MUTTONBIRD ISLAND NATURE RESERVE

PLAN OF MANAGEMENT

National Parks and Wildlife Service

Part of the Department of Environment and Climate Change NSW

June 2009

This plan of management was adopted by the Minister for Climate Change and the Environment on 4th June 2009.

Acknowledgments

This plan of management is based on a draft plan prepared by staff of the North Coast Region of NPWS with the assistance of the Northern Branch Planning Group.

Valuable information and comments were provided by NPWS specialists, the Regional Advisory Committee and members of the public.

NPWS would like to thank all those who took the time to make a submission during the preparation of this draft plan of management. Your comments and concerns were considered in the preparation of this draft plan and NPWS recognises the valuable contribution your comments have made to the planning process.

Drawing of Giidayn Miirral by Shane Phillips (a local Gumbaynngirr artist).

Inquiries about this reserve or this plan of management should be directed to the NPWS Coffs Coast Area Office at 32 Marina Drive (PO Box J200), Coffs Harbour, NSW 2450 or by phone on (02) 66520 900.

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FOREWORD

Muttonbird Island Nature Reserve covers an area of around 9 hectares and is located adjacent to the coastline at Coffs Harbour on the mid north coast of NSW. It consists of two islands: Muttonbird Island and Little Muttonbird Island.

The initial dedication of the reserve in 1971 covered Muttonbird Island (approximately 8 hectares) and was for the conservation and study of seabirds. Little Muttonbird Island was added to the reserve in 2005.

Wedge-tailed shearwaters (*Puffinus pacificus*), or muttonbirds, breed annually on both islands in the reserve. These birds are listed under international agreements for the protection of migratory birds, as are a number of other birds which frequent the reserve. The reserve also provides habitat for threatened species including the black-winged petrel.

The reserve is within the area of the Gumbaynggirr Aboriginal People who named Muttonbird Island "Giidayn Miirral" meaning moon-sacred place. Muttonbird Island is of mythological and symbolic importance to local Aboriginal people.

The reserve provides a unique opportunity to observe a wedge-tailed shearwater rookery at close quarters. A walking track, lookouts and information signs have been constructed on Muttonbird Island.

The New South Wales *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A plan of management is a legal document that outlines how an area will be managed in the years ahead.

A draft plan of management for Muttonbird Island Nature Reserve was placed on public exhibition from 4th June until 20th September 2004. The submissions received were carefully considered before adopting this plan of management.

This plan contains a number of actions to achieve the priorities listed in the NSW State Plan, including *Better environmental outcomes for native vegetation, biodiversity, land, rivers, and coastal waterways* (Priority E4), including works to protect the shearwater habitat, control of pest animals and weeds, and continuing research. The plan also contributes to *More people using parks, sporting and recreational facilities, and participating in the arts and cultural activity* (Priority E8) by providing facilities for improved interpretation and use of the reserve for educational purposes.

This plan of management establishes the scheme of operations for Muttonbird Island Nature Reserve. In accordance with section 73B of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

Carmel Tebbutt MP
Deputy Premier
Minister for Climate Change and the Environment

1. NATURE RESERVES IN NEW SOUTH WALES

1.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of nature reserves in NSW is in the context of the legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS). Section 72AA of the NPW Act lists the matters to be considered in the preparation of a plan of management. The policies are compiled from the legislative background, the NPW Regulations and internationally accepted principles of park management. They relate to nature conservation, Aboriginal and historic heritage conservation, recreation, commercial use, research and communication.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the *NSW Environmental Planning and Assessment Act 1979* (EPA Act) may require the assessment and mitigation of environmental impacts of works proposed in this plan.

The plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, no operations may be undertaken within Muttonbird Island Nature Reserve except in accordance with the plan. The plan will also apply to any future additions to the nature reserve. If management strategies or works are proposed for the nature reserve that are not consistent with the plan, an amendment to the plan will be required.

1.2 MANAGEMENT PURPOSES AND PRINCIPLES

1.2.1 Nature reserves

Nature reserves are reserved under the NPW Act to protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

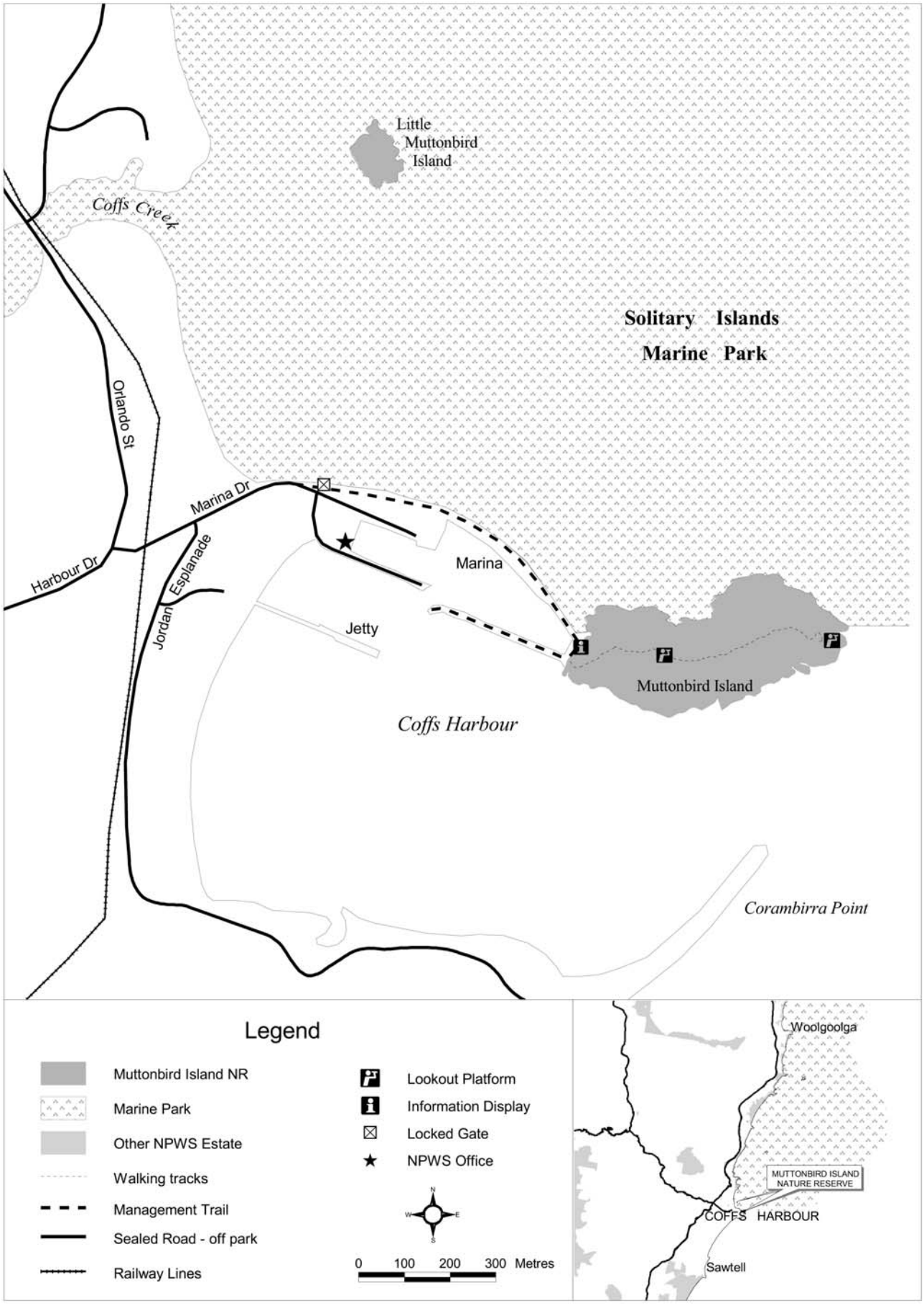
Under the Act, nature reserves are managed to:
- conserve biodiversity, maintain ecosystem functions, and protect geological and geomorphological features and natural phenomena;
- conserve places, objects, features and landscapes of cultural value;
- promote public appreciation, enjoyment and understanding of the reserve's natural and cultural values; and
- provide for appropriate research and monitoring.

