Approved Recovery Plan

Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan

November 2006

Natural Heritage Trust

Helping Communities Helping Australia

Department of
Environment and Conservation (NSW)

The National Parks and Wildlife Service is part of the Department of Environment and Conservation (NSW).

Department of Environment and Conservation (NSW)
43 Bridge Street
(PO Box 1967)
Hurstville NSW 2220
Tel: 02 9585 6444
www.environment.nsw.gov.au

For further information contact:
Biodiversity Conservation Section, North East Branch
Environmental Planning and Regulation Division,
Department of Environment and Conservation (NSW)
Locked Bag 914
Coffs Harbour NSW 2450
Tel: 02 6651 5946

Cover photo: adult Gould's Petrel (*Pterodroma leucoptera leucoptera*)
Photographer: Nicholas Carlile, Department of Environment and Conservation (NSW)

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Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan.

Executive Summary

This document constitutes the formal Commonwealth and New South Wales Recovery Plan for the Gould's Petrel (*Pterodroma leucoptera leucoptera*). It identifies the actions to be taken to ensure the long-term viability of the Gould's Petrel in nature and the parties who will carry these out.

The Gould's Petrel (*Pterodroma leucoptera leucoptera*) is listed as an endangered species on Schedule 1 of the NSW *Threatened Species Conservation Act 1995* and is also listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Gould's Petrel is Australia's rarest endemic seabird and only breeds on Cabbage Tree and Boondelbah Islands, off the coast of Port Stephens, NSW. Active management of the Gould's Petrel commenced in 1992, when the then National Parks and Wildlife Service (now the Department Environment and Conservation (DEC)) initiated a research program to determine the current status of the population and to identify any threats affecting the subspecies. At that time, there were less than 250 pairs. In 1996, an interim recovery plan for the Gould's Petrel was prepared.

Since 1992, the DEC, with the assistance of the Commonwealth Government and volunteers, has been working to identify and control threats and to enhance the small colony on Boondelbah Island. While some significant achievements have been made, including the eradication of rabbits from Cabbage Tree Island and an overall increase in population numbers and breeding success, further work is required to secure the recovery of this endangered subspecies.

This recovery plan describes our current understanding of Gould's Petrel, documents the management actions undertaken to date, and outlines the recovery program over the next five years.

To provide for the future recovery of Gould's Petrel, this plan advocates a recovery program that:

- favours in-situ protection and the management of threats at Cabbage Tree and Boondelbah Islands;
- maintains the translocated population on Boondelbah Island;
- raises public awareness of Gould's Petrel;
- identifies and recommends Cabbage Tree Island as critical habitat; and
- examines the ecological aspects of Gould's Petrel which will inform management decisions regarding the long-term conservation of the subspecies.

It is intended that this recovery plan will be implemented over a five-year period. Recovery actions will largely be implemented using existing resources of various NSW government agencies and community groups. The total cost to implement the plan is $203,500 over five years.

Lisa Corbyn
Director General

Bob Debus MP
Minister for the Environment

Acknowledgments

In October 1996, David Priddel and Nicholas Carlile, Biodiversity Conservation Science Section, NSW DEC prepared a Gould's Petrel (Interim) Recovery Plan for the period 1996 – 2001.

This Recovery Plan covers the period 2005/06 – 2010/11 and was prepared by Julie Ravallion, Ross Wellington and Tania Duratovic of the Biodiversity Conservation Section, Metro, DEC. Much of the background information in this plan has been taken from the 1996 (Interim) Recovery Plan and the entire recovery strategy was devised by David Priddel and Nicholas Carlile in consultation with the Gould's Petrel Recovery Team.

The assistance of the following people is gratefully acknowledged for both their contributions to this plan and to the implementation of the recovery program to date.

The Recovery Team

Previous and present members: David Priddel, DEC; Nicholas Carlile, DEC; Dr Peter Fullagar, Division of Wildlife and Ecology, CSIRO (retired); Keith Brandwood, Cumberland Bird Observers Club; George Malolakis, (ex) Hunter Region, DEC; Mick Murphy, Hunter Coast Region, DEC; Julie Ravallion, DEC; Tania Duratovic, DEC; Lloyd Van der Wallen, (ex)DEC.

For assistance in the preparation of the plan

The following DEC staff provided valuable input into the preparation of the plan: Robert Humphries, Biodiversity Conservation Section, Metro, DEC; Kerry Oakes and Tina Stojanovski, DEC, assisted with final production and printing.

To the staff at Hunter Coast Area and to Dean Portelli, Jeff O'Neill, Lisa O'Neill and to all the volunteers past and present who have helped over the years in the recovery of this subspecies.

Financial assistance

The DEC gratefully acknowledges the financial contribution made by the Foundation of National Parks and Wildlife and the Commonwealth Government through the Environment Australia's Endangered Species Program and more recently through the National Heritage Trust, to the recovery of the Gould's Petrel.

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1 Introduction

The Gould's Petrel (*Pterodroma leucoptera leucoptera*) is Australia's rarest endemic seabird. The subspecies has one significant breeding locality at Cabbage Tree Island, off the coast at Port Stephens, New South Wales (NSW). Without management, Gould's Petrel is extremely vulnerable to extinction due to a combination of low population numbers, limited breeding sites and severe threatening processes.

On Cabbage Tree Island, the subspecies is thought to have suffered substantial declines over the last 30 years due to the combined effects of predation by avian predators, entanglement in the sticky fruits of the Bird-lime Tree (*Pisonia umbellifera*) and degradation of habitat through rabbit grazing.

While the implementation of the Gould's Petrel recovery effort to date has achieved a significant reduction in mortality and a substantial increase in breeding success, population numbers remain low. Current estimates number the population at about 2500 individuals comprising 1000 breeding pairs (N. Carlile, DEC pers. comm. Nov. 2005).

This Recovery Plan describes the current understanding of the Gould's Petrel, reports on the implementation of the 1996 Gould's Petrel (Interim) Recovery Plan and outlines the recovery program for the next 5 years.

2 Legislative context

2.1 Legal status

The Gould's Petrel is listed on Schedule 1 of the NSW *Threatened Species Conservation Act 1995* (TSC Act) as endangered. The NSW Scientific Committee established under the TSC Act is responsible for maintaining the schedules under the Act. In January 1998, the Scientific Committee made a final determination to change the status of the Gould's Petrel from vulnerable (Schedule 2) to endangered (Schedule 1). It is the view of the Scientific Committee that the Gould's Petrel is likely to become extinct in nature in NSW unless the circumstances and factors threatening its survival cease to operate.

The nominate race *P. l. leucoptera* is also listed as endangered on the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2.2 Recovery Plan preparation

The TSC Act and EPBC Act require the preparation of recovery plans for species listed on the schedules of these Acts.

The TSC Act includes specific requirements for both the matters to be addressed by recovery plans and the process for preparing recovery plans. This plan satisfies these provisions.

In accordance with the requirements of the TSC Act, a draft version of this plan was placed on public exhibition from 28 October 2000 to 4 December 2000. No public submissions were received on this plan.

The Commonwealth EPBC Act requires the Federal Minister for the Environment to ensure that a recovery plan is in force for each species listed on the schedules of this Act.

The EPBC Act also includes specific requirements for both the matters to be addressed by recovery plans and the process for preparing recovery plans. This plan also satisfies these provisions.

2.3 Recovery Plan implementation

In NSW, the TSC Act requires that Ministers and public authorities (including the Director General of the DEC) take appropriate action available to them to implement those measures included in an approved recovery plan for which they are responsible. In addition, a Minister for a public authority must not undertake actions inconsistent with an approved recovery plan.

The NSW government agency relevant to this plan is the DEC. Consequently, the DEC, as the government agency responsible for the habitat of the species, must manage this species and its habitat in accordance with this recovery plan. The DEC has been implementing the actions in this recovery plan throughout the exhibition and approval process for the plan.

The EPBC Act requires that Commonwealth agencies must not take any action that contravenes a recovery plan. The only Commonwealth agency relevant to this plan is the Department of Defence.

2.4 Critical habitat

The TSC Act makes provision for the identification and declaration of critical habitat

for species listed as endangered. Declaration of critical habitat provides clear legal recognition of the significance of an area or areas of land for the ongoing survival of a species. Once declared, it becomes an offence to damage critical habitat (unless an action is specifically exempted under the TSC Act) and a Species Impact Statement is required for all development and activities proposed within critical habitat.

A draft recommendation for critical habitat was exhibited from 28 October 2000 to 4 December 2000 with the draft Recovery Plan. Subsequently, critical habitat for the Gould's Petrel was declared on 10th November, 2006.

2.5 Key threatening processes

Competition and grazing by feral European rabbit is listed as a key threatening process on Schedule 3 of the TSC Act and has relevance to the conservation of Gould's Petrel and its habitat.

Competition and land degradation by feral rabbits is also listed as a key threatening process under the Commonwealth's EPBC Act. A Threat Abatement Plan (TAP) has been prepared by Environment Australia in consultation with State agencies to address this threatening process. Rabbits are identified in this plan as a known threat to Gould's Petrel (Environment Australia 1999). One of the objectives of the TAP is "to eradicate rabbits from islands or isolated areas where they are a threat to endangered or vulnerable native species or ecological communities" (Environment Australia 1999, p. 24).

