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CHATHAM ISLAND PIGEON: CENSUS COUNTS AND HABITAT USE, OCTOBER - NOVEMBER 1990

by

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ABSTRACT

The census method used to study Chatham Island pigeons (*Hemiphaga novaeseelandiae chathamensis*) in the Tuku a Tamatea and Awatotara valleys, Chatham Island, during October-November 1990 recorded Chatham Island pigeon numbers more accurately than methods used in the past. Pigeon numbers may be higher than previously thought. Data on habitat use show that, during spring, Chatham Island pigeons prefer plants characteristic of mixed broadleaf forest over plants typical of *Dracophyllum* forest. Mixed forest is confined to gullies and valleys in the region. Browsing by cattle, sheep, pigs, and possums is rapidly degenerating these forest remnants. A reliable estimate of total pigeon numbers, and further information on habitat use require further study throughout the year. Survival may relate to the protection of broadleaf forest remnants.

1 INTRODUCTION

The Chatham Island pigeon (*Hemiphaga novaeseelandiae chathamensis*) is a heavier, larger and more drab coloured subspecies of the New Zealand pigeon (*H. n. novaeseelandiae*). It is the only surviving offshore island subspecies (Clout 1990), and is endemic to the Chatham Islands. The pigeon is critically endangered, with the population "optimistically" estimated at 40-45 birds (Grant 1990). More information about the ecology of the Chatham Island pigeon (CIP) is needed before sound recovery and management plans can be formulated (Grant 1990).

Historical records show hunting and habitat clearance to be the prime factors in the decline of CIP numbers. Oliver (1955) claims pigeons nearly became extinct by the 1890s, although he also cites Archery and Lindsay who regarded pigeons as abundant in the 1920s. While hunting or disease could explain the fluctuation in pigeon numbers around the turn of the century, habitat clearance most likely continued the decline to the present day. Recent records show CIPs confined mostly to the relatively undisturbed southern region of Chatham Island, with a few birds on Pitt Island (Fig. 1). Intermittent records from South East Island occur. They also depict a disheartening drop in numbers in these regions and unless this is reversed, extinction seems imminent for CIPs (Merton and Bell 1975, Lindsay *et al.* 1959, Fleming 1939).

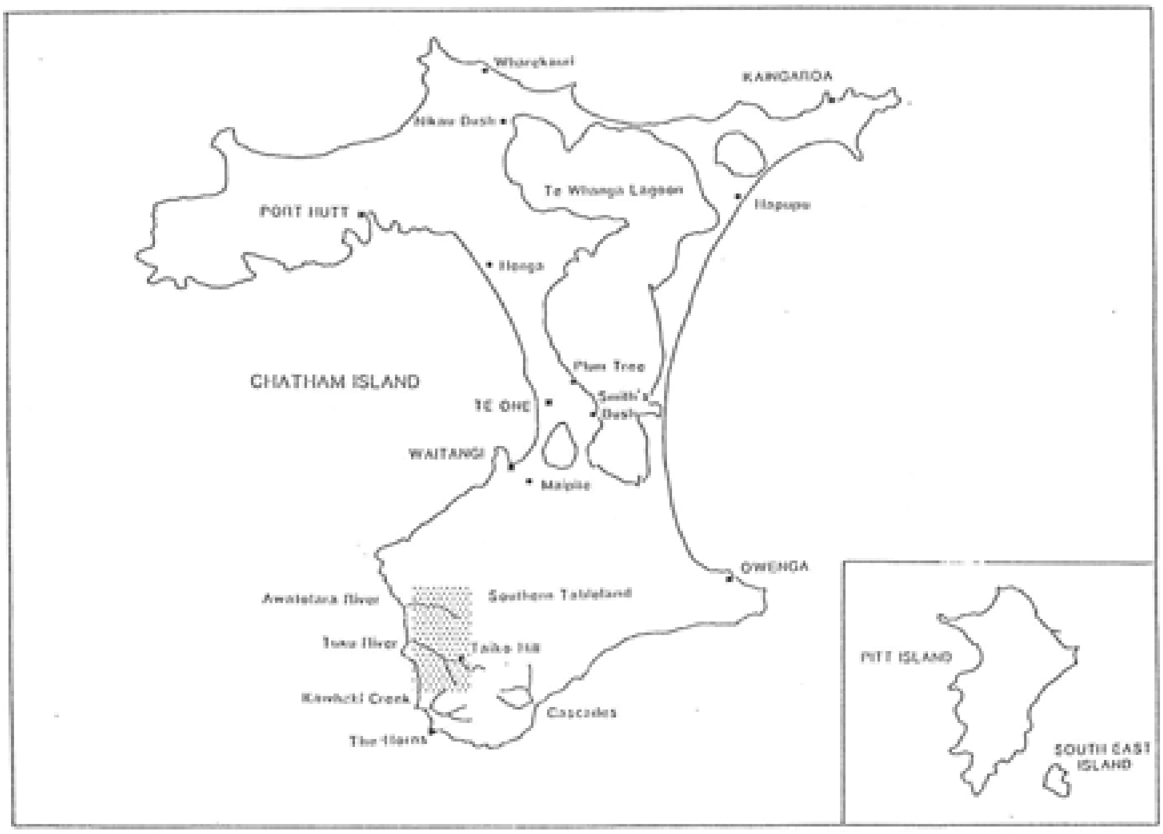

Fig. 1 Chatham Islands, showing the study area (shaded) and places mentioned in the text (adapted from Clout and Robertson 1991).

In July 1990 Clout and Robertson (1991) radio-tagged two pigeons and fitted leg jesses to another in the Awatotara and Tuku Valleys of Island (Fig. 1, 2). In October 1990 we were sent by Department of Conservation, Christchurch, to Chatham Island for two months to check the location of radio-tagged pigeons, determine their food sources and check for nests. During our initial observations we saw six birds together on two occasions in the Awatotara Valley, an area we thought only contained four birds, and suspected Island pigeon numbers might be higher than previously thought. We carried out a census of the study area. We also decided to quantify our habitat use observations by adopting the method of O'Donnell and Dilks (1988). No nests were found.

2 METHODS

2.1 Census

Birds were most conspicuous during the evening hours of fine days (although we no quantitative observations to test this). During the evening hours birds were more likely to fly and on fine days their white breast feathers were easy to see at a distance. Because CIPs fly infrequently, each count lasted at least two hours. We also recorded half-hourly totals and noted repeated sightings. It was possible to keep track of sightings for the following reasons:

1. Count sites overlooked large areas in which it was easy to keep track of separate sightings.
2. CIPs fly infrequently, but when they do they are very conspicuous.
3. Many of the sightings were of pairs.
4. Radio-tagged birds were monitored by the observer during counts. This helped to determine their location, their level of activity, and how far they moved each hour.

Between 21 and 24 November we counted CIPs at six sites within the study area. Three separate localities (Awatotara Valley, Tuku Valley, and Murphy's Hill, Fig. 2) were each counted once on consecutive fine days between 1700 hours and 2000 hours. Within each locality, two sites were counted simultaneously. Sites were either on a prominent knob (Taiko Hill, Murphy's East, and Murphy's South), or a plateau overlooking a valley (Tuku, Lower Awatotara, and Upper Awatotara), which gave good visibility and coverage. During previous weeks, monitoring radio-tagged birds in the Awatotara and Tuku had indicated the birds remained within these localities, and we have assumed that birds did not move from one area to another between counts.

2.2 Habitat use

We employed the habitat use method described by O'Donnell and Dilks (1988). However, CIPs are rare and inconspicuous, so we introduced two important modifications:

1. Instead of following transects, the radio-tagged birds (Blue and Green) were searched for and observed. These birds, their mates (Blunk and Grunk), and the bird with leg jesses only (Red) were identified on the habitat use sheets. Other pigeons encountered were listed as unknown.