1.2.2 CAMBA and JAMBA

The NPWS has obligations relating to the management of the reserve under international agreements ratified by the Australian Government. These agreements are:
- The Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- The Agreement between the Peoples Republic of China and the Government of Australia for the Protection of Migratory Birds and their Environment (CAMBA);

The agreements with Japan and China list 6 species found to frequent the reserve, including the wedge-tailed shearwater (*Puffinus pacificus*) and short-tailed shearwater (*Puffinus tenuirostris)* covered by JAMBA; and the white-bellied sea-eagle (*Haliaeetus leucogaster*) and eastern reef egret (*Egretta sacra*) covered by CAMBA. Both the JAMBA and CAMBA treaties cover the sooty shearwater (*Puffinus griseus*) and lesser frigatebird (*Fregata ariel*). A similar agreement is currently being negotiated with the Russian Government.

2. RESERVE MAP



3. MUTTONBIRD ISLAND NATURE RESERVE

3.1 LOCATION, RESERVATION AND REGIONAL SETTING

Muttonbird Island Nature Reserve (referred herein as "the reserve") is located adjacent to the coastline at Coffs Harbour (30°18' S, 153°6.6' E) on the mid north coast of NSW. The reserve is within the area of the Gumbaynggirr Aboriginal People who named Muttonbird Island "Giidayn Miirral" meaning moon-sacred place (Gumbular Julipi Elders, pers. comm.).

The reserve is approximately 9 hectares in size. The initial dedication of the reserve in 1971 covered Muttonbird Island (approximately 8 hectares) and was for the conservation and study of seabirds. Little Muttonbird Island, located 1 kilometre north west of Muttonbird Island, was added to the reserve in 2005. The reserve's boundary extends only to the mean high water mark on both islands. Muttonbird Island is linked to the mainland by a 500 metre breakwall constructed in 1924 and adjoins the southern boundary of the Solitary Islands Marine Park. Little Muttonbird Island is surrounded by the Solitary Islands Marine Park (see map).

The reserve is used as a rookery by a colony of wedge-tailed shearwaters (*Puffinus pacificus*). The common name 'muttonbird' was given to wedge-tailed shearwaters by the early settlers who followed the indigenous practice of harvesting the birds whose dark flesh was thought to taste like mutton.

Bird banding and research has been conducted on the reserve since 1960. In 1980 the population of wedge-tailed shearwaters was estimated at 12,000 breeding pairs.

The reserve is located within the Coffs Harbour Local Government Area. Muttonbird Island's close proximity to Coffs Harbour and spectacular views make it one of Coffs Harbour's most important and popular visitor destinations with more than 100,000 visitors each year.

3.2 LANDSCAPE CONTEXT

Natural and cultural heritage and on-going use are strongly inter-related and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land use practices, and the activities of modern day Australians continue to influence the environment through recreational use, cultural practices, the presence of introduced plants and animals and in some cases air and water pollution.

The geology, landform, climate and plant and animal communities of the reserve, plus its location, have determined how it has been used by humans. In the past indigenous and non-indigenous people hunted wedge-tailed shearwaters on the reserve. The connection of Muttonbird Island to the mainland in 1924 has had a marked influence on its land use history by increasing visitation to the island.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness natural and cultural heritage, non-human threats and on-going use are dealt with individually, but their inter-relationships are recognised.

3.3 MANAGEMENT DIRECTIONS

The following specific objectives apply to the management of the reserve:

- protection of migratory bird species covered by the CAMBA and JAMBA agreements in particular, the wedge-tailed shearwaters and threatened species recorded in the reserve;
- enhancement of the conservation values of the reserve through control and where possible eradication of introduced plant and animals species, in particular cats, rats and exotic grasses, and through exclusion of fire;
- increased understanding and recognition by visitors of Muttonbird Island's significance to the Gumbaynggirr Aboriginal people and for the shearwater colony and other sea birds;
- provision of opportunities for nature based activities including whale watching and observation of the wedge-tailed shearwater rookery;
- management of visitor use to minimise impacts and encourage appropriate visitor behaviour; and
- encouragement of continued research into the values of the reserve, and in particular of the wedge-tailed shearwater.

