

World Heritage Sites

Protected Areas and World Heritage



MACQUARIE ISLAND COMMONWEALTH OF AUSTRALIA

Macquarie Island lies in the Southern Ocean approximately halfway between Australia and Antarctica. It is the exposed crest of an undersea ridge where the earth's crust is being uplifted by tectonic pressure. As the only place on earth where mantle rocks from 6 km below the ocean floor are visible above sea level, it is a site of major geoconservation interest. Its unique exposures include active faults, examples of pillow basalts and other extrusive rocks, all geological evidence for sea-floor spreading and continental drift.

COUNTRY

Commonwealth of Australia

NAME

Macquarie Island

NATURAL WORLD HERITAGE SITE

1997: Inscribed on the World Heritage List under Natural Criteria vii and viii.

INTERNATIONAL DESIGNATION

1977: Designated a Biosphere Reserve under the UNESCO Man & Biosphere Programme (12,785 ha)

2010: Status to be withdrawn because there are no permanent human residents (UNESCO, 2010).

IUCN MANAGEMENT CATEGORY

Ia Strict Nature Reserve

BIOGEOGRAPHICAL PROVINCE

Insulantarctica (7.4.9)

GEOGRAPHICAL LOCATION

Macquarie Island lies in the Southern Ocean nearly halfway between Australia and Antarctica, approximately 1,470 km south-southeast of Tasmania and 1,130 km southwest of New Zealand between 54°29' to 54°47'S and 158°47' to 158°58'E.

DATES AND HISTORY OF ESTABLISHMENT

1933: The island gazetted a Wildlife Sanctuary under the provisions of the Animals & Birds Protection Act of 1928;

1971: Declared a Conservation Area under the Tasmanian National Parks and Wildlife Act;

1972: Upgraded a State Reserve under the same act by Statutory Rule 1972/152;

1977: Entered on the Register of the National Estate and designated a UNESCO Biosphere Reserve;

1978: Extended to its present boundaries to include the Bishop and Clerk islets, the Judge and Clerk islets and the surrounding seas out to 3 nautical miles. Formally declared a state Nature Reserve and a restricted area by Statutory Rule 1978/121);

1997: The marine area extended as the Macquarie Island Marine Park (16,244,510 ha) from the 3nm (5.5 km) limit to 12 nautical miles (22.24 km) over the southwest quarter of the surrounding exclusive economic zone. 5,798,970 ha of the zone is highly protected.

LAND TENURE

The state of Tasmania owns the island, islets, rocks, reefs and surrounding sea to 3 nautical miles from the low water mark. The Commonwealth of Australia has jurisdiction over the marine area from the 3nm limit to 12 nautical miles. It is now managed by the Tasmanian Parks and Wildlife Service (PWS) of the Department of Tourism, Arts and the Environment.

AREA

12,785 ha, land area. The 527,215 ha surrounding marine area within the 12nm limit is mapped in the World Heritage area by the Tasmanian Parks and Wildlife Service 2006 Management Plan.

ALTITUDE

0-433m (Mt. Hamilton).

PHYSICAL FEATURES

The Reserve, a subantarctic island 34 km long and averaging 5 km wide, with the Bishop and Clerk Islets 37 km to its south and the Judge and Clerk Islets 11 km to its north is the exposed crest of an undersea ridge. The main island landscape is a narrow undulating plateau 250m-300m above sea level, bounded on all sides by slopes and steep cliffs from the foot of which a coastal platform of beach slopes and terraces extends up to 800m wide to the coast. Glacial drift up to 20m thick covers much of the plateau. There are seven large lakes with a combined area of more than 200 ha and numerous small lakes, tarns and pools. On both the plateau and raised beach terraces there are fens, bogs and mires in wet valley bottoms and deep peat beds. There are relatively few streams because of the porous nature of the rock. Wet soils are fen mires and bog peats, dry soils are gravelly tundra loams. Overgrazing by rabbits has led to erosion and landslips of several cliffs. The coastline is generally rocky with a several offshore islets and stacks. Scenically the island can be grand but forbidding.