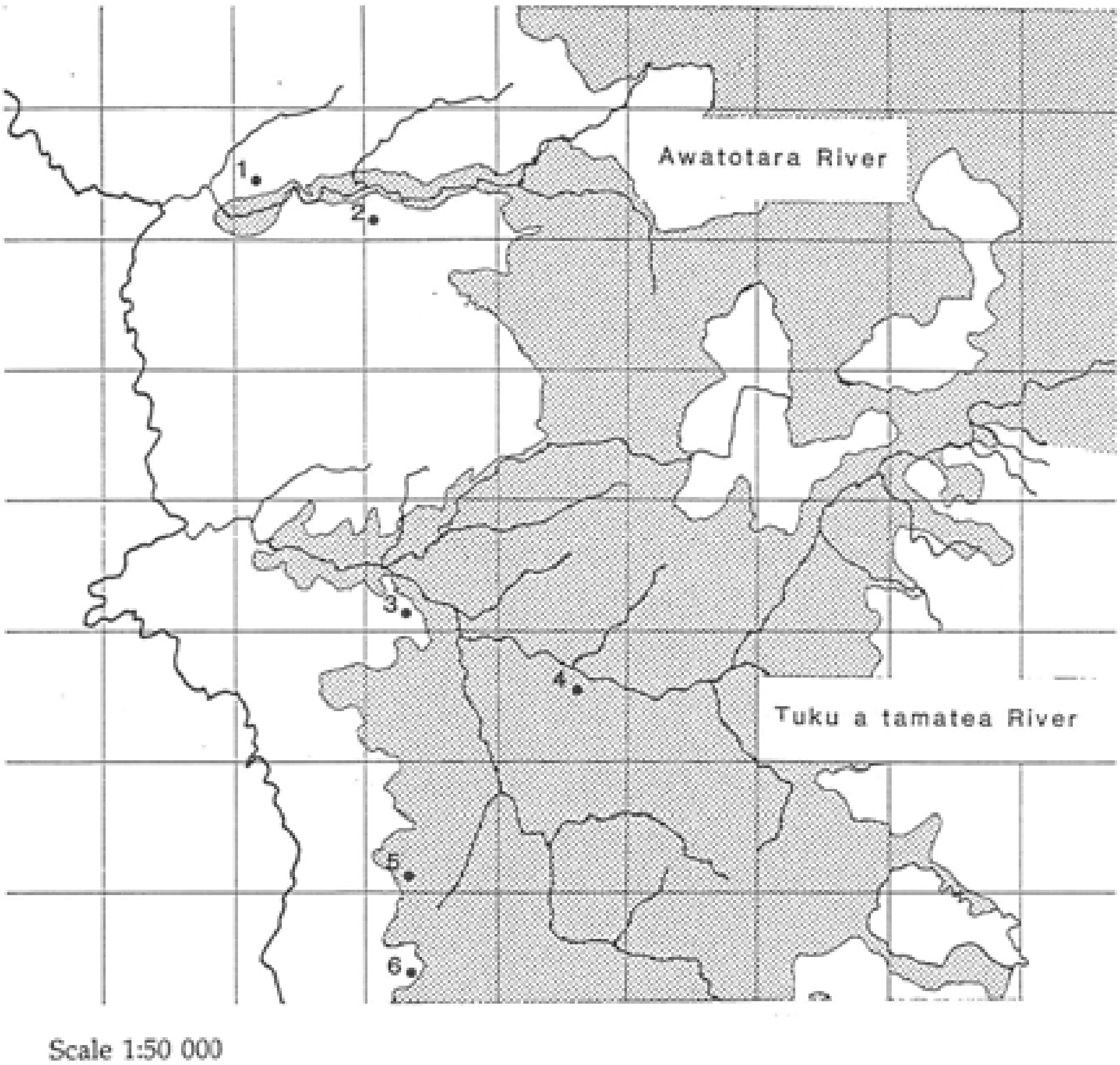

Fig.2 Count sites in the study area, southwest Chatham Island. 1=Lower Awatotara, 2=Upper Awatotara, 3=Tuku, 4=Taiko Hill, 5=Murphy's East, 6=Murphy's South. Shading indicates forest cover.

2. To ensure a large number of observations, birds were followed for up to two hours instead of the five minutes suggested by O'Donnell and Dilks (1988).

Most of the observations were made between 1100 hours and 1400 hours during fine weather. Other observations made in the morning, evening, and in poor weather conditions were also included. Care was taken to avoid disturbing the birds during habitat use observations. Radio-tagged birds were located using the receiver and then approached carefully. Once habits and favoured sites became known it was possible to approach birds to within less than 10 m.

Every minute, the position of the pigeon and its activity were recorded using the following criteria and definitions.

2.2.1 Activity

BRO	=	browsing - eating leaves and shoots
GLE	=	gleaning - eating fruits and flowers
SCA	=	scanning - actively looking (e.g., often searching for better access to food, another bird, or perching site)
ROO	=	roosting -asleep with head pulled in, drooping tail, hunched appearance, and sometimes breast lowered onto the perch
LOA	=	loafing - when bird is inactive, but not considered roosting
PRE	=	preening
DIS	=	displaying
CAL	=	calling - often associated with display behaviour

2.2.2 Food type

LEA	=	leaf
FRU	=	fruit
FLO	=	flower

2.2.3 Plant species

HOH	=	hoho – *Pseudopanax chathamicus*
MAH	=	mahoe – *Melicytus chathamicus*
MAT	=	Chatham Island matipo - *Myrsine chathamica*
KAR	=	karamu - *Coprosma chathamica*
KOP	=	kopi (karaka) – *Corynocarpus laevigatus*
TAR	=	tarahinau – *Dracophyllum arboreum*
AKE	=	akeake – *Olearia traversii*
TFN	=	tree fern – *Dicksonia squarrosa, D. fibrosa,* and *Cyathea medullaris*
COR	=	*Corokia macrocarpa*

2.2.4 Perch type

LBR	=	large branch
SBR	=	small branch
FOL	=	foliage

2.2.5 Stratum (refer to Fig. 4)

2.2.6 Bird height above ground. Expressed in metres estimated by observer. Low canopy height in the study area (<10 m) made estimates to within a metre possible.

2.2.7 Canopy height. Estimated in metres.

2.3 Vegetation description

Vegetation in the study region was sampled following Allan (1961) and Wilson (1982), so we could compare the availability of tree species with the frequency of use by pigeons. Six parallel north-south transects 250 m apart were followed across both the Tuku and Awatotara valleys (Fig. 3). At least one transect traced a line of longitude. Every 100 paces, vegetation was sampled (a plot) until 10 plots were completed. Sixty plots were recorded for Awatotara Valley, and 59 for the Tuku.