The Gould's Petrel recovery effort is directly relevant to the implementation of this TAP and contributes to the overall strategy to control feral rabbits on offshore islands in Australia (see Sections 7.3.1).

2.6 Environmental assessment

2.6.1 New South Wales

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) requires that consent and determining authorities, and the Director General of the DEC, as a concurrence authority, consider relevant recovery plans when exercising a decision-making function under Parts 4 and 5 of the EP&A Act. Decision-makers must consider known and potential habitat, biological and ecological factors and the regional significance of individual populations.

As the species is only known from lands managed by the DEC, the only relevant consent or determining authority for this plan is the DEC.

Any activity not requiring a consent or approval under the EP&A Act, and which is likely to affect Gould's Petrel, requires a Section 91 licence from the Director General of the DEC under the provisions of the TSC Act. Such a licence can be issued with or without conditions, or can be refused. If a significant effect on Gould's Petrel is unlikely, the Director General of the DEC will issue the proponent of such an activity with a Section 95(2) certificate that acts as a defence to prosecution under sections 118A-D of the *National Parks and Wildlife Act 1974* (NPW Act).

A scientific licence issued under Section 132C of the NPW Act is required to 'harm' Gould's Petrel or damage its habitat for scientific, educational or conservation purposes.

2.6.2 Commonwealth

The EPBC Act regulates actions that may result in a significant impact on nationally listed threatened species and ecological communities. It is an offence to undertake any such actions in areas under State or Territory jurisdiction, as well as on Commonwealth owned areas, without obtaining prior approval from the Commonwealth Minister for the Environment. As Gould's Petrel is listed nationally under the EPBC Act, any person proposing to undertake actions likely to have a significant impact on this species should refer the action to the Commonwealth Minister for the Environment for consideration. The Minister will then decide whether the action requires EPBC Act approval.

Administrative guidelines are available from Commonwealth Department of Environment and Heritage (www.deh.gov.au/epbc) to assist proponents in determining whether their action is likely to have a significant impact. In cases where the action does not require EPBC Act approval, but will result in the death or injury to Gould's Petrel in a Commonwealth area, a permit issued by the Commonwealth Minister for the Environment under the EPBC Act will be required.

The Commonwealth Minister for the Environment can also delegate the role of assessment and approval to other Commonwealth Ministers under a Ministerial Declaration and to the States and Territories

under bilateral agreements. The development of a bilateral agreement between NSW and the Commonwealth is not complete at the date of this publication, but when in place will avoid the need for duplication of environmental assessment.

3 Conservation status

Gould's Petrel is listed as endangered at a State (TSC Act) and National (EPBC Act) level. The species is considered to be at risk of extinction as a consequence of the following factors:

- Restricted extent of occurrence.
- The total population of Gould's Petrel is estimated to have declined by at least 26% between 1970 and 1992.
- Breeding success is consistently less than 25% when threatening processes are unmitigated.
- Threats to Gould's Petrel include predation by Pied Currawongs *Strepera graculina* and degradation of nesting habitat by the introduced Rabbit *Oryctolagus cuniculus.*

The conservation status of the Gould's Petrel has improved since the inception of the recovery program.

When management actions commenced in 1992, research determined that:

- less than 250 breeding pairs of Gould's Petrel nested on Cabbage Tree Island;
- less than 20% of pairs were successfully producing fledged young;
- less than 50 young were being produced annually;
- adult mortality exceeded 50 birds per annum; and
- the subspecies was declining in numbers.

Since that time, management of the population has improved the conservation status of the population. Monitoring undertaken has determined:

- 2500 individuals comprising 1000 breeding pairs nest on Cabbage Tree Island (2004/05);
- about 12 breeding pairs were discovered at a second breeding location on Boondelbah Island in 1999/2000;
- an average of 300 fledglings are produced each year;
- approximately 50% of pairs are successfully producing fledged young; and
- average adult mortality is now less than 10 birds per year.

The challenge for this recovery effort is to:

- maintain overall population numbers and breeding success;
- complete the enhancement of the Gould's Petrel colony on Boondelbah Island; and
- facilitate regeneration of the rainforest understorey on Cabbage Tree Island.

4 Description

Gould's Petrel (*Pterodroma leucoptera leucoptera)* is a member of the gadfly group of petrels. All members of the group are pelagic, soar erratically on narrow wings, and feed on surface fish, small squid and krill. Gould's Petrel is one of three subspecies of *P. leucoptera* that are currently recognised. The subspecies are all morphologically quite similar and as far as is known have similar general breeding habit. The two non-Australian subspecies *L.l. brevipes* and *L.l. caledonensis* occur in Fiji and New Caledonia respectively. Additional records of these subspecies may result in a broadening of our understanding of their distribution base but neither has been studied, consequently current taxonomic and conservation status for these is uncertain. However, like Gould's Petrel, both the other races are known to be rare and, from current understanding, have restricted breeding sites (Marchant and Higgins 1990; Cabot et al. 1998; Stattersfield and Capper 2000).

Gould's Petrel has a body length of 30 cm, a wingspan of 75 cm and weight of approximately 180 g. The upper surface of the long narrow wings has a distinctive 'M' pattern. This, together with a darker head, distinguishes it from other Australian *Pterodroma* of similar size. The underside of the body and wings are white with a dark edge to the wing that terminates in a diagonal bar from the carpel inwards. Both sexes are identical and immature birds fledge in adult plumage.

Figure 1: ***Gould's Petrel - adult.***
Photo N. Carlile, DEC

5 Distribution and Habitat

Gould's Petrel breeds on Cabbage Tree Island (32° 42` S; 152° 14` E), 1.4 km offshore from Port Stephens, NSW (Figure 4). This 30 ha island was thought to be the sole breeding locality for this species, but a few nesting birds were discovered on nearby Boondelbah Island in 1995 (Priddel and Carlile 1996a).

Cabbage Tree Island measures approximately 1.0 km by 480 m and rises abruptly to an elevation of 123 m (Priddel and Carlile, 1997). The principal nesting habitat of Gould's Petrel is located within two gullies on the western side of the island (Fullagar, 1976). These gullies have an approximate total area of 2 ha and are characterised by steeply sloping rock scree and a canopy of Cabbage Tree Palms (*Livistona australis)*, Deciduous Fig (*Ficus superba*), Sandpaper Fig (*Ficus fraseri),* and Native Plum (*Planchonella australis*) (Figures 2 & 3). Gould's Petrel nests predominantly in natural rock crevices among the rock scree, but nesting also occurs in hollow fallen palm trunks, under mats of fallen palm fronds and in cavities among the buttresses of fig trees. They breed colonially and the nests are clumped and often less than 1 m apart (D'Ombrain 1943).

Although the core breeding habitat for Gould's Petrel is contained within 2 ha on Cabbage Tree Island, additional nests have been located in areas fringing the gullies or in small rock scree around the periphery of the island (Priddel and Carlile 1997). These nests account for approximately 20% of the total nests (Priddel and Carlile 1997).

The non-breeding range and feeding areas of Gould's Petrel is unknown, but it appears that the species forages predominantly within the Tasman Sea. Beach washed specimens and sightings at sea extend as far north as the Queensland border and as far west as Eyre on the Western Australian south coast (Marchant and Higgins 1990).

Historical information pertaining to size of the population is scant and imprecise. When first described by John Gould in 1844, the information relayed to him was that the subspecies was "breeding in great numbers", but no estimation of population size was given. The first assessment of abundance was made in 1970 when the population ashore on Cabbage Tree Island was estimated at about 2000 individuals (Fullagar 1976). Work undertaken in 1992 and 1993, estimated population size at between 1150 and 1500 birds and indicated that the subspecies had declined by 26 - 42% during the past few decades (Priddel et al. 1995). Experimental

management actions undertaken between 1993 and 2003 has resulted in the total breeding population increasing from an annual average of 220 in the late 1980s (Priddel and Carlile, 1997) to more than 1000 pairs in 2004/5 (N. Carlile, DEC pers. comm. Nov. 2005– see section 7).

5.1 Land tenure

Cabbage Tree Island (John Gould NR) and Boondelbah Island are both gazetted Nature Reserves under the NPW Act. As such, the subspecies habitat is protected from land uses incompatible with nature conservation.