The island is part of the ocean crust (ophiolite) formed in water six kilometres deep at a spreading ridge in Miocene times and raised to its present height by the pressure of the Indian-Australian plate against the Pacific plate (Christodoulou *et al.* 1984). It probably appeared only 600,000 years ago (Marmion, 2008) and is still rising. Globally, the MacQuarie Ridge is the best preserved section of such an oceanic crust visible above sea level which nowhere else on earth has been retrieved from such a depth. Volcanic pillow basalts with massive lava flows, basaltic dykes and sediments cover the southern four-fifths of the island (Griffin, 1982; Varne & Rubenach, 1972). The island is still seismically active, and frequent earthquakes and landslides occur. A study of coccoliths in the nanno-foramiferous ooze characteristic of ocean floor deposition between 2,000m and 4,000m deep (Varne *et al.*, 1969), indicates that the crust was formed during the early or middle Miocene (Quilty *et al.*, 1973). The north of the island comprises mainly intrusive rocks apparently derived from deeper crustal levels than the southern section (Griffin & Varne, 1980; Varne & Rubenach, 1973). Dolerite dyke swarms are extensive in the north and around Lusitania and Sandell Bays in the south. Besides the dyke swarms, the northern section is composed mainly of serpentinised peridotite and gabbro masses, although there are small areas of extrusive volcanic rock. These rocks and active faults are geological evidence of sea-floor spreading and continental drift.

CLIMATE

The island has a cold temperate oceanic climate with persistent strong winds, continual clouds and rain and a very uniform temperature range. Meteorological observations were made at the station on the Isthmus between 1911 and 1915 and from 1948 on. The mean seasonal temperatures at sea level, average 6.6°C in summer and 3.3°C in winter. The mean annual precipitation is 950mm, falling over an average of 310 days a year. Some 70% of winds are westerly to north-westerly, cloud cover averages seven-eighths in all months, and mean daily sunshine ranges from 0.6 hours in June to 3.5 hours in February (DPWH, 1991). An earthquake occurs once a year, and a severe earthquake, once a decade.

VEGETATION

The flora and fauna of the site and the surrounding ocean have similarities with sea-based species in other islands of Insulantarctica. Its isolation and the short geological time since its emergence exemplify the colonization of a site by long distance dispersal and the evolution of endemic species (Marmion, 2008). The vascular flora contains at least 45 species, plus 80 moss species, 50 liverworts and

some 141 species of lichen. There are 20 species of freshwater algae and at least 90 diatoms and 110 species of marine and littoral algae (Lowry *et al.*, 1978; Ricker, 1981, 1987), Antarctic kelp *Durvillaea antarctica* being dominant (DPWH, 1991). Over 135 mushrooms, 60 cup fungi, 22 slime moulds and one false slime mould have been identified (Commonwealth of Australia, 1996). One species is listed as threatened in Tasmania. Since their introduction to the island, rabbits have modified the vegetation in most areas, overgrazing it to the point of erosion. The rabbit control programme, which started in 1978, led to rapid changes in the growth and to a lesser extent, the distribution of many vascular species, one being the recovery of tall grassland (Copson, 1984).

There are five main vegetation formations: tall tussock grassland, short tussock grassland (herbfield), fen, bog and feldmark (Selkirk *et al.*, 1990). Tall tussock grassland up to 2m high in places provides the island's tallest vegetation cover and shelter as there are no trees or tall shrubs. It is dominated by *Poa foliosa*, either in pure stands or with *P. cookii* and/or MacQuarie Island cabbage *Stilbocarpa polaris* and has been grazed down by rabbits, allowing short grassland to spread. Short tussock grassland covers areas of the raised beach terraces and the plateau. It also grows widely on coastal slopes which may previously have been covered by tall tussock grassland associations. Mires occur on raised beach terraces, valley bottoms and some poorly drained areas on the plateau, and rush *Juncus scheuchzerioides* is dominant in many areas. Feldmark is the most widespread formation, covering approximately half of the island and occupying the most stony wind-exposed areas of the plateau and mountain tops. The locally endemic cushion-forming *Azorella macquariensis* is the dominant vascular species in its more sheltered parts but by 2009 an unexplained dieback of this species had reached 90% in places (UNESCO, 2010).

