

# Forbes' parakeet and Chatham Island red-crowned parakeet recovery plan

2001-2011

THREATENED SPECIES RECOVERY PLAN 45

Published by  
Department of Conservation  
P.O. Box 10-420  
Wellington, New Zealand

© June 2001, Department of Conservation

ISSN 1172-6873

ISBN 0-478-22067-7

Cover: Forbes' parakeet. (*Dave Crouchley*)

## CONTENTS

Recovery plans	4
1. Introduction	5
2. Past/present distribution and population numbers	7
3. Cause of decline and present-day threats	8
4. Species ecology and biology	9
5. Past conservation efforts	10
6. Recovery goal	11
7. Options for recovery	12
8. Objectives for term of plan	16
9. Work plan	16
10. Review date	28
11. References	29

# Recovery plans

This is one of a series of recovery plans published by the Department of Conservation. Recovery plans are statements of the Department's intentions for the conservation of particular plants and animals for a defined period. In focusing on goals and objectives for management, recovery plans serve to guide the Department in its allocation of resources, and to promote discussion amongst a wider section of the interested public.

After a technical report which had been refined by scientists and managers both within and outside the Department had been prepared, a draft of this plan was sent to the Chatham Islands Conservation Board for comment. After further refinement, this plan was formally approved by the Wellington Conservator in January 2001. A review of this plan is due after ten years (in 2011), or sooner if new information leads to proposals for a significant change in direction. This plan will remain operative until a reviewed plan is in place.

The Department acknowledges the need to take account of the views of the tangata whenua and the application of their values in the conservation of natural resources. While the expression of these values may vary, the recovery planning process provides opportunities for consultation between the Department and the tangata whenua. Departmental Conservancy Kaupapa Atawhai Managers are available to facilitate this dialogue.

A recovery group consisting of people with knowledge of the Chatham Islands parakeets, and with an interest in their conservation has been established. The purpose of the Chatham Island Parakeet Recovery Group is to review progress in the implementation of this plan, and to recommend to the Department any changes which may be required as management proceeds. Comments and suggestions relating to the conservation of Forbes' parakeet and Chatham Island red-crowned parakeet are welcome and should be directed to the recovery group via the Wellington Conservancy office of the Department.

# 1. Introduction

Forbes' parakeet *Cyanoramphus auriceps forbesi* (sometimes referred to as the Chatham Island yellow-crowned parakeet) is a medium-sized parakeet with a long tail, bright green plumage, and yellow crown with a red frontal band. The similarly sized Chatham Island red-crowned parakeet *Cyanoramphus novaezelandiae chathamensis*, resembles the NZ red-crowned parakeet except for having the sides of the head emerald green and a larger amount of blue on the wings, and it is slightly larger. Both taxa are endemic to the Chatham Islands.

The taxonomic status of Forbes' parakeet has been contentious. Originally described by Rothschild in 1893 as a separate species, it was designated a subspecies of the yellow-crowned parakeet, *C. auriceps* by Oliver (1930). Fleming (1939), Taylor (1976) and Nixon (1982) described Forbes' parakeet's unique body size and plumage features, while Triggs & Daugherty (1996) proposed the restoration of *forbesi* to full species level, based on morphology and genetic analysis. Results from recent research on the phylogeny of the *Cyanoramphus* genus, using mitochondrial DNA techniques, has shown Forbes' parakeet to be highly differentiated from all other New Zealand *Cyanoramphus* taxa (Boon et al. 1999). On the basis of this research it is proposed that Forbes' parakeet be considered a full species endemic to the Chatham Islands.

CI red-crowned parakeet was originally identified by Dieffenbach in 1840, and was described as a distinct race by Oliver (1955). The recent mitochondrial DNA research confirms that CI red-crowned parakeet should be considered a subspecies of *Cyanoramphus novaezelandiae* (Boon et al. 1999).

Forbes' parakeet is one of the rarest of New Zealand's seven *Cyanoramphus* parakeet taxa. The Department of Conservation currently ranks it as Category B, the second highest priority category for conservation management (Molloy & Davis 1994). However, because of the small population size, limited distribution, and upgrade in taxonomic status, the species should be revised to a Category A. Forbes' parakeet is ranked as Endangered by the IUCN Red List Categories (BirdLife 2000).

CI red-crowned parakeet is also one of the rarer forms of New Zealand parakeets. The Department of Conservation ranks this species as Category B, the second highest priority category (Molloy & Davis 1994). The IUCN Red List Categories (IUCN 1994) rank CI red-crowned parakeet as Vulnerable.

This plan sets out the recovery programme for Forbes' parakeet and CI red-crowned parakeet over the next ten years (2001–2011). It is preceded by a draft recovery plan for Forbes' parakeet prepared by Bell (1997).