Figure 2: ***Gully with Cabbage Tree Palms, Cabbage Tree Island, NSW.***
Photo N. Carlile, DEC

Figure 3: ***Gould's Petrel breeding habitat, Cabbage Tree Island, NSW.***
Photo N. Carlile, DEC

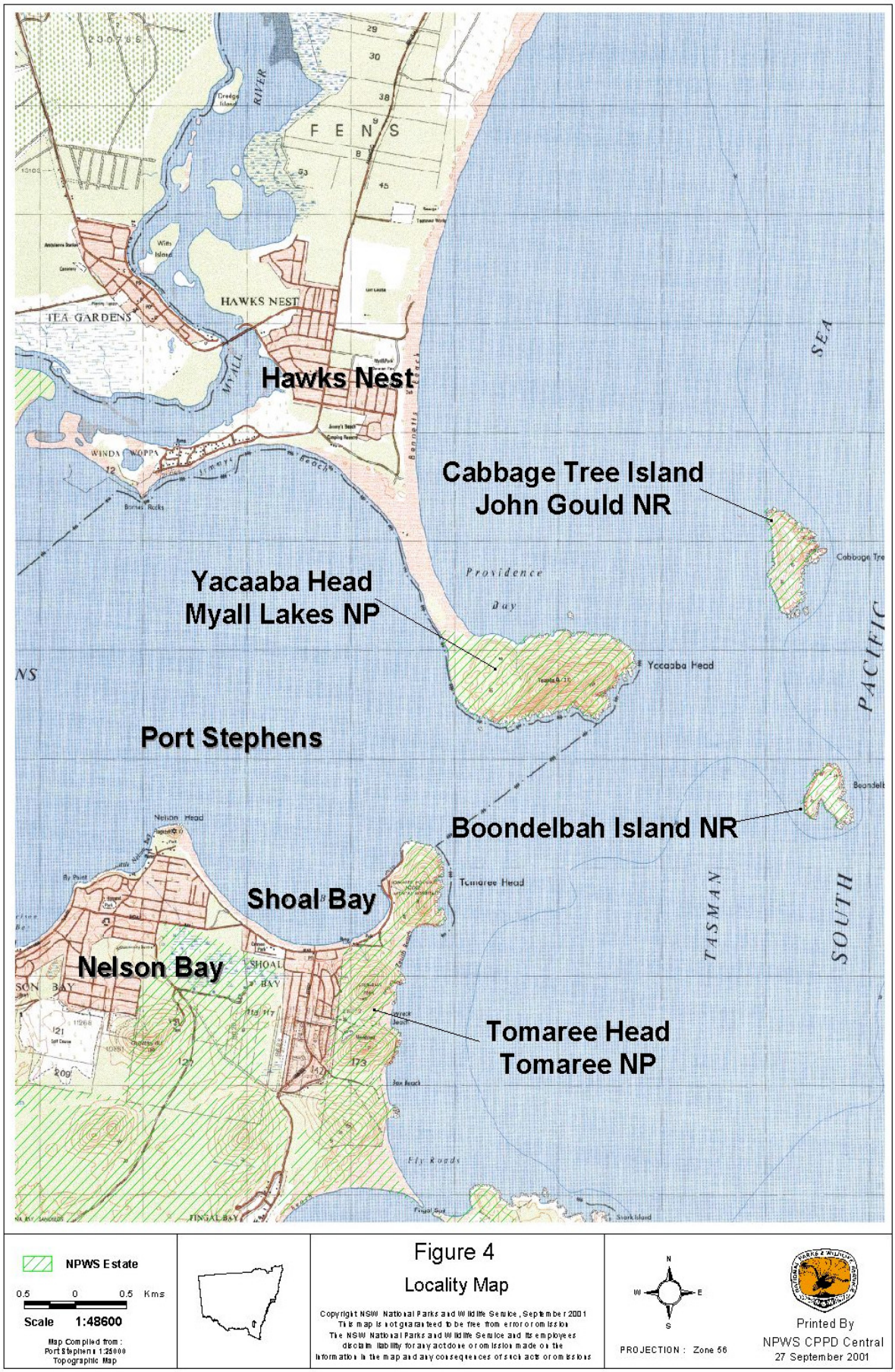

Figure 4: ***Locality map: Port Stephens, NSW.***

6 Biology and Ecology

Gould's Petrels begin to arrive on Cabbage Tree Island to breed from mid to late September. The birds arrive and depart the island under the cover of darkness. Egg laying takes place over a six week period commencing in early November. Gould's Petrels lay a single egg and, if lost, the egg is not replaced. Incubation takes 49 days to complete and usually involves incubation shifts by each parent in turns of around 16 - 17 days duration. The chick is brooded for one or two days only. Both parents then share the responsibility of feeding the chick. The young remain in the nest for about 13 weeks, during which time they can achieve weights of around one and a half times that of their parents. Fledglings depart the island from late March to early May. It is believed that young birds remain at sea for several years. The earliest record of first breeding is at 4-5 years of age although data is extremely limited (N. Carlile, DEC pers. comm.). Longevity can exceed 28 years (D. Priddel unpublished). Gould's Petrels are monogamous and pair bonds appear to be longstanding.

Figure 5: Courting Gould's Petrels
Photo N. Carlile, DEC

Figure 6: Nestling Gould's Petrel
Photo N. Carlile, DEC

7 Previous Recovery Actions

7.1 Recovery strategy

The Gould's Petrel has been the subject of an active research and management program by the DEC since 1992. This has included the preparation (in 1996) and implementation of a non-statutory interim recovery plan.

The recovery strategy outlined in the 1996 plan sought to control a range of threats severely affecting the population at that time, establish a second colony on Boondelbah Island, monitor overall population size and breeding success and increase community awareness of the recovery effort.

7.2 Establishment of a recovery team

A Gould's Petrel recovery team has been established to advise the Director General of the DEC during the preparation and implementation of this plan. The recovery team has convened annually since 1997 and includes representatives from:

- NSW DEC;
- CSIRO; and
- Cumberland Bird Observers Club.

7.3 Outcomes of implementing interim recovery objectives

The specific objectives of the 1996 interim Recovery Plan were to:

1. reduce and control the Pied Currawong and Raven populations on Cabbage Tree Island to less then 10 individuals;
2. suppress regeneration of the Bird-lime Tree *Pisonia umbellifera* within the nesting habitat of the Gould's Petrel;
3. eradicate rabbits from Cabbage Tree Island to facilitate regeneration of the nesting habitat;
4. enhance and sustain annual breeding success of Gould's Petrel above 45%;
5. continue annual monitoring of population size and breeding success;
6. band all fledglings and monitor recruitment;
7. establish a viable colony of Gould's Petrel on Boondelbah Island; and
8. conduct an education and awareness campaign within the local area.

The performance of the recovery effort against these objectives is discussed below.

7.3.1 Threat reduction (Objectives 1, 2 & 3)

Currawongs and Ravens have been culled on the Island on a yearly basis since 1993 (except in 2001/02). Seventeen Gould's Petrel deaths have been attributed to Currawongs and 55 to Ravens (41 of which occurred in 2001/02 when no culling occurred) since culling began in 1993.

All adult *Pisonia* were removed from breeding habitat in 1993 and each subsequent year seedlings are removed. Only one death of Gould's Petrel entanglement in *Pisonia* has been detected since 1993. Fixed vegetation survey quadrats have also been established across the island to measure rainforest regeneration and invasion by weed species.

A program to eradicate rabbits from Cabbage Tree Island was undertaken in 1997/98. The rabbit eradication program involved the use of myxomatosis, the release of rabbit calicivirus and poisoning with Talon® 20P. The program was preceded by an assessment phase to determine appropriate control techniques and was followed by a monitoring program to assess effectiveness. The rabbit eradication program is fully detailed in Priddel and Carlile (1996b) and Priddel, Carlile and Wheeler (2000). No evidence of rabbits has been observed on the island since this program was completed.

7.3.2 Breeding success (Objective 4)

The removal of *Pisonia* from the nesting sites and the control of avian predators dramatically reduced the mortality of Gould's Petrels on Cabbage Tree Island. Instigation of these management actions was coincident with a 68% rise in the number of pairs brooding eggs in 1993 (see figure 7). Further small increases in the breeding population occurred in subsequent years. Management of the colony was also coincident with a substantial increase in breeding success (up from 25% to 50% - see figure 9).

Breeding success peaked at 59% in the 1994-1995 season and has remained at approximately 50% in all subsequent years except 1995-1996 (see figure 9).

7.3.3 Monitoring (Objectives 5 & 6)

Biannual monitoring has occurred on Cabbage Tree Island from 1992-2005 with the assistance of volunteers from the Cumberland Bird

Observers Club. The population was monitored for:

- number of breeding pairs;
- number of eggs and number of subsequent fledglings; and
- mortality rates.

Data was also collected about pair bonds, age to first breeding, nest site fidelity, and individual fecundity. All fledglings detected have been banded.

