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**The Ecology of the Kakerori (Rarotonga Flycatcher) *Pomarea dimidiata*, With Special Reference to Fledged Young.**

A thesis presented in partial fulfilment of the requirements for the degree of  
Master of Science in Ecology at Massey University.

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**1993**

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## ABSTRACT

The Kakerori (*Pomarea dimidiata*) is a small flycatcher, endemic to Rarotonga in the Cook Islands. In August 1991 the total world population was estimated at 47 individuals, an increase of 14 birds from the previous year. Kakerori live in the forest canopy of small valleys in the steep, mountainous interior.

This study concentrated on the ecology of young birds and factors affecting the breeding success (the number of fledged young produced) of pairs. Young birds remain in the parental territory for up to four months after fledging, where they are commonly found high in the leafy canopy (mean = 25.7m n=36). After parental care has ceased, young birds move to the high, exposed ridges up to 100m from their natal territories (mean = 87m n=14), and remain on average, 2.4m (n=14) from the ground.

Successful Kakerori territories (those that have produced fledged young) have a relatively lowered canopy (10.3m) and few ferns (28.3%), with many juvenile trees (38.3%) and shrubs (33.4%) making up the shrub layer. These juvenile trees may ensure a continued closed canopy. Successful territories also have few, large trees (mean total basal area = 7.39m<sup>2</sup>) and a higher level of moss (16.5%) which may encourage larger populations of insects as well as providing possible nest sites for Kakerori. Unsuccessful territories (those that produced no fledged young) have many, immature trees (mean total basal area = 3.21m<sup>2</sup>) and little moss (8.1%).

In general, insect numbers varied little between successful and unsuccessful territories, however during February 1991 successful territories had a large percentage of flies (40.4% n=23) compared to unsuccessful (8.3% n=2). During February when adults are feeding newly fledged young, a greater availability of insects may positively affect breeding success.

Poison baits for rats have been laid in the study area since 1988 and the number of fledged young found has increased from one in 1987/1988 to 14 in

1990/1991. The most effective method of conserving the Kakerori may be to continue indefinitely the rat-baiting campaign throughout the study area and neighbouring valleys. This would depend entirely on the availability of funds and committed personnel.

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# Chapter 1

## INTRODUCTION

## 1.1 GENERAL BACKGROUND

### 1.1.1 TAXONOMY

Order : Passeriformes  
Sub-Order : Oscines  
Family : Muscicapidae  
Sub-Family : Muscicapinae / Monarchinae  
Genus : *Pomarea*  
Species : *dimidiata*

The Kakerori (Rarotongan flycatcher) *Pomarea dimidiata* is a small oscine passerine belonging to the old world Flycatchers - known as Muscipinae (Holyoak, 1980; Bryan, 1987; Mitchell, 1987), but more recently referred to as Monarchinae by Campbell & Lack (1985), Perrins & Middleton (1985), Pratt, Bruner & Berrett (1987), and Gill (1990).

*Pomarea* flycatchers are found on a number of eastern Polynesian islands, particularly those reaching high altitudes (above 400m). In the Red Data Book of endangered birds, King (1981) describes four species and six sub-species belonging to the genus *Pomarea*, however nine of the ten taxa are listed as extinct, endangered, or rare, including *Pomarea dimidiata* - the Kakerori.

The Tahitian Flycatcher (*Pomarea nigra*) is listed as endangered on Tahiti, while the two sub-species of *P. Nigra* have become extinct: *P. nigra tabensis* from the island of Tongatabu in Tonga, has been extinct since 1773, and *P. n. pomarea* became extinct from Maupiti in French Polynesia in 1823 (King, 1981).

A further three sub-species belonging to *Pomarea mendozae* from the Marquesas Islands in the South Pacific, are extinct or endangered. *P.*

*mendozae motonensis* was common on the island of Mohatani in 1975, but is now extinct. *P. m. nukuhivae* is probably extinct on Nukuhivae, as is *P. m. mira* on Uapou. Of the three remaining taxa, only one - *Pomarea iphis iphis* from the island Uahuka (Marquesas Group) - is still common. *P. i. fluxa* on Eiao (also in the Marquesas Group) has not been recorded since its discovery in 1922. The Large Flycatcher (*P. whitneyi*) is still common on Fatuhiva in the Marquesas which is free of the ship rat (*Rattus rattus*) (King, 1981).

