A BREEDING STUDY OF THE SOUTH ISLAND FANTAIL (Rhipidura fuliginosa fuliginosa)

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ABSTRACT

The breeding of the South Island Fantail was studied at Kowhai Bush, Kaikoura, for three breeding seasons from 1976 to 1978. Although 372 birds (nestlings and adults) were banded, few were seen again and very few bred in the study area.

Breeding occurred from August to February. Some pairs raised three broods but attempted up to five if failures occurred. Details are given of nests, nest building, egg laying, clutch size, incubation, hatching and fledging success, and juveniles. Both sexes shared nest building, incubation, brooding, feeding nestlings and feeding juveniles, although the division of labour was sometimes unequal. Some aspects of behaviour differed slightly from that of the North Island subspecies.

Females bred at one year old, but males could breed within one or two months of fledging when paired with an adult. A seemingly unpaired female successfully raised a brood of three young. Juveniles from one family group sometimes joined another family group and were accepted and fed by the foster parents.

Black pairs produced young in the ratio of three black to one pied, and black x pied matings produced approximately equal numbers of black and pied young. Pied pairs produced 97.8% pied and 2.2% black young, which conflicts with the model previously proposed for the genetics of melanism in the Fantail.

INTRODUCTION

The Fantail *(Rhipidura fuliginosa)* occurs in Australia, New Zealand and several other islands in the south-west Pacific. There are three subspecies in New Zealand, the North Island Fantail *(R. f. placabilis)*, the South Island Fantail *(R. f. fuliginosa)* and the Chatham Island Fantail *(R. f. penitus)*. Information on the breeding biology is available for all three subspecies; however, many studies were based on a few pairs only or are anecdotal in nature (Moncrieff 1931, Fleming 1949, Cunningham 1954, Blackburn 1966, Coates 1966, Flux 1974, Ude Shankar 1977 and Dennison *et al.* 1978, 1979). The most detailed studies are those by Blackburn (1965), McLean (1980) and McLean & Jenkins (1980). In the present study, observations were made on over 200 nests of the South Island subspecies at Kowhai Bush, Kaikoura, during the three breeding seasons 1976-77, 1977-78

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and 1978-79. Hunt & Gill (1979) described Kowhai Bush and its flora and fauna in detail.

METHODS

As many birds as possible were banded with metal serial bands and size A butt-ended plastic colour bands supplied by the Wildlife Service. Each bird received a unique combination so that it could be recognised. Nestlings were banded at 9-11 days old. Adults and independent young were caught by mist-netting during the non-breeding season, and were banded and weighed. Mist-netting was most successful from March to May. A few adults were caught and banded on the nest. This did not cause desertion of any of the nests. The study area and surrounding areas were searched in the non-breeding season to find banded birds.

Banding was carried out to determine the dispersal and longevity of the birds. It also enabled the sexes to be distinguished. There is no visible difference between the sexes, but males tend to sing more than do females (Ude Shankar 1977, McLean & Jenkins 1980), and if one bird can be recognised (for example, if one or both birds are banded or if one is black), the sexes can be distinguished.

Nests were found by following adult Fantails. Both members of a pair share nest building, incubation, and feeding and brooding of the young, and so nests could be found by following one of the adult birds until it visited the nest. The nests were watched to get information on the different stages of breeding: nest building, egg laying, incubation, the nestling period and the juvenile period.

The South Island Fantail has two colour morphs, black and pied. The colour morphs of parents and their offspring were recorded and the results are discussed in relation to the findings of Caughley (1969) and Craig (1972).

In the following section, average values are given in the form: average ± standard deviation.

RESULTS AND DISCUSSION

Survival and dispersal

Over the three seasons, 372 birds were banded (Table 1). Few were seen again and very few bred in the study area in the following breeding season: 3 out of 132-160 nestlings and 7 out of 88 adults for the first two seasons.

Only three banded birds were found breeding outside the study area. Therefore, dispersal does not account for the absence of banded birds in the study area. Mortality was probably high over the winter, especially among immatures. McLean & Jenkins (1980) found a low survival rate among first-year Fantails on Cuvier Island, and a 66% loss of first-year birds was found in *Rhipidura javanica* in South East Asia (McClure *in* Ude Shankar 1977).