FORBES' PARAKEET & CHATHAM ISLAND RED-CROWNED PARAKEET

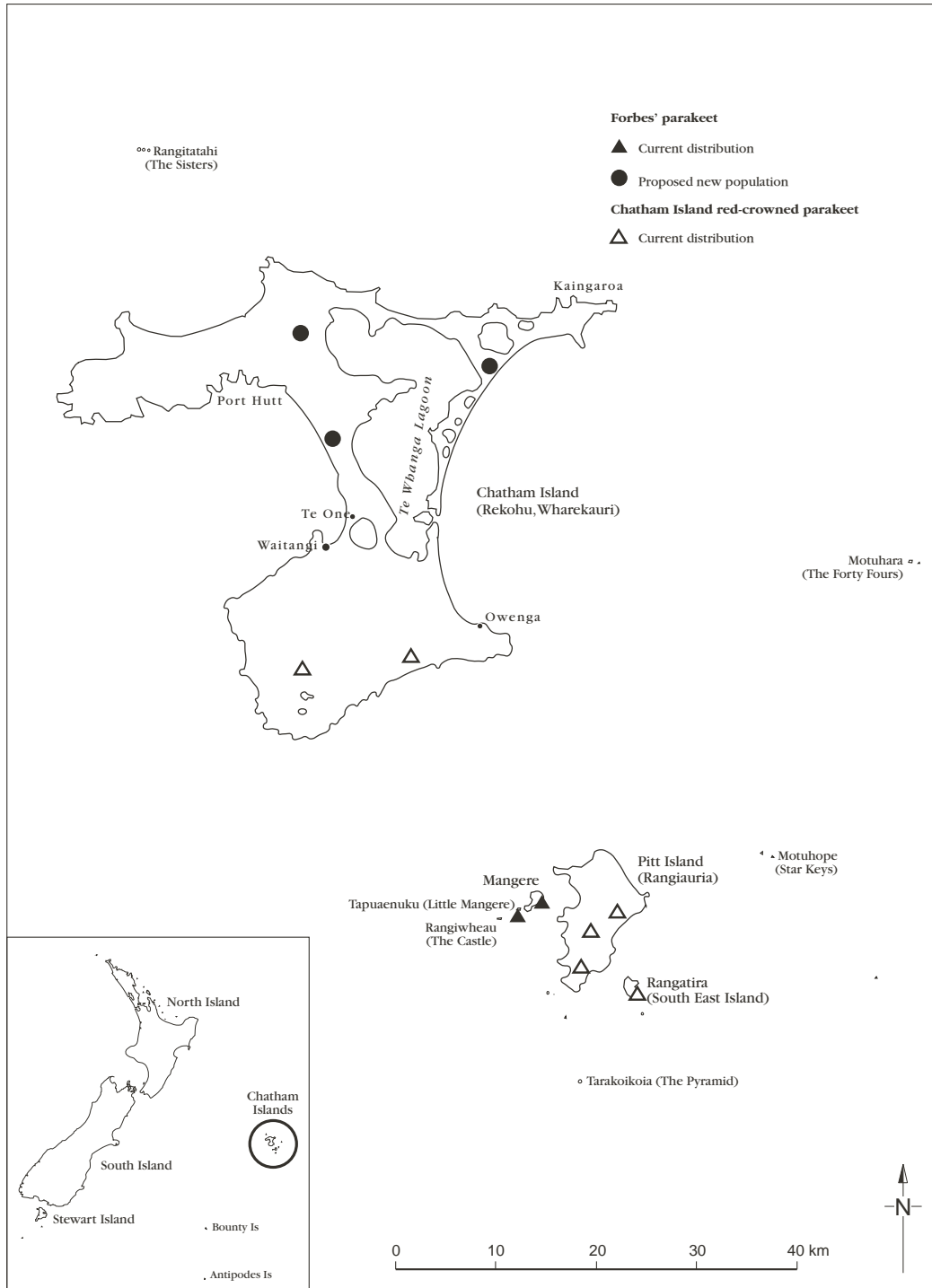


Figure 1. Historic, current, and possible future distribution of Forbes' parakeet and CI red-crowned parakeet.

## 2. Past/present distribution and population numbers

Records of the historic distribution of Forbes' parakeet include Mangere, Tapuaenuku (Little Mangere) and Pitt Islands (Fleming 1939). There are a few records of presumed Forbes' parakeets from Tuku valley in south-west main Chatham Island (Melville 1984; Greene 1989). Forbes' parakeet has never been recorded from Rangatira, where CI red-crowned parakeet have apparently always existed in good numbers.

CI red-crowned parakeets historically co-existed with Forbes' parakeets at these locations (Oliver 1955). Fleming (1939) recorded CI red-crowned parakeet on most islands, but only in good numbers on Rangatira and southern Chatham Island.

Both parakeets disappeared from Mangere after the total clearance of forest and introduction of cats at the beginning of the 20th century. When Fleming visited the Chathams in 1938, Forbes' parakeets were confined to the forested top of Tapuaenuku, with an estimated 100 Forbes' parakeets being present there. Archey & Lindsay (1924) recorded Forbes' parakeet as being absent from Mangere.

As some forest area re-established on Mangere and cats died out, Forbes' parakeets gradually re-colonised from Tapuaenuku, as did larger numbers of CI red-crowned parakeets (Taylor 1976). In 1970, birds bearing hybrid markings were observed by Taylor (1975), this being the first evidence of hybridisation between the two species.

Forbes' parakeets are currently confined to Mangere and Tapuaenuku. In 1968, Merton & Bell (1975) counted 26 Forbes' parakeet on Mangere, but by 1970 that number had declined to 5 birds (Taylor 1985). It was not until 1979-80 that numbers increased to 25-30 birds (Merton & Bell 1975). Forbes' parakeets continued to increase in numbers to a high of 250-300 birds in 1992 (Munn & Page 1992). The population increase since the early 1970s has been attributed to the regeneration of forest habitat and the culling of CI red-crowned parakeets and hybrids on Mangere. However, after 1993, Forbes' parakeet declined once again to 80-120 birds in 1996 (Bell & Tuuta 1996; J. Kearvell pers. comm.). This decline in numbers is thought to be due to the discontinuation of the culling programme between 1993 and 1996. Culling of CI red-crowned parakeet recommenced in 1996/97, and by 1999 the Forbes' parakeet population was estimated to be about 120 birds, although there have been no accurate counts to verify this number. In mid-1999 there were sightings of hybrid parakeets on Pitt Island (S. King pers. comm.).

By 1968, CI red-crowned parakeets were in very low numbers on Chatham Island, and were mainly confined to the southern forests (Merton & Bell 1975). A survey of forest birds on Chatham Island in the late 1980s found CI red-crowned parakeet to be persisting in low numbers in the southern forest areas (Grant 1991). As forest remnants in the northern Chatham Island have regenerated following fencing, CI red-crowned parakeets have been observed

occasionally (M. Bellingham pers. comm.). Today, CI red-crowned parakeets are recovering their population in the Tuku Nature Reserve in southern Chatham Island in response to ongoing possum and cat control. Current numbers of CI red-crowned parakeet in other parts of southern Chatham Island are not known.

Five-minute bird counts undertaken on Pitt Island from 1996 to 1999 found CI red-crowned parakeet to be common to occasional (S. King unpublished data). There was only minor variation in numbers recorded between years. However, the stronghold of CI red-crowned parakeets is Rangatira, which supports a large population. CI red-crowned parakeets would certainly have a large population on Mangere, if they were not removed for conservation of Forbes' parakeet.

### 3. Cause of decline and present-day threats

The destruction of forest habitat has been one of the key causes proposed for the decline of Forbes' parakeet and CI red-crowned parakeet (Taylor 1976, 1985; Nixon 1982). During the early part of the 20th century, much of the forest on Mangere and Pitt Islands was lost due to fire and conversion to farmland. Introduction of domestic stock accelerated the decline of remaining bush remnants. The untouched, but small, forest patch atop Tapuaenuku remained as a habitat refuge for Forbes' parakeet. Nearby Rangatira, from which Forbes' parakeet has never been recorded, but where CI red-crowned parakeet are present, also had much of its forest destroyed in the early part of the 20th century.

Loss of forest habitat is thought to have worked in two ways to cause the decline of Forbes' parakeet. Firstly, there would have been limited habitat area in which Forbes' parakeet could live and breed, and secondly it may have given CI red-crowned parakeet (which can survive better in a modified landscape) a competitive advantage over Forbes' parakeet once stock and introduced predators were removed from Mangere. CI red-crowned parakeet populations rapidly expanded, and at the same time Forbes' parakeet population underwent a decline. This is proposed to have led to hybridisation between the two species, with genetic swamping by the more numerous CI red-crowned parakeet (Taylor 1976, 1985; Nixon 1982).

Cats on Pitt Island, and cats and rats on Chatham Island probably had a role in the decline of both parakeets. Cats would also have had a role in the decline parakeets on Mangere, where cats were once present (Nilsson et al. 1994).

The culling of CI red-crowned parakeet, and CI red-crowned parakeet × Forbes' parakeet hybrids, done for the benefit of the endangered Forbes' parakeet, is the cause of CI red-crowned parakeet decline on Mangere Island (Taylor 1976, 1985; Nixon 1982).

Current threats to both parakeets remain very much the same as those threats in the past. For Forbes' parakeets these are:



- inadequate areas of suitable habitat and/or nesting sites on Mangere;
- the deterioration of the Tapuaenuku forest (from natural causes);
- genetic swamping by CI red-crowned parakeet.