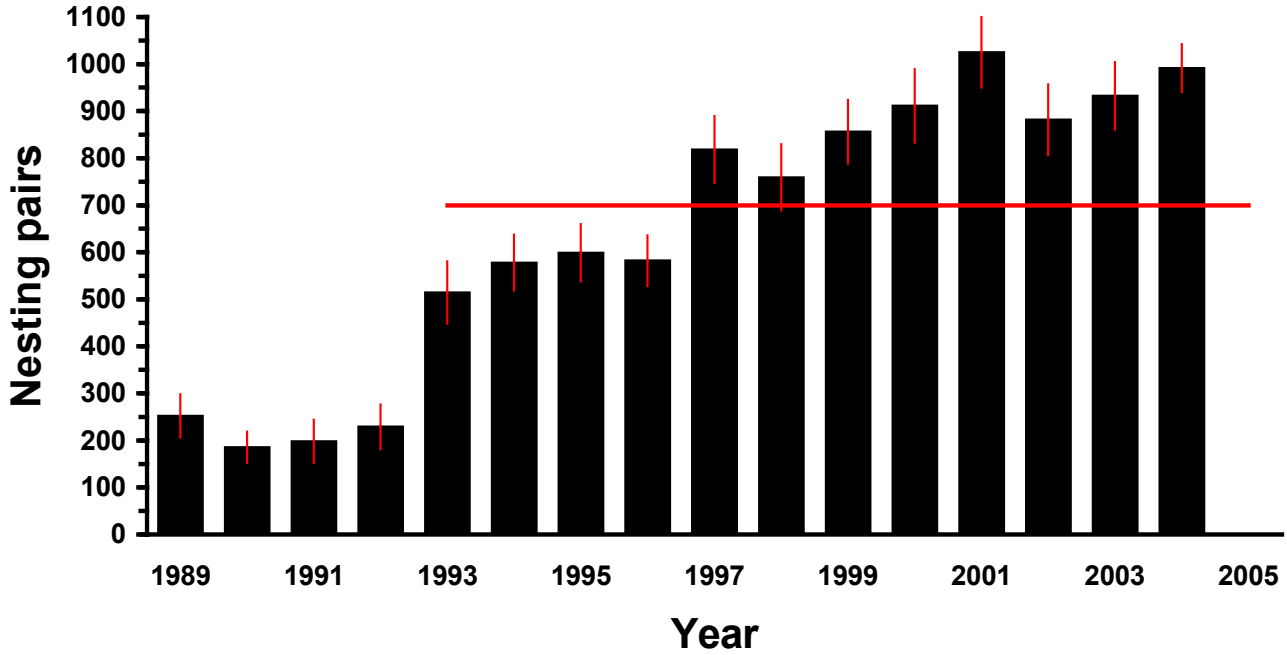

Figure 7: Number of nesting pairs on Cabbage Tree Island 1989 – 2004 (Priddel & Carlile unpublished 2004). (Horizontal line indicates current target).

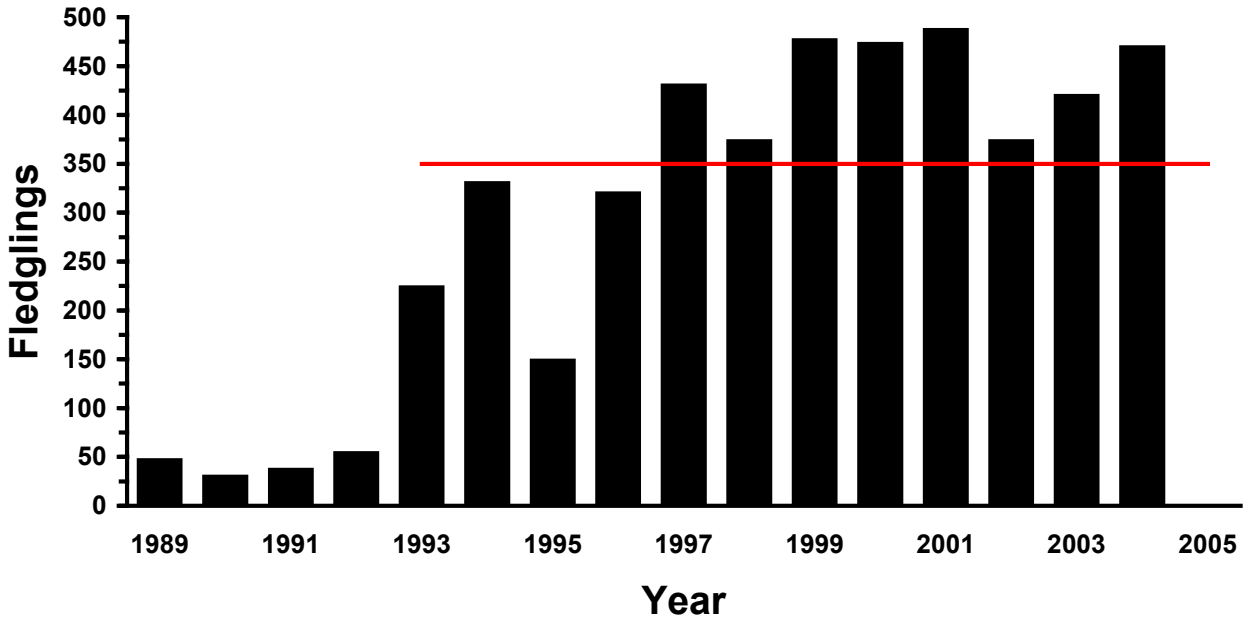

Figure 8: Number of fledglings on Cabbage Tree Island 1989 – 2004 (Priddel & Carlile 1997; Priddel unpublished). (Horizontal line indicates current target)**.**

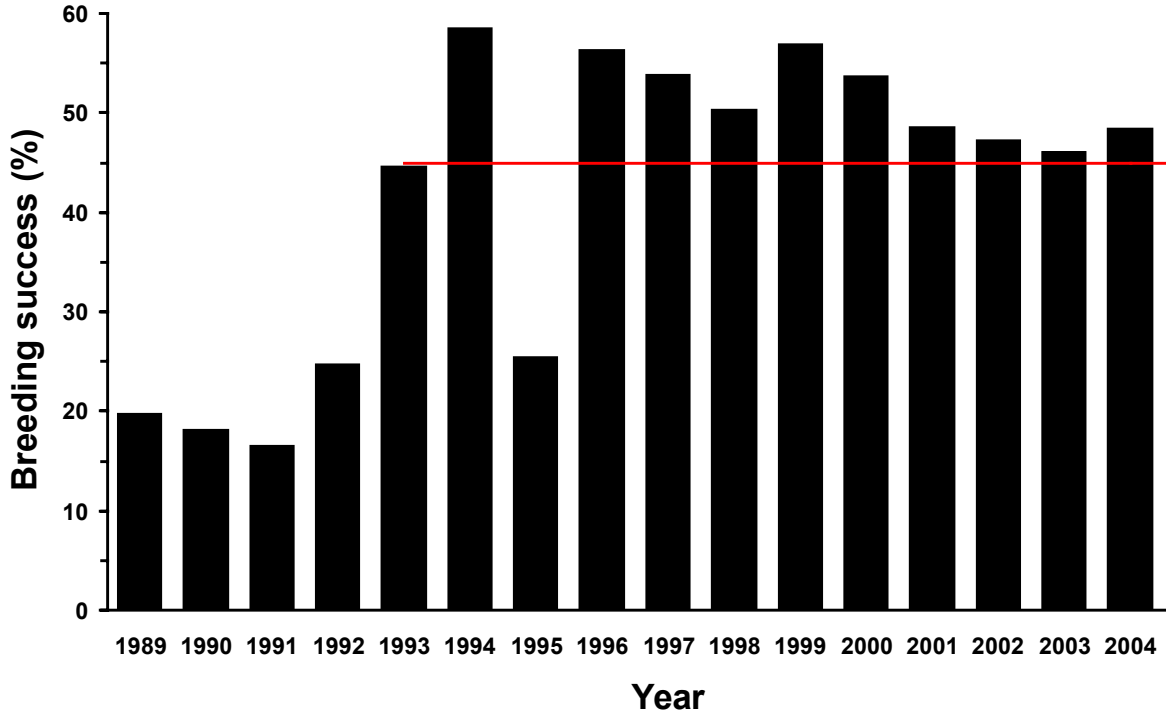

Figure 9: Breeding success on Cabbage Tree Island 1989 – 2004 (Priddel & Carlile 2002; Priddel unpublished). (Horizontal line indicates current target).

7.3.4 Establishment of a second colony (Objective 7)

Using techniques established from prior research (Priddel and Carlile 2001), a translocation procedure was developed. One hundred Gould's Petrel chicks were translocated from Cabbage Tree Island to Boondelbah Island in February 1999. They were placed into artificial nest boxes and 95% of the chicks fledged and left the island in the following months. In March 2000, a further 100 chicks were translocated and all successfully fledged.

The original objective to translocate 300 chicks was based on the expectation that 40%-60% of chicks would fail to fledge. This predicted mortality rate was based on comparable translocation programs undertaken on other seabirds. The translocation of 300 fledglings, therefore, was anticipated to produce 120-180 fledged young. Given the high survival rate of fledglings translocated to date (97.5% Carlile, DEC pers. comm.) it was not necessary to translocate as many chicks as originally anticipated. The translocation program is summarised in Appendix 1.

7.3.5 Community education and awareness (Objective 8)

Substantial media interest has been generated by the recovery effort. Every year, researchers on the islands invite local and State media to cover the recovery program. For example, in 1998/99 six newspaper articles, six radio interviews and one TV segment featured the Gould's Petrel recovery effort whilst more recently, in 2002/03 four newspaper articles, one radio interview and three TV segments featured the Gould's Petrel recovery effort.

