

Draft RECOVERY PLAN



Pterodroma leucoptera Gould's Petrel



Gavin Gansky '99

For public comment



Natural Heritage Trust
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Gould's Petrel Draft Recovery Plan

**Prepared in accordance with the New South Wales
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In October 1996, David Priddel and Nicholas Carlile, Biodiversity Research and Management Division, NSW NPWS prepared a draft Gould's Petrel Recovery Plan for the period 1996 – 2001.

This Recovery Plan covers the period 2000/01 – 2004/05 and was prepared by Julie Ravallion, Threatened Species Unit, Central Directorate, NSW NPWS. Much of the background information in this plan has been taken from the 1996 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

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Executive Summary

Introduction

This recovery plan details the work undertaken to date and the work that still needs to be done to secure the survival of Australia's rarest endemic seabird, the Gould's Petrel (*Pterodroma leucoptera leucoptera*).

The Gould's Petrel breeds on Cabbage Tree and Boondelbah Islands, off the coast of Port Stephens, NSW. Concern for the conservation of the Gould's Petrel dates back to 1989, when the NSW National Parks and Wildlife Service (NPWS) initiated a research program to determine the current status of the population and to identify any threats affecting the subspecies.

Since that time, the NPWS, 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.

Current species status

The Gould's Petrel is listed as endangered on the Commonwealth *Endangered Species Protection Act* 1992 (ESP Act) and the NSW *Threatened Species Conservation Act* 1995 (TSC Act). Its endangered status was based on the subspecies' small population size and low reproductive output, its total reliance on two islands for breeding purposes and its vulnerability to a range of threatening processes.

Whilst it is highly likely that the Gould's Petrel will always be of conservation concern, the opportunity exists to improve its current conservation status. The potential to achieve positive conservation benefits for the Gould's Petrel is based on 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;
- Security of habitats. The status of Cabbage Tree and Boondelbah Island as Nature Reserve removes the chance that future changes to land-uses will adversely effect the subspecies;
- Opportunity to enhance the colony at Boondelbah Island via the translocation program.

Legislative context

The TSC Act is NSW's legislative framework to protect and encourage the recovery of threatened species, populations and ecological communities. Under the TSC Act, the Director-General of National Parks and Wildlife has certain responsibilities including the preparation of recovery plans for all entities listed on the Schedules of the TSC Act. The TSC Act includes specific requirements for both the matters to be addressed by

recovery plans and the process for preparing recovery plans. This Recovery Plan has been prepared in accordance with the provisions of the TSC Act.

Likewise, the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EP&BC Act), which comes into effect on 16 July 2000 and replaces the ESP Act, also requires the preparation of recovery plans for the species and communities listed under the Schedules of the EP&BC Act. This plan also satisfies these provisions.

Preparation of plan

This Recovery Plan covers the period 2000/01 to 2004/05. It follows on from an earlier draft Recovery Plan prepared in 1996 for the Australian Nature Conservation Agency (now Environment Australia) by David Priddel and Nicholas Carlile for the period 1996/97 – 2000/01.

This Recovery Plan has been prepared with the assistance of a Recovery Team, a non-statutory group of interested parties with relevant expertise to discuss and resolve issues relating to the plan. Components of the plan do not necessarily represent the views nor the official position of all the individuals or agencies represented on the Recovery Team. The information in this Recovery Plan was accurate to the best of the NPWS' knowledge the date it was prepared.

This plan will be reviewed and updated 5 years from the date of publication.

Recovery plan implementation

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

The only NSW public authority relevant to this plan is the NPWS, as the NPWS is responsible for the care, control and management of the petrel's island habitats.

Similar provisions exist at a Commonwealth level. Under the EP&BC Act, a Commonwealth agency must not take any action that contravenes an approved recovery plan. The only relevant Commonwealth agency relevant to this plan, is the Department of Defence who operate an airforce base at Williamstown, Port Stephens.

Long-term recovery objective

The recovery effort for the Gould's Petrel has the long-term objective of downlisting the subspecies from endangered to vulnerable by 2011.

Long-term recovery criteria

The NPWS considers that the longer term objective of downlisting will be possible if:

1. breeding population of Gould's Petrel on Cabbage Tree Island has been sustained at 750 pairs for 5 years;
2. annual reproductive output maintained above 300 fledglings per annum, on average, for five years;
3. a viable population of no less than 30 birds is established on Boondelbah Island; and
4. rainforest understorey on Cabbage Tree Island regenerates.

Short-term recovery objectives

The objectives for the implementation of this recovery plan over the next five years are to:

1. increase overall population numbers;
2. maximise breeding success;
3. maximise survivorship rate of fledglings;
4. establish a second colony at Boondelbah Island to safeguard the population in the event of a catastrophic event on Cabbage Tree Island

Short-term recovery criteria

The specific performance criteria for this recovery plan over the next five years are:

1. breeding population of Gould's Petrel on Cabbage Tree Island maintained at 750 pairs;
2. average annual reproductive output maintained above 300 fledglings per annum;
3. 200 young fledge and depart Boondelbah Island; and
4. rehabilitation of degraded rainforest sufficient to facilitate recruitment of canopy and understorey species.

Recovery actions

The actions outlined in this recovery plan may be summarised as follows.

1. maintain predation of Gould's Petrels by avian predators at artificially low levels;
2. remove *Pisonia* seedlings from within the nesting habitat of the Gould's Petrel;
3. establish and maintain the translocated population on Boondelbah Island;
4. increase community awareness by dissemination of information through the NPWS' Discovery Program and through involvement of the local media;
5. identify Cabbage Tree Island as critical habitat;
6. minimise human induced disturbance to and damage of Gould's Petrel habitat;
7. undertake yearly monitoring program with the assistance of volunteers;
8. improve our level of understanding of the taxon and apply this knowledge to management;
9. co-ordinate recovery actions through a recovery team and annual reporting on implementation.

Biodiversity benefits

The recovery effort for the Gould's Petrel has, to date, and will continue to provide important information to other conservation biologists concerned with the protection of seabirds. In particular, the strategies adopted and the lessons learnt from the rabbit eradication program and the translocation program are likely to have broader application in Australia and worldwide.