3.4 NATURAL AND CULTURAL HERITAGE

Geology, Landform, Soils and Hydrology

The underlying geology of the reserve is composed of marine sediments from the Coffs Harbour Association Metasediments. The Coffs Harbour Association is comprised of the Coramba and Brooklana Beds and the Moonbil Siltstone and is described as a "thick monotonous sequence of turbidity–current derived greywacke, laminated siltstone and mudstone and massive argillite with some minor cherts, jaspers and metabasalts" (Milford 1999).

Greywacke dominates the reserve's geology and is evident in the rock ledges that meet the sea around the rim of the islands. The fertile soils on Muttonbird Island have been influenced by a combination of salt spray, bird droppings, bird egg debris, seashells and detritus from the nearby estuarine areas and algal communities.

Most of the surface of Little Muttonbird Island is bare rock, with the highest point only 5 metres above sea level. Muttonbird Island rises as a steep dome to 45 metres and much of its surface is covered by a shallow soil cap. These soils are generally moderately stony, well-drained Yellow Podzolic Soils and Brown Podsolic Soils, with moderately well drained Red Podsolic Soils and Brown Podsolic Soils on the more sheltered landward slopes (Milford 1999). Strong acid soils, low wet bearing strength and slow subsoil permeability are characteristic of the soil types found on the island (Milford 1999).

The exposed nature of the reserve means that it is significantly affected by the ocean and rainfall. Localised erosion occurs where water runs off the steep slopes, particularly on the eastern side of Muttonbird Island.

Muttonbird Island is a significant landscape feature to both indigenous and non-indigenous people. It is a prominent and notable feature in close proximity to the city of Coffs Harbour.

Native Plants

Vegetation on the reserve is generally low growing due to the exposed nature of the reserve and the shallow soil cap. Stresses on vegetation on the reserve include the effects of salt spray, introduced weeds and occasional long dry periods, especially in early spring.

Only 12% of Little Muttonbird Island has enough soil to sustain vegetation (Roberts 1976). This includes a dense, low thicket of tuckeroo (*Cupaniopsis anacardioides*) along the spine of the island.

The vegetation of Muttonbird Island was surveyed in 1980, and nine distinct associations were mapped (Floyd & Swanson 1983). Further flora surveys on this island have been undertaken in 1995 and 2002 (NPWS 2002a). Table 1 lists those plant species considered to be most common in the reserve. The only significant plant recorded from the reserve is headland plectranthus (*Plectranthus cremnus*). No threatened species have been recorded.

Table 1. Common native plant species on Muttonbird Island Nature Reserve.

Common name	Scientific name
Scurvy weed/ blue wandering jew/ commelina	*Commelina cyanea*
Tuckeroo	*Cupaniopsis anacardioides*
Rough flax lily	*Dianella caerulea*
Bull cane	*Flagellaria indica*
Coral pea	*Kennedia rubicunda*
Weeping grass	*Microlaena stipoides*
Variable groundsel bush	*Senecio lautus*
Pigface	*Carpobrotus glaucescens*
Sea purslane	*Sesuvium portlacastrum*
Little spurflower	*Plectranthus parviflorus*
New Zealand spinach	*Tetragonia tetragonioides*
Prickly couch	*Zoysia macrantha*

Source: NPWS 2002a

The vegetation of the reserve plays an important role in the burrowing habits of the wedge-tailed shearwaters. The burrows of wedge-tailed shearwaters are quite shallow with just a thin layer of vegetation, plant roots and soft soil above the burrow and are sometimes lined with plants. Where soil depth is sufficient to support burrows on Muttonbird Island, the common plants are rough flax lily, blue commelina, variable groundsel and coral pea. This is a mutually supporting relationship, with the plants thriving on the disturbed and fertilised soil, and the birds gaining advantage in burrow protection from predation and the weather. Areas dominated by flax lily or blue commelina provide the most successful shearwater burrow habitat, as the soft stems do not offer resistance to burrowing while still appearing to support the burrows. Where coral pea, with its thicker, stronger stalks, is more common, the density of burrows decreases. Notably, there are almost no burrows in areas dominated by grass (Floyd & Swanson 1983; Page 2001).

Native Animals

Wedge-tailed shearwaters (*Puffinus pacificus*) breed annually in the reserve. While breeding occurs on both islands, the number of breeding pairs on Little Muttonbird Island (up to approximately 20 (Roberts 1976)) are dwarfed by the thousands that breed every year on the upper parts of Muttonbird Island. Shearwaters are seabirds, found throughout the Pacific and also on the west coast of Australia, and are absent from the reserve during their migration to the tropical waters of the Pacific in the non-breeding winter months of June to August. Like most seabirds they select nesting locations (like islands) that provide uplift for take-off and protection from land predators. Wedge-tailed shearwaters are listed under the Japan-Australia Migratory Bird Agreement (JAMBA) (refer 1.2.2).

Records since 1969 show the timing of the breeding season on Muttonbird Island remains constant (Swanson & Merritt 1974; Swanson, pers. comm.). Wedge-tailed shearwaters return to the reserve from their annual migration from southeast Asia in August. Upon arrival on the reserve they establish territories, form pairs, renovate old burrows or dig new ones and commence mating. At the end of November, egg laying begins. The birds may nest in the same burrows year after year and in some areas on the reserve there is a burrow every square metre.

Muttonbird Island comes to life after dark, with chicks and adult birds calling to each other as the adult birds locate their young. The wailing cries of the wedge-tailed shearwaters led

to the common name “ghost bird”. Most adult birds leave the reserve on their annual migration in late March or early April. The fledgling chicks then begin to emerge from their burrows at night to exercise their wings and leave the reserve usually within a couple of weeks in late April/early May. The chicks departure usually corresponds with the full moon. By early May all the wedge-tailed shearwaters have left the island.

Muttonbird Island provides a unique opportunity to observe a wedge-tailed shearwater rookery at close quarters as most seabird rookeries are on inaccessible offshore islands (Swanson 1976).

The breeding success for each season is limited by natural occurrences, such as predation, limited availability of food, burrow collapse during extreme dry periods and the flooding of burrows during heavy rain events. Other recorded events that have impacted on the habitat available for breeding (and hence the number of successful breeding pairs), include fire, the spread of grasses and human trampling of the fragile burrows. The number of adult birds present in recent breeding seasons is declining (Swanson *et al*. 2007).