Since 2000, there has been more local than national media interest in Gould's Petrel. As a result, there has been a huge interest from the local community and from local schools. For example, in 2003 every school in the local area undertook a project about Cabbage Tree Island and an art exhibition about the island was held in October 2003.

Information about the Gould's Petrel has been supplied to many dolphin and whale watching tour boats operating in and around Port Stephens. This information is known to have been used in the guide commentaries provided for visitors and in various tour publications.

A species profile for Gould's Petrel has been prepared (Appendix 2) and released as part of the DEC's Threatened Species Information series. The NSW Foundation for National Parks and Wildlife also contributed to the profile of the subspecies through adopting an image of the Gould's Petrel on the DEC annual national park passes during 1998/99. The money generated by the program made a substantial financial contribution to the recovery program.

8 Management issues

8.1 Introduction

The management of the conservation of threatened species requires the development of a recovery program which considers (i) the biological and ecological aspects of the species; (ii) the social, political and organisational parameters that may affect the success or otherwise of the program; and (iii) the economic factors which may influence the operation of the program's implementation.

This section identifies the management issues affecting Gould's Petrel including:

- limits of current understanding of the sub-species' biology and ecology;
- threats and reasons for decline; and
- social and economic factors which may influence the success or otherwise of the recovery plan.

8.2 Understanding of biology and ecology

Gould's Petrel has been the subject of considerable scientific investigation. Over the last 12 years, scientific study has been undertaken in concert with the recovery effort (Priddel and Carlile 1995, 1996a, 1996b, 1997, 2001; Priddel, Carlile, Davey, & Fullagar 1995).

These studies have focused on the breeding habitat of the subspecies at Cabbage Tree Island and sought to establish:

- the nature and severity of threats acting on the subspecies during its breeding period on the island;
- the status of the population over time in terms of overall size, number of breeding pairs and breeding success;
- the efficacy or otherwise of various strategies to eliminate threats and increase breeding success. These strategies included the rabbit eradication program and the use of nest boxes; and
- appropriate translocation techniques.

The conservation issues associated with this subspecies when it returns to land are now understood with a reasonably high degree of confidence (see Section 8.3). However, there are a number of other issues that should be further investigated. These include the taxon's dietary preferences and the subspecies movements away from the island.

8.3 Threats and reasons for decline

Previous management actions have halted and reversed the decline of the Gould's Petrel. Overall, population numbers and breeding success rates have shown an upward trend since management actions were instigated in 1992.

Rabbit grazing no longer poses a threat to Gould's Petrel habitat following the successful completion of the rabbit eradication program. Current operating threats and potential threats are detailed below.

8.3.1 Entanglement with *Pisonia*

Together with predation by avian predators, entanglement in the sticky fruits of the Bird-lime Tree (*Pisonia umbellifera*) has been identified as a major cause of adult and nestling mortality. Unmanaged, the rate of mortality of adult Petrels is high and exceeds recruitment. Loss of understorey vegetation due to rabbit grazing is identified as a cause of increased mortality of Petrels because more of the *Pisonia's* sticky fruits reach the ground.

Regeneration of ground cover and the lower shrub layer as a result of the rabbit eradication program may eventually render the removal of *Pisonia* unnecessary as the sticky fruits of the *Pisonia* plant may be caught by the understorey vegetation and no longer pose a serious risk to Petrels when individuals are on the ground.

In the interim, all adult *Pisonia* have been removed from the breeding habitat of the Gould's Petrel and it is currently necessary to prevent regeneration of *Pisonia* through the annual removal of seedlings in the breeding areas.

The breeding habitat of the Petrel comprises a small component (about 2 ha) of the distribution

of *Pisonia* on the island. More than 100 adult *Pisonia* plants remain on Cabbage Tree Island and should not be affected by the recovery program. Entanglement in *Pisonia* fruits should not be an issue for the translocation program as *Pisonia* is not known to occur on Boondelbah Island.

8.3.2 Predation by avian predators

Predation by avian predators is a natural component of the species' ecology. However, predation has been intensified by the effects of rabbit grazing and currently poses a serious threat to the subspecies. Grazing degraded the nesting habitat and exposed the Petrels to an increased risk of predation. Known predators are the Australian Raven (*Corvus coronoides*) and the Pied Currawong (*Strepera graculina*). Other probable predators include transient visitors such as goshawks and owls.

Australian Ravens and Pied Currawongs are resident on the island and are widespread and common in Australia. Culling to keep population numbers artificially low is considered appropriate and at times will be undertaken. Other predatory birds such as goshawks and owls are less common and some of these potential visitors are listed as Vulnerable on the TSC Act. For this reason, control of owls and goshawks will not normally involve culling and will only occur if monitoring reveals predation exceeding 20 adult Petrels in a season. This will be assessed on a case by case basis and translocation from the island would be considered in the first instance.

This approach will be adopted in view of the serious risk posed by avian predators to the recovery of the Petrel and the relative conservation status of these native birds. Control of avian predators will be undertaken as an interim measure until the understorey of the rainforest regenerates sufficiently to provide cover for the Petrels.

8.3.3 Disturbance from jet aircraft

The Australian Department of Defence operates an airforce base at Williamtown, Port Stephens. It has been observed that noise generated by jet aircraft distresses birds and makes them more vulnerable to predation. This occurs as a result of the birds emitting a stress call in response to the sudden noise generated by low level fly overs. These calls have the potential to reveal the nest position to predatory birds (Priddel unpublished). The Department of Defence has recognised Cabbage Tree and Boondelbah Islands as a noise sensitive area since 1994 and a no fly-zone, with a ceiling of 2000 feet within 2 nautical miles of the islands, is in place.

8.3.4 Potential threats

Cabbage Tree Island and Boondelbah Island are within 2 km of the mainland and are situated close to an area of high recreational use. The possibility of the deliberate or accidental introduction of mammalian predators such as rats, foxes and cats to the island is a major potential threat to the Gould's Petrel. Given that Gould's Petrels nest on the ground, fire is also considered a major potential threat as it would likely destroy understorey and other important elements of the key gully habitat vegetation. Evidence of human presence (ie rubbish) on the Island is occasionally located and consequently there is a risk of direct disturbance to breeding habitat at key times as well as an increased risk of fire and the introduction of predatory or other exotic animals.

Cabbage Tree Island is situated close to areas identified as being suitable for aquaculture. Such activities are already underway, on a trial basis, north of Cabbage Tree Island. The operation of the aquaculture facility poses minimal threat to the Gould's Petrel as they do not forage in areas close to shore and are unlikely to become entangled in the nets that surround the facility. However, the facility will be staffed 24 hours a day and there is the possibility of staff visiting the island and causing damage to habitat.

Oil spills in the vicinity of the island are not considered a threat because the Gould's Petrel does not feed in coastal waters however, oceanic oil spills may pose some risk.

8.4 Social and economic considerations

8.4.1 Social considerations

Social considerations relate to those actions that seek to discourage public access to Cabbage Tree Island and Boondelbah Island. As the DEC must manage Cabbage Tree and Boondelbah Islands in accordance with the recovery plan, the recovery plan will effectively prohibit any future proposals to intensify recreational opportunities on the islands. However, given the terrain of Cabbage Tree Island and Boondelbah Island and the difficulties associated with providing secure

public access, it is unlikely that increasing visitation would ever be a viable option. Consequently, negligible adverse social impacts are anticipated.

8.4.2 Economic considerations

Significant resources have already been invested in the recovery of the Gould's Petrel. Since 1989, the DEC has contributed over $540,000 in funding, the Commonwealth Department of Environment and Heritage (first through the Endangered Species Program and then through the Natural Heritage Trust) have contributed over $300,000 and the NSW Foundation for National Parks and Wildlife has contributed over $80,000 to the recovery of this subspecies.

The economic consequences of this recovery effort arise from the cost of implementation. Estimates for this implementation are contained at Table 1.

8.4.3 Roles/interest of indigenous peoples

Aboriginal artefacts have been identified on both Cabbage Tree and Broughton Islands. It is believed that indigenous peoples visiting these islands in the past would most likely have utilised the eggs and larger older Gould's Petrel chicks as a resource (S. Brereton, DEC pers. comm.) as well as other fauna species available.

Indigenous communities with an interest in the actions proposed in this recovery plan have not yet been identified. Implementation of recovery actions under this plan will include consideration of the roles and interests of indigenous communities in the region.

8.4.4 Biodiversity benefits

The recovery effort for the Gould's Petrel has and will continue to provide important information to other conservation biologists concerned with the protection of seabirds. In particular, the strategies and techniques developed during the rabbit eradication program and the translocation program have broader application within Australia and elsewhere.

The program to eradicate rabbits also has broader biodiversity benefits for Cabbage Tree Island. Regeneration of the understorey is already evident across the island and with time the floristic structure and diversity should re-establish.

8.5 Translocation

The IUCN "Position Statement on Translocation of Living Organisms" (IUCN 1987) defines translocation as the movement of living organisms from one area with free release in another.