For CI red-crowned parakeets current threats are:

- degradation of forest habitat, particularly on northern Chatham Island and Pitt Island;
- the ongoing deterioration of the Chatham and Pitt Island forests (caused by browsing mammals);
- cat predation on Chatham and Pitt Islands;
- rat predation on Chatham Island;
- culling to protect Forbes' parakeet on Mangere Island.

Potential threats include further habitat loss from accidental fire, and predation from accidental introduction of mammalian predators such as rodents or cats to Mangere or Rangatira. Cats on Pitt Island may prevent Forbes' parakeets from colonising from Mangere, as there have been no reported sightings on Pitt Island this century. However, Forbes' parakeet × CI red-crowned parakeet hybrids have recently been sighted on Pitt Island (S. King pers comm.).

## 4. Species ecology and biology

The ecology and biology of Forbes' parakeets and CI red-crowned parakeets has been studied by Taylor (1976, 1985) and Nixon (1982, 1994).

Taylor (1976, 1985) suggested that Forbes' parakeets prefer dense unbroken forest and scrub, as evidenced by their decline on Mangere when the forest was destroyed, their decline on Tapuaenuku where forest rapidly deteriorated, and by their slow re-colonisation of Mangere Island after the forest began regenerating. Taylor's studies showed that CI red-crowned parakeet used open habitats such as forest margins, scrub and grassland as much as forest habitats.

Taylor (1985) also observed that Forbes' parakeets primarily fed on invertebrates, although leaves, flowers and seeds are also important in their diet. CI red-crowned parakeets fed primarily on leaves and shoots (60%), flowers (19%) and seeds (10%), and less on invertebrates, nectar and fruit (Taylor 1985).

On the other hand, Nixon (1982, 1994) showed that Forbes' parakeets used open habitats such as scrub and grassland as much as forest habitats, and in similar proportions to hybrid and CI red-crowned parakeets. He also found that plant material was important in Forbes' parakeet diet, and that their diet was no different from that of hybrid and CI red-crowned parakeets. Nixon suggested that Forbes' parakeets readily adopted non-forest habitats and foods when faced with a scarcity of their favoured habitat, forests. By sharing habitats and feeding patterns, Forbes' parakeets were brought into closer contact with CI red-crowned parakeet, thus facilitating hybridisation, particularly when Forbes' parakeets were in low numbers compared with CI red-crowned parakeets.

Forbes' parakeets are commonly seen as single birds or in pairs, with flocks rarely seen. It appears that pairs are sedentary and attached to nesting areas throughout the year. There is strong defence of territories. Nests are built in holes in trees. The breeding season is extended, eggs being laid at any time between October and March. Fledged juveniles have been observed until late May (Taylor 1985). Observations of breeding success in artificial nest boxes placed on Mangere over the 1998/99 breeding season showed a low hatch rate (O'Connor & Berry 1999). The reasons for this high failure rate are unclear.

CI red-crowned parakeets nest in holes in trees. The breeding season is extended, eggs being laid at any time between October and December. Clutches range from five to seven eggs (Taylor 1985). There has been no study of the breeding ecology of these two parakeet taxa.

Nixon (1982) defined the characteristic morphological differences between Forbes', CI red-crowned and hybrid parakeets, most notably based on plumage differences on the head. His illustrations of the various head plumage phenotypes of hybrid parakeets show the range from pure Forbes' parakeet to pure CI red-crowned parakeet.

## 5. Past conservation efforts

Conservation efforts to save Forbes' parakeet from complete hybridisation with CI red-crowned parakeet began in 1976 with the start of the project to revegetate forest habitat on Mangere, and to remove hybrids and CI red-crowned parakeets from both Mangere and Tapuaenuku. The culling of CI red-crowned parakeet and hybrids from Mangere was considered essential to ensure the continued survival of a distinct Forbes' parakeet. These actions have obviously had a negative impact on the CI red-crowned parakeet population on Mangere and Tapuaenuku .

Revegetation on Mangere has continued to the present day. Following nearly 20 years of removing hybrid and CI red-crowned parakeets from Mangere, this activity ceased from 1993 to 1996 (Munn & Page 1996). This allowed a build-up in hybrid and CI red-crowned parakeet numbers, but a concerted effort in the last three years has once again reduced their numbers on Mangere (Bell & Tuuta 1996; O'Connor & Berry 1999). In the 1998/99 season, 46 CI red-crowned parakeet and hybrids were culled on Mangere. Over the last decade, nest boxes have been placed in the revegetation plantings and established forest areas. However, except for the 1998/99 season, there has been no concerted effort to monitor the usefulness of nest boxes to Forbes' parakeet.

Limits on visits, mammalian predator and disease quarantine measures, and fire contingency plans for Mangere and Rangatira have been implemented for many years, providing protection for the Forbes' parakeet and CI red-crowned parakeet populations respectively on these islands. Efforts to improve habitat condition on Chatham and Pitt Islands will in the longer term benefit Forbes' parakeet populations by providing suitable habitat for their re-introduction and

will provide additional habitat for the expansion of CI red-crowned parakeet populations. Measures to improve habitat for parakeets have included fencing of bush habitat to exclude stock and the control of predators and competitors such as possums, rodents and cats.

The conservation of Forbes' parakeet and CI red-crowned parakeets is intertwined. Past and future management actions on one species affect the other species. Although Forbes' parakeet is under the most threat of extinction, CI red-crowned parakeet is also vulnerable. It is therefore essential that the recovery of Forbes' parakeet is not done at the expense of the conservation status of CI red-crowned parakeet.

## 6. Recovery goal

Two goals are proposed—a longer-term goal and a shorter-term goal. The short-term goal of ten years is to be achieved by the year 2011, which is when this plan expires.

### LONG-TERM GOAL

Restore sufficient areas of Chatham Islands' forests so that both Forbes' and CI red-crowned parakeet have been re-instated within the forest ecosystems, and that both species have re-established in a number of self-sustaining populations where there is minimal hybridisation.

### TEN-YEAR GOAL

The Forbes' parakeet populations on Mangere and Tapuaenuku are stable or increasing, hybridisation with CI red-crowned parakeet has been substantially reduced, and forest habitat on Mangere has expanded. Progress has been made towards the establishment of a new population of Forbes' parakeet on Chatham Island.

### **THIS WILL CHANGE THE IUCN CONSERVATION RANKING OF FORBES' PARAKEET FROM ENDANGERED TO VULNERABLE.**

CI red-crowned parakeet populations on Rangatira and Pitt Island have been protected, and restoration of habitat on southern Chatham Island has facilitated their expansion on Chatham Island. Any CI red-crowned parakeets on Mangere have been culled to protect Forbes' parakeet.

## 7. Options for recovery

Self-sustaining Chatham Island parakeet populations require the absence or sustained control of rats, cats, possums, and feral and domestic stock. In the short term, these conditions are only available on Mangere, Rangatira, Tapuaenuku, and Tuku Valley on Chatham Island. In the medium term, these conditions should be available at the Ellen Elizabeth Preece Conservation Covenant on Pitt Island, and at one or more sites in northern Chatham Island. Eradication or zero-density sustained control of these pests from all forest areas on the Chathams over 20 hectares in area, and forest restoration, would in the long term provide parakeets with sufficient habitat to secure their survival and reinstate their ecological role within the Chathams forests.