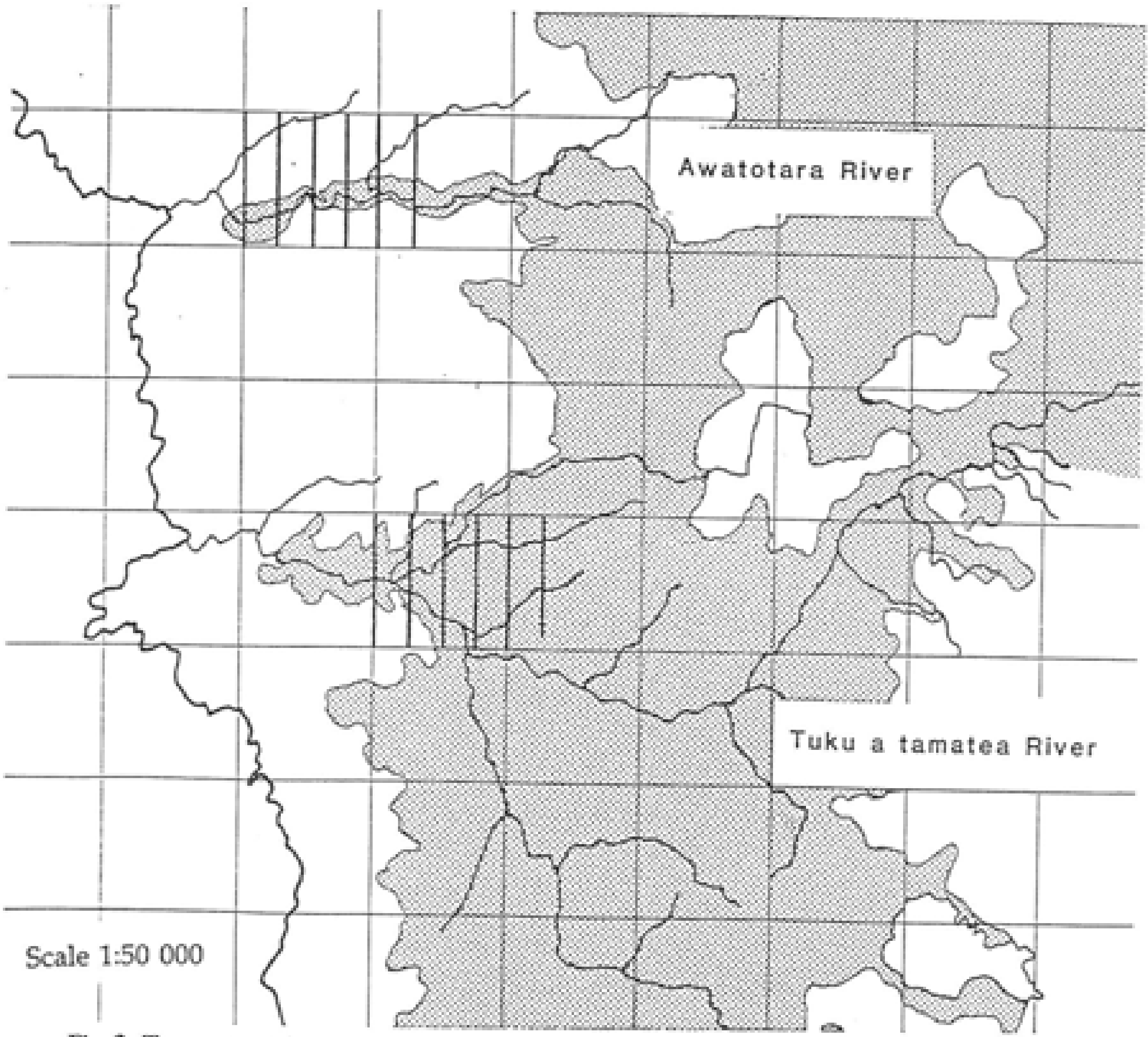

Fig. 3 Transects used for sampling the vegetation in the study area.

As P.E.P. was familiar only with recording vegetation by estimating percentage cover, this method was used. We assumed percentage cover was a good indicator of the relative availability of plant species. Species within view were ascribed to a forest stratum (Fig. 4), and the percentage cover by each species in each stratum was estimated. Preliminary observations indicated CIPs primarily used plants of the canopy strata (EME, USC, and SHC). Therefore, only plots with trees in the canopy strata, (i.e. forested plots), were used in the habitat use calculations. Eighteen plots in Awatotara and 45 in the Tuku fitted this criterium. Plant fruiting was noted.

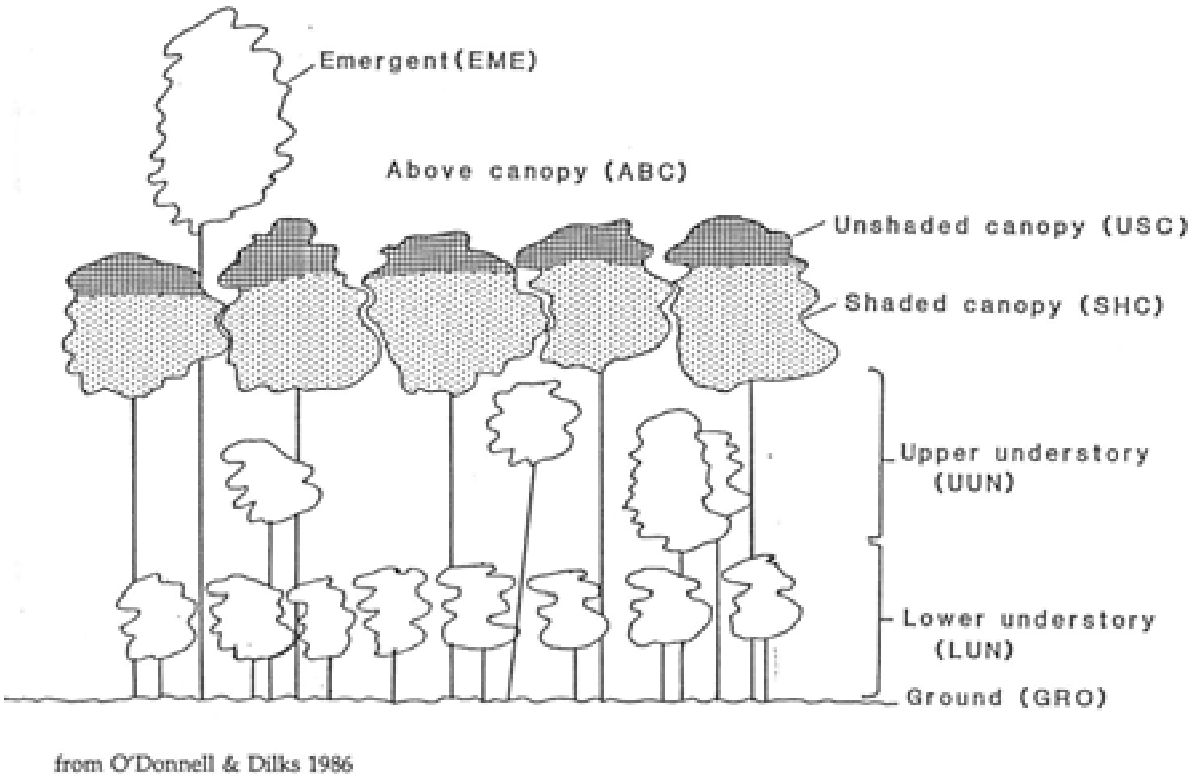

Fig. 4 Diagrammatic representation of the strata in a forested area (from O'Donnell and Dilks)

2.4 Determining plant preferences

Plant use was determined by combining percentages of all activities except flying. Using Ivlev's preference index formula cited in Strauss (1979), we related plant use by CIPs to plant availability.

$$E=\frac{\tau_i-p_i}{\tau_i+p_i}$$

E is the measure of electivity, T_i the percent use of canopy plant species and p_i the relative abundance of canopy plant species.

3 RESULTS

3.1 Census counts

Usually, CIPs were not seen until they eventually flew, so a longer count increased the chance of sighting a bird. Half-hour subtotals varied markedly within a 2 hour count period (Table 1). The Tuku count recorded no birds in the first half-hour and seven birds in the last half-hour. A total of 25 birds was recorded from the count sites. Three other birds were recorded in adjacent forest.

Since no birds were recorded at the Murphy's East and Murphy's South count sites, these counts have not been included in Table 1.

Table 1 Totals and half-hour subtotals from the Tuku and Awatotara count sites.