Translocation has been undertaken as a recovery strategy for the Gould's Petrel as outlined in the 1996 interim recovery plan. In accordance with the DEC "Policy for the Translocation of Threatened Fauna in NSW", a translocation proposal was prepared for the Gould's Petrel translocation program (see Appendix 1 for summary). The objectives, feasibility, methods and expected impacts on source and host environments and on the parental Petrel colony were addressed in the proposal.

8.6 Ability to recover

8.6.1 Likelihood of extinction

The success of the recovery effort, to date, has substantially reduced adult and juvenile mortality and increased the number of successful breeding pairs (see Figure 7). Overall, numbers of the subspecies, while low, are on the increase. However, until the success or otherwise of the translocation program is known, the subspecies remains highly vulnerable due to its virtual total reliance on Cabbage Tree Island as the key breeding site.

8.6.2 Likelihood of recovery

'Recovery' is a concept that is dependent on the conservation objective for each taxon. The overall objective of 'recovery' in relation to Gould's Petrel is to initially remove it from a position of imminent risk of extinction and then to downlist the subspecies from its current endangered status to vulnerable by 2011. Recovery is considered feasible due to the following factors:

- Demonstrated ability to control threats. The recovery effort to date has demonstrated that it is possible to either eliminate or ameliorate the threats acting upon the subspecies.
- The subspecies has demonstrated an ability to respond when threats are controlled with increased breeding success, recruitment and increased population size.

- Security of habitats. The status of Cabbage Tree and Boondelbah Islands as Nature Reserves removes the chance that future changes to land-uses will adversely affect the subspecies.
- Opportunity to establish a second major breeding site via the translocation program.

However, Gould's Petrel is restricted to a very small number of breeding sites and is at high risk of the introduction of pest species and other human induced impacts. Consequently, the sub-species will always remain vulnerable.

The consequences of not implementing the provisions of this recovery plan are such that the probability of extinction in nature within the next 20 years is high. The subspecies will require active management for the foreseeable future (ie the next five years). Without further biological and ecological research, important aspects of the taxon's biology will remain uncertain and not applied to management.

9 Objectives and performance criteria

The overall objective of the Gould's Petrel recovery effort is for Gould's Petrel to be downlisted from endangered to vulnerable by 2011.

The specific recovery objectives are:

1. To identify and manage the threats operating at sites where the subspecies occurs;
2. To establish and maintain a translocated second colony at Boondelbah Island,
3. To raise awareness of the subspecies with the local community and involve volunteers in the recovery program;
4. To promote research and continue monitoring that will assist with the management of the subspecies; and
5. To co-ordinate recovery actions through a recovery team and annual reporting on Recovery Plan implementation.

Specific Objective 1: To identify and manage the threats operating at sites where the subspecies occurs

Continued control of avian predators on Cabbage Tree Island and the continued suppression of seedlings of the *Pisonia* plant from within the core nesting habitat of the Gould's Petrel are essential for the conservation of this subspecies.

Actions

1.1 Pied Currawongs and Australian Ravens will be controlled by shooting. Culling is to be undertaken in October when Currawongs are brooding nestlings and are most easy to locate and shoot. Currawong nests and nestlings will also be destroyed. Annual culling will need to be ongoing or continued until the understorey has recovered sufficiently to provide nesting Petrels with adequate concealment from avian predators.

1.2 Other avian predators such as Goshawks and Owls will be assessed on a case by case basis. Action will only be taken to control these species where predation of adult Petrels exceeds 20 birds. The removal of these avian predators may involve translocation to the mainland.

1.3 All mature *Pisonia* plants have been removed from within the nesting habitat of the Gould's Petrel. Annual removal of seedlings is required. Regeneration of ground cover and the lower shrub layer as a result of the rabbit eradication program will eventually render this action unnecessary as the sticky fruits of the *Pisonia* plant will be caught by the understorey vegetation and no longer pose a risk to the ground-dwelling Petrel.

Gould's Petrel's are prone to disturbance. Unsupervised public access, particularly to breeding areas, poses a potential threat to Gould's Petrel. It has also been observed that noise generated by jet aircraft distresses birds and makes them more vulnerable to predation. The Australian Department of Defence has recognised Cabbage Tree and Boondelbah Islands as a noise sensitive area since 1994. There is a no fly-zone below a ceiling of 2000 feet within 2 nautical miles of both islands in place.

Actions

1.4 The DEC will restrict access to Cabbage Tree and Boondelbah Islands and access will only be permitted for scientific and conservation purposes.

1.5 The DEC will discourage unsupervised public access by way of installation of advisory signs on Cabbage Tree and Boondelbah Island and at other appropriate locations in Port Stephens. The status of Cabbage Tree Island as critical habitat, its significance to the Gould's Petrel and the penalties associated with harming Gould's Petrel and damaging its habitat will be included in the signage.

1.6 The Australian Department of Defence will instruct personnel to observe the no fly zone over Cabbage Tree and Boondelbah Islands.

Performance criterion 1:

- Pied Currawong and Australian Raven numbers on Cabbage Tree Island are maintained at less than 10 individuals.
- Monitoring of mortality caused to Gould's Petrel by other avian predators reveals that overall predation from this cause does not exceed 20 adult Petrels per annum.
- *Pisonia* is eliminated from the nesting habitat of the Gould's Petrel.
- Recreational boat users will be aware of the status of Cabbage Tree Island as critical habitat for the Gould's Petrel.
- Visitation to Gould's Petrel habitat will be limited to scientific and conservation purposes.
- Australian Department of Defence aircraft will observe the no fly zone to alleviate any increased risk of predation caused by the noise generated from jet aircraft.

Specific Objective 2: To establish and maintain a translocated second colony at Boondelbah Island.

The translocation program began with the translocation of 100 chicks in March 1999 and a further 100 chicks in March 2000. A third translocation of chicks was not required in 2001 as recruitment was higher than expected and met the programs' objectives. Any future additional translocation will be considered on the basis of recruitment to Boondelbah Island.

Actions

2.1 Any future translocated chicks or chicks produced from recruitment to the island will be banded (using the appropriate protocol).

2.2 The 100 nest boxes currently in place on Boondelbah Island will be maintained in functional condition and monitored 3 times per year (pre-season, egg laying and at fledgling stage).

2.3 Weed control (prickly pear, bitou bush etc.) and native vegetation control will be undertaken as necessary in the nest box gully to allow birds to have clear access to nest box entrances

Performance criterion 2:

- All translocated chicks are banded, nest boxes are maintained and monitored, weeds are controlled and a second viable breeding colony is established on Boondelbah Island and contributes to an overall increase in the Gould's Petrel population.

Specific Objective 3: To raise awareness of the subspecies with the local community and involve volunteers in the recovery program

The community education program within the local area will continue, as will the involvement of volunteers in the recovery effort. Increased awareness of the Gould's Petrel within the local area will enhance the community's sense of responsibility to protect the subspecies and its habitat.

Actions

3.1 Volunteers will continue to be invited to participate in the recovery effort.

3.2 Print and electronic media coverage of the recovery program at the local, regional, national and international level will continue to be promoted.

3.3 Annual invitations will be sent to the media to view each year's success of the program.

3.4 Dissemination of information about the Gould's Petrel will be included as part the DEC's Discovery Program during regular holiday activities within Tomaree National Park and will be made available to owners of recreational boats and to those operating various commercial activities such as whale and

dolphin watching tours etc in the vicinity of Cabbage Tree and Boondelbah Islands.

3.5 The Gould's Petrel threatened species information profile will be made available as a hard copy and on the DEC website and updated as required.

Performance criterion 3:

- The broader community is made aware of the conservation values of Cabbage Tree and Boondelbah Islands and the Gould's Petrel recovery effort and community members have the opportunity for hands-on involvement with the recovery effort.

Specific Objective 4: To promote research and continue monitoring that will assist with the management of the subspecies.

Continued monitoring of population parameters and breeding success is necessary to assess the effectiveness of the recovery actions and to inform future recovery actions. Survey methods for estimating population size and breeding success are outlined at Appendix 3.

Actions

4.1 Population size and breeding success of the colony on Cabbage Tree and Boondelbah Islands will be monitored annually utilising trained volunteers in accordance with the survey methods outlined at Appendix 3. Techniques are described in Priddel *et al.* (1995) and all birds handled will be banded with incoloy bands supplied by the Australian Bat and Bird Banding Scheme.

4.2 Collection of demographic and life history data is required to facilitate population modelling and to track/monitor recruitment and recovery. The data collected will also provide important information regarding age of first breeding, the survival of sub-adults, longevity and age-specific mortality.

4.3 Dietary studies and a greater understanding of the Petrel's movements away from the island are needed. Research will be conducted into these studies by the DEC as funds become available.

Performance Criterion 4:

- The success or otherwise of the recovery actions outlined in this plan is assessed using population monitoring data.
- Ecological data is available to inform future management actions.
- Dietary and movement studies undertaken when funds are available.

Specific Objective 5: To co-ordinate recovery actions through a recovery team and annual reporting on Recovery Plan implementation.

Overall, co-ordination of the recovery effort is required to ensure the implementation of the recovery plan. This includes the annual convening of a recovery team and annual reporting on implementation.