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

**BRIAN GILLIGAN
DIRECTOR-GENERAL**

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1 Introduction

The Gould's Petrel (*Pterodroma leucoptera leucoptera*) is Australia's rarest endemic seabird. The species has one significant breeding locality at Cabbage Tree Island, off the coast at Port Stephens, 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 species 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 2000 individuals comprising 800 breeding pairs (D. Priddel pers. comm., January 2000).

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

2 Legislative context

2.1 State and Commonwealth listing

At a State level, the Gould's Petrel is listed on schedule 1 of the *Threatened Species Conservation Act 1995* (TSC Act). 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 subspecies is listed on schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* (ESP Act). The schedules in the ESP Act are based on the lists compiled by the Australian and New Zealand Environment Conservation Council (ANZECC). The Commonwealth schedules are currently under review but the outcomes of this review are currently not known.

2.2 Recovery Plan preparation and implementation

2.2.1 Recovery Plan preparation

The NSW *Threatened Species Conservation Act 1995* requires 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.

At a Commonwealth level, the *Environment Protection and Biodiversity Conservation Act 1999* (EP&BC Act) (which will come into effect on 16 July 2000 and replaces the ESP Act), requires that the Federal Minister for the Environment ensures that a recovery plan is in force for each species listed on the schedules of the EP&BC Act.

The EP&BC 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.

2.2.2 Recovery Plan implementation

In NSW, the TSC Act requires that Ministers and public authorities (including the Director-General of National Parks and Wildlife) 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 public authority must not undertake actions inconsistent with an approved recovery plan.

The NSW government agency relevant to this plan is the NPWS. Consequently, the NPWS, 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 EP&BC 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 (see Section 8.3).

2.3 Relationship to legislation

2.3.1 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 or land for the ongoing survival of a species. Once declared, it becomes an offence to damage critical habitat (unless the action is specifically exempted by the TSC Act) and a Species Impact Statement is required for all development activities proposed within critical habitat.

To date, critical habitat has not been declared for the habitat of the Gould's Petrel. Whether critical habitat should be declared for this species is considered by this recovery plan (see Section 10.5 & Appendix 3)

2.3.2 Key threatening processes

There are currently no key threatening processes listed on Schedule 3 of the TSC Act that are relevant to the Gould's Petrel.

Competition and land degradation by feral rabbits is listed as a key threatening processes under Schedule 3 of the Commonwealth ESP Act. A Threat Abatement Plan (TAP) has been prepared by Environment Australia in consultation with the States 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 the TAP and contributes to the overall strategy to control feral rabbits on offshore islands in Australia (see Sections 7.3.2 & 8.3.3).

2.3.3 Environmental assessment

The TSC Act amendments to the environmental assessment provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) requires that consent and determining authorities consider relevant recovery plans when exercising a decision making function under the EP&A Act. As the species is only known from lands managed by the NPWS, the only relevant determining authority for this plan is the NPWS.

2.4 Land tenure

Cabbage Tree Island and Boondelbah Island are both gazetted Nature Reserves under the *National Parks and Wildlife Act 1974* (NPW Act). As such, the species habitat is protected from land uses incompatible with nature conservation.

3. Conservation status

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;
- the subspecies was declining in numbers. Between 1970 and 1992, the Gould's Petrel population is estimated to have declined by at least 26%.

Since that time, management of the population has improved the conservation status of the population. Monitoring undertaken in 1999/00 has determined that:

- 2000 individuals comprising 800 breeding pairs nest on Cabbage Tree Island
- about 12 breeding pairs nest at a recently discovered second breeding location on Boondelbah Island;
- an average of 300 fledglings are being produced each year;
- 50% of pairs are successfully producing fledged young;
- adult mortality, on average, has been reduced to 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;
- 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 *Pterodroma leucoptera*. The subspecies are all morphologically dissimilar and differ in their breeding habits and their relative taxonomic status is uncertain. The two other subspecies *L. brevipes* and *L. caledonensis* occur in Fiji and New Caledonia respectively, but neither have been studied and their current conservation status is unknown. Like Gould's Petrel, both are rare and have restricted breeding sites.

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 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 that terminates in a diagonal bar from the carpal inwards. Both sexes are identical and immature birds fledge in adult plumage.

5 Distribution and habitat

Gould's Petrel breed on Cabbage Tree Island (32° 42' S; 152° 14' E), 1.4 km offshore from Port Stephens, New South Wales (Figures 1 & 3). 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, 1996).

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 Petrels is located within two gullies on the western side of the island (Fullagar, 1976). These gullies are approximately 2 ha in size and characterised by steeply sloping rock scree with a canopy of Cabbage Tree Palms (*Livistona australis*), Deciduous Fig (*Ficus superba*), Sandpaper Fig (*Ficus fraseri*), and Native Plum (*Planchonella australis*) (Figure 2). Gould's Petrel nest predominantly in natural rock crevices among the rock scree, but nests also occur 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 metre apart.

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 the Gould's Petrel are 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.