Time	Lower Awatotara 24 Nov. 90	Upper Awatotara 24 Nov. 90	Taiko Hill 21 Nov. 90	Tuku 21 Nov. 09
1700 - 1730	+	*	0	0
1730 - 1800	+	*	0	1
1800 - 1830	+	1	3	0
1830 - 1900	+	2	2(1)	3
1900 - 1930	+	0	*	3
1930 - 2000	+	2(1)	*	6(1)
TOTAL	2	5	5	13

* = Not counted
() = Number of repeated sightings (not included in the total)
\+ = half-hour subtotals not recorded

3.2 Vegetation

The percentage cover provided by each canopy species in the forested plots is shown in Fig. 5. However, canopy species distribution within the study area was not uniform. In the Awatotara particularly, canopy species occurred in patches interspersed by bracken slopes and tree fern gullies. In the Tuku, the lower region of the study area was dominated by tree ferns while the upper regions were dominated by trees.

Dracophyllum was more common in upper valley plots while mahoe (*Melicytus chathamica*) was found in lower valley plots. Hoho (*Pseudopanax chathamicus*), matipo *(Myrsine chathamica)* and karamu *(Coprosma chathamica)* were found scattered throughout, but kopi (*Corynocarpus laevigatus)* was found in groves. *Pinus radiata* occurred as a shelter belt in the Awatotara. Pasture grasses surrounded the lower valley regions and occurred in small clearings within the forest. Bracken slopes and the proportion of tree ferns indicate the amount of forest disturbance in the area.

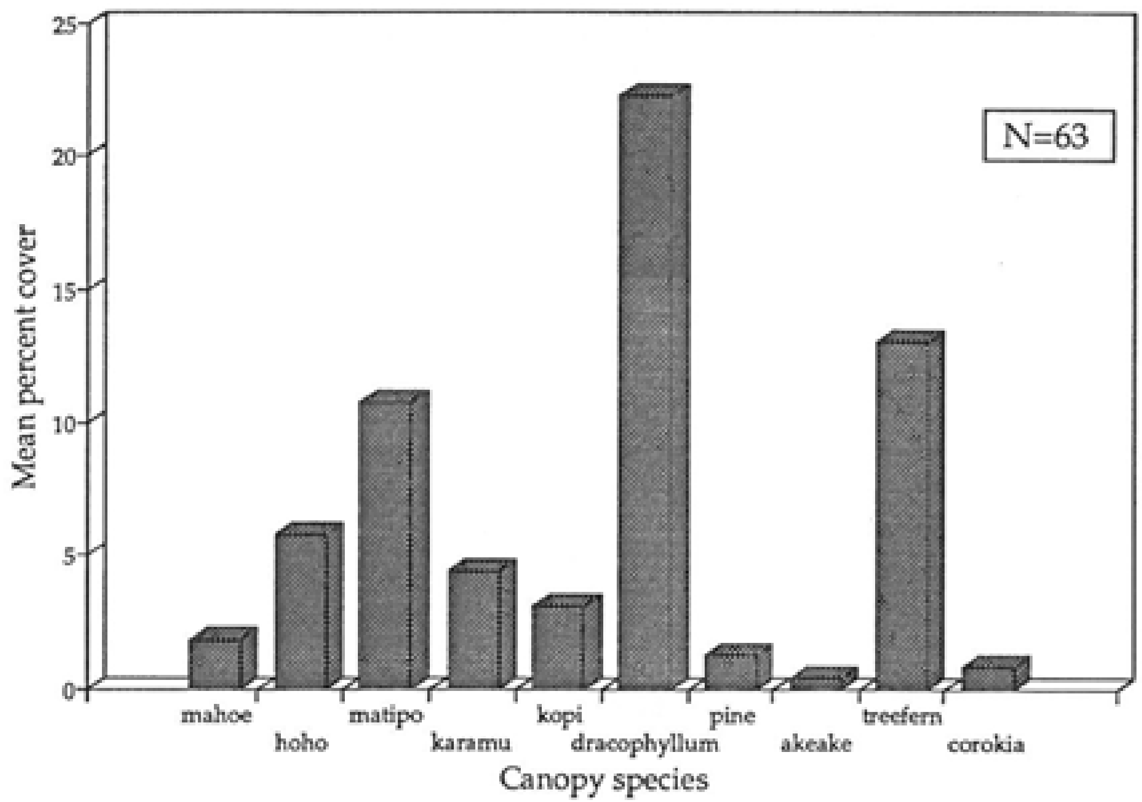

Fig. 5 Canopy species as a percentage of vegetation cover in forested plots of the Tuku and Awatotara valleys.

3.3 Habitat use

The total number of observations made was 5054. Over half (61.5%) of the observa-tions were of one pair only (Blue and Blunk, Fig. 6). Green, the only other single significant contributor, provided 15.7% of all observations. Nearly all observations (94%) were of pigeons in the canopy strata (SHC and USC in Fig. 7). This supports our assumption that the measure of canopy cover is a good measure of the relative availability of plant species for pigeons.

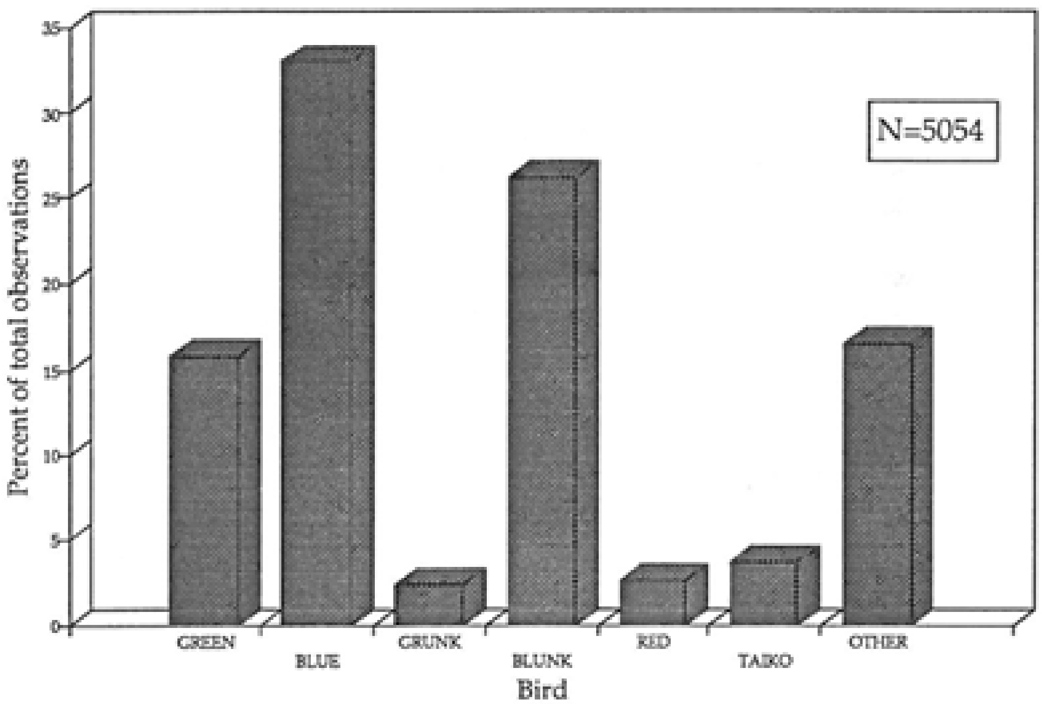

Fig. 6 Total observations expressed as percentages per named bird.