There are a number of other bird species that frequent the reserve that are covered by the CAMBA and JAMBA agreements including the short-tailed shearwater (*Puffinus tenuirostris*), eastern reef egret (*Egretta sacra*), white-bellied sea-eagle (*Haliaeetus leucogaster*), the sooty shearwater (*Puffinus griseus*) and lesser frigatebird (*Fregata ariel*) (refer 1.2.2).

In addition to providing habitat for migratory bird species, a number of threatened species have been recorded on the reserve. These include the vulnerable black-winged petrel (*Pterodroma nigripennis*) which nests on Muttonbird Island (Holmes 1975), osprey (*Pandion haliaetus*) and sooty oystercatcher (*Haematopus fuliginosus*).

Appendix 1 lists those common animal species known to frequent or occur on the reserve. Very few reptiles have been recorded, apart from Burton’s snake-lizard (*Lialis burtonis*) and a recent sighting of a blue-tongued lizard (*Tiliqua scincoides*).

Aboriginal Heritage

Aboriginal communities have an association and connection to the land. The land and water biodiversity values within a whole landscape context are the centre of Aboriginal spirituality and contribute to Aboriginal people’s identity. Aboriginal communities associate natural resources with the use and enjoyment of valued foods and medicines, caring for the land, passing on cultural knowledge and strengthening social bonds. Aboriginal heritage and nature are inseparable from each other and need to be managed in an integrated manner across the landscape.

The reserve is located within the area of the Gumbaynggirr Aboriginal People. Its significance to local Aboriginal people stems from the mythological and symbolic importance of Muttonbird Island, explaining the origins of the island and its importance as a food resource. It forms an important part of the Gumbaynggirr Dreamtime and the Gumbaynggirr Aboriginal people refer to the area as Giidayn Miirral, which means ‘Moon - Sacred Place’.

The traditional Aboriginal story of this area relates to the moon, the guardian, which keeps the wedge-tailed shearwaters on the island for the Gumbaynggirr Aboriginal people. In this way muttonbirds were not over-harvested and remained as a food source for future generations. According to the Gumbaynggirr, each month the full moon returns, renewing life for the plants and animals and the moon uses the tides, riptides and floods against those who do not respect Aboriginal lore. Muttonbird Island is also significant for its medicinal plants (Gumbular Julipi Elders Group and CHLALC, pers. comm.).

The reserve is located within the Coffs Harbour Local Aboriginal Land Council area.

Non-Aboriginal Heritage

The reserve has a long history of research. A.J. North recorded probably the earliest ornithological information about the reserve when noting the collection of wedge-tailed shearwater eggs in 1887 from Muttonbird Island (Swanson 1976). The earliest scientific report of the island as a breeding ground for wedge-tailed shearwaters was by A.F. Bassett Hull and Henry Grant in 1913, who described the birds as being “packed closer together than any other locality I have visited” (Yeates 1990).

Bird-banding commenced on Muttonbird Island in 1960, focussed on the shearwaters (Swanson 1976). Since 1969, regular visits to the island have been made by bird-banders whose efforts have contributed to our knowledge of wedge-tailed shearwaters. There have been few banding trips made to Little Muttonbird Island (Roberts 1976; D. Page, pers. comm.).

In 1924 a breakwall was constructed to connect Muttonbird Island to the mainland. This exposed the wedge-tailed shearwater colony to increased predation by introduced species and people, as well as human trampling. Anecdotal evidence suggests that during the Depression the wedge-tailed shearwater population was severely depleted by unregulated egg collection.

There are no recorded non-Aboriginal sites within the reserve.

3.5 VISITOR USE AND EDUCATION

Visitor use

The reserve’s close proximity to Coffs Harbour and its natural and cultural values have made it one of the city’s most popular visitor destinations. More than 100,000 tourists and local people visit the reserve each year to undertake a range of activities including walking, seasonal whale watching, rock fishing and general sightseeing.

Almost all of this visitation occurs to Muttonbird Island via the Marina’s breakwall, which provides easy walking access to the island. The breakwall is gated to vehicles at its western entrance off Marina Drive and is managed by the Department of Lands. Little Muttonbird Island can be accessed from Park Beach at low tide by wading through the surf. As a consequence, visitation to this island is infrequent and occurs mostly in summer.

Visitor facilities in the reserve include interpretation signage, a walking track, two lookout platforms, two bench seats and a raised steel mesh section of the track. Disabled and pusher access is currently available along the walking track as far as the second/middle platform where there is a small step. There are no facilities on Little Muttonbird Island.

Education

The reserve provides a unique opportunity to observe a wedge-tailed shearwater rookery at close quarters. The first public awareness tours were conducted by NPWS on Muttonbird Island in the late 1970s during school holiday periods. NPWS Discovery tours continue to the reserve as well as specialised tours in association with local marina businesses to ‘farewell’ wedge-tailed shearwater fledglings during April and May. An education kit has been developed for primary and secondary school groups visiting the reserve. NPWS is also developing an education video and CD ROM documenting the different life stages of the wedge-tailed shearwaters on the reserve.

Visitor education is important to increase understanding of the natural and cultural values and potential impacts from inappropriate use of the reserve.

3.6 RESEARCH

Research in the reserve dates back to 1913, when ornithologists first visited the shearwater colony on Muttonbird Island. Most of the information for the wedge-tailed shearwater in Australia, such as longevity records, migratory movements, breeding behaviour and timing has been obtained from Muttonbird Island (e.g. Purchase 1974, Swanson & Merritt 1974). Much of this information has been collected by volunteer bird banders, who operate under strict guidelines and are licensed by NPWS. As of April 2002, more than 25,000 birds have been banded on the island. The island is also a popular site for university projects.

Research into the size and health of the wedge-tailed shearwater population is continuing with the assistance of volunteers. Future research on the reserve will also aim at population estimates and further analysis of bird banding data.

In addition to providing information on the wedge-tailed shearwaters, researchers have also provided management with valuable historical records of the reserve's fire history.

3.7 THREATS TO RESERVE VALUES

Fire

While the NPWS regards fire as a natural phenomenon in most vegetation communities, it is not considered natural on offshore islands. Fire can have a devastating effect on wedge-tailed shearwater burrow habitat and cause the death of breeding birds. Although the fuel load is not great, the high level of humus in the soil combined with good ventilation from the burrows can result in ground fires that can cover a large area undetected. There have been a number of deliberately lit fires on Muttonbird Island, with a major fire in 1970 (Swanson 1976). Following this fire, it took many years for the vegetation to recover to levels which supported successful shearwater breeding (Floyd & Swanson 1983).