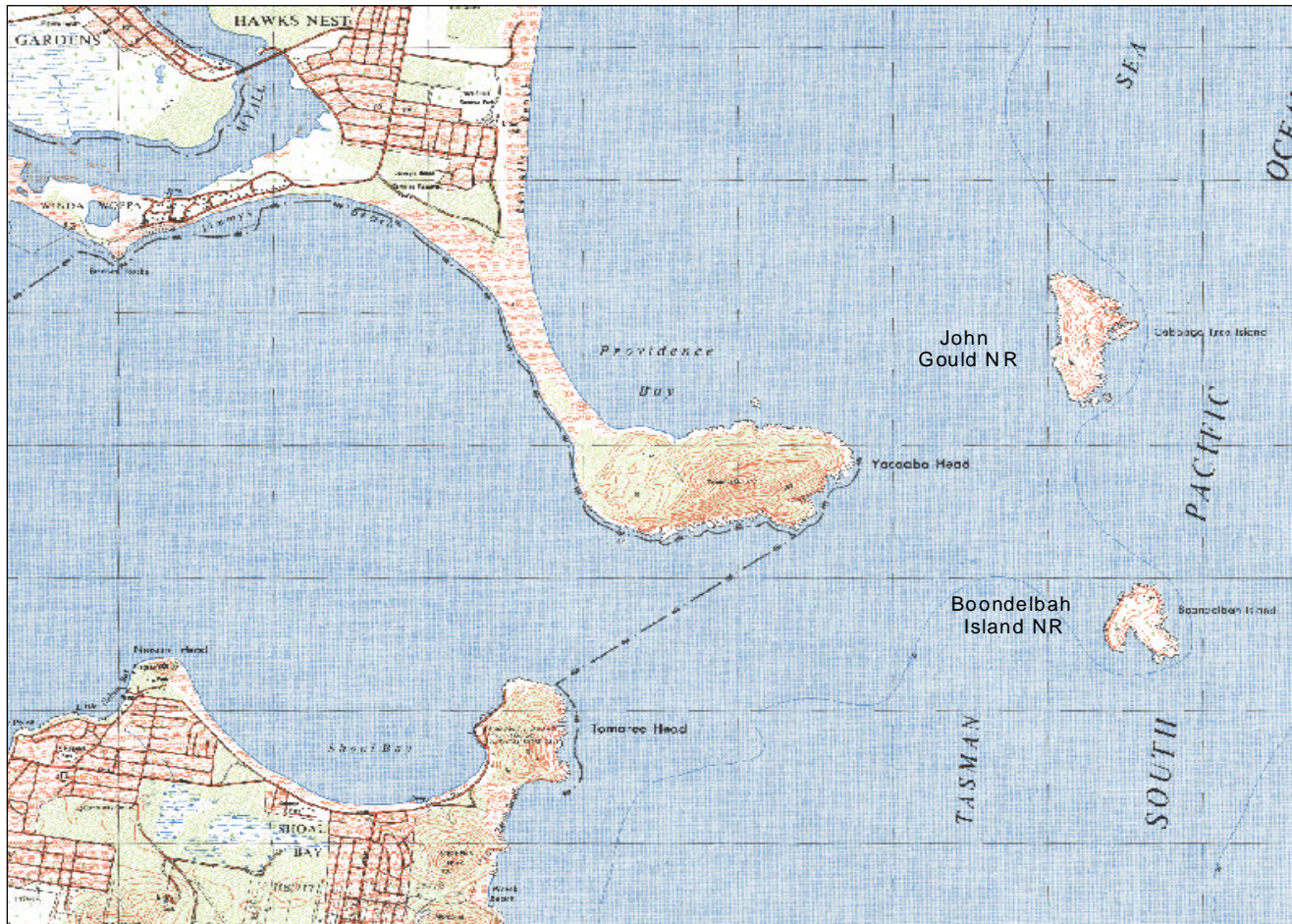
Historical information pertaining to size of the population is scant and imprecise. When first described by John Gould in 1844, the information relayed to him was that the species was "breeding in great numbers", but no estimation of population size was given. The first assessment of abundance was made in 1970 when the population ashore on Cabbage Tree Island was estimated at about 2000 individuals. Work undertaken in 1992 and 1993, estimated population size at between 1150 and 1500 birds, indicating that the species has declined by 26 - 42% during the past few decades. Experimental management action has seen the total breeding population increase from an annual average of 220 in the late 1980s (Priddel and Carlile, 1997) to now exceed 800 pairs (D. Priddel pers. comm., January 2000).

Figure 1: Cabbage Tree Island, NSW. Photo N. Carlile, NPWS



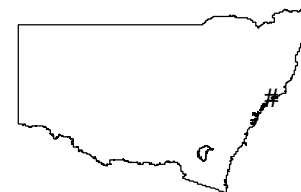
Figure 2: Gould's Petrel breeding habitat, Cabbage Tree Island, NSW. Photo N. Carlile





**Figure 3
Locality Map**

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 Towns from AUSLIG



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 Australian Map Grid
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6 Biology and ecology

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 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 are extremely limited (N. Carlile pers comm. December 1999). Longevity can exceed 28 years. Gould's Petrels are monogamous and pair bonds appear to be longstanding.

Figure 4: Gould's Petrel - adult. Photo N. Carlile



7 Previous actions undertaken

7.1 Recovery strategy

The Gould's Petrel has been the subject of an active research and management program by the NPWS since 1992. This has included the preparation (in 1996) and implementation of a draft 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, increase community awareness of the recovery effort and monitor overall population size and breeding success.

The recovery actions are listed at Appendix 2 along with a report on their implementation.

7.2 Establishment of a recovery team

A Gould's Petrel recovery team has been established to advise the Director-General of National Parks and Wildlife during the preparation and implementation of this plan.

The recovery team has convened annually since 1997 and includes representatives from:

- NSW NPWS
- CSIRO
- Environment Australia
- Cumberland Bird Observers Club.

7.3 Performance against recovery objectives

The specific objectives of the 1996 draft Recovery Plan were:

1. Reduce and control the pied currawong population on Cabbage Tree Island to less than 10 individuals.
2. Suppress regeneration of the bird-lime tree 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 50%.
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.
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 abatement (Objectives 1,2 & 3)

The 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 (1996) and Priddel, Carlile and Wheeler (in press). No evidence of rabbits has been observed on the Island since this program was initiated.

Fixed vegetation survey quadrants have also been established across the Island to measure rainforest regeneration and invasion by weed species.

All adult *Pisonia* were removed from breeding habitat in 1993 and in each subsequent year seedlings are removed. No evidence of Gould's Petrel entanglement in *Pisonia* has been detected since 1993.

Currawongs and Ravens have been culled on the Island on a yearly basis since 1993. Only 3 Gould Petrel kills have been attributed to these predators since 1993. This is down from almost 50 in 1992.

7.3.2 Breeding success (Objective 4)

The removal of *Pisonia* 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 birds brooding eggs in the following year. 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%).

Breeding success increased to 59% in the 1994 - 1995 season and has been maintained above 50% in all subsequent years except 1995 - 1996.