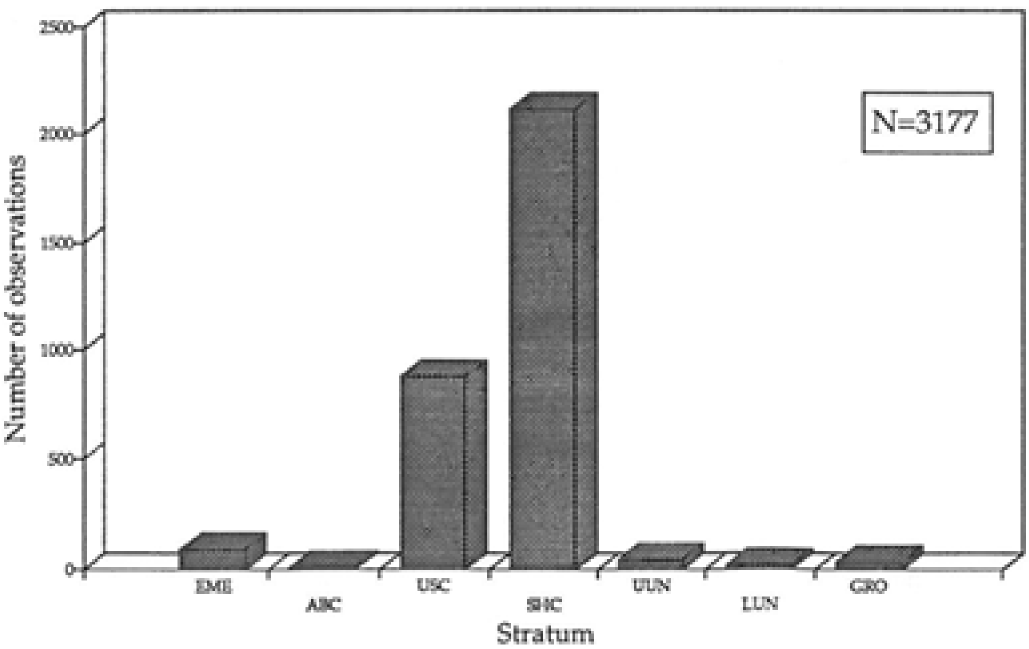

Fig. 7 Location of birds within the forest strata. See Fig. 4 for explanation of the three-letter strata codes.

Three quarters (75%) of the observations were of pigeons roosting, loafing, and preening (Fig. 8), usually in hoho and to a lesser extent, matipo. Pigeons were only occasionally recorded flying.

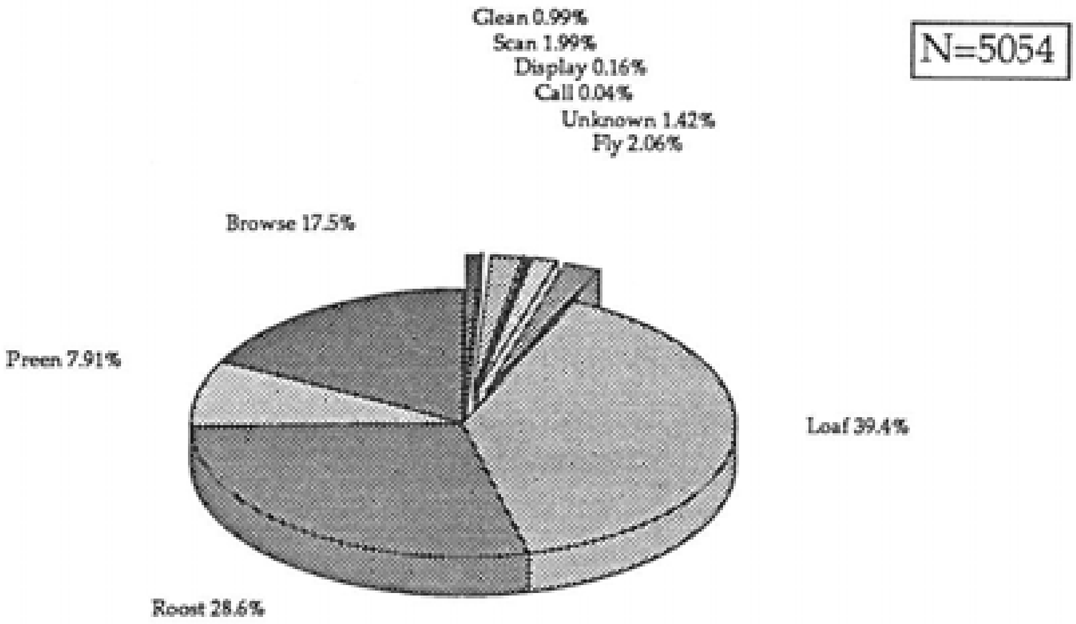

Fig. 8 All activities expressed as percentage of total number of observations.

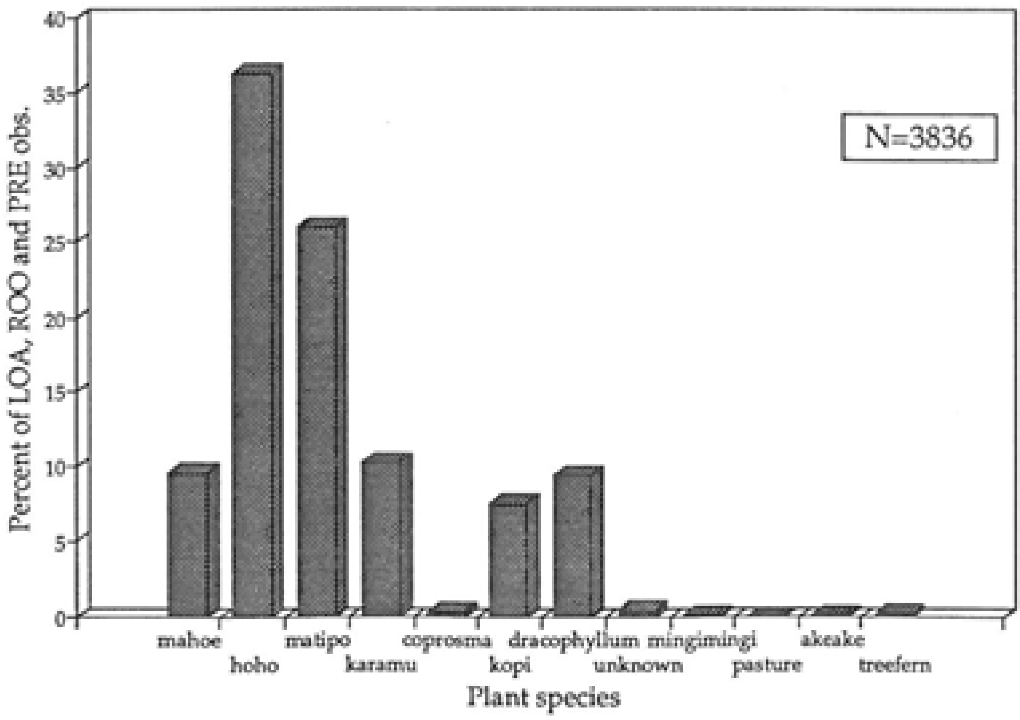

Fig. 9 Observations of loafing, roosting, and preening on named plant species.

The greatest proportion of observations were of pigeons in hoho (Fig. 11). Matipo was used often while mahoe, karamu, *Dracophyllum,* kopi, and *Coprosma propinqua* var. *martinii*, were used occasionally. Mingimingi (*Cyathodes robusta*), pasture, tree ferns, and akeake were seldom used.

CIPs loafed, roosted, and preened mainly in hoho and matipo, but often used karamu, kopi, and *Dracophyllum* for these activities (Fig. 9).

3.4 Feeding observations

The total number of feeding observations are listed in Table 2. Hoho was the most important food plant (Fig. 10). Mahoe and *Coprosma propinqua* var. *martinii* were the next most important, and pigeons sometimes fed on matipo and karamu. Only a small percentage of observations were of pigeons feeding while on the ground. Pigeons almost never fed on kopi, *Dracophyllum*, and mingimingi. Pigeons did not feed on akeake, or tree ferns.

Table 2 Total number of feeding observations (N=931) and number of feeding recorded for Chatham Island pigeon per food plant.