Only two birds banded at Kowhai Bush were known to have bred in two seasons. One of these, a female, was banded as a nestling in 1976 and bred in the following two breeding seasons. The other was an adult male which was banded in the 1977-78 season and which bred again in the 1978-79 season.

Most resightings of banded birds in the non-breeding season were before June. This partly reflects the less time I spent in the bush in winter, but Fantails seemed to be numerous in autumn and decreased in numbers over the winter. Ude Shankar (1977) found a similar pattern in Christchurch in 1975, when the numbers of Fantails seen dropped markedly in June. Likewise, McLean & Jenkins (1980) saw more banded birds on Cuvier Island in May 1973 than in August 1973 or in the subsequent breeding season. The birds may be quieter and therefore less conspicuous in winter, or mortality and dispersal may reduce their numbers. The low number of banded birds that were seen suggests that mortality was the main factor.

Weights

The average weight of 65 birds caught in autumn (March to May) was 7.6 ±0.6 g and the range was 6.4-9.1 g (Figure 1). The weights are for adult and first-year birds because, by March, immature birds had moulted into adult plumage and were indistinguishable from adults. The distribution is skewed slightly to the left but is not bimodal as would be expected if there was any weight difference between the sexes or between first-year birds and adults. Average

TABLE 1 — Summary of banding and resightings of fantails

Breeding Season	1976-77	1977-78	1978-79	Total
NESTLINGS				
No. banded	61	111	108	280
No. fledged*	≥56	76-104	≥76	≥208
No. resighted in autumn and winter	3	12	16	31
No. present in following breeding season	2	1	-	c.3
ADULTS				
No. banded	41	47	4	92
No. resighted in autumn and winter	14	14	1	29.
No. present in following breeding season	6	1	-	c.7

* The exact number of nestlings which fledged was not known because some were not seen after fledging.

weights of birds for each month were March, 7.8 ±1.1 g (18 birds); April 7.4 ±0.7 g (4 birds); May 7.5 ±0.8 g (43 birds).

Breeding

The results of banding showed that both male and female Fantails breed when one year old. However, males can apparently breed as immatures, within one or two months of fledging. This occurred twice, in December 1976 and December 1978, when males in immature plumage paired with adult females whose previous mates had disappeared. Both females laid fertile eggs. The 1976 pair were seen together before nest building began. The female's previous nest had been preyed on at the nestling stage and her adult mate had disappeared at the time of predation. The 1978 pair was first seen just after a nest had been completed. Their history was not known

