the total area). The strategic objectives for the Reserve are to protect conservation values of HIMI; provide an effective conservation framework to contribute to the in-

tegrated and ecologically sustainable management of the HIMI region; provide a scientific area for the study of ecosystem function within the HIMI region; and add representative examples of the HIMI EEZ to the National Representative System of Marine Protected areas. (Figure 8)

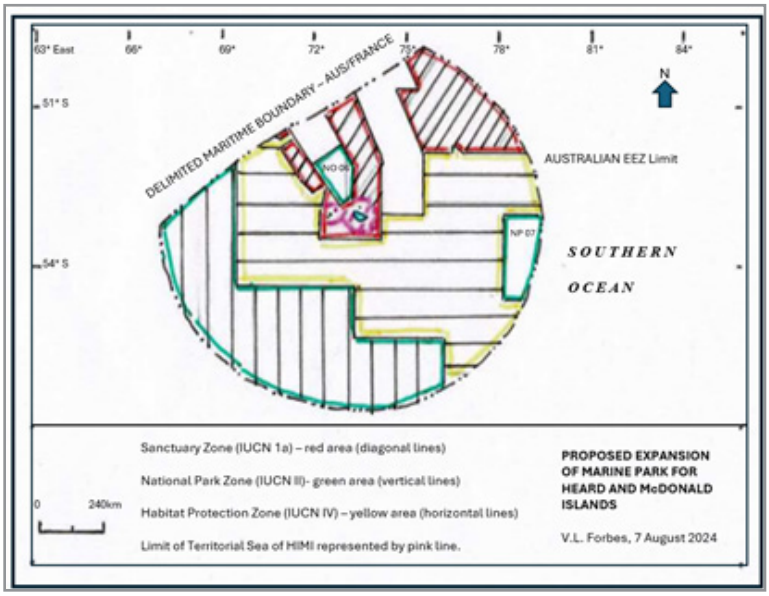

Figure 8: HIMI Conservation and Marine Reserve Zones, Showing the Continental Shelf and EEZ.

The Conservation Zone comprises four separate areas: a portion of the Northeastern Plateau region to the north of Shell Bank; a southern portion of the Shell Bank; Aurora Bank in the western region and surrounding deeper waters; and a portion of the deep waters in the western region to the north of Coral Bank and near the Western Trough. One of the strategic objectives for the Conservation Zone is to obtain additional scientific and fishing data [13, 15].

Conclusion

These two remote islands both experience extreme, sub-Antarctic climates, and both have felt the heavy hand of human exploitation: the destruction of wildlife populations, and, particularly in the case of Macquarie Island, serious environmental damage by introduced organisms. Recent recovery has been spectacular.

There have been major differences in the history of the islands (and also geology and physical geography). The differences in the sovereignty of the islands have been reflected in major differences in the manner in which attempts have been made to manage the conservation of the islands. In view of the importance of the links between the marine and terrestrial environments, the aim has been to bring the management of the terrestrial environment (living and non-living), the immediate offshore zone and the deeper surrounding ocean into a single framework: the designation of marine parks within the last two decades has been an important component in this. Co-operation, in the case of Macquarie Island between State and Commonwealth authorities has been critical.

Notes

1. P. H. Armstrong is Adjunct Professor at the University of Western Australia. He has had a long interest in the Polar regions.
2. V. L. Forbes is Professor and Adjunct Research Fellow at the University of Western Australia. In July 2022, he was awarded the higher degree of Doctor of Letters by UWA.

References

1. Armstrong, P. H. (1992). Seals, Science and Sovereignty on Heard Island. Indian Ocean Review, 5(2), 25-29.
2. Thost, D. E., & Truffer, M. (2008). Glacier recession on Heard Island, southern Indian ocean. Arctic, Antarctic, and Alpine Research, 40(1), 199-214. DOI: 10.1657/1523-0430(06-084) [THOST]2.0.CO;2
3. Duncan, R. A., Quilty, P. G., Barling, J., & Fox, J. M. (2016). Geological development of Heard Island, central Kerguelen plateau. Australian Journal of Earth Sciences, 63(1), 81-89. https://doi.org/10.1080/08120099.2016.1139000
4. Quilty, P. G., & Wheller, G. E. (2000). Heard Island and the McDonald Islands: a window into the Kerguelen Plateau, 133(2), 1-12, https://doi.org/10.26749/rstpp.133.2.1
5. Frey, F. A., Coffin, M. F., Wallace, P. J., Weis, D., Zhao, X., Wise Jr, S. W., ... & Antretter, M. (2000). Origin and evolution of a submarine large igneous province: the Kerguelen Plateau and Broken Ridge, southern Indian Ocean. Earth and Planetary Science Letters, 176(1), 73-89. https://doi.org/10.1016/S0012-821X(99)00315-5
6. Turner, P. A. M., Scott, J. J., & Rozefelds, A. C. (2006). Probable long-distance dispersal of *Leptinella plumosa* Hook. f. to Heard Island: habitat, status and discussion of its arrival. Polar Biology, 29, 160-168. https://doi.org/10.1007/s00300-005-0035-z

7. Hnatiuk, R. J, (1993). “Subantarctic Islands”, in George, A G, Flora of Australia: Oceanic Islands, Australian Government Publication Service, 53-62.
8. Varne, R., Brown, A. V., & Falloon, T. (2000). Macquarie Island: its geology, structural history, and the timing and tectonic setting of its N-MORB to E-MORB magmatism, Special Paper of the Geological Society of America, 301-320. DOI: 10.1130/0-8137-2349-3.301
9. Colhoun, E. A., & Goede, A. (1974). A reconnaissance survey of the glaciation of Macquarie Island. In Papers and proceedings of the Royal Society of Tasmania, 108, 1-19. https://doi.org/10.26749/rstpp.108.1
10. Armstrong, P. (1982). Rabbits (*Oryctolagus cuniculus*) on islands: a case-study of successful colonization. Journal of Biogeography, 353-362. https://doi.org/10.2307/2844722
11. Robinson, S. A., & Copson, G. R. (2013). “Eradication of feral cats from subantarctic Macquarie Island”, Ecological Management and Restoration, 15(1), 34-40. https://doi.org/10.1111/emr.12073.
12. Parks and Wildlife Service. (2006). Macquarie Island nature reserve and World Heritage area management plan.
13. Australia, P. (2023). Public Consultation Paper – Proposal to Expand Macquarie Island Marine Park.
14. (2002). Environment Australia (Department of the Environment and Heritage), Heard Island and McDonald Islands Marine Reserve Proposal.
15. National Parks Australia. (2023). Concerning the Expansion of Macquarie Island Marine Park (Proposal to Expand…) Director of National Parks, Australia.