Plant species	Foliage	Fruit/Flowers	Total
mahoe	168	11	179
hoho	383	30	413
matipo	47	9	56
karamu	51	0	51
kopi	1	0	1
Dracophyllum	2	0	2
mingimingi	5	0	5
Coprosma[1]	198	0	198
pasture	26	0	26

[1]*Coprosma propinqua* var. *martini*

Browsing was the dominant feeding method (Fig. 8), particularly in hoho, mahoe and *Coprosma propinqua* var. *martinii* (Fig. 12). Some hoho, mahoe and matipo fruits were eaten (Fig. 13). Mingimingi, common on heathlands in the region, was fruiting copiously but no CIPs were seen eating the fruit.

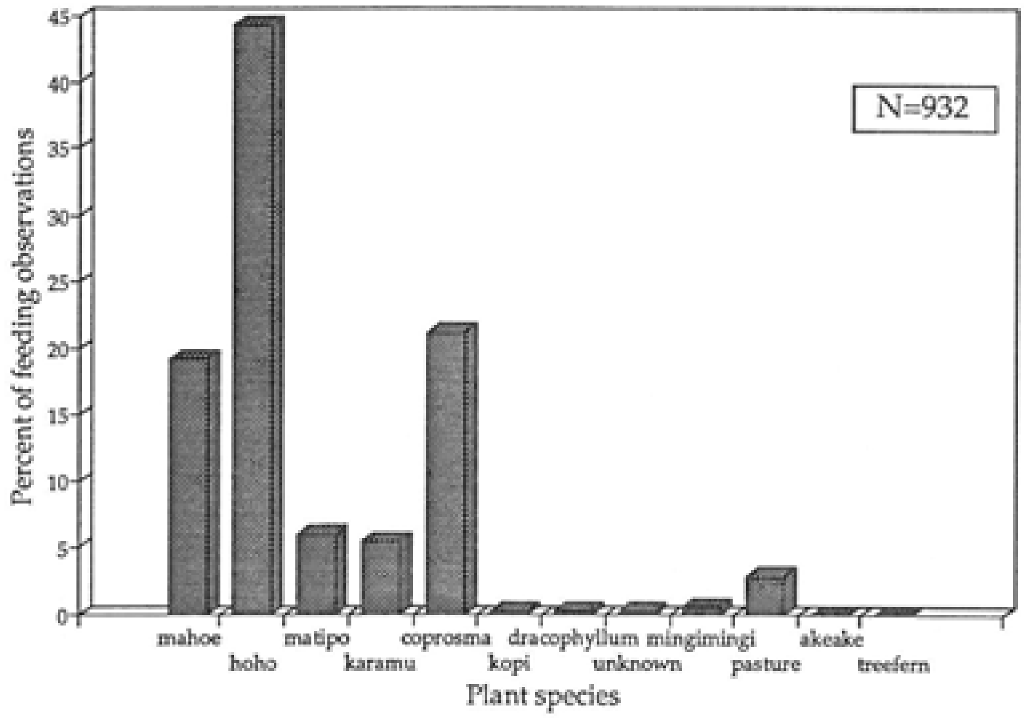

Fig. 10 Observations of feeding (browsing and gleaning) on named plant species.

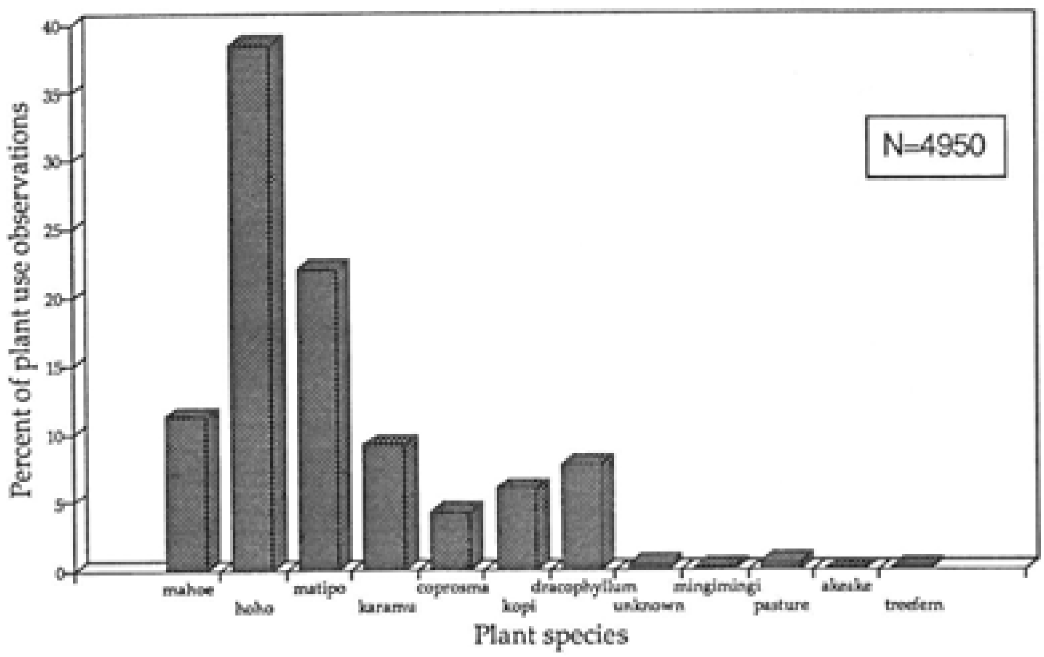

Fig. 11 Plants used by pigeons for all observed activities (except fly) combined.

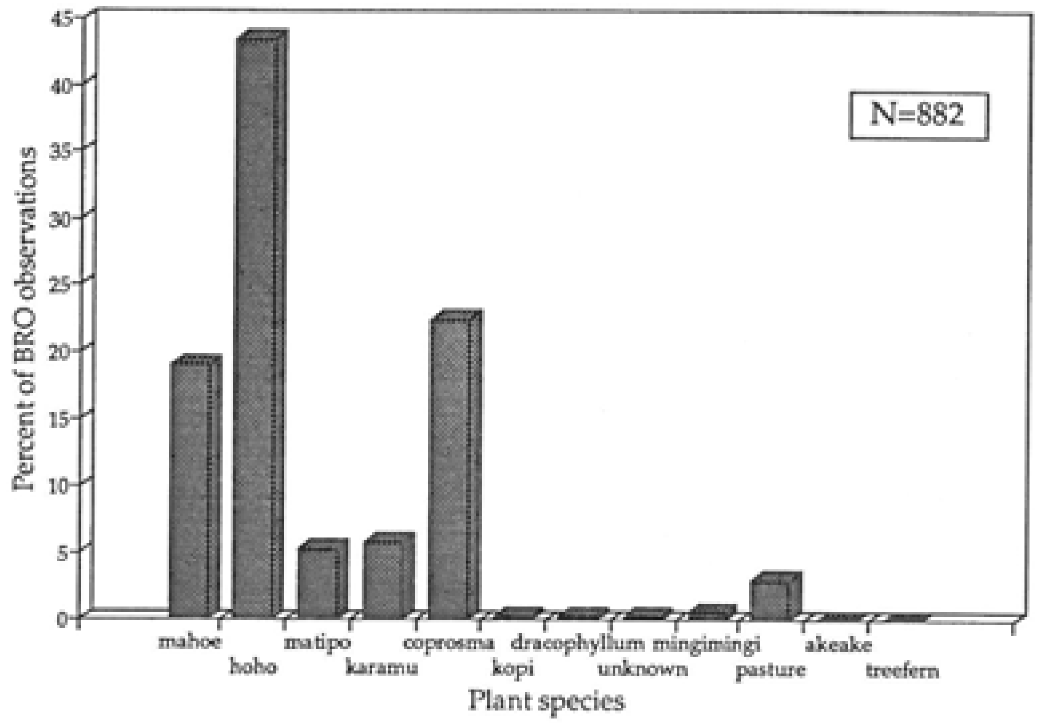

Fig. 12 Percentage of named plants providing leaf food, from browsing observations.