*Pomarea dimidiata* (Kakerori or Rarotongan Flycatcher) is the only flycatcher present in the Cook Islands, on Rarotonga. Unlike some species of *Pomarea* flycatchers, there are no sub-species of *P. dimidiata* - geographically, the nearest related forms are the sub-species of *P. mendozae* in the Marquesas Islands.

### 1.1.2 MORPHOLOGY

Like most flycatchers, the Kakerori is a small, compact bird with a high crown, short round wings, and a tail slightly longer than its wings. Fine legs and beak are also characteristic of this family (Campbell & Lack, 1985; Pratt, Bruner & Berrett, 1985), and Kakerori have pronounced whiskers surrounding the base of the beak. An adult Kakerori stands approximately 10 cm high and weighs from 20 grams (small female) to 25 grams (large male). Beak length also varies dimorphically - approximately 13mm for females and 14mm for males (Robertson & Hay, 1989). The plumage is of two distinct colours - grey and orange. Gill (1885) believed that the grey and orange birds belonged to different species, while Hartlaub and Finch (1871) identified the grey birds as male and orange birds as females and juveniles. In 1983, David Todd found two grey birds feeding an orange chick, and described distinct colour phases for maturing Kakerori - bright orange young and dull grey adults (D. Todd, pers. comm.). This has been supported by annual studies of colour-banded individuals over a six year period (Robertson & Hay, 1989; G. McCormack, pers. comm.). For a week after hatching, the chicks carry pale grey down



Dr. Rod Hay



Plate 1.1 Young male Kakerori (first year) on *Macropiper*.

Dr. Rod Hay



Plate 1.2 Adult female Kakerori on nest in Mato.

which is replaced by burnt orange beginning with the head. Juvenile males and females are orange with dark grey/brown tips to the primary wing feathers and in the tail. This plumage persists through the first year, and in the second year the bill changes from blue/grey above with a pale yellow lower mandible to entirely blue/grey (D. Todd, pers. comm.).

In the third year adult plumage begins to show and these birds are referred to as 'mixed'. There are more dark grey/brown feathers throughout the orange, especially along the back and wings. Toward the close of the bird's third year, the plumage is almost entirely grey with a few remaining bright orange feathers in the wings and tail.

At four years of age, Kakerori are entirely grey. The abdomen is a pale silver with darker grey upperparts, however this can differ considerably between individuals. The back, wings and tail can range from battleship grey to a soft, pale grey similar to the abdomen.

The changes in plumage colour may be partly sex-related as well as age-related. Robertson & Hay (1989) noted a female banded as a 'mixed' bird in September 1988, still retained some 'mixed' plumage when re-trapped a year later. They suggested that males gain their full adult plumage a few months earlier than females.

### 1.1.3 GENERAL BIOLOGY

Kakerori live in densely forested areas on the southern side of Rarotonga, which is wetter than the northern side - especially between November and April. Year-round the climate is usually warm and humid, and the area to which the Kakerori are now restricted is somewhat sheltered from the constant trade winds that blow across the island (Leslie, 1980). Although the usual flycatcher diet consists entirely of insects (Campbell, 1974; Campbell & Lack, 1985; Dupont, 1985; Perrins & Middleton, 1985; Pratt, Bruner & Berrett, 1987;



Erard, 1990), Kakerori sometimes take nectar from the large flowers of the endemic Neinei (*Fitchia speciosa*) which are abundant in higher territories during May and June.

They mostly inhabit the sub-canopy of small, steep-sided valleys and remain very active throughout the day. The breeding season is approximately from September to March and Kakerori are capable of raising two clutches in a season. Breeding pairs actively defend a year-round territory up to 100m in diameter and are usually monogamous. Individuals have been known to live as long as 15 years (Robertson & Hay, 1989; McCormack & Kunzle, 1990).

#### 1.1.4 STATUS

##### Past

The Kakerori is found only in the Cook Islands, on Rarotonga, where it may have been present for hundreds of years (J. Hoskings, pers. comm.). No evidence of the Kakerori has been found on any other island in the Cook Islands group. In the 1800's Gill (1885), noted that Kakerori were very common in Rarotonga and inhabited most parts of the island including large areas of taro swamps, where it appears they ate insects associated with the taro crops. Gill (1885) first noted that Kakerori had declined and by the late 1800's were not apparent in lowland areas.