Actions

5.1 The DEC will convene a recovery team meeting at least once a year. Representatives of a community conservation group and an independent scientific expert will be invited to be on the recovery team.

5.2 The DEC will provide a written report on the outcomes of the previous years implementation to the recovery team. This will include the results of the yearly monitoring program. This report will be made available to the public on request.

Performance criterion 5:

- DEC performance in relation to the implementation of the recovery plan will be documented and communicated to interested parties.

10 Implementation

The total cost to implement this plan is estimated to be $203,500 over 5 years comprising recurrent and external funds. This amount does not include the preparation of any plans of management for the islands. Table 1 details the cost and identifies the parties responsible for the implementation of specific recovery actions.

11 Preparation details

This recovery plan was prepared by Julie Ravallion, Ross Wellington and Tania Duratovic of the Biodiversity Conservation Section, Metropolitan Branch, based on the work undertaken by David Priddel and Nicholas Carlile, Biodiversity Conservation Science Section, Policy and Science Division and in

consultation with the Gould's Petrel Recovery Team.

12 Review date

This recovery plan will be reviewed after 5 years of the date of publication. It will be reviewed by the DEC in consultation with the Recovery Team. At a minimum, membership on the Recovery Team will include a representative from a community conservation group and an independent scientific expert.

13 Contacts

The Threatened Species Recovery Team for the Gould's Petrel is coordinated by the Threatened Fauna Ecology Unit, Biodiversity Conservation Science Section, Policy and Science Division, Department of Environment and Conservation, PO Box 1967, Hurstville, NSW 2220. Telephone (02) 9585 6554.

Action No.	Action Description	Priority	Responsible Party	Fund Source	Cost Estimate ($/year)					
					1	2	3	4	5	Total
1	**Identification & management of threats**									
1.1	Control of Pied Currawongs and Australian Ravens	1	DEC (PWD)	In-kind	2,500	2,500	2,500	2,500	2,500	**12,500**
1.2	Control of other avian predators*	1	DEC (PWD)	In-kind	5,000					**5,000**
1.3	Annual removal of *Pisonia* seedlings	1	DEC (PWD	In-kind						**see 4.1**
1.4+1.5	Restriction of access + advisory signs	1	DEC (PWD)	In-kind	200	200	200	200	200	**1,000**
1.6	No fly zone	1	DoD	In-kind						**Negligible**
2	**Establishment & maintenance of 2nd colony**									
2.1	Future translocated chicks to be banded	1	DEC (PWD, PWS)							
2.2	Maintenance of nest boxes	1	DEC (PWD)	In-kind	1,000	1,000	1,000	1,000	1,000	**5,000**
2.3	Control of weeds and native vegtn. in nest box gully	1	DEC (PWD)	In-kind	3,000	2,000	2,000	2,000	1,000	**10,000**
3	**Raising community awareness & involvement**									
3.1	Volunteers invited to participate	3	DEC (PWD)	In-kind	500	500	500	500	500	**2,500**
3.2+3.3	Promotion of print & electronic media coverage + Annual media visit to island	3	DEC (PWD)	In-kind	2,000	2,000	2,000	2,000	2,000	**10,000**
3.4	Dissemination of information	3	DEC (PWD)	In-kind	400	400	400	400	400	**2000**
3.5	Species profile made available		DEC (EPRD)	In-kind						**Negligible**
4	**Monitoring and Research**									
4.1 + 4.2	Annual monitoring & collection of demographic & life history data	1	DEC (PWD, PSD)	In-kind	22,000	22,000	22,000	22,000	22,000	**110,000**
4.3	Dietary & movement studies	2	DEC (PSD)	In-kind & external grants or students	24,000	2,000	2,000	2,000	2,000	**32,000**
9.5	**Co-ordinate recovery actions**									
	Convene Rec. Team meeting annually	1	DEC (PSD)	In-kind	2,000	2,100	2,200	2,300	2,400	**11,000**
	Provision of annual implementation report	1	DEC (PWD, PSD)	In-kind	500	500	500	500	500	**2,500**
	Total				56,400	32,400	28,100	28,200	28,300	**203,500**

Table 1: Gould's Petrel Implemetation Estimates

Priority ratings are: 1 – action critical to meeting plan objectives, 2 – action contributing to meeting plan objectives, 3 – desirable but not essential action
*These funds will be required should predation by owls or goshawks require active control. Contingency funding will be sought should the need arise.
Costings table explanation: DEC = Department of Environment & Conservation, **PWD** = Parks & Wildlife Division, **PSD** = Policy and Science Division, **EPRD** = Environment Portection & Regulation Division. **DoD** = Department of Defence.

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Appendices

Appendix 1: Translocation program - summary

Appendix 2: Gould's Petrel Species Information Profile

Appendix 3: Survey methods for estimating population size and breeding success

Appendix 4: Summary of Scientific Committee advice on the recovery plan

Appendix 1: Translocation program (Summary)

1 Introduction

In accordance with the DEC's policy for the Translocation of Threatened Fauna in NSW (July 2001) requiring persons undertaking a translocation program to prepare a translocation proposal, a proposal was prepared and adopted in 1999. This document provides a summary of the translocation program.

2 Objectives and justification for the proposal

The objective of the translocation is to establish a viable Gould's Petrel population on Boondelbah Island, off the coast of Port Stephens, NSW. Viable in the context of this translocation effort means that translocated chicks fledge, depart the island, return, and successfully breed at Boondelbah Island. Given that the earliest known age of first breeding is 4-5 years and that Petrel pairs may take several seasons to successfully breed, (N. Carlile, DEC pers comm.), it is unlikely that viability will be established before 2010.

Translocation was adopted as a conservation strategy for Gould's Petrel for the following reasons:

- the innate vulnerability of the species' chief breeding site on Cabbage Tree Island and the potential for a catastrophic event decimating the entire population;
- sufficient information on key lifecycle characteristics is available to inform the translocation program;
- sufficient information is available from other translocation programs of seabirds to suggest that translocation is a feasible conservation strategy for this species;
- opportunity is available to undertake translocation within the context of a broader research and recovery program for the species;
- suitable potential translocation site is available (ie Boondelbah Island). This Island was considered suitable in both ecological terms (eg, suitability of habitat, absence of threatening processes) and in terms of habitat security (Boondelbah Island is a Nature Reserve under the NPW Act); and
- opportunity is available to contribute to the wider body of scientific literature on the translocation of threatened seabirds.

The conservation benefits of translocating Gould's Petrel include:

- Expanding breeding area of this species and thus reducing the likelihood of extinction;
- Developing expertise and experience with the translocation of this species. This also has spin-off benefits for the conservation of other endangered seabirds.

The conservation problem that may arise from the translocation of Gould's Petrel is the death of translocated individuals due to unforeseen factors and the consequent effect on the overall size of the population and recruitment rate.

3 Natural history and ecology of the species

Please refer to Recovery Plan for details of the species, taxonomy, status and distribution, ecological requirements, and threatening processes.

4 Composition of transfer population

One hundred chicks were transferred each year from Cabbage Tree Island to Boondelbah Island over a 2 year period commencing 1999. (Originally a third translocation of chicks was planned for 2001 but this was not needed due to recruitment being higher than expected). Sex cannot be determined in the field for individuals of this age. Based on 1998/99 population numbers, 100 chicks represents

28% of the population on Cabbage Tree Island. The reproductive output of the species on Cabbage Tree Island will be diminished in the short term.

No other species are expected to be affected by the transfer of individuals.

Chicks were collected in March and transferred by boat to Boondelbah Island. Chicks were transferred at 3 weeks prior to fledging to facilitate imprinting.

5 Host environment

At the time, Boondelbah Island supported a small breeding population of Gould's Petrel. The most suitable habitat is located at North Ravine. Nest boxes were installed to provide appropriate nesting habitat. The nest boxes are made from polyethylene and are 500 * 250 * 230 mm in size.

Holding capacity of the Island will be dependant on the number and maintenance of nest boxes and the availability for natural breeding cavities. There are no foreseeable impacts on any plants or animals on Boondelbah Island. No disease risks are anticipated.

6 Monitoring requirements

All chicks translocated were banded to allow for future assessment regarding site fidelity and future breeding success.

7 Threat abatement

Yearly maintenance of the nest boxes is being undertaken. Natural regeneration of understorey vegetation and weeds may block entrance tunnels and may have to be controlled in the future as a routine maintenance procedure.

8 Resources

DEC research staff and volunteers undertook the translocation of chicks, and will be required to undertake the yearly monitoring and maintenance. Financial commitment for the program is outlined in Table 1 of the recovery plan.

9 Community Resources

The translocation program offers an opportunity for hands-on community involvement with a recovery program. Members of the Cumberland Bird Observers Club and Birds Australia, Threatened Bird Network will continue to be involved in and committed to the project. The translocation program will also figure prominently in the community awareness component of the recovery plan.

Appendix 2: Gould's Petrel Species Information Profile

THREATENED SPECIES INFORMATION

Gould's Petrel

(Pterodroma leucoptera leucoptera)

Conservation Status

Gould's Petrel is listed as an endangered species on Schedule 1 of the *Threatened Species Conservation Act* 1995 (NSW). The species is also listed as a nationally endangered species under the *Environment Protection and Biodiversity Conservation Act* 1999.