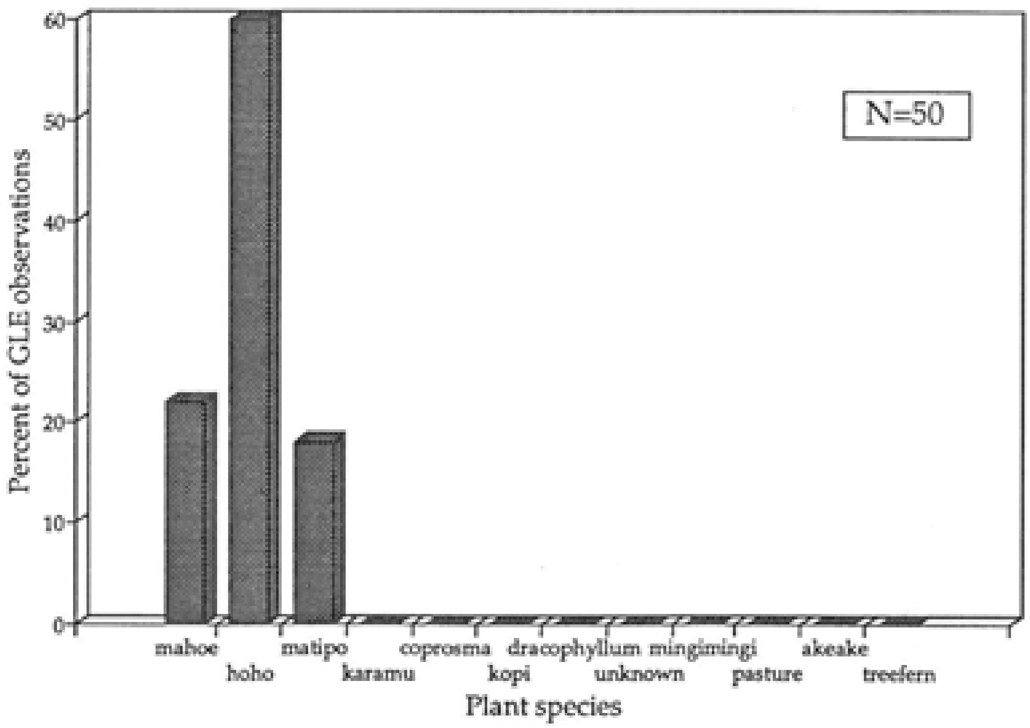

Fig. 13 Percentage of named plants providing fruit and/or flowers, from gleaning observations.

Ivlev's preference index (Fig. 14) relating the frequency of plant use (Fig. 11) to the frequency of availability (Fig. 5) shows CIPs prefer some canopy plants over others. During our study, hoho, karamu and kopi were preferred over *Dracophyllum,* akeake, tree ferns and *Corokia macrocarpa,* which were avoided.

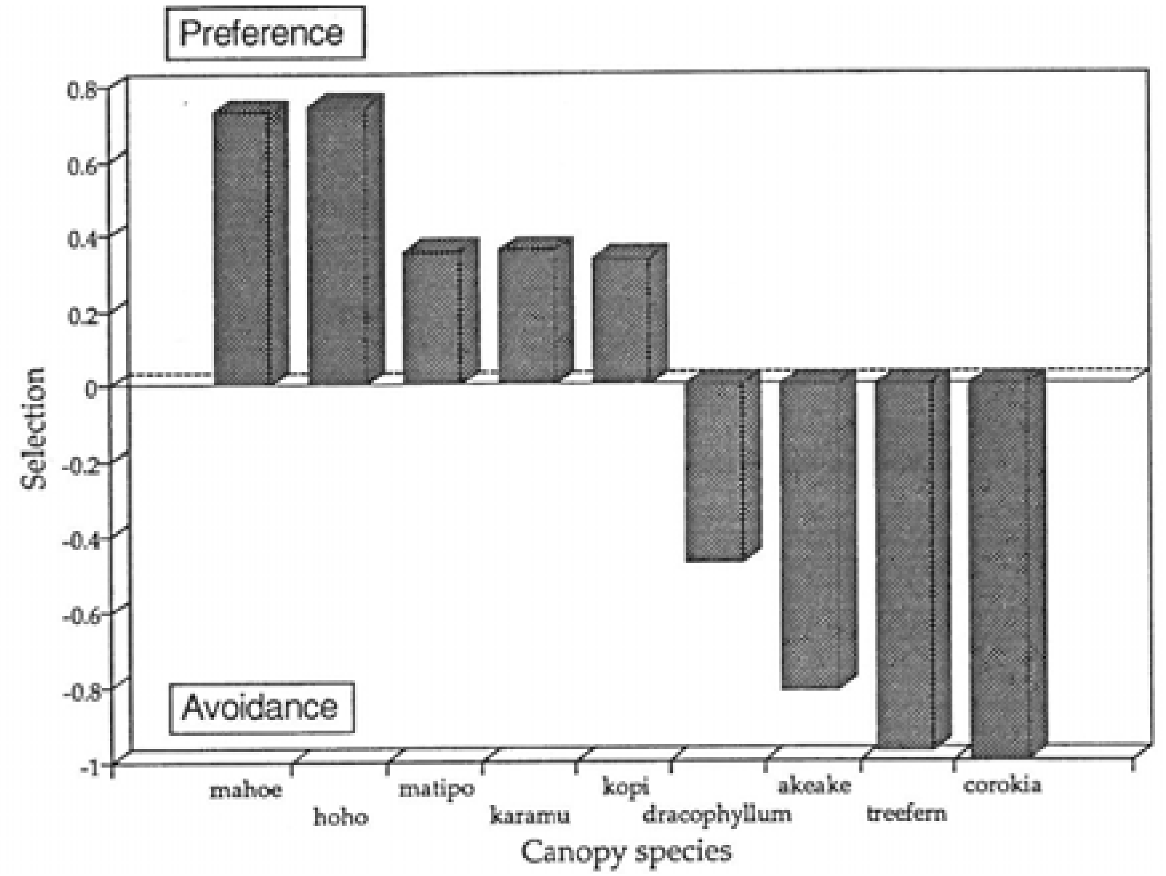

Fig. 14 **Preference and avoidance of canopy plant species.** Ivlev's preference index U-A/U+A was calculated. U=percentage of use of a plant spp. by CIP. A = percentage of availability (% cover) each plant spp. The index varies between +1 for preference and -1 for avoidance. Figures close to indicate non-selective use.

4 DISCUSSION

4.1 Census

Our census of CIPs in the Tuku and Awatotara indicated a larger population of pigeons than previously recorded. While only one count per site was done, our census method was probably more appropriate for recording CIP numbers than other methods used. In 1988, Grant and others recorded only four CIPs (A. Grant pers. comm.) in the immediate vicinity of our study area. They used the transect and five-minute count bird mapping method of O'Donnell and Dilks (1986). West (1988) recorded no pigeons in any of her 100 five-minute counts, and only three after 19 hours walking along transects and through the bush in the Tuku region (J. West pers. comm.). Five-minute counts and transects are designed to record the relative abundance, conspicuousness, and range of bird species in the forest. We feel these methods are not sensitive enough for recording CIPs. Five minute counts are too short for a rare and largely sedentary species and the transect method is biased toward noisy and active birds (pers. obs.). The CIP is not a conspicuous bird, it seldom calls and is a quiet flyer.

The variability between half-hour subtotals (Table 1) shows how easy it is to miss sighting pigeons, even over this length of time. At the Tuku count site, no birds were seen in the first half-hour, but seven birds were seen in the last half-hour. A longer count period improves the chances of being present when a pigeon takes flight. Although the chances of double counting increase as count duration lengthens, we found we were able to keep track of individual pigeons. Many of the sightings were of pairs, which effectively reduced the number of records to keep track of. Good visibility from the count sites allowed us to see individuals as they flew from one spot to another. Also, their white breast feathers were so conspicuous on sunny evenings that birds were immediately visible the moment they took flight. Monitoring radio-tagged birds previously and during the counts showed that the evening CIP flight was often a single flight to a favoured roost.

