

FEEDING BEHAVIOUR OF THE FANTAIL (*Rhipidura fuliginosa*)

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ABSTRACT

Three feeding methods are described for Fantails: hawking, flushing, and feeding associations. Hawking Fantails cover large distances, use any available perch, and often feed above the forest canopy. Flushing Fantails cover small distances, perch on twigs and small branches, and feed mostly within the canopy or on the ground. Fantails in feeding associations feed where the species being followed feeds. Changes in the proportion of use of each feeding method in relation to breeding stage are described; the sexes did not differ in feeding methods during breeding. By using several feeding methods, Fantails forage in a wider range of microhabitats and so may obtain a wider range of prey than they would by only one method.

INTRODUCTION

Although many studies have dealt with the feeding ecology of insectivorous New Zealand passerines (Clout & Gaze 1984, and references therein), most have emphasised habitat selection and few have concentrated on the details of feeding by each species. Available data indicate that there is considerable variation in feeding behaviour and/or habitat use through the year (*Petroica australis*, R. Powlesland 1980, 1981; *Bowdleria punctata*, Best 1979; *Gerygone igata*, *Zosterops lateralis*, *Mohoua novaeseelandiae*, Gill 1980). Several unpublished theses support these results. In general, insectivorous forest passerines in New Zealand spend most of their time feeding, each species using a range of feeding methods. Any seasonal variation is in habitat use and the proportions of use of each feeding method, rather than in overall time spent foraging.

The Fantail (*Rhipidura fuliginosa*) takes flying prey by hawking from a perch, flushes prey by disturbing vegetation, and may form feeding associations with other species (McLean 1984, Cameron 1985, McLean *et al.* 1987, Read 1987). Prey are rarely taken directly from the substrate (Cameron 1985, pers. obs.). Here, I describe the feeding behaviour of Fantails in relation to season, forest structure, breeding status and sex. The three feeding methods are described and compared and predictions are developed allowing discrimination between them.

METHODS

Feeding behaviour in relation to habitat use was studied on Cuvier Island during two weeks in May 1981. Each time I encountered a Fantail I recorded up to five samples of height, perch used, and feeding method, at 30 s intervals (details of the sampling procedure and statistical analysis are in McLean 1984). Due to lack of independence in the data, statistical significance was set at $P < 0.01$.

Feeding behaviour in relation to stage of the breeding cycle, and sex, was studied on Tiritiri Island during the summer of 1981/82 by the same methods as on Cuvier Island. Most birds were individually colour-banded and all nests were found. Thus each bird's breeding status was known on the day samples were taken. Breeding stages distinguished were: not breeding (including between nests), building/laying, incubating, feeding nestlings, and feeding fledglings.

Behavioural details of the differences between feeding methods were gathered on Little Barrier Island during one week in July 1985. Thus details of behaviour of Fantails in feeding associations were for birds following Whitehead (*Mohoua albicilla*) flocks.

About 40 and 24 Fantails made up the study populations on Cuvier and Tiritiri Islands respectively. Different numbers of samples were taken from each individual.

Perch size was defined in terms of vegetation that a hopping Fantail could disturb. Only twigs (<0.5 cm diameter) and leaves shook when a Fantail hopped on them. Small branches (0.5-2.5 cm), large branches (>2.5 cm), and trunks were also distinguished during data collection.

To distinguish between the two feeding methods used by Fantails feeding alone, I made two predictions: 1) flight lengths of birds feeding alone would show a bimodal distribution; and 2) perches from which short flights were made would be significantly smaller (i.e. twigs) than perches from which longer flights were made.

My aim was to use descriptive data gathered independently of subjective assignments of feeding method to show that Fantails used two distinct feeding methods when alone. I had previously observed that flushing Fantails made short flights whereas hawking Fantails made long flights (hence prediction 1). Flushing Fantails should use only small perches because an 8 g bird is not likely to disturb larger perches. In contrast, hawking Fantails should use any available perch (hence prediction 2). If the predictions were not supported, it is unlikely that my subjective assignments of feeding methods in data presented in other sections would reflect real differences in feeding behaviour by Fantails.

The lengths of flights and time spent perching were compared for Fantails using all three feeding methods on Little Barrier Island. I predicted that flushing Fantails would make short flights and have short perch times, hawking Fantails would make long flights (I made no prediction about perch time), and Fantails in an association would make short flights (i.e. similar to flushing) but would perch for long periods (because movement rate depends on prey items being disturbed by the host).