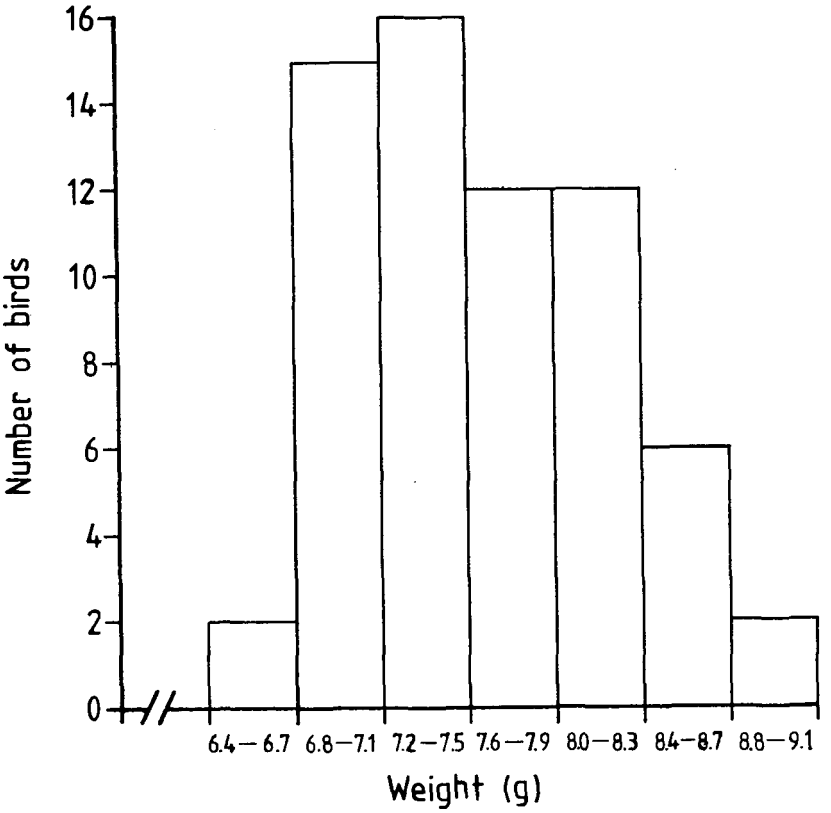

FIGURE 1 — Weights of Fantails in autumn (March-May) 1977 and 1978 (from 65 birds)

and the eggs may have been fertilised by a previous mate rather than by the immature male. The 1976 pair laid three eggs, all of which hatched, but predators took the nestlings at about five days old. The 1978 pair laid four eggs, all of which hatched, but the fate of the brood is not known.

Although the sexes shared breeding activities, birds could rear young alone. Sometimes, usually late in the season, one member of a pair disappeared, leaving the other to feed the nestlings. During mid-November 1978, one apparently unpaired female was found nest building and she subsequently raised a brood of three to fledging. She renested in the same nest and laid three eggs, one of which was infertile. However, the two nestlings were preyed on soon after hatching. I saw no male at any time, although I watched the nest for several one-hour periods during the incubation and brooding of both clutches, as well as making brief visits to check on the nest at other times. During my observation of incubation and brooding, the female came and went from the nest on her own. This contrasts with the behaviour of a normal pair, where one bird usually waits for the other to arrive before leaving the nest.

The number of pairs in the study area was not accurately assessed because only a small proportion of the pairs included a banded bird and not all nests or all pairs were found. Even in the areas searched most thoroughly, I occasionally found a pair where I had previously not heard or seen any birds.

In autumn and winter, Fantails were often in groups of more than two birds. However, when building began in August, they were in pairs and showed aggression to other Fantails. A banded male who bred in two breeding seasons occupied the same territory in both seasons and was seen on the territory in May of the intervening non-breeding season. He had a different mate in each season.

The breeding season extended from August to February. Nest building started in late August and the first eggs were laid in September; on the 10th in 1976, the 17th in 1977 and about the 11th in 1978. In the 1976-77 season, the last brood fledged on 8 February and in 1977-78 on 21 January. In 1978-79, one clutch hatched on about 20 January and chicks were still present in several other nests at this time. All these nestlings were preyed on but otherwise would not have fledged until early February.

The breeding season of Fantails at Kowhai Bush was shorter than that of the North Island Fantail at Gisborne, where the first eggs were laid in August and the last young fledged in March (Blackburn 1965). This may reflect the milder North Island climate. However, the 1981 breeding season on Tiritiri Matangi Island (Hauraki Gulf) did not start until November (I. G. McLean, pers. comm.) and so there is considerable variation in starting time. The shorter breeding season at Kowhai Bush meant that fewer successful broods were possible; two or three compared with three to five in Blackburn's study.

TABLE 2 — Fate of fantail eggs in each month of the breeding season

Month	No. of eggs laid	Per cent hatched	Per cent failed to hatch			
			Preyed upon	Infertile	Abandoned	Other
September	103	83	8	3	3	3
October	122	89	4	0	0	7
November	207	85	11	1	1	2
December	107	74	24	0	0	2
January	7	100	0	0	0	0
Total	546	83	12	1	1	3

Most pairs had several successive nests during the breeding season. However, the exact number of nests for most pairs in a season was not determined because of the problems of identifying birds and because not all nests were found. In 1976-77, one pair had five nests, of which the contents of at least two were preyed upon. One clutch fledged and another two clutches may have fledged. In 1977-78, no pair produced more than two broods of fledglings, but in 1978-79 one pair raised three broods to independence. Thus a pair was able to raise three broods within a breeding season, but most pairs lost one or more clutches and could build and lay in up to five nests. Predation considerably diminished the breeding success of the Fantails at Kowhai Bush (Tables 2 and 3), where the main predators were mustelids and rodents (see Flack & Lloyd 1978, Moors 1978).