The removal of hybrid and CI red-crowned parakeets from Mangere should ensure that the full genetic diversity of Chathams parakeets is retained, even if unmanaged hybridisation occurs at some sites where the future ranges of both species may overlap, such as on Pitt Island and southern Chatham Island.

The transfer of Forbes' parakeet from Mangere to a secure forest site in northern Chatham Island could provide a separate location to establish a new population. Forbes' parakeet would then be expected to be the dominant parakeet on Mangere, Tapuaenuku, and northern Chatham Island, while CI red-crowned parakeet would be expected to dominate Rangatira, Pitt Island and southern Chatham Island. Removal of CI red-crowned parakeet from the sites inhabited by Forbes' parakeet will need to continue, at least in the medium term, until self-sustaining populations of Forbes' parakeet are established.

Forbes' parakeet have never been recorded on Rangatira, and it seems unlikely that they will establish on Rangatira in the future as long as CI red-crowned parakeets remain the dominant species on Pitt Island. This would result in a pure CI red-crowned parakeet population persisting on Rangatira. However, should Forbes' parakeet reach Rangatira in the future, a revision of the Chatham Island parakeet recovery plans will be required to determine appropriate management actions. The recent sighting of hybrid parakeets on Pitt Island shows that we must remain open to the possibility of Forbes' parakeets or hybrids reaching Rangatira.

In the longer term, it is hoped that both Chatham Islands parakeet species will co-exist, with minimal hybridisation, in the larger forested areas on Pitt Island and southern Chatham Island. This will require the dispersal of Forbes' parakeet from Mangere and northern Chatham Island to these locations. However, if in the future, significant hybridisation does occur on Pitt and southern Chatham Island, then hybrid swarms of parakeets should be accepted at these sites.

Various options could be taken to recover the Forbes' parakeet and CI red-crowned parakeet populations.

## 7.1 OPTION 1

### **No action**

This option is not recommended. If there was no further management effort for Forbes' parakeet, it is almost certain that the species would become lost through complete hybridisation with CI red-crowned parakeet. It is believed that widespread hybridisation between the two Chatham Islands parakeet species is the result of human-induced habitat changes, and as such justifies management intervention to lessen the impact of hybridisation. With only one small population (on two adjacent islands), Forbes' parakeet is exposed constantly to the risk of loss through natural or human-induced disaster.

Management of CI red-crowned parakeet is justified on the grounds of its threatened conservation status. Its total population is relatively small, with the majority of the population found only on one island, Rangatira. This exposes CI red-crowned parakeet constantly to the risk of loss through natural or human-induced disaster.

## 7.2 OPTION 2

### **Provide opportunities for CI red-crowned parakeet to establish, maintain or expand its population on Mangere, Rangatira, Tapueanuku, Pitt and Chatham Islands**

This option is not recommended in the short to medium term. Habitats free from, or with low numbers of CI red-crowned parakeet are scarce, and such sites are required for Forbes' parakeet. Instead, it is recommended that the various islands in the Chatham group are selected to manage one or other parakeet species, but not both in the same habitat. For the foreseeable future, Mangere Island will need to be kept relatively free of CI red-crowned parakeets.

## 7.3 OPTION 3 (PREFERRED OPTION)

### **Cull hybrid and CI red-crowned parakeets from Mangere, and continue revegetation of forest on Mangere to provide further habitat for Forbes' parakeet**

This option is recommended in conjunction with Option 5. The key management action will be to cull hybrid and CI red-crowned parakeets from Mangere. The programme to restore forest to Mangere by undertaking revegetation will also need to continue. This should expand habitat available to Forbes' parakeet and allow for an increase in its population size. There will continue to be interchange between the Mangere and Tapuaenuku Forbes' parakeet sub-populations. Research on Forbes' parakeet ecology, biology and genetics is required to guide management actions. This option allows for the survival of Forbes' parakeet, although it remains at some risk of extinction, as there remains effectively only one population.

#### 7.4 OPTION 4

##### **Re-introduce Forbes' parakeet to Rangatira, Pitt Island, or Tuku Valley in southern Chatham Island once sufficient habitat has been restored**

This option is not recommended in the short term. Although suitable parakeet habitat occurs on Rangatira, it is assumed that Forbes' parakeet will not need Rangatira for its recovery. It has never been recorded there, and this is the key habitat for CI red-crowned parakeet. Currently, CI red-crowned parakeets are present in low numbers on Pitt Island, but as work is undertaken to improve habitat there, parakeets of both species are expected to re-colonise Pitt from Mangere and Rangatira. Forbes' parakeets are unlikely to establish on Pitt Island unless there is active predator and browser control. There is a high risk of hybridisation occurring between parakeets on Pitt Island, which may put greater pressure on the Forbes' parakeet population on Mangere as they move between the two islands. It is proposed to leave the situation on Pitt Island to develop and reassess at a later date what actions, if any, should be taken. There is a relatively extensive area of mature forest in Tuku Valley, and with a programme of intensive predator and browser control, this area may provide suitable Forbes' parakeet habitat. However, the presence of CI red-crowned parakeet there means that there is the risk of hybridisation occurring between the two parakeet species. Also, southern Chatham Island provides habitat for a self-sustaining CI red-crowned parakeet population, itself a threatened species.

#### 7.5 OPTION 5 (PREFERRED OPTION)

##### **Re-introduce Forbes' parakeet to sites in northern Chatham Island once sufficient habitat has been restored**

This option is recommended in conjunction with Option 2. The establishment of new population(s) of Forbes' parakeet on Chatham Island will eventually reduce the IUCN status of the species from Endangered to Vulnerable (IUCN 1994). This option requires the selection of one or more sites on Chatham Island where the threats to Forbes' parakeet can be removed or mitigated, and the transfer of birds from Mangere. There is a risk that Forbes' parakeet will not remain within their new habitats despite the low or zero density of predators, as the habitats would be small in size. Careful attention is required to provide habitat that will support Forbes' parakeets. If dispersal of Forbes' parakeets from their safe release sites does occur, continuation of this option will be reassessed at the time. Reduction or elimination of predators from various forest patches in northern Chatham Island is likely to take a number of years to achieve, but significant progress may be made towards preparing sites for Forbes' parakeet re-introduction within the time span of this recovery plan.

Time is also needed to increase Forbes' parakeet numbers on Mangere so that birds can be removed for release at new sites without jeopardising the Mangere population. Forbes' parakeet survival will continue to be safeguarded by protection and restoration of Mangere, and the removal of hybrids and CI red-

crowned parakeet. However, Forbes' parakeet conservation status will not improve without the establishment of new populations.