Forest types in each of the study areas were broadly similar. An upper canopy of pohutukawa (*Metrosideros excelsa*) and/or kanuka (*Kunzia ericoides*) reached to 20 m. Below this, a dense canopy of mixed broadleaf forest ranged from 3 to 6 m. The amount of ground cover varied from little to dense, depending on light intensities, but usually consisted of a variety of seedlings, shrubs and ferns.

RESULTS

Feeding methods

Almost all prey taken by Fantails were in the air when taken. Three main feeding methods were used: *hawking* (termed 'static searching and pursuit' by Cameron 1985), *flushing* (Cameron's 'progressive searching and pursuit'), and *feeding associations*. Each method was identifiable by characteristic behaviour. Birds switched quickly between methods.

When *hawking*, a Fantail captured flying prey it had seen from a perch. The Fantail either flew to a new perch or returned to the same perch after a hawking flight. Fantails often hawked through swarms of small insects in calm sunlit clearings, over the forest canopy, or along forest margins; that is, where the vegetation was open or patchy and the bird could see long distances. More than one prey item could be taken during a hawking flight (indicated by several bill snaps). In contrast to the other feeding methods, availability of prey did not depend on movements by the Fantail or any other species.

When *flushing*, moving Fantails disturbed resting prey and captured them in flight. Only one item seemed to be taken per flight. Flushing often occurred in dense vegetation, where visibility was limited.

When in a *feeding association* Fantails followed another bird (or occasionally a mammal such as a human or a large ungulate). The Fantail made short hawking flights to capture prey disturbed by the host. Feeding sites and prey availability for Fantails in feeding associations depended mainly on the habits of the species being followed. The only choice was whether to follow. Fantails formed short-term associations with most forest birds, but these rarely lasted for more than a few seconds, unless the bird was a messy or clumsy feeder (e.g. Saddleback, McLean 1984) or a member of a flock. Within a flock, the Fantail rarely stayed with the same individual for long.

Distinguishing feeding methods

Foraging associations were easily distinguished because the Fantail perched close to, scanned the air around, and moved at the same pace as, the host.

For Fantails feeding alone, I recorded a large number of very short flights, and a relatively large number of very long flights, supporting prediction 1 (Fig. 1).

Variation in length of flights in relation to perch size was significant (Fig. 2; $X^2_2 = 10.02$, Yates correction applied, $P < 0.01$). Most flights from twigs were short, whereas flights from larger perches varied in length and were often long (supporting prediction 2).

These results indicate that my subjective assignment of foraging type in the following sections reflect real differences in the foraging behaviour of Fantails.

Feeding methods and microhabitat use

When *flushing* and *hawking*, Fantails used significantly different perch types (Fig. 3; $X^2_5 = 56.1$, $P < 0.001$) and fed at significantly different heights (Fig. 4; $X^2_8 = 29.6$, $P < 0.01$). While *flushing*, Fantails fed primarily from

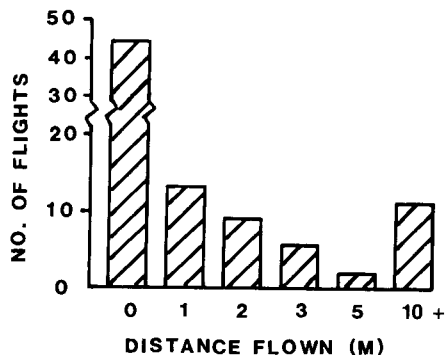


FIGURE 1 — Distances flown by Fantails feeding alone on Little Barrier Island in July. Includes flights from ground

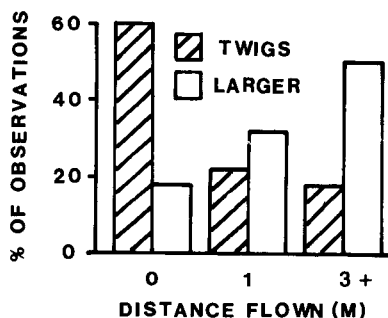


FIGURE 2 — Distances flown by Fantails feeding alone in July on Little Barrier Island in relation to perch used (twigs, N = 50; larger, N = 22)