Description

Gould's Petrel is a member of the gadfly group of Petrels. All members of the group are pelagic, soar erratically on narrow wings, and feed on surface fish, small squid and krill. Gould's Petrel is one of three subspecies of *Pterodroma leucoptera*. The two other subspecies, *P. leucoptera brevipes* and *P. leucoptera caledonensis,* occur in Fiji and New Caledonia respectively (Naurois de 1978; Marchant and Higgins, 1990). Like Gould's Petrel, both are rare and have restricted breeding sites (Stattersfield and Capper, 2000).

Gould's Petrel has a body length of 30 cm, a wingspan of 75 cm and weight of approximately 180g. The upper surface of their long narrow wings has a distinctive 'M' pattern. This, together with a darker head, distinguishes them from other *Pterodroma* of similar size. The underside of the body and wings are white with a dark edge to the wing, which terminates in a diagonal bar from the wrist joint inwards. Sexes appear identical and immature birds fledge in adult plumage.

Distribution

Gould's Petrel breed primarily on Cabbage Tree Island, offshore from the entrance to Port Stephens, New South Wales. This 30 ha island was thought to be the sole breeding locality for this species, but a few nesting birds have been discovered on nearby Boondelbah Island (Priddel and Carlile 1996a). The non-breeding range and feeding areas of the Gould's Petrel are unknown, but it appears that the species forages predominantly within the Tasman Sea.

Recorded occurrences in conservation reserves

Both Cabbage Tree and Boondelbah Islands are declared Nature Reserves under the *National Parks and Wildlife Act 1979* and are under care, control and management of the DEC.

Adult Gould's Petrel. *Photo N. Carlile, DEC*

Habitat

Nesting habitat is concentrated in two steep gullies on the western side of the island. The gullies are characterised by steep rock-scree slopes with a canopy of Cabbage Tree Palms (*Livistona australis*) and several species of figs. Fallen palm fronds provide protection from the weather and concealment from avian predators.

Behaviour

The first arrival of Gould's Petrel on Cabbage Tree Island occurs from mid to late September. The birds arrive and depart the island under the cover of darkness. Egg laying takes place over a six-week period commencing in early November. Gould's Petrels lay a single egg, and if lost the egg is not replaced. Incubation takes 49 days to complete, and usually involves incubation shifts of around 16 - 17 days duration.

The young remain in the nest for about 13 weeks, during which time they can achieve weights of around 150% of their parents. Fledglings depart the island from late March to early May. Gould's Petrel are monogamous and pair bonds appear to be longstanding.

Threats

The introduction of rabbits to Cabbage Tree Island severely degraded the nesting habitat of the Gould's

Petrel, removing the understorey, and increasing the risk from avian predators. Rabbit grazing also prevents regeneration of the rainforest canopy and allows invasion by exotic plant species.

Entanglement in the sticky fruits of the Bird-lime Tree (*Pisonia umbellifera)* and predation by Pied Currawongs (*Strepera graculina)* and Australian Ravens (*Corvus coronoides)* have been the major causes of adult and nestling mortality on Cabbage Tree Island (Priddel and Carlile 1995).

Cabbage Tree Island is situated close to an area of high recreational use. The possibility of the deliberate or accidental introduction of mammalian predators or fire to the island is a major potential threat to the Gould's Petrel.

Recovery program

The Gould's Petrel has been the subject of an active research and recovery program since 1989. The majority of the population has been banded and studies undertaken to determine population size, breeding success and lifecycle characteristics.

Rabbits have been totally eliminated from Cabbage Tree Island following an extensive eradication program by the DEC (Priddel and Carlile 1996b). The Birdlime Tree has been eliminated from the petrel's breeding habitat and avian predators have been controlled.

Recently the DEC sought to establish a second breeding colony for Gould's Petrel on nearby Boondelbah Island. Nest boxes have been installed and chicks transferred. This work is continuing and, if successful, will extend the breeding habitat for the petrel.

A recovery plan has been prepared for Gould's Petrel and is available from the DEC.

Critical habitat

The draft Gould's Petrel Recovery Plan recommended that Cabbage Tree Island be declared as critical habitat under the TSC Act. This has been declared in conjunction with the adoption of the recovery plan.

For further information

Biodiversity Conservation Section, Metro, Dept. of Conservation & Environment, PO Box 1967, Hurstville NSW 2220 Phone 02 9585 6678 http://www.DEC.nsw.gov.au

Acknowledgments

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Appendix 3: Survey methods for estimating population size and breeding success of Gould's Petrels on Cabbage Tree Island, New South Wales

Number of breeding pairs

Procedure and timing

The number of breeding pairs is estimated from the number of birds found sitting on eggs during week 50.

Setting out transects

Transects are laid at 10 metre intervals across the slope of each of the two gullies on the island (South Gully and North Gully). The starting point of the first transect is at the lowest point of the permanently surveyed grid system (marked E00N00 in the South Gully and E500 N00 in the North Gully) and runs uphill from this point.

Each transect runs on a compass bearing, 160º/340º for the North Gully and 168º/348º for the South Gully. A 100m fibreglass tape laid across the ground and two metres each side of the tape is systematically searched for nesting petrels. The current nest markers provide a good guide to the extent of nesting habitat.

Searching for nests

Searching is labour intensive and involves every potential cavity being searched, often made easier with the aid of a torch. Any dead palm fronds must be lifted out of the way to ensure that all the transect area is inspected. Marked nest sites that fall within the transect should be inspected and any occupants included in the tally.

Handling birds

Each bird found is inspected to determine if it is sitting on an egg. If the sitting bird is banded the number is noted. An appropriately qualified and licensed person is needed to band any unbanded birds. For every nest encountered, a separate line on the data sheet needs to be filled in.

On land, these birds are nocturnal. A distressed petrel may attempt to take flight if they are disturbed from their nesting cavity during the day. When replacing a bird into its nest cavity, the careful placement of a palm frond or two over the nest entrance will reduce the amount of light in the nest and help the bird to settle.

Data Sheet for Gould's Petrel Transects – Week 50.

Date	Gully N/S	Transect Number.	Distance from 0.0	Nest No.	Bird Y/N	Egg Y/N	Comments (New nest locations and banding details)

Appendix 4: Summary of advice provided by the Scientific Committee on the recovery plan.

Under section 66A a recovery plan approved by the Minister must include a summary of any advice given by the Scientific Committee with respect to the plan, details of any amendments made to the plan to take account of that advice and a statement of the reasons for any departure from that advice.

Advice/comment was provided by the Scientific Committee with respect to:

Comment: Reservation was expressed regarding the need to continue with *Pisonia umbellifera* control.

Whilst Petrel entanglement with the sticky fruits of *Pisonia* is part of the natural ecology of the island this process has been exacerbated by the removal of rainforest understorey by rabbits. The lack of understorey allowed the fruits to fall directly on the ground where ground nesting adults and offspring become entangled. The Recovery Plan only intends that *Pisonia* seedlings be removed until the understorey regenerates following rabbit eradication and are only to be removed from the Gould's Petrel breeding area. Over 100 *Pisonia* plants remain on Cabbage Tree Island outside the breeding area and are not targeted for removal.

The plan has been amended to clarify this point and allay any concern over loss of *Pisonia* plants from the island.

Comment: Reservation was expressed regarding the culling of avian predators some of which have the potential to be vagrant individuals of threatened owl or goshawk species.

Given the size of the Gould's Petrel population culling of owls or goshawks would not be considered until predation exceeded 20 adult individuals. Greater losses than this on an ongoing basis are considered to have the potential to compromise the recovery of the Petrel.

The plan has been amended to indicate that any proposal to cull owls or goshawks would be assessed on a case by case basis and that translocation from the island would be considered as an alternative. The regeneration of understorey vegetation on the island since rabbits were eliminated means that the need to cull these avian predators is unlikely.

Comment: Comment was made questioning the advisability of continuing to promote amongst tour operators the presence of Gould's Petrel on the island as it was considered this might have the potential to increase undesirable visitation rates. It was particularly mentioned in relation to commercial tour operators and the aquaculture industry. The greatest risk to the Gould's Petrel is people and the possibility of the introduction of exotic species.

The solution to this issue is problematic. Two approaches are possible one being to keep the Gould's Petrel a low key matter with the risk of inadvertent impacts by people visiting the island or the alternative of raising awareness of what the issues are and how vitally important the island is to the survival of this species. The latter approach is that taken in the recovery plan because access to the island is very difficult and opportunistic visitation is unlikely. The presence of the Gould's Petrel on Cabbage Tree Island has already been promoted by tour operators for some years. Furthermore, the declaration of the island as critical habitat will be sign posted and this should strengthen community awareness of the values of the island and the factors that could threaten it.

The other comments provided relate to editorial or clarification matters and these have been addressed in the final plan.

Department of
Environment and
Conservation (NSW)

43 Bridge Street
Hurstville 2220
www.npws.nsw.gov.au