## 7.6 OPTION 6 (PREFERRED OPTION)

### **Protect the CI red-crown population on Rangatira, and restore forest habitat in southern Chatham Island and Pitt Island so that CI red-crowned parakeet populations can expand at these sites**

This option is recommended for the recovery of CI red-crowned parakeet. Rangatira is the stronghold of this species, and the population there must be protected. The southern Chatham Island and Pitt Island forests already have low numbers of CI red-crown parakeet from which large populations could establish. Programmes of intensive predator and browser control could create viable populations of CI red-crowned parakeets at both these sites.

Forbes' parakeet have been seen in the Tuku Nature Reserve from time to time (Melville 1984, Greene 1989), and hybridisation between Forbes' parakeet and CI red-crown parakeet may in future occur here and on Pitt Island. It is proposed to leave the situation at these sites to develop and to re-assess at a later date what actions, if any, should be taken.

It is assumed that Forbes' parakeet will not need Rangatira for its recovery. It has never been recorded on Rangatira, and this is the key habitat for CI red-crowned parakeet. Mangere is critical for the survival of Forbes' parakeet, and any CI red-crowned parakeet that colonise Mangere will potentially threaten the survival of Forbes' parakeet.

## 7.7 OPTION 7

### **Establish Forbes' parakeet and/or CI red-crowned parakeet populations in captivity**

This option is not recommended unless either parakeet is under immediate threat of extinction. This could occur if predators were to invade Mangere or Rangatira. However, captive breeding may be required for research on hybridisation between Chatham Island parakeets, or to produce sufficient Forbes' parakeets for release at new sites. In the past, Forbes' parakeets have been kept in captivity, where they bred successfully (Taylor 1985). CI red-crowned parakeet have not been kept in captivity, but there is considerable expertise in holding and breeding parakeets in captivity in New Zealand.

## 8. Objectives for term of plan

The objectives for Forbes' parakeet recovery for the term of this plan are:

1. Seek recognition of Forbes' parakeet as a distinct species and reassessment of its priority for conservation.
2. Research aspects of Forbes' parakeet ecology, biology and genetics and their interactions with CI red-crowned parakeets.
3. Protect and enhance the Forbes' parakeet population on Mangere and Tapuaenuku.
4. Restore areas of forest habitat on Mangere.
5. Protect CI red-crowned parakeet populations on Rangatira, Pitt Island, and Chatham Island.
6. Select and prepare a site for the establishment of a second Forbes' parakeet population on Chatham Island.
7. Protect areas of forest habitat in southern Chatham Island for the benefit of CI red-crowned parakeet.

## 9. Work plan

Specific tasks required to achieve each objective, and performance measures to assess success in meeting objectives are set out below.

### OBJECTIVE 1. SEEK RECOGNITION OF FORBES' PARAKEET AS A DISTINCT SPECIES AND REASSESSMENT OF ITS PRIORITY FOR CONSERVATION

#### **Performance measures**

New information on the distinctiveness of Forbes' parakeets and recommendation that it be recognised as a separate species provided to group re-assessing priority rankings for conservation management by the Department of Conservation.

#### ***Explanation***

Recent research shows that Forbes' parakeet is a highly distinct species. Elevation from a subspecies to a species status gives Forbes' parakeet Endangered conservation status. With a change in taxonomic status and new information regarding current population size, the priority ranking of Forbes' parakeets for conservation management by the Department of Conservation should also be reassessed.



## **Actions required**

### **Action 1.1 Recommend reassessment of the priority ranking given by DOC to Forbes' parakeet, based on new information on taxonomic distinctiveness and population status**

#### ***Explanation***

A workshop convened by Wellington Conservancy in March 1999 provided an opportunity to discuss the implications of the research on parakeet genetics undertaken by W. M. Boon (Anon. 1999). Publications on this work by Boon and co-workers will provide the opportunity to formally elevate the Forbes' parakeet taxonomic status. A request should be made to the Biodiversity Recovery Unit, Department of Conservation, to review the conservation priority given to Forbes' parakeet.

#### ***Priority***

High

#### ***Responsibility***

Wellington Conservancy

## **OBJECTIVE 2. RESEARCH ASPECTS OF FORBES' PARAKEET ECOLOGY, BIOLOGY AND GENETICS AND THEIR INTERACTION WITH CI RED-CROWNED PARAKEETS**

### **Performance measures**

- (1) A comprehensive study of Forbes' breeding biology on Mangere completed by 2003.
- (2) Research programme establishing the phenotypic and genotypic relationship within the Forbes' parakeet population completed by 2003.
- (3) Selected data, to be determined by the research programme, collected from all parakeets culled on Mangere and analysed each year.

#### ***Explanation***

Research undertaken in the 1970s and 1980s by R. Taylor and A. Nixon has provided most of the information on Forbes' parakeet ecology and biology. Nixon's research on both of the Chatham Islands parakeets provides comprehensive data on their diet and feeding behaviour. A research programme on Forbes' parakeet biology and ecology has been initiated to ensure management actions are directed in the optimum areas for Forbes' parakeet recovery. The research will also provide an opportunity to study CI red-crowned parakeets. Management of the hybrid problem requires an understanding of the biology and ecology of both species, including population dynamics, mate selection and fecundity of the two species and their hybrids.

## **Actions required**

### **Action 2.1 Conduct research into aspects of Forbes' parakeet breeding biology, ecology, and interactions with CI red-crowned and hybrid parakeets on Mangere**

#### ***Explanation***

A three-year field research programme on Forbes' parakeet has been initiated to investigate whether mating is assortative or random, nest site preferences, productivity of differing phenotype pairings, population ecology, productivity, survivorship, and dispersal. Use of artificial nest sites by parakeets will also be investigated. The programme includes research on the interactions between Forbes', CI red-crowned and hybrid parakeets and should answer questions about the directionality of the hybridisation process. Population dynamics including productivity, survivorship and population numbers will be investigated. This will require banding of birds so they can be individually identified. The research results will be vital for directing future management of the Chatham Island parakeet species, including the transfer and establishment of Forbes' parakeet at new locations. Aspects of CI red-crowned parakeet biology and ecology on Rangatira could be included in this research programme, for comparison with Forbes' parakeet, but they are of lower priority.

#### ***Priority***

High

#### ***Responsibility***

Wellington Conservancy

Chatham Island Area Office

### **Action 2.2 Conduct research on the genetics of Chatham Islands parakeets**

#### ***Explanation***

A PhD study linking parakeet phenotype (appearance) and genotype (based in microsatellite DNA variation) commenced in 1999/2000. The main purpose of the research is to determine levels of hybridisation within the Forbes' parakeet population and to establish whether phenotype reflects genotype, i.e. whether the genetic make-up of a hybrid parakeet is evident from its appearance. Identification of the Forbes' genotype may then be distinguishable in the field, either by some morphological characteristics or a simple genetic test. Further work on DNA should confirm the genetic distinctiveness of Forbes' parakeet. Details on genetic research proposed for the Chatham Islands parakeets are included in the minutes of the Chatham Islands parakeet workshop held in March 1999 (Department of Conservation 1999) and in Miskelly (1999).