Nests

Nests were built in mahoe *(Melicytus ramiflorus)*, 19% of 202 nests; kanuka *(Leptospermum ericoides)*, 17.8%; karamu *(Cop-*

TABLE 3 — Fate of Fantail nestlings in each month of the breeding season

Month	No. Hatched	Per cent Fledged	Per cent failed to Fledge			
			Preyed Upon	Died in nest	Other	Per cent unknown
September	85	71	4	0	2	23
October	109	57	11	6	6	20
November	176	55	18	3	1	23
December	79	34	18	3	1	44
January	7	71	29	0	0	0
Total	456	55	14	3	2	26

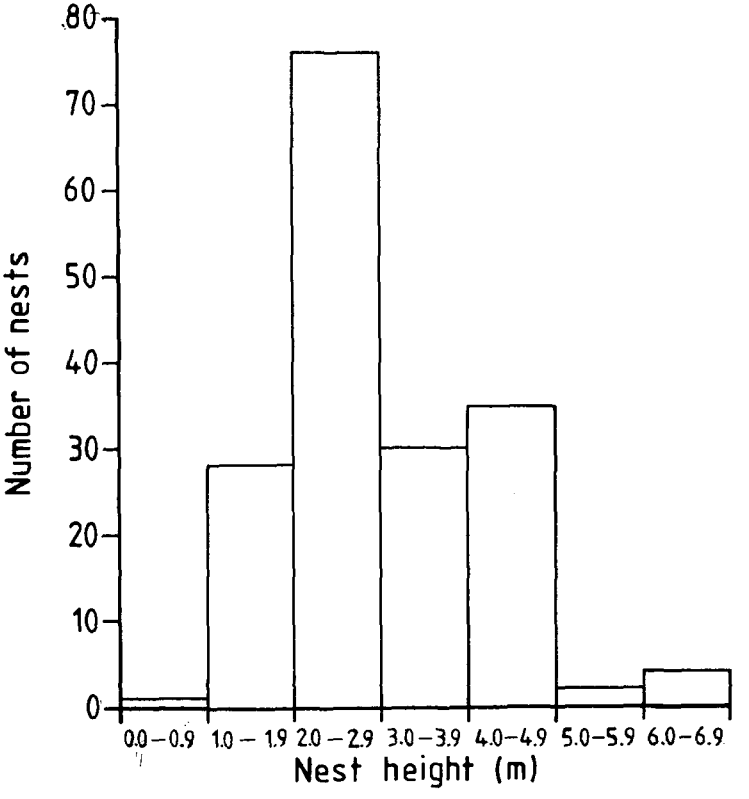

FIGURE 2 — Frequency distribution of nest heights of the Fantail, 1976-1978 (176 nests)

rosma robusta), 8%; tutu *(Coriaria arborea)* and *Coprosma australis,* 4% each; and 22 other species.

Nest height varied from 0.8 to 6.9 m and most nests were between one and five metres (Figure 2). The mean height was 2.9 ±1.1 m (176 nests), as compared with a canopy height of 7-12 m. Average nest height varied little from year to year: 2.9 ±0.9 m in 1976 (52 nests), 3.0 ±1.3 m in 1977 (73 nests) and 2.8 ±1.1 m in 1978 (51 nests). The F-value from a single classification ANOVA is 0.58, which is not significant. Similarly, nest height varied little from month to month: 3.4 ±1.2 m in September (27 nests), 2.6 ±1.1 m in October (38 nests), 2.9 ±1.2 m in November (67 nests), 2.9 ±0.9 m in December (38 nests) and 2.9 ±1.0 m in January (6 nests). The F-value is 1.72, which is not significant.

Nests were usually built around several thin branches, for

example, where several branches forked close together in mahoe or the crown of kanuka. Most nests were sheltered from above by foliage. Birds started building by wrapping cobwebs, then other material such as wood fibres and moss, around a branch. This was extended below into a ' tail ' (though this was not always present) and built up above to form a base. Then the cup was added and finally the nest was lined with fine material such as dried grass, rootlets, moss setae, fern hairs or wool. Material was sometimes carried several hundred metres, although it was often gathered near the nest.