The number of incubating pairs and the number of fledglings recorded for the period 1989 to 1998 are shown on Figures 5 and 6 respectively.

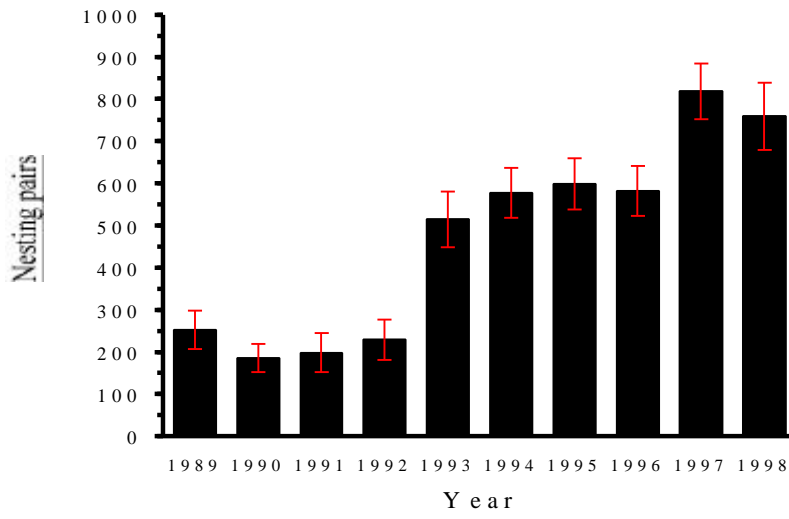


Figure 5: Number of nesting pairs 1989 - 1998

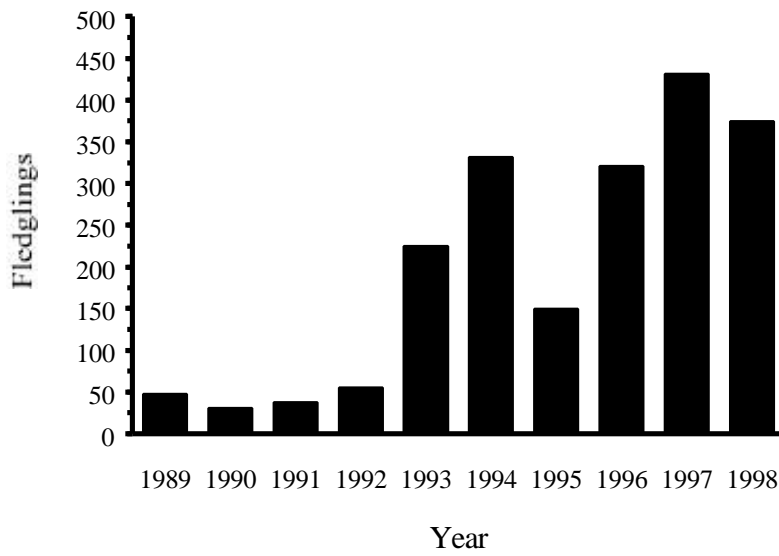


Figure 6: Number of fledglings 1989 - 1998

7.3.3 Establishment of a second colony (Objective 7)

The translocation program is fully detailed in Appendix 4.

100 Gould's Petrel chicks were translocated into artificial nest boxes in the summer of 1999 with 95% of chicks fledgling and leaving the island in the following months. In March 2000 a further 100 chicks will be translocated.

The original objective to translocate 300 chicks was based on the expectation that 40%-60% of chicks would fail to fledge. This mortality rate was based on comparable translocation programs undertaken in New Zealand. The translocation of 300 fledglings, therefore, was anticipated to produce 120-180 fledged young. Given the high survival rate of translocated to date fledglings (95%) it may be unnecessary to translocate as many chicks as originally anticipated.

7.3.4 Monitoring (Objectives 5&6)

Monitoring has occurred twice yearly on Cabbage Tree Island with the assistance of volunteers from the Cumberland Bird Observers Club. This monitoring sought to establish:

- 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 have been banded.

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 6 newspaper articles, no fewer than 6 radio interviews and 1 TV segment featured the Gould's Petrel recovery effort. In addition NPWS researchers presented various aspects of their research at 5 public seminars about Gould's Petrel.

In 1998, information about the Gould's Petrel was made available to many dolphin and whale watching boats operating in and around Port Stephens.

A species profile for Gould's Petrel has been prepared (Appendix 5) and will be released as part of the NPWS' Threatened Species Information series. The NSW Foundation for National Parks and Wildlife also contributed to the profile of the species through adopting the Gould's Petrel on the NPWS' annual park passes in 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 taxon's 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 10 years, scientific study has been undertaken in concert with the recovery effort (Priddel, D. and Carlilie, N. 1995, 1996a, 1996b, 1997, Priddel, D., Carlilie, N., Davey, C. & Fullagar, P.J. (1995)).

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

- Nature and severity of threats acting on the species during its breeding period on the Island;
- Status of the population over time in terms of overall size, number of breeding pairs and breeding success;
- Efficacy or otherwise of various strategies to eliminate threats, and to 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 species when it returns to land is now understood with a reasonably high degree of confidence. (See Section 8.3). There are a number of issues, however, that require further investigation. These include the taxon's dietary preferences and energetics associated with its reproduction.

8.3 Threats and reasons for decline

Previous management actions have halted and reversed the decline of the Gould 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.

All adult *Pisonia* have been removed from the breeding habitat of the Gould's Petrel. It is now necessary to prevent regeneration of *Pisonia* through the annual removal of seedlings.

Regeneration of ground cover and the lower shrub layer as a result of the rabbit eradication program will eventually render the removal of *Pisonia* 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.

The breeding habitat of the Petrel comprises a small component (about 2 ha) of the distribution of *Pisonia* on the Island. Well over 100 adult *Pisonia* remain on Cabbage Tree Island and will not be effected by the recovery program. Entanglement in *Pisonia* fruits will not be an issue for the translocation program as no *Pisonia* exist 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. Grazing degrades the nesting habitat and exposes the petrels to an increased risk of predation.