A recent review of fire management throughout the Northern Branch by NPWS has resulted in a modified approach to fire based on the level of complexity involved. In regard to Muttonbird Island Nature Reserve, the NPWS considers that is appropriate to include the specific fire management strategies for the reserve in this plan of management. Programs are also submitted to the District Bush Fire Management Committees (DBFMC).

The NPWS approach to fire management planning uses a system of zones which are compatible with the system adopted by the Bushfire Coordinating Committee for use in DBFMC bushfire risk management plans.

NPWS has assessed the reserve for fire management planning purposes and has zoned the reserve as a Heritage Area Management Zone (HAMZ). The primary fire management objectives within this zone are to prevent the extinction of all species that are known to occur naturally within the reserve, and to protect the cultural values of the reserve. The reserve has been designated as a HAMZ because it is considered that there is a low risk of natural fire events in the reserve. In addition, the reserve is not adjacent to built assets, which would be exposed to a high level of bushfire risk or known areas of high bushfire behaviour potential.

The HAMZ does not require intensive management and focuses on those actions appropriate to conserve biodiversity and cultural heritage including exclusion of fire from the reserve.

NPWS maintains cooperative arrangements with surrounding land managers, (such as Department of Lands, Coffs Harbour City Council and the Department of Commerce) and Rural Fire Service brigades, and is actively involved in the Coffs Harbour Bush Fire Management Committee. Cooperative arrangements include approaches to fuel

management, access for management vehicles along the breakwall, and information sharing.

Introduced Plants and Animals

The North Coast Region Pest Management Strategy (NPWS 2002c) identifies the weed and feral animal issues for the reserve. The biggest threat to the seabird rookery on Muttonbird Island is predation by introduced animals. The creation of the breakwall in 1924 allowed access to Muttonbird Island by terrestrial predators, such as black rats (*Rattus rattus*) and cats (*Felis catus*). Foxes (*Vulpes vulpes*) have also been recorded on the island, and have the potential to cause significant impacts on the shearwaters. Fox predation was the suspected cause of death of more than 30 fledglings in April 2007. There have been a number of attempts over the years to control these animals.

NPWS has undertaken strategic baiting for rats designed to complement the existing black rat-baiting program conducted by Department of Lands along the breakwall and around the marina. Rats pose a continuing problem as they are attracted to the area by food scraps in the adjoining marina. Rats prey on the birds and eggs and can damage the soil structure by building nests and digging for food. Native swamp rats are also found on Muttonbird Island, being first recorded in 1999. While there is no evidence that they prey upon shearwater eggs or young, they are likely to add to impacts on vegetation, particularly through browsing on blue commelina and by their own burrowing behaviour, thereby affecting the habitat for shearwaters.

Feral and domestic cats frequent Muttonbird Island and feed on the wedge-tailed shearwaters, including the eggs and chicks. Domestic cats are known to access the island from boats in the marina as well as from nearby urban areas. Some trapping and removal of cats has been undertaken.

Introduced animals known to occur on Muttonbird Island are listed in Appendix 1. No introduced animals are known to occur on Little Muttonbird Island.

Flora surveys undertaken on Muttonbird Island have mapped and identified exotic plant species (Table 2). A survey on Little Muttonbird Island, conducted in 2007, found no evidence of weeds in that section of the reserve.

Table 2: Weed species found on the reserve.

Common name	Scientific name
Farmers friend	*Bidens pilosa*
Turkey rhubarb	*Acetosa saggittata*
Madeira vine	*Anredera cordifolia*
Spiny burrgrass	*Cenchrus longispinus*
Crowsfoot grass	*Eleusine indica*
Green panic	*Panicum maximum* var. *trichoglume*
Kikuyu	*Pennisetum clandestinum*
Lantana	*Lantana camara*
Paspalum	*Paspalum sp.*

Source: NPWS 2002a.

Weed control has been a long-term project on Muttonbird Island undertaken by NPWS field staff and weed contractors. The steep terrain and presence of burrows on the reserve makes weed control difficult, however, the eradication of some weeds is considered achievable given the small size of the reserve.

Surveys of weed species indicate that weed control programs have been successful in eradicating bitou bush (*Chrysanthemoides monilifera ssp.rotundata*), whisky grass (*Andropogon virginicus*) and wild tobacco bush (*Solanum mauritianum*).

Weed infestation, particularly grasses, on the reserve remain a concern as they have the ability to out-compete native plants like the blue commelina which provide habitat for burrowing wedge-tailed shearwaters. Weeds are spread by animals and people accessing the reserve and tend to be concentrated near pathways.

Visitor impacts

The level of visitation is a significant management issue for Muttonbird Island. Peak visitation to Muttonbird Island generally occurs during school holidays, particularly during summer, and coincides with the breeding cycle of the wedge-tailed shearwaters.

In the past, special events such as the Royal Visit by Queen Elizabeth II to Coffs Harbour in 1970 and the First Fleet re-enactment in 1988 have attracted large crowds to Muttonbird Island. This impacted on the natural values by causing significant destruction of burrows and eggs and the death of juvenile birds by people trampling nests. Littering of nests also occurred.

NPWS aims to minimise visitor impacts by limiting large groups visiting Muttonbird Island and increasing public awareness about appropriate visitor behaviour. More recently NPWS has closed Muttonbird Island to visitors on New Years Eve in an attempt to protect Muttonbird Island from the impact of large numbers of visitors.

NPWS constructed a paved walkway on Muttonbird Island in 1987 to encourage visitors to stay on the path and avoid the creation of new walking trails. In general most visitors stick to the paved walkway, however, rock fishers do use unformed tracks to access fishing spots. Research into the impact of visitor infrastructure on the breeding success of the wedge-tailed shearwaters on Muttonbird Island found there appeared to be no adverse impacts of the bench seats on burrowing activity and while the track had some localised impact immediately adjacent to the walking track its benefits far out way the impacts (J Cavanaugh, 2001). There are also small sections of erosion off the eastern deck caused by water running off the path.

There is some visitation to Little Muttonbird Island in summer months but numbers are low. There are no facilities on this island.