Both sexes built, although the amount done by each varied. Often one bird, apparently the female, did all the building when there were dependent juveniles from a previous nest, but in at least two such cases both birds built. Ude Shankar (1977) at Christchurch, found that the female played a greater role in nest building than did the male. She determined that when juveniles were not present the male assisted the female during the early stages of building, but that he spent more time foraging, feeding the female, and displaying than building. When juveniles were present, he spent even less time building. I. G. McLean (pers. comm.) found that on Tiritiri Island the male of the North Island subspecies did no building, even when there were no juveniles.

Early in the breeding season, there were sometimes false starts at building, a small amount of material being placed at a site and then abandoned. The sites may sometimes have been abandoned because of cold, wet, or windy weather, which occurred most often in 1977, when the weather was particularly variable in late August. Several pairs completed their first nests but did not lay in them and built others.

Nest building took 12-16 days (mean 13.9 $\pm$1.4 days, seven nests) in August, September and early October, and 3-7 days (mean 4.6 $\pm$1.3 days, 11 nests) in late October and November. Thus the time taken to build a nest decreased during the course of the season, as was found by Ude Shankar (1977), perhaps because longer days, warmer weather, and more abundant food allowed time previously spent foraging to be spent building. Furthermore, the nests built early in the season seemed to be larger and bulkier than later ones. During the course of the season, similar decreases occurred in the length of the pre-lay period and the period between fledging and renesting. The time between the fledging of young from one nest and the beginning of building of another varied from up to 14 days in October to only one or two days in November and December.

The same nest was sometimes used for two successive broods. Eight of 70 nests (11.4%) were re-used in 1976, six of 81 (7.4%) in 1977, and five of 51 (9.8%) in 1978, an overall total of 19 out of 202 nests (9.4%). Three nests were re-used after predators had taken their contents, all in September and October. Fifteen were re-used

after a brood had fledged: two in October, eight in November, two in December and three in January. For one nest, the outcome before re-use was not known. Therefore, most nests that were re-used were ones in which a brood had been fledged and the largest proportion was in November. An advantage in re-using a nest is the saving in time and energy compared with building a new one, although nests that were re-used were relined. Re-use of nests by Fantails has been reported before, by Stead (1932), Fleming (1949), Cunningham (1954), Blackburn (1966), Coates (1966) and Flux (1974).

A period of a few days usually elapsed between completion of the nest and start of egg laying. This prelay period shortened as the season progressed, from 7-14 days in September (six nests) to 1-5 days in October and November (12 nests). For three nests in December, the birds laid as soon as the nests were completed. While the nest was being built and during the pre-laying period, the male frequently fed the female, and copulation occurred.