#### ***Priority***

High

***Responsibility***

Wellington Conservancy

Victoria University

Chatham Island Area Office

**Action 2.3 Collect and analyse data from all parakeets culled on Mangere**

***Explanation***

The culling of hybrid and CI red-crowned parakeets on Mangere has been suspended for the duration of the current research programme. The results of the research will help determine the requirements for future culls and the information that should be collected from any parakeets that are culled. Information on numbers culled and appropriate morphological and ecological data will be collected and analysed every year to guide future culls. Biological and ecological data on hybrid parakeets can be obtained from this information.

***Priority***

High

***Responsibility***

Chatham Island Area Office

Wellington Conservancy

**OBJECTIVE 3. PROTECT AND ENHANCE THE FORBES' PARAKEET POPULATION ON MANGERE AND TAPUAENUKU**

**Performance measures**

- (1) The Forbes' parakeet population on Mangere and Tapuaenuku is increasing in size above the current population level over the term of the plan.
- (2) CI red-crowned and hybrid parakeet populations on Mangere are controlled to the level recommended by research findings.
- (3) Programme for monitoring the Forbes' parakeet population on Mangere is developed by 2002 and implemented annually.

***Explanation***

Protection of the Forbes' parakeet population on Mangere and Tapuaenuku is essential for the species' survival. An increase in the Forbes' parakeet population on Mangere would give this population greater security. Ongoing monitoring of the parakeet population on Mangere and Tapuaenuku will be required to ensure that the objective is being met. This objective will enhance the recovery of Forbes' parakeets, but will have a negative impact on CI red-crowned parakeets on Mangere. Management will be required at other locations to ensure that the CI red-crowned parakeet population is protected (covered in Objectives 5 and 7). The need to cull CI red-crowned parakeet on Mangere will

continue to be reassessed as the Forbes' parakeet population increases in size and additional populations are established within the Chatham Islands.

### **Actions required**

#### **Action 3.1 Implement quarantine measures and restrict visitors to Mangere**

##### ***Explanation***

With the total Forbes' parakeet populations being found on only two small islands, it is essential that they are protected from a range of risks. The arrival of introduced predators (rodents and cats) and of alien diseases must be prevented. The risk of habitat loss or deterioration due to human disturbance, the introduction of invasive plant species, disease or fire must also be mitigated. Quarantine measures have been in place on Mangere for many years; new people visiting the island need to be made aware of these measures, and there should be regular audits to ensure they are being followed vigilantly. Mangere is a Nature Reserve, and all entry is by permit only. It is a fragile island and easily damaged by people. Currently, numbers of people permitted entry are restricted and this needs to continue. Prevention of illegal entry needs to be rigorously enforced.

##### ***Priority***

Essential

##### ***Responsibility***

Chatham Island Area Office

#### **Action 3.2 Monitor the Forbes' parakeet population**

##### ***Explanation***

A programme for monitoring the Forbes' parakeet population on Mangere will be developed in conjunction with the current research programme. This monitoring will need to be continued annually, after completion of the research programme, to determine the status of the Forbes' parakeet population and whether the goals of the plan are being met. Genetic monitoring may also be required to identify Forbes' parakeet genotype in relation to various hybrid phenotypes. Current research should clarify whether identification of a pure Forbes' parakeet is accurate if based solely on morphological characteristics. Also, knowing whether a hybrid is an F1 cross or contains a greater proportion of Forbes' parakeet genes may become important if pure Forbes' parakeets become very low in numbers and Forbes'-type hybrids are required for the Forbes' parakeet recovery programme. Monitoring information will be used to guide the culling programme. A system is required to record parakeet sightings on Pitt or Chatham Island and a programme to monitor Forbes' parakeet on Tapuaenuku should be discussed with the island's owners.

##### ***Priority***

Essential

***Responsibility***

Chatham Island Area Office

Wellington Conservancy

**Action 3.3 Undertake culls of CI red-crowned and hybrid parakeets on Mangere, as required to protect the Forbes' parakeet population**

***Explanation***

Removal of CI red-crowned parakeets and hybrid parakeets from Mangere has been achieved by sporadic culls, using Nixon's 1984 paper as a guide to recognise hybrid birds. A protocol is required to ensure hybrid birds are being correctly identified and to decide when to intervene to cull hybrids. All culling has been suspended for the duration of the research programme. The Recovery Group will review this decision if it is shown that Forbes' parakeets are rapidly declining, and culling may be resumed. Once the research has been completed, the results will be used to review the culling programme and to develop protocols for implementing future culls.

***Priority***

High

***Responsibility***

Chatham Island Area Office

**Action 3.4 Install nest boxes on Mangere for Forbes' parakeet**

***Explanation***

Installation of nest boxes on Mangere should provide a surplus of available nest sites to encourage Forbes' parakeet population growth. Availability of nest cavities may be limited in the forest on Mangere. Care will be needed to prevent the nest boxes facilitating starling breeding and population increase on Mangere. The low hatching rate of Forbes' parakeet in 1998/99 may indicate inadequacies in nest box design or disturbance of birds by people approaching nest boxes for monitoring checks. A protocol is required on nest box design, site placement and monitoring checks.

***Priority***

High

***Responsibility***

Chatham Island Area Office

## OBJECTIVE 4. RESTORE AREAS OF FOREST HABITAT ON MANGERE

### **Performance measures**

- (1) Planting of native species undertaken on Mangere, to at least the current level each year, using best practice to ensure a minimum survival rate of 70%.
- (2) Changes in forest boundaries recorded, and forest structure and composition measured in selected plots, at five-yearly intervals.

### ***Explanation***

The forest habitat on Mangere is small in area, and its expansion is necessary for the Forbes' parakeet population to expand. Natural regeneration and revegetation plantings of further forest habitat will provide for the expansion of the Forbes' parakeet population. Many other threatened Chatham Island bird species will benefit from revegetation of Mangere.

### **Actions required**

#### **Action 4.1 Implement revegetation programme on Mangere each year**

##### ***Explanation***

The creation of further forest habitat on Mangere will provide Forbes' parakeet with an opportunity to expand their population. A programme of planting native species to restore forest habitat began in the 1970s, and continues today. Around 7000 plants have been planted each year from 1995 to 1999. Planting should continue at at least the current rate, with increased numbers of trees planted if possible. Plantings will create a native cover to facilitate natural forest regeneration. The more sensitive species can now be planted in the recently tracked dense flax areas of Douglas Basin. The harsh environment on Mangere means plantings require considerable maintenance to improve plant survival. The benefits of planting particular plant species for Forbes' parakeet need to be investigated and incorporated into the planting programme.

##### ***Priority***

High

##### ***Responsibility***

Chatham Island Area Office

#### **Action 4.2 Monitor survival rate of plantings using the results to alter revegetation methods as appropriate**

##### ***Explanation***

The harsh climatic conditions on Mangere reduce survival rates and growth rates of plantings. From monitoring of survival rates, and the conditions where plants establish and grow best, planting techniques can be altered to achieve a greater success. Small-scale experimentation with different planting and maintenance techniques should be undertaken to find the most successful approach.