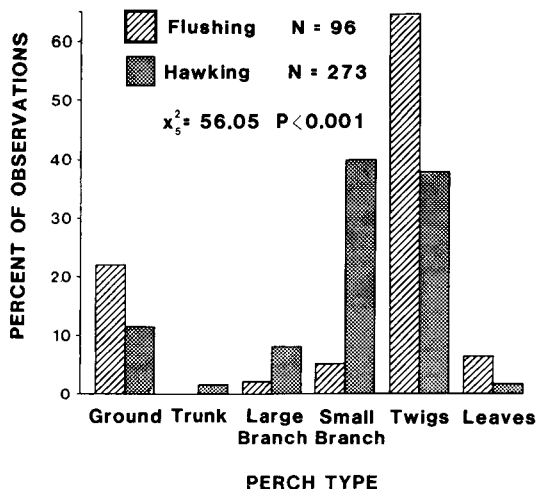


FIGURE 3 — Perches used by Fantails feeding alone on Cuvier Island in May

small perches in the thicker vegetation of the lower canopy, or on the ground. Hawking Fantails fed from all perches between the ground and the top of the lower canopy, or in the open canopy above the broadleaf forest.

The heights used by Fantails feeding in an association were intermediate between those for flushing and those for hawking (Fig. 2 in McLean 1984). Perches used by Fantails in an association probably depend on the behaviour of the host.

Feeding methods and behaviour

There was significant variation among all three feeding methods for flight lengths ($X^2_8 = 49.7$, $P < 0.001$) and perch time ($X^2_6 = 73.8$, $P < 0.001$) (Table 1). In accordance with predictions, flushing Fantails made short flights and perched for short times; hawking Fantails made long flights (they also perched for fairly short periods); and Fantails in an association made mostly short flights and spent long periods perching.

Feeding behaviour, breeding status, and sex

Most Fantails fed from small branches and twigs during all stages of breeding, and no significant variation was found in either perches used or feeding heights (data not presented). Significant variation in the feeding methods used during each breeding stage was found ($X^2_8 = 70.2$, $P < 0.001$, Fig. 5), with most of the significance attributable to differences between non-breeding and breeding birds. As Fantails advanced through the breeding cycle, the proportion of hawking increased, reaching $> 80\%$ when fledglings were being fed. Feeding associations were rarely formed by breeding Fantails (see also McLean 1984).

No differences were found between male and female Fantails in feeding methods used, perches used, or heights at which feeding occurred (Table 2). I used birds in this analysis only if they had a nest on the day I took the sample.

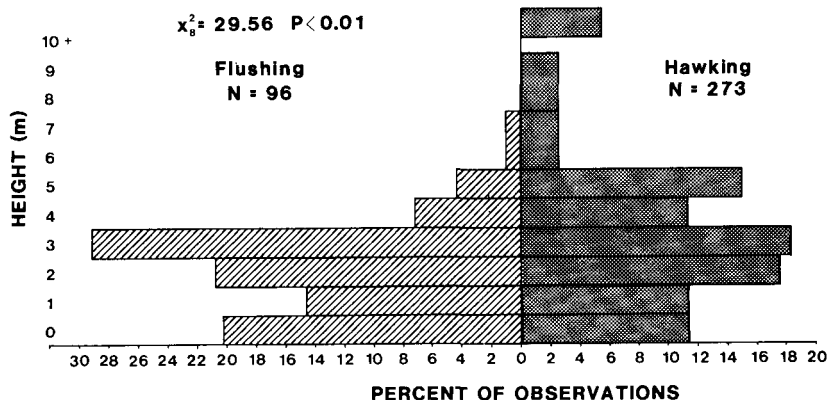


FIGURE 4 — Heights at which Fantails feeding alone perched on Cuvier Island in May

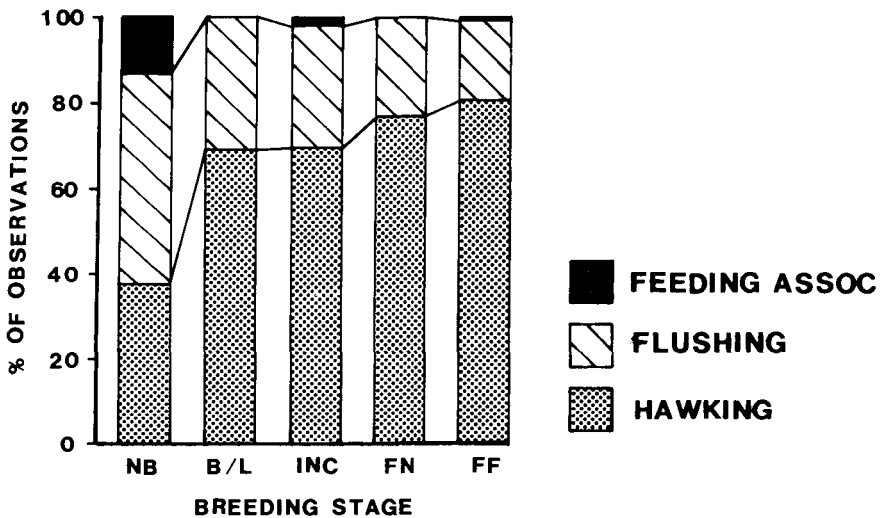


FIGURE 5 — Proportion of each feeding method used by Fantails at each stage of breeding on Tiritiri Island. NB = Not Breeding (88 observations); B/L = Building/Laying (29); INC = Incubation (59); FN = Feeding Nestlings (91); FF = Feeding Fledglings (145). Overall $X^2_8 = 70.2$, $P < 0.001$