Lighting

Wedge-tailed shearwaters use the moon for navigation and generally fly off in the direction of the brightest horizon. Artificial lighting, particularly bright halogen lights from sources such as boats, the stadium and other playing fields, as well as general lighting in the marina and surrounding city can create a false horizon which disorientates the birds. Lighting can impact on both adult shearwaters returning to the reserve and young shearwaters leaving the reserve. There is observable disturbance to arriving adult birds when strong moving lights and floodlights are focused on the Muttonbird Island (N. Swanson, pers. comm.). The bright lights attract the young wedge-tailed shearwaters as they leave their burrows on their first migratory journey and they often fly inland instead of out to sea. Disorientated birds are often found within the city limits, at sites such as sports fields and resorts, and in the jetty area. Firework displays that occur when feeding adults return to the reserve (typically in the first hour after dusk) can also impact on the birds.

NPWS and community organisations such as the Coffs Harbour Streets Ahead Committee have endeavoured to increase awareness about the effects of lighting on the wedge-tailed shearwaters. Options such as reducing the intensity of lighting and hoods on fixed lights in the Jetty area is being explored in an effort to minimise the impact on the birds. Noticeable improvements have been reported in areas where low intensity yellow lighting has been installed (A. Baker, pers. comm.).

4. MANAGEMENT ISSUES AND STRATEGIES

Current Situation	Desired Outcomes	Strategies	Priority
4.1 Geology, landform, Soil and Hydrology The reserve's small size and exposed nature makes it very influenced by the effects of salt spray and wave action. Muttonbird Island has fertile, shallow soils and because of its dome shape and steepness it is vulnerable to localised water erosion. Some erosion is occurring from runoff at the eastern lookout platform. The reserve is visually prominent from the surrounding marina, harbour and beaches and is a significant landscape feature in Coffs Harbour.	• Soil erosion is minimised. • Areas of disturbance are rehabilitated. • The integrity of the landscape, scenic values and natural landscape features of the reserve are protected.	4.1.1 Undertake all works in a manner that minimises erosion. 4.1.2 Undertake works at the eastern lookout platform to stop erosion from water running off the decking. 4.1.3 Where appropriate rehabilitate the reserve's vegetation following any fires to minimise any potential erosion (refer also to Fire). 4.1.4 Locate and design management infrastructure and visitor facilities to minimise their visual impact.	Ongoing High High/ Ongoing Ongoing
4.2 Native plants and animals Vegetation in the reserve is generally low growing due to the reserve's exposed nature and shallow soil cap. No threatened plants have been recorded within the reserve. The reserve's vegetation is important to the burrowing habits of a colony of wedge-tailed shearwaters (*Puffinus pacificus*) that use the reserve as a rookery. A number of threatened bird species and other migratory bird species covered by CAMBA and JAMBA international agreements frequent the reserve. Several native terrestrial animals (namely swamp rats and lizards) are currently found on Muttonbird Island and may have moved onto the island since it was linked to the mainland by the breakwall in the 1920s. There is evidence that swamp rats have a significant impact on the breeding success of shearwaters (N. Swanson pers. comm.).	• All native plant and animal species and communities are conserved, including significant species listed under CAMBA and JAMBA. • Vegetation structural diversity and habitat values are conserved and restored. • Increased knowledge of the ecology of plant and animal species.	4.2.1 Exclude fire from the reserve to protect nesting sea birds and prevent loss of habitat and erosion (refer Fire). 4.2.2 Protect native plant and animal species from visitor impacts and introduced species (refer Introduced Species, Visitor Opportunities and Education). 4.2.3 Implement recovery plans for threatened species as prepared. 4.2.4 Continue existing research into the wedge-tailed shearwater population and other significant species in the reserve (refer Research). 4.2.5 Monitor the impacts of native fauna on shearwater populations, and introduce control measures as necessary.	High/ Ongoing High Ongoing Ongoing High

Current Situation	Desired Outcomes	Strategies	Priority
4.3 Cultural Heritage Muttonbird Island is of mythological and symbolic importance to the Gumbaynggirr people who call the area Giidayn Miirral. The reserve is located within the Coffs Harbour Local Aboriginal Land Council area. The reserve also has a long history of non-indigenous visitation dating back to 1887. Construction of the breakwall in 1924 linking Muttonbird Island to the mainland increased visitation and harvesting of wedge-tailed shearwaters. There are no recorded non-indigenous sites in the reserve.	• Cultural heritage of the reserve is recognised and preserved and where appropriate interpreted. • The significance of the island to the local Aboriginal community is recognised and preserved and where appropriate interpreted. • There is cooperative and integrated management of the islands Aboriginal Heritage.	4.3.1 Protect and manage Aboriginal heritage values associated with the reserve in partnership with the local Aboriginal community including the Coffs Harbour Aboriginal Land Council (LALC), Gumbaynggirr Elders and other relevant individuals. 4.3.2 Precede all ground disturbance work by a check for cultural features. 4.3.3 Provide on-site briefings for staff and contractors, prior to working on Muttonbird Island, to increase awareness about the Aboriginal significance of the island. 4.3.4 Encourage studies into the reserves cultural heritage including formal documentation of cultural resources and locations. 4.3.5 Interpret the Aboriginal and non-Aboriginal cultural heritage of the reserve. Ensure interpretation of Aboriginal heritage is undertaken with permission and in partnership with the local Aboriginal community including the Coffs Harbour Aboriginal Land Council (LALC), Gumbaynggirr Elders and any other relevant individuals. 4.3.6 Continue to work closely with the local Aboriginal community in the management and use of the reserve. 4.3.7 Encourage research into cultural heritage values in the reserve and develop appropriate strategies for their protection of any sites found. 4.3.8 Support moves to dual name the island to an agreed Aboriginal name. Use this name as much as possible in interpretation and signage.	High/ Ongoing Ongoing Ongoing Medium High Ongoing Medium Ongoing
4.4 Visitor use and Education More than 100,000 visitors to Muttonbird Island each year to undertake activities including walking, whale watching, rock fishing and sightseeing and environmental education.	• Visitor use is ecologically sustainable and disturbance is minimised. • Visitors and the local	4.4.1 Liaise with the Department of Lands to ensure continued pedestrian and management vehicle access along the breakwall, and continued access by visitors to the public facilities in the Marina Area. 4.4.2 Permit nature based organised group and	Ongoing Ongoing