The status of the Kakerori went unrecorded until 1973 when David Holyoak found two birds in the southern Papua Valley, and heard Kakerori calls in the north-eastern Tupapa Valley (D. Holyoak, pers. comm. to G. McCormack). Although the exact area of the observations were not known, Kakerori have not been found since then in either valley (G. McCormack, pers. comm.). Later, Holyoak & Thibault (1984) described three sightings made in 1973 in the Tupapa area. Eight years after that, in 1981, the New Zealand

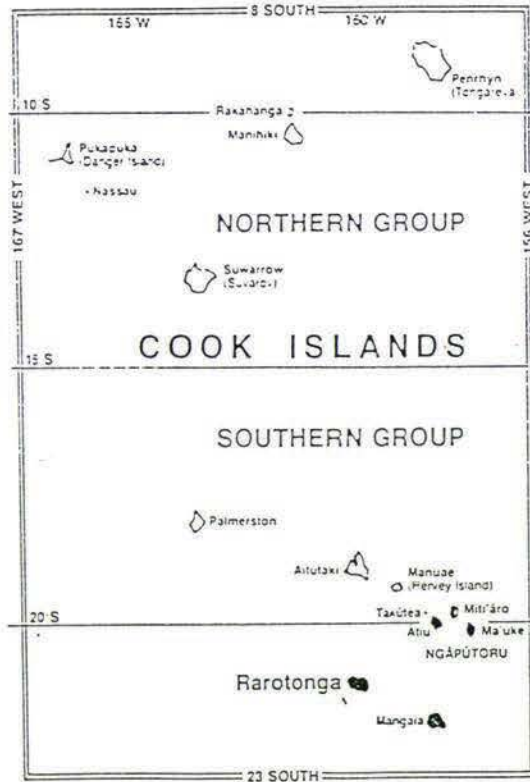
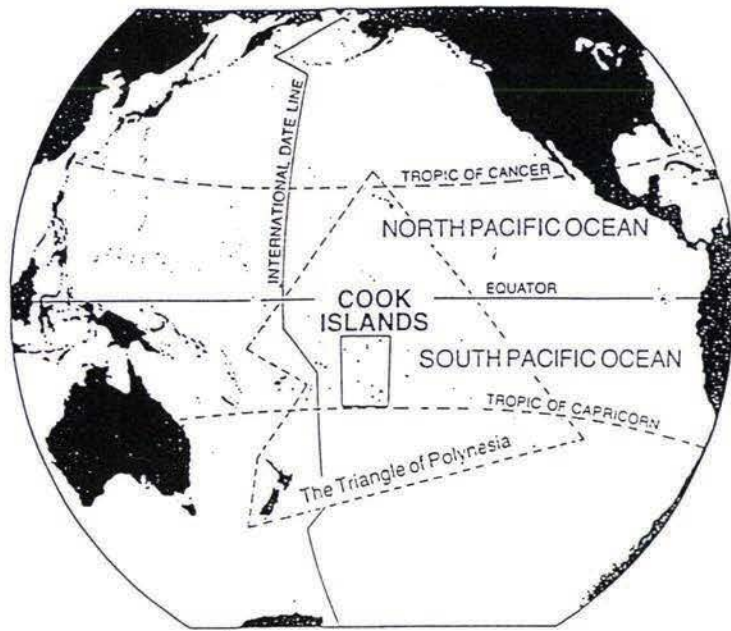


Fig. 1.1 Maps showing the location of the Cook Islands (above) and the position of Rarotonga within the Cooks Group (below). Maps prepared by McCormack & Künzle (1990).

Ornithological Society searched a large area of the island for Kakerori. The search lasted 5-6 weeks but yielded no signs of any birds. Following this extensive effort, there were two sightings of Kakerori in the densely forested Taipara Valley - one in August 1982 by E. Cameron, and another in 1983 by E. Turbott and J. Hosking (Hay & Robertson, 1988).

In December 1983, the first estimate of the Kakerori population was made by David Todd who positively identified 20 Kakerori (and sighted possibly three others) in the upper reaches of three southern catchments. Three orange and six grey birds were recorded in the Totokoitu Valley, four orange birds in the neighbouring Turoa Valley and four grey birds plus one orange individual in the Avana Basin. Todd also located two Kakerori nests, each occupied by a single chick. These nests in the Totokoitu and Turoa Valleys were the first ever recorded (D. Todd, pers. comm.).