The recovery plan aims to maintain natural predators at artificially low levels. Some of these, such as Australian Ravens and Pied Currawongs are resident on the Island. Others such as goshawks and owls are transient visitors. While Ravens and Pied Currawongs are widespread and common in Australia, goshawks and owls are less common and some potential owl 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 predation exceeds 20 adult petrels.

This approach has been 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 Commonwealth Department of Defence operates an airforce base out of Williamstown, Port Stephens. It has been observed that noise generated by jet aircraft distress birds and makes them more vulnerable to predation. The Australian Department of Defence has recognised Cabbage Tree Island and Boondelbah Islands as a noise sensitive area since 1994 and a no fly-zone of 2 nautical miles around and 2000 feet above the Island is in place.

8.3.4 Potential threats

Cabbage Tree Island is situated close to an area of high recreational use. The possibility of the deliberate or accidental introduction of mammalian predators 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. There is currently no signage on either Cabbage Tree or Boonbelbah Islands that is clearly visible to boats at sea. Evidence of human presence (ie rubbish) on the Island is occasionally located.

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 Petrel does not feed in coastal waters.

8.4 Social and economic considerations

8.4.1 Social considerations

Social consideration relate to those actions which seek to discourage public access to Cabbage Tree Island. As the NPWS must manage Cabbage Tree Island in accordance with the recovery plan, the recovery plan will effectively prohibit any future proposals to intensify recreational opportunities on the Island. However, given the terrain of Cabbage Tree Island and the difficulties associated with providing secure public access to the Island, it is unlikely that increasing visitation could ever be a viable option. Consequently, negligible adverse social impacts are anticipated.

8.4.2 Economic considerations

The economic consequences of this recovery effort arise from the cost of implementation.

Significant resources have already been invested in the recovery of the Gould's Petrel. Since 1989, the NSW NPWS has contributed over \$540,000 in funding, Environment Australia 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 \$80,000 to the recovery of this species.

Cost estimates for the implementation of this plan are contained at Section 11.

8.4.3 Biodiversity benefits

The recovery effort for the Gould's Petrel has, to date, and will continue to provide important information to other conservation biologists concerned with the protection of seabirds. In particular, the strategies adopted and the lessons learnt from the rabbit eradication program and the translocation program are likely to have broader application in Australia and worldwide.

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

8.5 Translocation

The IUCN Position Statement on Translocation of Living Organisms (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 draft Recovery Plan. In accordance with the NPWS draft policy on the translocation of fauna a translocation proposal has been prepared for the Gould's Petrel translocation program (Appendix 4). The objectives, feasibility, methods and expected impacts on source and host environments as well as the Petrel are covered by this translocation 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. Overall species numbers, while low, are on the increase. However, until the success or otherwise of the translocation program is known, the species remains highly vulnerable due to its virtual total reliance on Cabbage Tree Island as a 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 downlist the species from its current endangered status to vulnerable by 2011. This objective 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;
- Security of habitats. The status of Cabbage Tree and Boondelbah Island as Nature Reserve removes the chance that future changes to land-uses will adversely effect the subspecies;
- Opportunity to establish a second major breeding site via the translocation program.

It should be noted that taking the species off the schedules entirely is not considered a viable future option. Gould's Petrel will always be:

- restricted a very small number of breeding sites; and
- vulnerable to the introduction of pest species and other human induced impacts.

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 taxon will require active management for the foreseeable future (ie the next five years). Without further biological and ecological research, key aspects of the taxon's biology will remain uncertain and not applied to management.

9 Objectives and performance criteria

9.1 Overall objective of the recovery effort

The overall objective of the Gould's Petrel recovery effort is carried over from the 1996 draft Recovery Plan. This objective is that Gould's Petrel be downlisted from endangered to vulnerable (Commonwealth *Endangered Species Protection Act* 1992 and NSW *Threatened Species Conservation Act* 1995) by 2011.

9.2 Criteria for downlisting to vulnerable

In order to achieve this objective, the following would need to be achieved.

1. breeding population of Gould's Petrel on Cabbage Tree Island has been sustained at 750 pairs for 5 years;
2. annual reproductive output maintained above 300 fledglings per annum, for five years;
3. a viable population of no less than 30 birds is established on Boondelbah Island; and
4. rainforest understorey on Cabbage Tree Island regenerates.

9.3 Objectives of this recovery plan

The objectives of this recovery plan are to:

1. increase overall population numbers;
2. maximise breeding success;
3. maximise survivorship rate of fledglings;
4. establish a second colony at Boondelbah Island to safeguard the population in the event of a catastrophic event on Cabbage Tree Island

9.4 Criteria for recovery plan implementation

Performance criteria for the implementation of this recovery plan are:

1. breeding population of Gould's Petrel on Cabbage Tree Island maintained at 750 pairs;
2. average annual reproductive output maintained above 300 fledglings per annum;
3. 200 young fledge and depart Boondelbah Island
4. rehabilitation of degraded rainforest sufficient to facilitate recruitment of canopy and understorey species.

10. Recovery actions

In order to achieve this recovery plan's objectives, a number of specific actions are identified by this recovery plan. Recovery actions will seek to:

1. maintain predation of Gould's Petrels by avian predators at artificially low levels;
2. remove *Pisonia* seedlings from within the nesting habitat of the Gould's Petrel;
3. establish and maintain the translocated population on Boondelbah Island;
4. increase community awareness by dissemination of information through the NPWS' Discovery Program and through the involvement of the local media;
5. identify Cabbage Tree Island as critical habitat;
6. minimise human induced disturbance to and damage of Gould's Petrel habitat;
7. undertake yearly monitoring program with the assistance of volunteers;
8. improve our level of understanding of the taxon and apply this knowledge to management
9. co-ordinate recovery actions through a recovery team and annual reporting on implementation

10.1 Threat abatement

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

Actions

1. Pied Currawongs and Australian Ravens will be controlled by shooting using a silenced .22 rifle fitted with telescopic sights. 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.
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 birds may involve translocation to the mainland.
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.