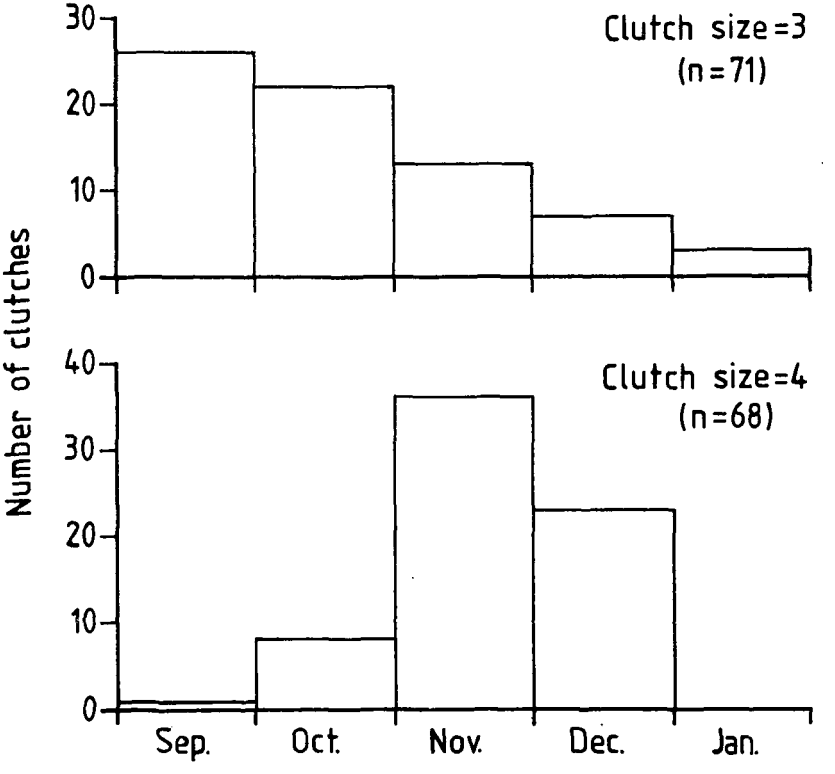

FIGURE 3 — Number of three-egg and four-egg clutches for each month of the breeding season (142 clutches)

Eggs

The eggs of a clutch were laid at daily intervals. This was noted on 48 occasions. Laying was observed once, on 11 December 1976. Both birds approached the nest several times, the male singing. The female went on the nest at sunrise (0430 h NZ Standard Time) and came off 10 minutes later after laying an egg.

Two eggs from an abandoned clutch were 16.1 mm x 12.1 mm and 16.2 mm x 12.2 mm.

Clutch size varied from three to five and the average was 3.5 ±0.5 eggs (142 clutches). Four nests were found with two eggs but these clutches may have lost eggs, as was noted at two other nests. Clutch size of the Fantail is usually given as three to four (Oliver 1955, Falla *et al.* 1979, McLean & Jenkins 1980). However, Moncrieff (1931) and Soper (1976) report five-egg clutches, and three clutches of five were found at Kowhai Bush.

Clutch size varied over the season (Figure 3). Nearly all first clutches were of three eggs. The proportion of four-egg clutches increased as the season progressed but decreased again towards the end of the season. This is similar to the pattern found by Blackburn (1965) and McLean & Jenkins (1980). The average clutch sizes for each month were 3.0 ±0.2 in September, 3.3 ±0.5 in October, 3.8 ±0.5 in November, 3.8 ±0.5 in December and 3.0 ±0.0 in January. Most eggs hatched (Table 2). The main cause of failure to hatch was predation (11.6%), which was highest in November and December. In Table 2, the category 'other' includes eggs that fell out of the nest, disappeared, or were dented, and eggs that did not hatch for unknown reasons.

Incubation

Both sexes incubated, even when there were juveniles from a previous nest to feed. In contrast, Blackburn (1965, 1966) found for the North Island subspecies that when juveniles were present the male fed them while the female built the next nest and incubated.

At Kowhai Bush, a bird was sometimes seen on the nest the day the first egg was laid and frequently there was a bird on the nest when two eggs had been laid. However, I followed Moreau (1946) in calculating the length of the incubation period from the laying of the last egg. Incubation ends when the last egg hatches, but I seldom noted this date. Therefore the incubation period was calculated from the laying of the last egg to the hatching of the first nestling. In 10 clutches, all the eggs hatched on the same day. In most other clutches, one egg remained to hatch and I do not know when this took place. Incubation periods were 13 days (three nests), 14 days (21 nests), 15 days (seven nests) and 16 days (one nest). The mean was 14.2 ±0.6 days. Thus the incubation period at Kowhai Bush was usually 14 or 15 days, as it was in Blackburn's (1965) study. Dennison *et al.* (1978) gave a period of 15 days for the Chatham Island Fantail,

calculated from the laying of the penultimate egg. My observations during egg laying indicated that, although the birds spent much time on the nest before all the eggs were laid, full incubation did not occur until the clutch was complete.

The time spent incubating was timed with a stopwatch for 13 nests, including two nests which involved an immature male and two at which only the female seemed to be present. The total observation time was 22.3 h. Many factors could influence the time spent incubating, for example, time of day, time of the breeding season, weather, sex of the bird and the stage of the incubation period. My sample is too small to take account of all these factors, but the results give a general indication of the pattern of incubation. For 'normal' pairs (both members adult and both sharing incubation) there was a bird on the eggs for 91.4-99.2% of the time and the average value was 96.8% (10.1 h observation). In three cases where the sexes were known, the female incubated more than did the male: 47.9% of the time compared with 43.5% (1.5 h of observation), 58.8% compared with 33.0% (1.2 h) and 53.2% compared with 45.9% (3.3 h). The average incubation spell was 17 min 26 s, but one pair incubated for spells of 40 min or more at a time. The incubating bird usually remained on the nest until the other bird relieved it, and the eggs were left unattended for a few seconds only.

