BREEDING OF THE NORTH ISLAND FANTAIL

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SUMMARY

The nesting of two pairs of N.I. Fantails, *Rhipidura fuliginosa placabilis,* in isolated territories throughout two seasons is recorded in detail. Nest construction, clutch size, incubation and nestling periods, hatching, fledging, and survival successes are discussed, as are the division of labour between the sexes, the effect of isolation on fertility, and of weather conditions on nesting. The details from 68 cards in the Society's Nest Records Scheme are summarised and commented upon.

INTRODUCTION

In the spring and summer of the years 1959 and 1964 I was able to follow closely the nesting of two pairs of Fantails, and so make a number of observations on their breeding behaviour which do not appear to be recorded in the literature on the species. Two rather isolated study areas were used, both adjacent to my home, so that observations were possible at any hour of the day. The areas were isolated in the sense that in one of them at no time during the breeding season was a strange Fantail observed to enter the area, or appear on the periphery, and seldom did this occur in the other. This isolation possibly resulted in a low hatching success which is referred to later in this paper.

In any study of this nature, it is necessary to be able to distinguish between the sexes, not always easy in the case of the Fantail. Fortunately for me, although not so for the bird, the female in one area, both in 1959 and in 1964, was troubled with lice, so that preening, scratching and ruffling was throughout each season a full spare time activity; and thus she was easily distinguished. Quite often I have found the nests of various species to be heavily infested with lice during and at the end of the nestling period; but an examination of the nests of these two females disclosed a quite heavy infestation shortly after brooding began. However, lice apparently do not inhibit breeding success, for it will be seen later that one of these birds had 15 fledged young during the season. As the season advances, sexual differences become noticeable, particularly in the wearing of the tail feathers. Subsequent to the first nest, the female appears to do all the brooding, so that the tips of her tail feathers become much more worn than those of the male, even to the loss, in two observed cases, of all or part of one of the central dark feathers.

But there is a reasonable division of labour between the sexes. Oliver (1955) states "both sexes build and both incubate," but it will be seen from my observations that this applies mainly to the first nest of the season. The female does most or all of the building of subsequent nests, and the brooding of the eggs, while the male is occupied in feeding the fledged young.

Nests were extraordinarily easy to find in the two study areas, but not in the Buller (1888) tradition. The activity of one or both birds soon disclosed the location of the first nest of the season; and on the day after the fledging of each clutch, a minute or so of watching usually revealed the beginning of a new nest. Fig. 1 shows the locations of the several nests, and indicates that the birds mostly favoured a limited portion of their territories for nesting.

I must stress the fact that my observations and conclusions relate to the breeding histories of but two pairs of birds over two seasons. In consequence, further study may possibly show that some aspects of their behaviour may be atypical of the species.

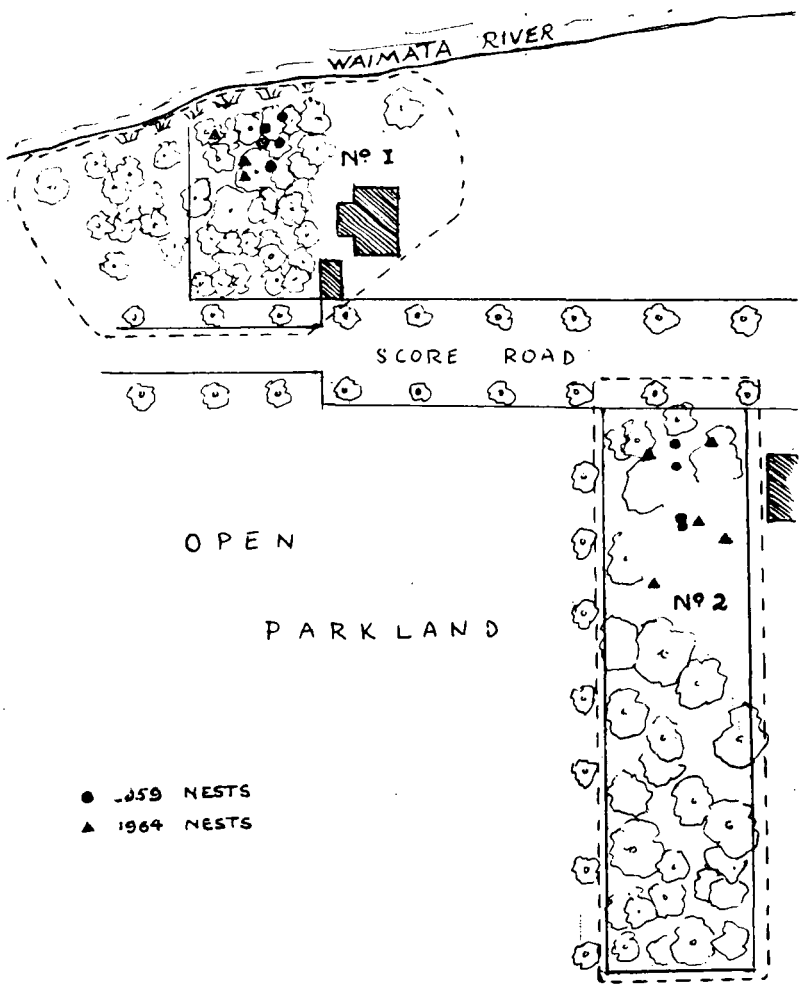


Fig. 1 — Sketch Plan of Territories

Description of Territories. What is designated as No. 1 Territory consists in part of an area of mixed native plantation 38 x 24 yds., bounded on the north by a tidal river, on the east by my house, and the other sides enclosed with a manuka breakwind. Fig. 1 shows that the territory extended to the west into some scattered native trees, to the south into silver birches lining a park roadway, and to the east to a very large myrtle tree on a neighbouring property. No. 2 Territory comprised an area of rather open mixed native plantation 124 x 34 yds. Both plantations are 40 years old.