Outcomes

- Pied Currawong and Australian Raven numbers on Cabbage Tree Island are maintained at under 10 individuals;
- Other avian predators are controlled such that overall predation does not exceed 20 adult Petrels per annum; and
- *Pisonia* is eliminated from within the nesting habitat of the Gould's Petrel.

10.2 Establishment and management of the translocated population

The translocation program is partially completed with the translocation of 100 chicks in March 1999. A further 100 chicks will be translocated in March 2000. A third translocation of chicks will occur in 2001 if required to meet the programs objectives. (See Appendix 4 for further detail).

Actions

- 100 chicks will be translocated to Boondelbah Island in March 2000 ;
- Further chicks will be translocated in following years should this be necessary to meet the objectives of the translocation program ;
- All chicks will be banded ;
- Nest boxes will be maintained.

Outcomes

- Necessary steps have been taken to establish a second viable breeding colony on Boondelbah Island.

10.3 Community education

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 species and its habitat.

As part of the preparation of this plan, a Gould's Petrel Species Profile has been prepared (Appendix 5). This profile will be placed on the internet and will form part of the NPWS' threatened species information profiles

Actions

- 1 Volunteers will continue to be involved in the recovery effort;
- 2 Print and electronic media coverage of the recovery program at the local, regional, national and international level will continue;
- 3 Annual invitations to the media to view each year's success of the program;
- 4 Dissemination of information about the Gould's Petrel will be included as part the NPWS' Discovery program during regular holiday activities within Tomaree National Park and will be made available to owners of recreational boats operating commercial activities such as whale and dolphin watching tours in the vicinity of Cabbage Tree and Boondelbah Islands;
- 5 Gould's Petrel threatened species information profile will be made available.

Outcomes

- Community members have the opportunity for hands-on involvement with the recovery effort and their skills and knowledge are applied to the conservation of Gould's Petrel;
- Broader community is made aware of the conservation values of Cabbage Tree and Boondelbah Islands and the Gould's Petrel recovery effort.

10.4 Minimising disturbance

Gould's Petrel's are prone to disturbance. Unsupervised public access, particularly to breeding areas pose 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 Island and Boondelbah Islands as a noise sensitive area since 1994 and a no fly-zone of 2 nautical miles around and 2000 feet above the Island is in place.

Actions

1. The NPWS will ensure that access to Islands supporting Gould's Petrel shall be permitted only for scientific and conservation purposes. The NPWS will also discourage unsupervised public access.
2. Advisory signs will be installed on Cabbage Tree and Boondelbah Island, at boat ramps at Shoal Bay, Fingal Bay and Tea Gardens and at the Anchorage and D'Albora Marinas (where feasible). The status of the Island as critical habitat, its significance to the Gould's Petrel and the penalties associated with damage to individual Gould's Petrel and its habitat will be included.
3. The Department of Defence will continue to observe the no fly zone over Cabbage Tree and Boondelbah Islands.

Outcomes

- 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;
- Gould's Petrels breeding on Cabbage Tree or Boondelbah Islands will not be exposed to increased risk of predation caused by the noise generated from jet aircraft.

10.5 Critical habitat

In order to declare critical habitat, the TSC Act requires that the Director-General prepare a recommendation report for the consideration of the Minister for the Environment. This report is contained at Appendix 3. This report concludes that critical habitat declaration is a worthwhile and feasible option for Cabbage Tree Island.

Actions

- 1 The NPWS recommend to the Minister for the Environment that critical habitat be declared for Cabbage Tree Island; and
- 2 The NPWS, when reviewing this plan, should consider whether critical habitat should be extended beyond Cabbage Tree Island to other islands in the Broughton Group or to any other area.

Outcome

- The conservation significance of Cabbage Tree Island will be legally recognised through critical habitat declaration.

10.6 Research and monitoring

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 6.

Actions

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 6. Techniques are described in Priddel *et al.* 1995. All birds handled will be banded with incology bands supplied by the Australian Bat and Bird Banding Scheme.

Collection of demographic and life history data is also required to facilitate population modelling and track 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.

3. Dietary and energetic studies are needed to identify marine food resources and the physiological factors that affect the reproductive success of adult petrels. Exploitation of marine resources and the potential introduction of marine organisms and pathogens may detrimentally affect the food resources of the Gould's Petrel. A dramatic reduction in food resources may have dire consequences for the Gould's Petrel. This study will be undertaken by a PhD student working from Wollongong University. The data collected will also provide important information regarding the length of each incubation shift, meal size, feeding frequency, chick growth and the weight changes of adults through the breeding season.

Outcomes

- The success or otherwise of the recovery actions outlined in this plan is known;
- Data is available to inform future management actions.

10.7 Co-ordination of recovery actions

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

1. The NPWS will convene a recovery team at least on a yearly basis. Representatives of a community conservation group, an independent scientific expert and Environment Australia will be invited to be on the recovery team;
2. The NPWS 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.

Outcome

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

11 Implementation schedule

Action	Description	Year of implementation					Source of funding		
		1	2	3	4	5	Total	NPWS	Other
10.1	Management of nesting habitat								
	Suppression of Pisonia and control of Pied Currawongs and Aust. Ravens	6	6,3	6,6	6,9	7,2	33	33	
	Control of other avian predators*	6					6	6	
10.2	Establishment of second colony								
	Translocation of fledglings**	10					10	10	
	Maintenance of nest boxes	3	2,2	2,5	2,7	2,9	13,3	12,3	
10.3	Community education								
	Media visit to island	4,5	3,2	3,5	3,7	3,9	18,8	17,3	
	Distribution of information	.6	.6	.6	.6	.6	3	3	
10.4	Minimising disturbance								
	Advisory signs	-	4,4	-	-	-	4,4	4,4	
10.5	Critical habitat	1,5					1,5	1,5	
10.6	Monitoring and Research								
	Monitoring	27	18,2	18,6	18,8	19	101,6	101,6	
	Research***	29,5	29,5	29,5	-	-	88,5	22,5	66
10.7	Co-ordinate recovery actions	2	2,1	2,2	2,3	2,4	11		
	Total	90,1	66,5	63,5	35	36	291,1	225,1	66

*These funds will be required should predation by owls or goshawks require active control. Contingency funding will be sought should the need arise.