TABLE 1 — Distances flown and length of time perched by Fantails using three feeding methods on Little Barrier Island in July

Distance flown (m)	Flushing	Hawking	Association
0-0.9	51	6	24
1-1.9	13	4	15
2-4.9	3	16	14
5+	0	14	2
Total	67	40	55
Time perched (s)	Flushing	Hawking	Association
0-0.9	31	15	4
1-1.9	14	10	10
2-2.9	5	4	6
3-4.9	0	5	12
5+	0	6	16
Total	50	40	48

DISCUSSION

Fantails used three feeding methods and obtained food from different parts of the forest by each method. The main difference between methods was in how prey were detected. Fantails feeding alone detected their prey either by scanning a large airspace (hawking) or by disturbing vegetation to expose prey (flushing). In feeding associations, Fantails gained the advantages of

TABLE 2 — Feeding behaviour of breeding female and male Fantails on Tiritiri Island

Feeding method	Females (N = 61)	Males (N = 141)
hawking	50	118
flushing	11	23
$X^2 = 0.1, P \gg 0.1$		
Perch used		
ground	1	3
trunk	4	9
large branch	6	15
small branch	26	66
twig	23	47
leaf	1	1
$X^2_4 = 0.5, P \gg 0.1$ (not including leaf)		
Height (m)		
0-1.9	19	45
2-3.9	25	49
4-5.9	10	34
6+	7	13
$X^2_3 = 1.8, P \gg 0.1$		

short capture flights (as with flushing) and long perching periods. By using different methods, the birds used more parts of the habitat for feeding than they could by using one method only.

Each feeding method presumably represents a tradeoff between energetics, the kinds of prey obtained, the rate at which prey are captured, and the needs of the moment (Rudolph 1982). Fantails feeding young must catch prey quickly, and having to carry the prey, probably prefer large items. Hence, by hawking when breeding, they can scan large amounts of airspace and detect large prey more often than they would by the other feeding methods. Birds flushing or in feeding associations move more slowly (and so may conserve energy) but scan smaller areas. Fantails rarely form feeding associations during breeding, presumably in part because of having to keep finding the host again after feeding chicks (McLean 1984).

No differences between the sexes in feeding behaviour or microhabitat use were found in this study. As female and male Fantails provide approximately equal amounts of parental care (Powlesland 1982), it is not surprising that they feed in similar ways during the breeding period. However, differences between the sexes have been found in some small, insectivorous forest passerines (Holmes 1986), and they may occur in New Zealand species in which there is division of labour. Suggestions of sexual differences have been found for the Robin (proportions of time spent foraging during the breeding period differ between males and females, Powlesland 1980) and the Rifleman (*Acanthisitta chloris*); males gather most or all of the food required for manufacturing eggs and courtship-feed it to the female, Sherley 1985).

Other feeding methods reported for Fantails include 'tumble-chase' (birds use aerobic manoeuvres to chase prey, Ude Shankar 1977, Crome 1978), which I include in hawking, 'spinning' (birds spin back and forth

through a 180° arc as they move, Diamond 1972, in Cameron 1985), and 'flitting' (birds move rapidly through vegetation, Crome 1978). I include the last two in flushing.

Flushing is rarely recognised as a distinct foraging mode of small flycatchers (e.g. Powlesland 1981, Robinson & Holmes 1982, Cameron 1985). Whether this is because few birds use this method, or because researchers have not recognised the method as distinct, is not clear. Observations of flushing by Fantails may lead to understanding the function of the unusually large tail in this species. Ude Shanker (1977) rejected flushing as a specific function of the Fantail's tail. Here, I argue that the bird uses its entire body for flushing by disturbing twigs and leaves as it moves, enhanced by wing and tail motions. Fantails also flush while on the ground, a substrate which they cannot disturb except by generating air currents. The wings seem to be used for this function, and I suggest that the tail is also used.

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