***Priority***

High

***Responsibility***

Chatham Island Area Office

**Action 4.3 Monitor replacement and expansion of forest habitat on Mangere**

***Explanation***

A five-yearly comparison of photopoints and/or aerial photos should be used to monitor forest expansion. Photos should be taken in 2000 and again in 2005. Plots representative of the forest type on Mangere should be established to measure the cover percentage, height and trunk dimensions of all plants growing within the plot. This will provide information on forest replacement, and the vegetation composition and structure. In the long term, regeneration of forest on Mangere will provide a greater habitat area for a larger Forbes' parakeet population. A larger Forbes' parakeet population may place it in a better position to withstand hybridisation with CI red-crowned parakeet.

***Priority***

Moderate

***Responsibility***

Chatham Island Area Office

**OBJECTIVE 5. PROTECT CI RED-CROWNED PARAKEET POPULATIONS ON RANGATIRA, PITT ISLAND AND CHATHAM ISLAND**

**Performance measures**

The CI red-crowned population does not decline in size or range, over the term of the plan.

***Explanation***

Protection of the CI red-crowned parakeet population on Rangatira at their current population level is the minimum requirement to protect it from extinction. Protecting CI red-crowned parakeet on Pitt and Chatham Islands extends the distribution of the species and meets the five-year goal of this plan. Monitoring of the CI red-crowned parakeet populations will need to be carried out to ensure that this objective is being met.

## **Actions required**

### **Action 5.1 Implement quarantine measures and restrict visitors to Rangatira**

#### ***Explanation***

With most of the CI red-crowned parakeet population being found on Rangatira it is essential that it is protected from a range of risks. The arrival of introduced predators (rodents and cats) and of alien diseases must be prevented. The risk of habitat loss or deterioration due to human disturbance, the introduction of invasive plant species, disease or fire must also be mitigated. Quarantine measures have in been place for many years; new people visiting the island need to be made aware of these measures, and there should be regular audits to ensure they are being followed vigilantly. Rangatira is a Nature Reserve and all entry is by permit only. It is a fragile island and is easily damaged by people. Currently, numbers of people permitted entry is restricted and this needs to continue. Rats and possums are currently not present on Pitt Island, and quarantine measures being implemented in co-operation with the Pitt Island community need to continue to ensure these pests do not arrive.

#### ***Priority***

Essential

#### ***Responsibility***

Chatham Island Area Office

### **Action 5.2 Control cats and weka in selected areas on Pitt and Chatham Islands**

#### ***Explanation***

Predator control programmes in forest habitats on Chatham and Pitt Islands will usually be undertaken as part of recovery programmes for more endangered species. However, whenever possible, these programmes will be designed to also benefit CI red-crowned parakeets. Cat and weka numbers are currently controlled to low densities in the Ellen Elizabeth Conservation Covenant on Pitt Island, and a predator enclosure for black robin is being constructed at this site which will provide further protection for forest species. Predator control is needed in other protected areas on Pitt Island, particularly Waipaua, for the benefit of a range of forest birds. The reduction in cat and weka numbers around the taiko breeding areas in southern Chatham Island for the benefit of taiko and parea also benefits CI red-crowned parakeets. As resources permit, predator control measures will be extended to other sites on Chatham Island. An assessment of sites should first be undertaken to determine where the maximum benefits could be achieved for a suite of species.

#### ***Priority***

Moderate

#### ***Responsibility***

Chatham Island Area Office



**Action 5.3 Monitor population trends and habitat range of CI red-crowned parakeet**

***Explanation***

A programme to monitor CI red-crowned parakeet population trends and their distribution on the Chatham Islands needs to be developed and implemented. The CI red-crowned parakeet population on Pitt Island is currently being monitored as part of a programme of twice yearly five-minute bird counts. On Chatham Island it is proposed to establish a programme of monitoring all forest bird species. CI red-crowned parakeet would be included in these counts.

***Priority***

Lower

***Responsibility***

Chatham Island Area Office

**OBJECTIVE 6. SELECT AND PREPARE SITE FOR THE ESTABLISHMENT OF A SECOND FORBES' PARAKEET POPULATION ON CHATHAM ISLAND**

**Performance measures**

(1) A list of potential sites for release of Forbes' parakeets prepared by 2005, which includes an assessment of management requirements at each site to enable parakeets to establish.

(2) A programme to reduce or exclude predators from a site identified for the release of Forbes' parakeet initiated during the term of the plan, subject to funding.

***Explanation***

Locations in northern Chatham Island may be suitable, with the appropriate management, for Forbes' parakeet. Release of Forbes' parakeets into further secure sites will improve its conservation status. Having two or more Forbes' parakeet populations would spread the risk of loss of the species through unplanned events, such as predator or disease invasion, or habitat loss from fire. Preparation of a site such as the provision of nest boxes if the forest is not sufficiently mature and the reduction of predator numbers to zero density will be needed prior to any releases. Before Forbes' parakeet can be considered for release into a new site, a greater understanding of its biology, ecology and population dynamics is needed. There also need to be sufficient Forbes' parakeets on Mangere for transfers to occur without jeopardising the Mangere population.

## **Actions required**

### **Action 6.1 Develop criteria, and select sites suitable for a new Forbes' parakeet population**

#### ***Explanation***

Criteria to select sites suitable for the establishment of new Forbes' parakeet population(s) will need to cover parameters such as habitat type and quality, predator status and ability to control predators, the ability to exclude domestic and feral stock, pigs and possums, availability of preferred food items, availability of nest holes or ability to maintain nest boxes, and isolation from CI red-crowned parakeet populations. Forest patches in northern Chatham Island are proposed as the most likely candidates, although exclusion of predators will be required, as well as intensive management to maintain the newly established Forbes' parakeet population while it is small. The northern Chatham Island forest patches contain relatively diverse vegetation types, dominated by broad-leaf species.

#### ***Priority***

High

#### ***Responsibility***

Wellington Conservancy

Chatham Island Area Office

### **Action 6.2 Create a predator-free habitat enclosure or zero-density predator habitat at site(s) selected for future releases of Forbes' parakeet**

#### ***Explanation***

An intensive predator control programme will be essential to maintain Forbes' parakeet on Chatham Island in view of the presence of cats, weka, rodents and possums. Also, exclusion of domestic and feral stock and pigs will be necessary. One means to control predators could be the creation of forest habitat enclosures by building predator-proof fences such as that proposed for black robin on Pitt Island. This fence design could be applied to the creation of a predator-free area for Forbes' parakeet, although intensive trapping and poisoning of predators to zero density may achieve similar result. Rodents may have to be controlled by poisoning in either situation. Such an enclosure could also benefit other threatened Chatham Islands forest birds such as black robin, Chatham Island tui, Chatham Island snipe, and Chatham Island tomtit, and threatened plants.

#### ***Priority***

High

#### ***Responsibility***

Wellington Conservancy

Chatham Island Area Office

**Action 6.3 Translocate Forbes' parakeet and monitor their establishment**

***Explanation***

The transfer of Forbes' parakeet to a new site in northern Chatham Island is unlikely to occur within the ten-year life of this plan. However, planning for their release can proceed within the next ten years and should include development of a transfer proposal. A protocol is also required for monitoring Forbes' parakeet after its release. There is a possibility that Forbes' parakeet will disperse from predator-free release sites in northern Chatham Island because of the inadequate area of forest habitat. In situ captive breeding of Forbes' parakeets at proposed release sites may be necessary to reduce dispersal of released birds.