**These funds will only be required should the second transfer of fledglings to Boondelbah Island in March 2000 suffers serious mortalities of chicks. Experience gained from the 1999/99 transfer of chicks suggests that this is an unlikely eventuality.

***Funds have been secured through a SPIRT scholarship to undertake this work

12. Preparation and review details

12.1 Persons responsible for the preparation of the plan

This recovery plan was prepared by Julie Ravallion, Conservation Planning and Programs Division, Central Regional Directorate, based on the work undertaken by David Priddel and Nicholas Carlile, Biodiversity Research and Management Division, Policy and Science Directorate and in consultation with the Gould's Petrel Recovery Team

12.2 Date of last amendment

This recovery plan follows on from the recovery plan prepared by David Priddel and Nicholas Carlile in October 1996.

12.3 Review

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

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Appendices

Appendix 1: Implementation Schedule from the draft Recovery Plan prepared in 1996

Appendix 2: Implementation report for the draft recovery plan prepared in 1996

Appendix 3: Draft critical habitat recommendation report

Appendix 4: Translocation proposal

Appendix 5: Gould's Petrel Species Information Profile

Appendix 6: Survey methods

Appendix 1: Implementation Schedule from the draft Recovery Plan prepared in 1996

Task Description	Priority	Feasibility	Responsible Party	Funding	Cost Estimates (\$000s/year)						
					1997	1998	1999	2000	2001	TOTAL	
1 Management of nesting habitat											
1.1 Control of avian predators	1	100%	NPWS	a	4.4	4.7	5.1	5.4	5.9	25.5	
1.2 Suppression of <i>Pisonia</i>	1	100%	NPWS	a	3.1	3.4	3.8	4.1	4.5	18.9	
1.3 Eradication of rabbits	1	90%	NPWS	a,b	105.2	98.0	75.4	10.0	10.0	298.6	
2 Establishment of a second colony											
2.1 Survey Boondelbah Island	1	100%	NPWS	a,b	7.6	4.2	4.2	2.2	2.2	20.4	
2.2 Augment nesting habitat and translocate fledglings	1	80%	NPWS	a,b		31.0	32.6	33.0		96.6	
2.3 Monitor translocated population	1	100%	NPWS	a				4.3	4.3	8.6	
3 Community education											
3.1 Produce an information brochure	2	100%	NPWS	a		4.6				4.6	
3.2 Collaborate in the production of a film documentary	2	100%	NPWS	a	5.0	5.0				10.0	
3.3 Media publicity	2	100%	NPWS	a	2.5	2.6	2.7	2.8		10.6	
4 Population monitoring											
4.1 Population size and breeding success	1	100%	NPWS/CBOC	a	6.5	6.8	7.2	7.6	8.0	36.1	
4.2 Demography	1	100%	NPWS	a	6.1	6.3	6.5	6.7	6.9	32.5	
5 Further research											
5.1 Dietary studies	3	100%	NPWS	c		28.0	28.5	29.0		85.5	
5.2 Impact of changes in food supply	3	80%	NPWS	c			30.0	32.0	34.0	96.0	

*a: Funded by National Parks and Wildlife Service; b: ESP contribution required; c: sponsorship to be sought

Appendix 2: Implementation report for the 1996 draft recovery plan

Recovery Action Threat Mitigation	Implementation report
Control of avian predators	Avian predators have been culled on the Island on a yearly basis since 1993. Approximately 40 Currawongs were destroyed each season for the first 2 years and 6 birds were destroyed each year thereafter. Approximately 2 Aust. Ravens were destroyed each year since 1993.
Suppression of <i>Pisonia</i>	All adult <i>Pisonia</i> plants were removed from breeding habitat in 1993. Approximately 50 adult plants were removed. Removal of seedlings has occurred on an annual basis since that time
Eradication of rabbits	In 1997, rabbits were eradicated by the combined effects of poisoning (Talon 20p), myxomatosis and the rabbit calicivirus.
Establishment of a second colony	(See also translocation proposal at Appendix 5)
Survey Boondelbah Island	In 1996, Boondelbah Island was surveyed to locate the best sites for the installation of nest boxes. North Ravine was identified as the most suitable location for the installation of nest boxes.
Augment nesting habitat and translocate fledglings	In 1998, 100 nest boxes were installed. In March 1999, 100 chicks were translocated from Cabbage Tree Island to Boondelbah Island. 95% of these chick subsequently fledged and left the Island in April
Community education	
Produce an information brochure	Carried over to this plan
Collaborate in the production of a film documentary	Not achieved
Media publicity	Substantial media interest generated by recovery effort. For example in 1998/99 6 newspaper articles, 6 radio interviews and 1 TV segment covered Gould's Petrel. In addition NPWS researchers presented at 5 seminars about Gould's Petrel.
Population monitoring	
Population size and breeding success	Undertaken annually
Demographic studies	Undertaken annually
Further research	
Dietary studies	Identified in this plan.
Impact of changes in food supply	Identified in this plan

Appendix 3: Draft critical habitat recommendation report

1 Legislative framework

The *Threatened Species Conservation Act* makes provision for the identification and declaration of critical habitat for species, populations and communities listed as endangered on Schedule 1 of the TSC Act.

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

The Director-General of National Parks and Wildlife is responsible for identifying critical habitat and in doing so must prepare a recommendation report for the Minister for the Environment's consideration. Critical habitat is declared by the Minister for the Environment.

Like recovery plans, critical habitat recommendations must be placed on public exhibition and submissions must be invited from the public and then considered in the finalisation of the recommendation report. For Gould's Petrel the exhibition of this recommendation report and the Gould's Petrel Recovery Plan will occur simultaneously.

This recommendation report is concerned with addressing the two statutory requirements of critical habitat identification, namely:

- Feasibility of identifying critical habitat: Section 37(1) defines critical habitat as being the habitat of an endangered species that is critical to the survival of the species (Section 40(1));
- Likely social and economic consequences of declaring critical habitat (Section 40(2))

This report also considers the likely contribution to the conservation of the Gould's Petrel as a consequence of critical habitat declaration. This report should be read in conjunction with the Gould's Petrel Recovery Plan.