FAUNA

With some 100,000 seals and 3-4 million penguins, the island teems with life, though the number of species is relatively low; 16 of these however are listed in the Schedules of the Tasmanian Threatened Species Protection Act 1995. There are no native terrestrial mammals and the indigenous mammals are all marine. They include southern right whale *Balaena glacialis*, killer whale *Orcinus orca*, the commonest whale observed, long-fin pilot whale *Globicephala melaena* and rare sightings of sperm whale *Physeter macrocephalus* (VU). The only other positive whale records are southern bottlenose whale *Hyperoodon planifrons* and Cuviers beaked whale *Ziphius cavirostris*. Southern elephant seal *Mirounga leonina*, once widely killed off for its oil, numbered 110,000 during the mid-1950s (Carrick & Ingham, 1962). New Zealand fur seal *Arctocephalus forsteri*, sub-Antarctic fur seal *A. tropicalis* and Antarctic fur seal *A. gazella* all occur having recovered from the destruction of the 19th century sealing industry. But the indigenous fur seal, of unknown species, was early exterminated (Cumpston, 1968). Leopard seal *Hydrurga leptonyx* and the occasional New Zealand sea lion *Phocarctos hookeri* (VU) visit each winter and spring. Weddell seal *Leptonychotes weddellii* and crabeater seal *Lobodon carcinophagus* are very rare vagrants from the south.

Four species of introduced mammal still survive. In 1978 the over wintering population of European rabbit *Oryctolagus cuniculus*, imported in the 1870s for food, was estimated at 150,000 (Copson *et al.*, 1981), but in 1978 myxomatosis was introduced with an initial overall reduction of more than 50% and in some areas of over 90% (Brothers *et al.*, 1982). In 1993 the rabbit population was estimated at less than 10,000 (PSW) and the number of feral cats *Felis catus* in 1997 was about 100. But the latter had a disastrous effect on some of the smaller burrowing birds (Jones, 1977; Brothers, 1985) and were therefore eradicated during the 2000s which led to an explosion of the rabbit population which by 2005 was estimated at 148,200 (UNESCO, 2010). House mouse *Mus musculus* and ship rat *Rattus rattus* both became established on the island in the 19th century (Cumpston, 1968), the numbers of rats decreasing as their tall grassland shelter was grazed down by rabbits, and increasing on its recovery.

Sixty-seven species of birds are recorded at Macquarie Island: 25 breeding species, four probably breeding and 38 non-breeding species. The breeding bird fauna includes four penguins, four albatrosses, fourteen petrels, two ducks, two passerine, one species each of rail, skua, gull, tern, and an endemic sub-species of imperial shag *Phalacrocorax atriceps purpurascens*, estimated at 660 pairs (Brothers, 1985). Two endemic sub-species became extinct in the 19th century: banded rail *Rallus phillippensis macquariensis* and red-fronted parakeet *Cyanoramphus novaezelandiae erythrolis*, and three species of introduced domestic poultry are no longer on the island.

Penguins are the most numerous breeding birds on the island. King penguin *Aptenodytes patagonicus* has recovered dramatically from their slaughter for oil in the 19th century, and the population, estimated at 400,000 in 1989 is protected and still expanding (Rounsevell & Copson, 1982; Scott, 1994); there is a

huge colony at Lusitania Bay. The island's endemic royal penguin *Eudyptes schelegli* (VU) has a breeding population of 850,000 in 57 colonies (Copson & Rounsevell, 1987); the southern rockhopper penguin *E. chrysocome* (VU) breed in medium to large colonies with a total population of 500,000 breeding pairs (Rounsevell & Brothers, 1984); and the gentoo penguin *Pygoscelis papua papua* population is about 5,000 breeding pairs (Robertson, 1986).

There are 500-700 pairs of light-mantled albatross *Phoebastria palpebrata* (PWS, 1993) and three other albatross species, wandering *Diomedea exulans* (VU), black-browed *Thalassarche melanophrys* (EN) and grey-headed albatross *T. chrysostoma* (VU) occur in lower numbers. No native passerines have been recorded, but redpoll *Acanthis flammea* and common starling *Sturnus vulgaris* are both widespread and common. Weka *Gallirallus australis scotti* (VU) were introduced from New Zealand in the mid 1800s as a source of food for the sealers (Cumpston, 1968). They probably contributed significantly to the extinction of the endemic sub-species of land rails and parakeets (Taylor, 1979). The number of fish recorded around the island is 12 benthic and 21 pelagic species (Williams, 1988). Of some 27 species of marine mollusc 64% are endemic (Dell, 1964). The island's fauna has probably less than 300 species of terrestrial invertebrates, approximately 10 percent endemic with a few others doubtfully so (Greenslade, 1990). An annotated checklist of mammals, birds and fish is given in DPWH (1991), and of mammals and birds is given in Commonwealth of Australia report (1996).