For one nest, incubation was timed during the egg-laying stage. Incubation increased from 40.3% for two eggs (1.0 h of observation) to 73.8% for three eggs (1.5 h) and 98.2% for four eggs (the full clutch, 1.0 h).

For adult-immature pairs, the time spent incubating was similar to that of adult-adult pairs, about 97%, but immature birds spent less time than adults on the nest; 24.7% compared with 71.9% (5.8 h of observation). The average spells on the nest were 17 min 6s for immature birds and 31 min 5 s for adults. The longest incubation spell was 75 min 11 s by an adult.

A lone female spent 79.7% of her time incubating (2.9 h of observation), less than the time spent by a pair. The average time on the nest for the lone female was 34 min 23 s and the average spell off was 3 min 53 s.

Nestlings

At hatching, nestlings were sparsely covered in brownish down. The feather quills soon became visible and by four days of age (day of hatching = day zero) those on the wings were 5-10 mm long and those on the back and underside were 1-2 mm. By seven days of age, the feathers had begun to protrude from the quills and by the tenth day they were well developed over most of the body, except the tail where the feathers protruded only about 5 mm.

The average weight on the day of hatching was 1.2 g ($n=3$).

This increased to 1.3 g on day one (n=6) and then increased in a linear fashion to be 5.7 g at five days of age (n=5). The rate of increase then slowed, the average weight reaching 7.4 g at nine days of age (n=6). A decrease occurred between nine and 10 days of age, to 7.2 g (n=3).

Both sexes brooded and fed the nestlings. Each bird usually fed the nestlings before brooding. At one nest, nestlings about four days old were brooded 98.9% of the time (1.2 h of observation), the effort being divided fairly evenly between the parents. For two other nests, a lone female brooded one-day-old nestlings for 79.0% of the time.

The nestling period (the time from hatching of the first nestling to the fledging of the brood) was 12 days for six nests, 13 days for four nests and 14 days for one nest. This is shorter than the 14-16 days found by Blackburn (1965, 1966) for the North Island subspecies.

In many nests, the nestlings were infested with blood-sucking mites, identified by Dr G. W. Ramsay (Entomology Division, DSIR) as *Ornithonyssus bursa*. Mites were most noticeable after the nestlings had fledged, when they congregated in large numbers all over the nest and swarmed on to anything that touched it.

At least 55% of nestlings fledged (Table 4), but others not seen as fledglings may have survived as the family groups were sometimes very hard to find after fledging. Of the nestlings which did not fledge, most were preyed on, but a few died in the nest, fell out of the nest, or disappeared.

Juveniles

Newly fledged juveniles spent much time perched together, but they were capable of rapid flight if disturbed. As they got older, they spent more time flying about and catching an increasing proportion of their food. At fledging they had very short tails. These grew during the juvenile period, and so tail length provided an indication of how long the juveniles had been out of the nest. McLean & Jenkins (1980) showed the rate of tail growth during the nestling and juvenile periods for the North Island Fantail.

Both adults fed the juveniles, though the female possibly played a lesser role once renesting began. The length of time for which the juveniles were dependent on their parents was not determined. One brood which fledged in October was fed by the parents for at least 24 days after fledging.