In 1984 Rod Hay and Gerald McCormack estimated the Rarotonga population at 24 birds. From these 24 they were able to band eight birds in the Totokoitu Valley (Hay & McCormack, 1984). In 1987, two Cambridge University students found 24 birds - 11 in the Totokoitu Valley and 13 in the Avana Basin (Mitchell, 1987). Since 1984 several visits have been made to valleys near, or similar to, the three populated catchments, including the Papua and Taipara where previous sightings suggested Kakerori may be found. However, no Kakerori have since been found outside of the areas described by Todd in 1983 (G. McCormack, pers. comm.).

### Present

At present, the Kakerori is listed as endangered (King, 1981; Johnson & Statterfield, 1990) and a remarkably small number of birds remain. In August 1991 the total number of Kakerori (including recently fledged young) was 47. Currently, the total known population occupies approximately 2 x 1.5 km of heavily forested land on the southern side of Rarotonga. This 3km<sup>2</sup> area includes three main catchments - the Totokoitu, the Turoa and the Avana



(divided into lower and upper basins).

At the time of this study, approximately 13 Kakerori lived in the Totokoitu Valley, nine in the Turoa Valley, two in the Upper Avana Basin and four in the Lower Avana Basin. In August 1991, five young birds inhabited the ridge between the Totokoitu and Turoa Valleys. The remaining 14 birds (newly fledged young) had no fixed territories and were scattered.

According to Gerald McCormack (pers. comm.), 13 Kakerori specimens are located in museums around the world. In 1869, six specimens - three grey and three orange - were taken by A. Garret for the avifauna collection in the Godeffroy Museum in Hamburg and were later described by Harlaub & Finsch (1871). Of these six birds, two are now in the Bremen Museum, Germany. The location of the remaining four is unknown. A pair dated 1850, are kept in the Academy of Natural Sciences in Philadelphia. In 1901 W.E. Gudgeon, the Resident Commissioner, collected a pair of Kakerori for the British Museum (Ogilvie & Grant, 1905). In 1903 three birds were taken by A. Seale for the Bishop Museum in Hawaii where two remain, but the third (a juvenile), was sent to the American Museum of Natural History in New York. Two pairs are also held in the Hamburg Museum, Germany and the Cambridge Museum in England, however it is not known when they were collected, or by whom.

## 1.2 AIMS

### 1.2.1 DISPERSAL OF YOUNG

More can be learnt about a crucial point of Kakerori survival by investigating the dispersal and dispersion of newly fledged birds. This includes keeping records of the location of juveniles from when they leave the nest until the following breeding season. From this information the progressive movement of young birds from the parental territory can be followed, and the range of habitats that juvenile birds use during their first year identified.

An estimate of the pairing success of one and two year old birds can also be made, ie: the proportion of juvenile birds that successfully find a territory and/or mate during the following breeding season.

### **1.2.2 DIURNAL ACTIVITY BUDGET**

Very little is known about the daily activities of the Kakerori. An outline of activities of both adults and juveniles will give a clearer indication of their daily requirements and allow comparative analyses to be made. This will help define important variations in requirements for a range of ages.

### **1.2.3 HABITAT STRUCTURE**

By quantifying the components that make up the habitat of each territory, comparisons can be made between the habitat composition in successful (fledged young produced) and unsuccessful territories (no fledged young produced).

Included in this is a break-down of the structure and position of the territory, its vegetation and geographic features. The aim is to pin-point factors causing low breeding success, and achieve a better understanding of the type habitat needed for breeding to be most successful.

### **1.2.4 INSECT AVAILABILITY**

Because food is very important to survival, monitoring the availability of insects in territories will allow a better understanding of the chance for survival of birds in different areas and over different times of the year. This will highlight food as a limiting factor in the Kakerori population.

### 1.2.5 THE AFFECT OF RAT NUMBERS ON BREEDING SUCCESS

Indices of rat numbers in the study area have been made using the number of rat baits taken from each bait station per week. These records can be used in relation to Kakerori breeding success.

By comparing the nesting success in areas with high rat numbers to those of areas that are low in rats, the level of impact that rats have on breeding Kakerori can be gauged.