4.2 Diet

CIPs are rare and difficult to find. Nearly three quarters of our habitat use observations were on only three individuals and the data are strongly influenced by the behaviour of these birds. We endeavoured to obtain a large number of observations by concentrating on the most accessible birds which resulted in this bias. Following more individuals for shorter periods should reduce this bias (O'Donnell and Dilks 1988).

Coprosma propinqua var. *martinii* featured strongly in the browsing observations, but all these observations were from Blue and Blunk only. Similarly, only two birds browsed while on the ground and then, only during a few prolonged sessions. For example, the Taiko bird was observed only once feeding on pasture, but it did so for over half an hour. While these data show CIPs have a varied diet, the extent to which the entire population feeds on pasture and *Coprosma propinqua* var. *martinii* is unknown. Other CIPs have been seen feeding on pasture (M. Blake pers. comm. and Morris 1979) and in December 1990 the Taiko bird was often seen doing so (G. Murman pers. comm.). CIPs may feed on pasture more frequently than we observed, and when they do, they may be vulnerable to cat predation.

During our study CIPs fed mainly on leaves. A small number of hoho, mahoe and matipo had begun fruiting, but CIPs more often browsed these trees, and ignored the fruit. All fruit was still green during our study. Hoho, for example, will not ripen until winter (Salmon 1980).

4.3 Importance of fruit

The importance of hoho fruiting in winter needs investigating. and Dilks (1986) found *Pseudopanax* spp. (Araliaceae) became more important to New Zealand pigeons during winter. Snow (1981) said the Araliaceae family is one of the most important for producing nutritious fruits for frugivorous birds in the tropics. He also cited the importance of a northern European member of the family, *Hedera helix,* which produces unusually nutritious fruits in late winter-early spring. It is possible hoho fruits are of significant nutritional value to CIPs, especially in winter. During July 1990, Clout and Robertson (1991) found that hoho leaves and fruit were important foods for CIPs. However, they recorded only 40 feeding observations in total, 25 of these being hoho. They gave no indication of the number of birds involved in these feeding observations, nor of the relative availability of fruit. Hence the significance of these observations is difficult to determine.

Kopi, a prolific fruit-producer, may become an important food source during its fruiting season even though it provides little leaf food. Similarly, the fleshy and perhaps palatable fruits of *Corokia macrocarpa* may become important when they ripen. Morris (1979) notes that observers saw CIPs "taking" *C. macrocarpa,* but did not indicate if fruits or foliage were eaten. Mahoe, a preferred foliage provider, should become even more important in the diet of CIPs when its fruits ripen. Other species from which CIPs have been seen taking fruit are: *Coriaria arborea, Macropiper excelsum* and *Rhipogonum scandens* (Morris 1979). *R. scandens, C. arborea,* and *M. excelsum* were present, but their fruits were not ripe. The dry, capsular fruits of *Dracophyllum* are probably not eaten by CIPs.

Fruiting species may become so important to CIPs that they travel some distance to obtain fruits. The only *Fuchsia excorticata* seen in the study area was a seedling directly beneath a favourite roosting site of Blue and Blunk in the Awatotara. Pigeons may visit a stand of *F. excorticata* near Maipito, about 12 km north of the Awatotara (Fig. 1), when its fruits ripen.

4.4 Habitat preference

Our habitat use data show CIPs prefer mahoe, hoho, kopi, karamu, and matipo: species typical of mixed broadleaf forests on the Chatham Islands (Kelly 1983, Cockayne 1901). They also show CIPs avoid *Dracophyllum* and tree ferns: species common in upland *Dracophyllum* forests (Kelly 1983). However, not all preferences were based on food selection; for instance, kopi was only used for loafing and preening.

4.5 Quality of remaining habitat

Lowland forest which once occurred over most of Chatham Island, except in the Southern Tablelands (Cockayne 1901), has all but disappeared (pers. obs.). The Southern Tablelands are dominated by *Dracophyllum* forest and *Sporadanthus* wetland and mixed broadleaf forest occurs only in gullies and valleys (Kelly 1983) such as the Tuku and Awatotara. The only other significant areas of mixed broadleaf forest are the Cascade Valley on Chatham Island (Fig. 1), and the southern region of Pitt Island (A. Grant, pers. comm.). The present distribution of CIPs coincides with the distribution of these remaining mixed broadleaf forest refuges. *Dracophyllum* forests do contain food species (e.g. hoho), and probably support some CIPs. CIP feathers and feeding sign were seen by us within this forest type.

The Awatotara and the lower Tuku valleys are still undergoing habitat modification and deterioration through browsing by cattle, sheep, and possums, and through rooting and browsing by pigs. Cockayne (1901) writes of tree ferns forming the forest undergrowth while our data show they now form a high proportion of the canopy (Fig. 5). The lower Awatotara has suffered noticeable loss of canopy trees in the last 10 years (B. Tuanui pers. comm.) and there is extensive cattle grazing damage. Only bush patches remain. The lower Tuku has a healthier, more intact canopy, but is also deteriorating and shows much browsing damage in the understorey and ground strata plants. Canopy tree seedlings are constantly browsed and uprooted. Similarly, the Cascade valley is under intense browsing pressure and seedling disturbance by cattle, sheep, possums, and pigs (G. Murman pers. comm.). The effect on the CIP population by browsing and destruction of CIP food species needs investigating. The Awatotara, in an advanced state of deterioration, still supports up to seven pigeons although their ability to breed occurs only as isolated patches in both valleys. Further browsing trees and the destruction of seedlings could eliminate this CIP food source.

It might be possible to restore the mixed broadleaf forest. Regeneration in Chatham Island forests is rapid provided grazing animals are removed (Kelly 1983). Given and Williams (1984) note that mahoe might even extend its range in regenerating mixed broadleaf forest.

5 CONCLUSIONS

Our census results indicate Chatham Island pigeon numbers may be higher than previously thought. Transect and five-minute counts used previously may be an inappropriate method for counting pigeons. A reliable estimate of CIP numbers is still not known.

CIPs preferred mixed broadleaf forest species over *Dracophyllum* forest species in October-November 1990, but a few birds may occur in forest. Survival of CIPs may relate to the survival of mixed broadleaf forest remnants on Pitt Island and in gullies of the Southern Tablelands.

Mixed broadleaf habitats on Chatham Island are still under threat from browsing by cattle, sheep, pigs, and possums.

CIPs occasionally feed on pasture and could then be vulnerable to cat predation.

6 RECOMMENDATIONS

As a result of our survey we recommend:

1. The adoption of a counting method appropriate for CIPs. We suggest this method include: a minimum count period of 2 hours; site selection which enables large areas of forest to be scanned; and counts made on fine evenings.

2. Counts using this method be made throughout the year and continued every year, to accurately establish numbers and population trends of CIPs.

3. Habitat use studies and monitoring of tagged birds be continued through 1991, particularly during the 1991/92 fruiting season.

4. Tagging and monitoring CIPs in other areas to increase data sample size.

5. Observers be trained in the habitat use method and written guidelines be provided.

6. Surveying the vegetation of the Tuku and Awatotara valleys in more detail, and setting up plant phenology lines.

7. Securing and fencing all remaining mixed broadleaf forest in southern Chatham Island to exclude cattle, sheep, and pigs. The control of possums in mixed broadleaf forest is also recommended.

8. Establishing the feasibility of extending the boundaries of existing mixed broadleaf forest and the revegetation of new areas.

9. Monitoring pigeon use of *Fuchsia excorticata* as a food source, when fruiting.

10. Investigating the threat of cat predation.

7 ACKNOWLEDGEMENTS

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