CULTURAL HERITAGE

Sealers discovered the island in 1810 and visited and lived on it intermittently throughout the 19th century. They exterminated the endemic fur seals for their pelts within ten years of the island being discovered and greatly reduced the elephant seal population by 70 percent within 20 years, rendering it down for oil. Gangs came in 1870 to exploit the king and royal penguin populations, also for oil, almost eliminating the former. The sealers also brought exotic mammals which caused the extinction of the two endemic subspecies of land birds, and they left many small industrial sites behind. In the 2006 Management Plan conservation of the historic cultural heritage is given high priority. This tradition of exploitation ended after the establishment in 1919 of the scientific station by Douglas Mawson, who campaigned for the island's present protected status. The island's name commemorates the governor of New South Wales at the time it was discovered.

LOCAL HUMAN POPULATION

In recent years the Australian National Antarctic Research Expedition (ANARE) station on the Isthmus has been staffed by 15-20 overwintering personnel from the Department of Environment & Land Management, though over the summer periods the number can double. Temporary influxes of over 100 people may occur when supply or tourist ships visit the island (DPWH, 1991). There are no other inhabitants. The toothfish fishery is important offshore.

VISITORS AND VISITOR FACILITIES

The first tourists arrived in 1968 and today a limit of 750 tourists per year is allowed by the state Parks & Wildlife Service, though between 1990 and 2005, the average annual number of visitors was 334. The only access is by sea - some eight ships and yachts call per year - (Potter, 2007) and most of the island is closed so as not to disturb the wildlife. There are three Tourism Management Areas: the Isthmus near the Research Station, Sandy Bay, and Lusitania Bay for viewing the wildlife. Visits are now by permit only, with care taken not to import any pathogens. Guidelines for tourism operations are based on the regulations of the Tasmanian National Parks & Wildlife Reserves Regulations. Visitors must be ship-based and walkways and viewing platforms provide protection against erosion.

SCIENTIFIC RESEARCH AND FACILITIES

The first scientific visitor was the Russian von Bellingshausen in 1820. Scientists and Antarctic expeditions in the late 19th and early 20th centuries made small collections. Mawson established the first research station in 1911 which became permanent in 1948. The meteorological station established then has maintained records and an ozone measuring regime ever since. Other studies have covered geophysics and earth science, meteorology and atmospheric monitoring. An active programme is conducted under the auspices of ANARE by a permanent staff with visiting university and government scientists. Research on the Reserve is very wide-ranging and encompasses global monitoring programs. It provides a base for gathering valuable long-term data over a broad range of disciplines to compare with those of other stations in the Southern Ocean, especially the status of wide-ranging species and thus the health of the oceans in which they forage, linking the findings with those from other breeding locations (Marmion, 2008). Research has focused on seabird and mammal ecology, their distribution and abundance, the state and status of albatross, penguin and seal species, and in association, the causes of

erosion, the effects and control of introduced animals and human biology. The monitoring of alien species during and after the eradication campaign, with the use of 28 rabbit exclusion plots, is important to help secure the future of nesting seabird populations. Equally important are trials monitoring the success of mitigating measures to lessen the effects of long-line fishing on seabirds (UNESCO,2010).

The Research Station comprises over 40 buildings and smaller structures housing scientific equipment and experiments. Proposals to carry out scientific research programs are considered by several committees, including the Macquarie Island Advisory Committee (MIAC) which liaises between the Department of Parks, Wildlife & Heritage and other organisations. The Antarctic Division of the Federal Department of the Arts, Sport, Environment, Tourism & Territories which owns the Station and has supported much of the work, reduced its mission in 2007. This may encourage a change of patronage. Both the Bureau of Meteorology and the international geological community are to continue their research and monitoring programs; and educational tourist interest in the Reserve will probably grow in future. A comprehensive bibliography is provided in DASETT (1991).