2 Identification of critical habitat

In order to identify critical habitat it is necessary that the distribution of a species and the relative significance of habitat are understood with a high degree of confidence. For the Gould's Petrel, Cabbage Tree Island has been established as the major breeding location for the species and it is highly unlikely that any additional breeding areas, above those currently known will be discovered in NSW.

As Gould's Petrels effectively breed at only one locality worldwide it is considered that the maintenance of the breeding habitat on the Cabbage Tree Island is essential to their reproductive success and ultimate survival. A local catastrophe would make this subspecies extremely vulnerable to extinction.

The majority of the breeding habitat for Gould's Petrel is contained within 2 ha on the western side of Cabbage Tree Island (Fullagar, 1976) with additional nests located in areas fringing the gullies or in small rock scree around the periphery of the island (Priddel and Carlile, 1997). These additional nests account for approximately 20% of the total nests (Priddel and Carlile, 1997).

The Gould's Petrel faces the following potential threats: accidental fire, introduction of exotic animals, disturbance from jet aircraft, weed invasion, predation by companion animals, trampling and collection. Declaration of the entire island as critical habitat will provide greater scope for the exclusion of potential threats and the integrated management of this species.

The non-breeding range and feeding areas of the Gould's Petrel are unknown and cannot be identified at this time.

3 Status of habitat on Boondelbah Island

Several adults and nestlings were found in 1996 on nearby Boondelbah Island, a Nature Reserve approximately 1.4 km south of Cabbage Tree Island. This island is also the site of the translocated Gould's Petrel population. Given that the success of the translocation program is not yet known, it is recommended that Boondelbah Island not be identified by this report as critical habitat, but that the NPWS revisit this decision before the Gould's Petrel Recovery Plan is reviewed in 2006.

4 Social and economic consequences of critical habitat declaration

Given that Cabbage Tree Island is a declared Nature Reserve under the National Parks and Wildlife Act 1974, the economic consequences of critical habitat declaration are minor. Costs will be incurred by the NPWS to install appropriate signage etc.

The social consequences of any future declaration should be positive, as the understanding of the public about the natural heritage values of the Island will be improved.

5 Value of declaration to the conservation of the species

To determine whether critical habitat will be a useful conservation option for a species the following potential threatening processes should be apparent:

1. a genuine risk of direct human interference (e.g. trampling, collection, accidental fire, predation by companion animals, introduction of exotic species), which could lead to serious harm to the species and its habitat. In such cases critical habitat declaration provides a clear public statement as to the significance of an area to a species; or
2. a genuine likelihood that poorly conceived and implemented development activities are likely to have a detrimental impact on critical habitat and these impacts can be minimised by appropriate development assessment and control.

With regard to point 1, the risk of direct human interference is real and could be potentially catastrophic for Gould's Petrel. Cabbage Tree Island lies in close proximity to areas of high recreational activity and the accidental release of fire, dog predation, direct damage to habitat and harm to individuals are potential consequences of the presence of humans on the Island.

With regard to point 2, given that the species occurs on land managed for conservation purposes, it is highly unlikely that any development pressures or reserve management practices are likely to adversely affect the species in the future. Cabbage Tree Island does not support any identified public recreation areas, nor is it subject to any hazard reduction or other potentially damaging management program.

It is considered therefore that the conservation of the Gould's Petrel will be enhanced by critical habitat declaration of Cabbage Tree Island. Community education initiatives and *in-situ* interpretative material should be strengthened by such a declaration. Given the importance of maintaining the ecological integrity of the Island, it is considered appropriate to declare the entire Island as critical habitat for this species.

Recommendations

It is recommended that

- the whole of Cabbage Tree Island be identified as critical habitat for the Gould's Petrel. Cabbage Tree Island (32 42 S; 152 14 E) is situated 1.4 km offshore from Port Stephens, New South Wales;
- the NPWS, when reviewing this plan, should consider whether critical habitat should be extended beyond Cabbage Tree Island to other islands in the Broughton Group or to any other area

Appendix 4: Translocation proposal

1. Introduction

The NPWS' draft policy for the translocation of Threatened Fauna in NSW (December 1998) requires that persons undertaking a translocation program prepare a translocation proposal. This document seeks to satisfy that requirement

2. Objectives and justification for the proposal

The objective of the translocation proposal 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 and 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 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 was 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)
- 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

100 number of chicks will be transferred from Cabbage Tree Island to Boondelbah Island over a 2-3 year period commencing 1999. 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 will be diminished in the short term.

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

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

5 Host environment

Boondelbah Island currently supports a small breeding population of Gould's Petrel. The most suitable habitat is located at North Ravine. Nest boxes will need to be installed to provide appropriate nesting habitat. The nest boxes are made from polyethelene 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 will be banded to allow for future assessment regarding site fidelity and future breeding success.

7 Threat abatement

Yearly maintenance of the nest boxes is anticipated. Natural regeneration may block entrance tunnels and may have to be controlled in the future.

8 Resources

NPWS research staff and volunteers will be required to undertake the translocation of chicks, yearly monitoring and maintenance. Financial commitment for the program is outlined in Appendix 4 of the recovery plan.

9 Community Resources

The translocation program offers a opportunity of 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 5: Gould's Petrel Species Information Profile



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 *Endangered Species Protection Act 1992*.

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.

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 *March, 2000*

species, but a few nesting birds have been discovered on nearby Boondelbah Island (Priddel and Carlile 1996). 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.

Adult Gould's Petrel. Photo N. Carlile



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 NSW National Parks and Wildlife Service.

Habitat

Nesting habitat is concentrated in two steep gullies on the western side of the Cabbage Tree Island. The gullies are characterised by steep rock-scrub 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 (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 NSW NPWS. The birdlime tree has been eliminated from the petrel's breeding habitat and avian predators have been controlled.

Recently the NPWS 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 NPWS.

Critical habitat

The Gould's Petrel Recovery Plan recommends that Cabbage Tree Island be declared as critical habitat under the TSC Act. This should occur in 2000.

For further information

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