Occasionally, juveniles from one family joined, and were fed by, a pair of adults that were not their parents and that had juveniles of their own. This event occurred at least four times and possibly in two other cases, and was detected when one or both groups were banded or when the adopted juvenile was significantly younger than the others, as indicated by the tail length. The newcomer to one banded group was of a similar age to the rest and was apparently

TABLE 4 — Colour morphs of offspring produced by different matings

Parents	No. of Nests	No. of offspring Pied	Black
Black and Pied			
1976 Pair 1	3	7	2
2	1	0	3
3	1	2	1
4	1	1	3
5	2	4	4
1977 Pair 1	1	3	1
2	2	4	3
3	1	1	3
4	2	2	3
5	1	1	2
1978 Pair 1	3	5	5
2	2	2	4
3	2	2	5
4	1	1	2
5	1	4	0
Total	24	39	41
Both Black			
1976 Pair 1	2	1	7
1977 Pair 1	2	3	4
2	1	0	3
1978 Pair 1	1	1	1
Total	6	5	15
Both Pied			
1976 Pair 1	2	4	2
2	2	5	1
All others	20	58	0
1977 Pair 1	1	2	1
All others	26	80	0
1978 Pair 1	2	5	1
All others	20	67	0
Total	73	221	5

permanently adopted. However, in another instance the adopted bird was younger than the rest and disappeared after a few days. Perhaps this adoption occurs when young join a different family group when two family groups come in contact. On one occasion when two groups came close together, one set of parents was seen with five young instead of three. Rowley (1965) reported similar behaviour in the Superb Blue Wren *(Malurus cyaneus)*.

Colour Morphs of Offspring

Among nestling Fantails for which the colour morph was determined, 18.7% were black. Because of the difficulty of distinguishing individuals, the proportion of black adults at Kowhai Bush was not determined accurately, but approximate values were 7 out of 52 (14%) in 1976-77, 10 out of 82 (12%) in 1977-78 and 7 out of 48 (15%) in 1978-79. Values for the South Island as a whole are 13.0% (Caughley 1969) and 11.6% (Craig 1972). However, Craig (1972) found considerable variability in the proportion of black Fantails in different vegetation types, from 5% in *Leptospermum* associations to 21% in hardwood forest.

Caughley (1969) and Craig (1972) proposed that colour in Fantails is controlled by a single gene locus with two alleles, one for pied and one for black, and that black is dominant over pied. According to this model, pied pairs should produce only pied offspring. However, four pied pairs at Kowhai Bush produced black young (Table 4), making up 2.2% of the young from pied matings. There are several possible explanations for this result. Firstly, it could be caused by mutation. However, 2.2% is much higher than the accepted level of spontaneous mutation.

Secondly, the genetical model could be incorrect. However, the other data agree well with the model. Birds homozygous for black will have only black offspring. One out of 15 pied x black matings had only black offspring (Table 4). This gives a frequency of 0.067 homozygous blacks. The average ratio of pied to black adults for the three seasons was 87% pied to 13% black. Using the Hardy-Weinberg law and following the calculations of Caughley (1969) and Craig (1972), the expected value for the proportion of pied x black matings which involve a homozygous black is 3.7%. Therefore the expected proportion of black to pied among 80 offspring is 38.5 pied to 41.5 black, which is close to the observed 39:41 (Table 4). Likewise, the expected proportion of black to pied for 20 offspring from black x black matings is 15.4 black to 4.6 pied, which is close to the observed 15:5. Nevertheless, it is possible that some other model may explain these data and the anomaly of the black young from pied matings as well.

The third possibility is that the pied female copulated with a black male who was not her partner during the raising of the brood. This has been suggested to explain the one previous report of black offspring from a pied pair (Craig 1972). Craig reported several cases where one member of a pair disappeared and was replaced by another bird. For two of the four pairs which produced black offspring in this study such changes apparently did not occur because the birds had been together for previous nests. One pair contained a banded bird and the other pair renested within a few metres of their previous nest. It is possible that these females copulated with black males but remained with their pied mates to raise the brood.

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SHORT NOTE

A REPEAT NESTING OF BELLBIRDS

Over parts of the Marlborough Sounds, the land is rapidly regenerating from pasture back to bush. Kanuka *(Leptospermum ericoides)* is the main canopy tree in this second-growth association, and the most conspicuous native bird is the Bellbird *(Anthornis melanura)*, especially from shoreline to 150 metres a.s.l.

On New Years Day 1981, I found a brood of five newly fledged Bellbirds at Arthur's Bay, Queen Charlotte Sound. I estimated that they had left the nest within the previous 24 to 48 hours. Their gapes were bright yellow, their tails were about 5 mm long and traces