Current Situation	Desired Outcomes	Strategies	Priority
Visitor access to Muttonbird Island is by foot along the breakwall, which is managed by the Department of Lands. Visitor infrastructure on Muttonbird Island includes a paved walkway, viewing platforms, bench seats, and interpretation/display panel. Access for visitors with limited mobility is restricted to the middle-viewing platform because of a small step off the deck. Rock fishers use several routes to access fishing spots. These informal tracks (two on the eastern edge of the island and one on the south-western edge) are located well below the burrowed area, crossing grassy vegetation near to the high tide mark. It is important that visitor numbers and access to the reserve is managed to minimise the impacts from inappropriate use. In the past large group numbers associated with major events have impacted on the rookery by destruction of burrows, eggs and the death of juvenile birds by people trampling nests. It is therefore important for the Coffs Harbour community to appreciate the reserve's values and its associated management issues, and to be supportive of NPWS's management of the reserve.	community are aware of, understand and support the area's natural and cultural values and their responsibilities for minimal impact use. • There is increased awareness and use of Muttonbird Island as an educational resource by educational institutions and community organisations. • There is widespread community understanding and cooperation with management programs such as fire management and introduced species control. • Visitor facilities are safe, accessible and contribute to a positive visitor experience and have minimal impact on the reserve and its rookery.	educational visits of not more than 20 people and subject to other conditions necessary to minimise impacts. Tour leaders will be informed of the need to obtain a separate consent or licence from the Department of Lands to use and access the facilities of the Marina Area. 4.4.3 Prohibit cycling, camping and horse riding. 4.4.4 If problems of illegal use of bicycles continue, install a bike rack in the vicinity of the nature reserve, and clearer signage at the entry to the reserve. 4.4.5 Continue to close the reserve to visitors on New Years Eve and at other times when crowds might impact on burrows/nests. 4.4.6 Liaise with Coffs Harbour City Council to look at establishing an alcohol free zone on the island's approaches. 4.4.7 Monitor the impacts of visitor use and if necessary close areas permanently or temporarily or otherwise restrict access if there is unacceptable damage to natural or cultural values. 4.4.8 Restrict general public access to the paved walkway. 4.4.9 Monitor the informal tracks used by rock fishers and close any new tracks should they occur (this may involve formal signposting or other measures). Assess the need for erosion control along existing tracks. 4.4.10 Upgrade the entry to the reserve to incorporate group seating for the delivery of education programs and update the style of interpretative display. Interpretation will focus on the island's cultural significance, its value as a migratory bird rookery, its vegetation and minimal impact use. 4.4.11 Construct a small ramp off the eastern side of the middle deck to allow access for people with limited mobility. 4.4.12 Support and assist use of the reserve by	High/ Ongoing Medium High/ Ongoing Medium High/ Ongoing High/ Ongoing High Medium High Ongoing

Current Situation	Desired Outcomes	Strategies	Priority
		schools, tertiary institutions, community groups and others for nature based educational purposes. This may include the Discovery program providing iinformation, guided walks and lectures where appropriate. Update the existing education kit as needed.	
		4.4.13 Liaise with tourism associations to ensure promotion of accurate information on the values of the reserve and appropriate visitor behaviour.	Ongoing
		4.4.14 Promote visitor feedback through visitor surveys to monitor use and the value of the information provided.	Ongoing
		4.4.15 Investigate the installation of a fee-paying telescope at the middle viewing platform or another suitable location.	Low
		4.4.16 Allow the Australian National Sportsfishing Association (ANSA) to install two pedestals at agreed sites on the eastern edge of the island for the storage of life saving devices known as “angel rings”, subject to the satisfactory environmental impact assessment and ANSA being responsible for the continued inspection and maintenance of the rings.	Low
		4.4.17 Support the establishment of a local community consultative group (‘Friends of Muttonbird Island’) to work with NPWS on approaches to maximise public awareness and appreciation of Muttonbird Island and its associated management issues.	High
4.5 Fire management In the past fires have been deliberately lit on the reserve by arsonists. The last major fire on Muttonbird Island was in 1970. Fire has the capacity to devastate the wedge-tailed shearwater rookery and, if followed by a major rainfall event, cause erosion. The reserve is zoned as a Heritage Management Zone (HAMZ) to protect the natural and cultural	• Fire is excluded from the reserve. • Persons, wildlife and property on the reserve are protected from fire.	4.5.1 Manage the reserve as a HAMZ to suppress unplanned fires and where possible, exclude fire from the reserve.	High/ Ongoing
		4.5.2 Prescribed burning will not be undertaken unless research indicates that fire is necessary to protect biodiversity values.	Ongoing
		4.5.3 Prohibit open fires within the reserve.	High
		4.5.4 Where necessary rehabilitate the reserve’s vegetation immediately following any unplanned fires to minimise potential erosion.	High

Current Situation	Desired Outcomes	Strategies	Priority
values.		4.5.5 Participate in District Bush Fire Management Committee. Maintain coordination and cooperation with Rural Fire Service brigades, Coffs Harbour Fire Brigade and Council fire control officers with regard to fuel management and fire suppression.	Ongoing
		4.5.6 Liaise with Department of Lands to ensure continued access along the breakwall for fire management purposes.	Ongoing
4.6 Introduced Plants and Animals The biggest threat to the seabird rookery is predation by introduced animals such as rodents, cats and foxes which can easily access Muttonbird Island via the breakwall. The construction of barrier fencing is being investigated to limit this access. The four main weed species found on the reserve are farmers friend, hillside burr grass, lantana and paspalum. The steep terrain and presence of burrows on the reserve makes weed control difficult however, the eradication of some weeds is considered achievable given the small size of the reserve.	• The impact of introduced species on native species is minimised. • Introduced plants are controlled and, where practicable, eradicated. • Native vegetation in disturbed areas is restored.	4.6.1 Carry out pest plant and animal control in accordance with the priorities outlined in the North Coast Pest Management Strategy.	High
		4.6.2 Use control techniques that have minimal environmental impact and, where possible, are timed and carried out to minimise impacts on shearwater breeding and burrows.	Ongoing
		4.6.3 Provide on-site briefings for staff and contractors, prior to working on the reserve, to increase awareness about shearwater habitat protection.	Ongoing
		4.6.4 Monitor the occurrence and distribution of weeds and grasses on the reserve. Continue to undertake annual weed control programs targeting farmers friend, hillside burr grass, lantana and paspalum.	Ongoing
		4.6.5 Continue to undertake targeted control programs for introduced pest animals, especially baiting of rats along the breakwall, and control of rodents and cats in the reserve.	High/ Ongoing
		4.6.6 Continue cooperative arrangements with other authorities, in particular the Department of Lands and Coffs Harbour City Council, in implementing weed and pest animal control programs.	High/ Ongoing
		4.6.7 Ensure that management activities, such as mowing along the path, use techniques that minimise the spread of weeds.	High/ Ongoing
		4.6.8 In cooperation with the Department of Lands, investigate the feasibility of constructing a barrier to	Medium