CONSERVATION VALUE

The major purpose of the state reserve was the conservation and protection of its flora, fauna, natural beauty and as the earth's best preserved fragment of ocean crust above sea level. The Reserve lies within a Conservation International-designated Conservation Hotspot, a WWF Global 200 Eco-region and is a UNESCO Biosphere Reserve.

CONSERVATION MANAGEMENT

Until 2007 daily administration was by the ANARE station leader, an employee of the Antarctic Division of the national Department of Tourism, Arts & Environment (formerly the Department of the Arts, Sport, the Environment, Tourism & Territories, DASETT) who was made an honorary Parks Service ranger during his stay in the Reserve (DPWH, 1991). The position is now held by the Parks & Wildlife Service of the Tasmanian Department of Environment & Land Management. The Australian Antarctic Division is reducing its logistical support which will be replaced from other sources. Legislation relevant to the island totals 18 Australian Government acts and seven Tasmanian State Government acts, listed in DASETT (1991).

A revised management plan was adopted in 2006 (PWS,2006). To protect the natural and historical values of the Reserve, repair past damage to vegetation and soils and encourage research, it was declared a restricted area under the National Parks and Reserves Management Act of 2002. The plan establishes three management zones. The first zone covers the research station; the second covers the rest of the island and adjacent sea stacks; the third covers the seas to the 3-km limit of state waters from low-water mark, including the Bishop and Clerk Islets, and Judge and Clerk Islets. Special Management Areas such as the islets and the Caroline Cove/southern peaks may be designated in any zone to preserve them as nearly undisturbed as possible and to control human access especially during the breeding season. Tourism is allowed for in the management plan, limited to the carrying capacity of the island and its wildlife. .

MANAGEMENT CONSTRAINTS

Alien vertebrates have been and remain the main threat to native species. The relationships between the two faunas are complex and difficult to assess. Programs to eradicate introduced species are regularly undertaken with considerable success as with the weka which no longer exists on the island. Rabbits have been the worst threat, causing widespread vegetation change though providing abundant prey for cats and the main native predator, the great skua *Stercorarius skua lonnbergi*. These decline as a result of rabbit control and turn to preying on native burrowing birds (Copson & Whinam, 2008; PWS,1994). However, the successful eradication of cats in 2000 led to an explosion in the rabbit population which severely degraded the grassland habitat of breeding albatrosses. After long delay, the Federal and State governments undertook in 2007 to jointly fund a \$24.6 million Macquarie Island Pest Eradication Project based on the successful Campbell Island rat eradication program, to eliminate rabbits, rats and mice from the island, starting with a poison-drop in 2010, and pest hunting with trained dogs. By 2008 the rabbit population had been brought down to 79,700 (UNESCO,2010).

Parts of the nominated area such as the Bishop and Clerk Islets, Judge and Clerk islets and the surrounding seas have remained in pristine condition (DASETT, 1991). Increased human activity on the island, through the maintenance of the ANARE station and tourist visits, has brought the inevitable though limited environmental impacts such as waste disposal, walking tracks and the introduction of alien pests and seeds. The Tasmanian Department of Parks, Wildlife & Heritage and the Antarctic Division

have established and formalised management procedures to deal with these threats (PWS,2006). Strict and detailed regulations govern quarantining to guard against the accidental introduction of alien species (Potter,2007).

STAFF

The Tasmanian Parks & Wildlife Service usually has between one and three authorised officers working in the area throughout the year. These may be rangers, technical officers, scientific officers or wildlife management officers carrying out research and management programmes. Maintenance, communication and logistical support staff have been provided by the Antarctic Division.

BUDGET

This was estimated at A\$4.7 million (US\$3,550,000) for the period between July 1995 and June 1996. The 2007-2014 rabbit and rodent eradication program alone is budgeted at A\$24.6 million (US\$19 million) (Antarctic Division of DASETT, 2008).

LOCAL ADDRESSES

Parks & Wildlife Service, GPO Box 44A, Hobart, Tasmania 7001 (Macquarie Island and sea to 3 nm)
Government of Australia, Canberra (for the marine area from 3-12 nautical miles).

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