***Priority***

Lower

***Responsibility***

Chatham Island Area Office

Wellington Conservancy

**OBJECTIVE 7. PROTECT AREAS OF FOREST HABITAT IN SOUTHERN CHATHAM ISLAND FOR THE BENEFIT OF CI RED-CROWNED PARAKEET**

**Performance measures**

(1) Reduction of stock to zero densities in protected areas identified as priorities for forest birds in southern Chatham Island, subject to funding.

(2) Reduction in possum densities to a catch rate of 1 possum or less per 100 trap nights in selected areas on Chatham Island, subject to funding (this rate may be increased if it is shown that forest bird populations are stable or increasing in the presence of higher possum densities).

***Explanation***

The long-term goal of this plan is to reinstate Chathams parakeets to the Chathams forest ecosystems. To work towards this goal, improvements will need to be made to the area of protected forest and to the quality of the forest on Chatham Island, including a greater area of mature phase forest and of zero-density predator numbers.

**Actions required**

**Action 7.1 Control introduced browsers in protected areas in southern Chatham Island**

***Explanation***

Introduced browsers are major threats to forest regeneration on Chatham Island. Browsers cause changes in forest composition, and by browsing the

understorey, increase wind damage to regeneration and canopy health. The programmes to reduce domestic and feral stock, including pigs within Chatham reserves needs to continue, with the long-term aim of achieving zero density of stock, and densities of pigs where forest regeneration is not being adversely affected. Regular inspections and maintenance of fences to ensure they are in good condition should ensure domestic stock is excluded. Possums also threaten forest regeneration and cause canopy deterioration, as well as being a potential predator of parakeets. Control of possums around the taiko breeding areas in southern Chatham Island has led to improvements in forest health, and anecdotal evidence suggests that parakeet numbers have increased in this area. When setting priorities for possum control on Chatham Island, consideration needs to be given to determining which areas will provide the greatest benefits to a range of forest species.

***Priority***

Moderate

***Responsibility***

Chatham Island Area Office

**Action 7.2 Promote the protection of forest habitat on private land**

***Explanation***

Significant areas of forest habitat on Chatham Island are in private ownership. Protecting these forest areas, as well as forest reserves, would enhance the conservation of CI red-crowned parakeet. Fencing domestic stock out of these areas is urgent to prevent further deterioration of the forest. Reduction of possum, pig and feral stock densities is also needed. Covenants would provide long-term legal protection to these private forest habitats, and negotiations to secure private forest areas as covenants will need to continue. Resources need to be made available to assist landowners to carry out some of this protection work themselves. Initiatives to protect forest areas will be undertaken to benefit a wide range of forest species, and a land protection strategy is planned to prioritise work in this area.

***Priority***

Lower

***Responsibility***

Chatham Island Area Office

## 10. Review date

This plan will be reviewed after ten years, or sooner if new information leads to proposals for a significant change in direction. The plan will remain operative until a reviewed plan is in place. The date that is proposed for review of this recovery plan is **July 2011**.

# 11. References

- Archey, G.; Lindsay, C. 1924: Notes on the birds of the Chatham Islands. *Records of the Canterbury Museum* 2: 185–201.
- Bell, M. 1997: Forbes' parakeet recovery plan 1997–2006. Unpublished report, Department of Conservation, Chatham Islands.
- Bell, M.; Tuuta, A. 1996: Report on Forbes' parakeet on Mangere – 1995/96 season. Unpublished report, Department of Conservation, Chatham Islands.
- BirdLife International. 2000: *Threatened Birds of the World: The official source for birds on the IUCN Red List*. Lynx Edicions, Barcelona, and BirdLife International, Cambridge, UK.
- Boon, W.-M.; Chambers, G.K.; Daugherty, C.H. 1999. Genetic analysis of Forbes' parakeet (*Cyanoramphus forbesi*). *Conservation Advisory Science Notes* 262.
- Department of Conservation. 1999: Genetics, hybridisation and management of Chatham Island parakeets. Minutes of workshop held in Wellington, March 1999. Unpublished report, Department of Conservation, Wellington.
- Fleming, C.A. 1939: Birds of the Chatham Islands. *Emu* 38: 380–413, 492–509.
- Grant, A.D. 1991: Chatham Islands bird survey. Unpublished report, Department of Conservation, Christchurch.
- Greene, T. 1989: Forbes' parakeet on Chatham Island. *Notornis* 36: 326–327.
- IUCN Species Survival Commission. 1994: *IUCN Red List Categories*. IUCN, Gland, Switzerland.
- Melville, D. 1984: A yellow-crowned parakeet on Chatham Island. *Notornis* 31: 91.
- Merton, D.V.; Bell, B.D. 1975: Endemic birds of the Chatham Islands. Unpublished report, New Zealand Wildlife Service, Department of Internal Affairs, Wellington.
- Miskelly, C. 1999: Captive rearing Chatham Island parakeets to match genotypes and phenotypes versus an integrated field and laboratory research programme. Unpublished report, Department of Conservation, Wellington.
- Molloy, J.; Davis, A. 1994: *Setting priorities for the conservation of New Zealand's threatened plants and animals*. (2nd edn) Department of Conservation, Wellington.
- Munn, A.; Page, R. 1992: Report on Forbes' parakeet on Mangere --1991/92 season. Unpublished report, Department of Conservation, Chatham Islands.
- Nilsson, R.; Kennedy, E.; West, G. 1994: Birdlife of South East Island (Rangatira), Chatham Islands, New Zealand. *Notornis* 41 (supplement): 109–126.
- Nixon, A.J. 1982: Aspects of the ecology and morphology of the *Cyanoramphus* parakeets and hybrids from Mangere, Chatham Islands. MSc thesis, Zoology Department, Victoria University of Wellington.
- Nixon, A.J. 1994: Feeding ecology of hybridising parakeets on Mangere Island, Chatham Islands. *Notornis* 41 (supplement): 4–18.
- O'Connor, S.; Berry, R. 1999: Chatham Island threatened species programme report: Forbes' parakeet. Unpublished report, Department of Conservation, Chatham Islands.
- Oliver, W.R.B. 1930: *New Zealand birds*. (1st edn) Reed, Wellington.
- Oliver, W.R.B. 1955: *New Zealand birds*. (2nd edn) Reed, Wellington.
- Taylor, R.H. 1975: Some ideas on speciation in New Zealand parakeets. *Notornis* 22: 110–121.
- Taylor, R.H. 1976: Chatham Island parakeets. *Notornis* 23: 198–200.
- Taylor, R.H. 1985: Status, habits and conservation of *Cyanoramphus* parakeets in the New Zealand region. Pp.195–211 in: Moors, P.J. (ed.) *Conservation of island birds*. International Council for Bird Preservation, Cambridge, UK.
- Triggs, S.J.; Daugherty, C.H. 1996: Conservation and genetics of New Zealand parakeets. Pp. 89–101 in: Management of Endangered Species. *International Council for Bird Preservation Bulletin* 6.