Current Situation	Desired Outcomes	Strategies	Priority
		restrict the movement of terrestrial predators onto Muttonbird Island. If feasible, construction of such a barrier may occur following public exhibition of the proposal and its environmental impact assessment.	
4.7 Lighting Night lighting around the Jetty and the city attracts and disorientates young wedge-tailed shearwaters as they leave their burrows on their first migratory journey. Often disoriented birds fly inland instead of out to sea and are found within the city limits. Fireworks that coincide with the return of feeding adults (typically in the first hour after dusk) can also impact on the birds. There is no lighting on either island in the reserve.	• Impact of lighting on wedge-tailed shearwaters is minimised.	4.7.1 Work with the Streets Ahead Committee, Coffs Harbour City Council, Department of Commerce, Department of Lands, local businesses, the boating and fishing community and others to minimise the impacts of lighting on wedge-tailed shearwaters. Efforts to minimise impacts will focus on April/May and may include use of hooded lights and low intensity lighting. 4.7.2 Investigate the impact of torches and other hand held lighting devices and develop guidelines to minimise impacts. 4.7.3 Investigate inclusion of the impacts of torches in interpretive material when updated. 4.7.4 Work with event organisers to ensure that firework displays in and around the harbour are delayed until 10pm during summer. 4.7.5 No fixed lighting will be installed in the reserve.	High/ Ongoing Medium Medium High/ Ongoing High/ Ongoing
4.8 Research There is a long history of research on the reserve by dedicated volunteers. Regular visits to Muttonbird Island by bird-banders have provided information about the longevity of the wedge-tailed shearwaters, their migratory path and their breeding age. Further scientific study is needed to improve understanding of the reserve's natural and cultural heritage, the processes that affect them and the requirements for management of particular species. Current priority areas for research are: wedge-tailed shearwater and island ecology; the	• Research enhances the management information base and has minimal environmental impact. • Improved management by incorporating the results of research into management decision making.	4.8.1 Encourage and/ or undertake research in the identified priority areas. 4.8.2 Provide support and management assistance to researchers where appropriate. 4.8.3 Permit low impact research only unless alternative opportunities are not available elsewhere and the results of the research can be demonstrated to offer significant benefits for management programs or knowledge of the natural and cultural heritage of the reserve. 4.8.4 Require researchers to provide their results to NPWS. 4.8.5 Require any research structures and markers to	High Ongoing Ongoing High/ Ongoing High/

Current Situation	Desired Outcomes	Strategies	Priority
impacts of native and non-native fauna, particularly on nesting seabirds; the impacts associated with visitation to the island and town lighting; and the reserve's Aboriginal and non-Aboriginal heritage values. Research into wedge-tailed shearwater ecology should include regular assessments of vegetation and habitat, and their relationship to the effective sustainable breeding of the shearwaters.		be placed in locations that will minimise their visual impact. Require their removal upon completion of the research unless the markers may be useful for future research. 4.8.6 Incorporate the outcomes of research into NPWS databases and into park management practices where there is an opportunity to improve management.	Ongoing High/ Ongoing

High priority activities are those imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources.

Medium priority activities are those that are necessary to achieve the objectives and desired outcomes but are not urgent.

Low priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

5. REFERENCES

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APPENDIX 1

Animal species known to occur on the reserve

Common name	Scientific Name	Status
Reptiles		
Burton's snake lizard	*Lialis burtonis*	(B)
blue-tongued lizard	*Tiliqua scincoides*	(B)
Birds		
Richard's pipit	*Anthus novaeseelandiae*	(B)
white-faced heron	*Egretta novaehollandiae*	
eastern reef egret	*Egretta sacra*	M
black-shouldered kite	*Elanus axillaris*	M
Nankeen kestrel	*Falco cenchroides*	M
lesser frigatebird	*Fregata ariel*	M
Australian magpie	*Gymnorhina tibicen*	
sooty oystercatcher	*Haematopus fuliginosus*	V (B)
white-bellied sea-eagle	*Haliaeetus leucogaster*	M
Brahminy kite	*Haliastur indus*	
welcome swallow	*Hirundo neoxena*	(B)
silver gull	*Larus novae-hollandiae*	(B)
eastern osprey	*Pandion cristatus*	V
black-winged petrel	*Pterodroma nigripennis*	V (B)
sooty shearwater	*Puffinus griseus*	M
wedge-tailed shearwater	*Puffinus pacificus*	M (B)
short-tailed shearwater	*Puffinus tenuirostris*	M (B)
crested tern	*Sterna bergii*	
barn owl	*Tyto alba*	
silvereye	*Zosterops lateralis*	
rock dove (feral pigeon)	*Columba livia*	* (B)
Mammals		
swamp rat	*Rattus lutreolus*	# (B)
feral cat	*Felis catus*	*
house mouse	*Mus musculus*	* (B)
black rat	*Rattus rattus*	* (B)
European red fox	*Vulpes vulpes*	*

Status:

- M listed migratory species under the Commonwealth's *Environment Protection and Biodiversity Conservation Act*
- V listed as Vulnerable on Schedule 2 of the NSW *Threatened Species Conservation Act*
- * introduced species (not native to Australia)
- # only recorded on Muttonbird Island since 1999
- (B) breeds in the reserve

Sources: NPWS Atlas 2007, Swanson, pers. comm.
Breeding status based on Swanson (1976), Roberts (1976), D. Page pers. comm., N. Swanson pers. comm. and staff observations.