Sequence of Nesting. The following tables 1 to 4 set out the details of breeding by each pair in both territories for 1959 and 1964.

TABLE 1 — No. 1 Territory 1959

	1st nest	2nd nest	3rd nest	4th nest	5th nest
Building started	—	—	—	28/12/59	
Building completed	17/8/59	11/10/59	23/11/59	10/1/60	no observ-
First egg laid	22/8/59	14/10/59	24/11/59	10/1/60	ations but
Number in clutch	3	3	4	3	3 newly
Brooding began	25/8/59 (a.m.)	16/10/59 (a.m.)	28/11/59	12/1/60	fledged with parent
Young hatched & No.	8/9/59 3	30/10/59 3 (p.m.)	12/12/59 3	27/1/60 3	on 21/3/60
Young fledged & No.	23/9/59 3	14/11/59 3	27/12/59 3	11/2/60 3	
Young surviving after 1 week	3	3	3	3	

Bad weather from 18/8/59 to 21/8/59 affected the first nest, which was temporarily deserted for this period. Heavy continuous rain from 2/10/59 to 9/10/59 also delayed completion of the second nest, but similar conditions on 14/10/59 and 15/10/59 did not affect laying. The general effect of weather on nesting is discussed later.

TABLE 2 — No. 2 Territory 1959

	1st nest	2nd nest	3rd nest	4th nest
Building started		8/9/59	—	—
Building completed		17/9/59	28/10/59	2/12/59
First egg laid	Nest	19/9/59	29/10/59	5/12/59
Number in clutch	destroyed	3	4	3
Brooding began	after completion	22/9/59 (a.m.)	2/11/59	8/12/59
Young hatched & No.		6/10/59 3 (p.m.)	71/11/59 2	23/12/59 3
Young fledged & No.		21/10/59 3	30/11/59 1	7/1/60 3
Young surviving after 1 week		2	1	3

The building of the fourth nest was interesting in that on 30/11/59, the date of fledging of the single young, the female was observed to be completing the rim of another nest, in the same mahoe tree as the third nest. Such behaviour may, or may not, be unusual in the Fantail, and has been recorded in other small passerines. Berger (1961) mentions that the Cedar Waxwing of America may lay the first egg in a second nest the day before the young leave the first nest. In the above table, the single young in the third nest fledged in 13 days.

TABLE 3 — No. 1 Territory 1964

	1st nest	2nd nest	3rd nest
Building started	17/9/64	28/10/64	3/12/64
Building completed	24/9/64	3/11/64	7/12/64
First egg laid	26/9/64	4/11/64	8/12/64
Number in clutch	3	4	3
Brooding began	28/9/64 (a.m.)	7/11/64	10/12/64
Young hatched & No.	13/10/64 3 (a.m.)	22/11/64 1 (4 p.m.)	24/12/64 1 (2 p.m.)
Young fledged & No.	28/10/64 3	3/12/64 1 (9 a.m.)	6/1/65 1 (3 p.m.)
Young surviving after 1 week	2	1	1

The male deserted the territory at 8 a.m. on 4/1/65, although three days earlier he was observed displaying vigorously to the female, which was unresponsive. The reasons for his desertion, and for the low hatching success in the second and third nests are discussed under "Hatching success."

TABLE 4 — No. 2 Territory 1964

	1st nest	2nd nest	3rd nest	4th nest	5th nest
Building started	Eggs	3/10/64	8/11/64	12/12/64	19/12/64
Building completed	destroyed	—	10/11/64	16/12/64	23/12/64
First egg laid	in a.m.	6/10/64	10/11/64	16/12/64	27/12/64
Number in clutch	29/9/64	3	4	Eggs	Eggs
Brooding began		8/10/64	13/11/64	destroyed	destroyed
Young hatched & No.		23/10/64 3	28/11/64 3	in p.m.	in p.m.
Young fledged & No.		7/11/64 3	12/12/64 3	18/12/64	30/12/64
Young surviving after 1 week		3	1	? mynas	? mynas

With the fifth nest of this pair, the reproductive urge was probably weakening. On 25/12/64, I found the hen on the nest at 7 a.m., and she vacated it at 8.30 a.m. without producing an egg. At

6 a.m. next day she was again on the nest, and was still there at 10 a.m. without laying. Again at 3 p.m. I found her on the nest, and she apparently laid the first egg in the late afternoon, for at 6 a.m. on on 27/12/64 the nest contained one egg. Subsequent to predation of this nest, the hen deserted the territory, and was not seen after 5 a.m. on 31/12/64, when I observed both birds flying frequently to the nest and inspecting the damaged eggs. The male remained on the territory, and on 2/1/65 was observed still feeding the single surviving young bird which fledged from the third nest on 12/12/64.

Nest Construction. The appearance of the nest is delightfully described by Buller (1888), who mentions a few of the infinite variety of materials used in construction. I examined the series of nests in Tables 2 and 3, to find that for each series the materials used were precisely the same, except that the first nest in Table 3 contained three tiny feathers from the bird itself, and a small wad of cat's fur, presumably from the only feline predator, which unwisely entered the area early in the nesting season. So having examined one nest of a particular pair, another nest of the same pair could be positively identified as belonging to them. This applied even to the two or three inch-long chips of decayed wood incorporated in the tails of one series. But a particular pair may, or may not, commence their nest by building a tail. For instance, in Table 3 the first two nests, built in rather open situations, had distinctive tails, whereas the third, in an enclosed position, completely lacked a tail. To list the materials used in different parts of the nests by the same and different pairs, to show up similarities and differences, would extend this paper beyond reasonable length, and may provide the basis for a later paper.

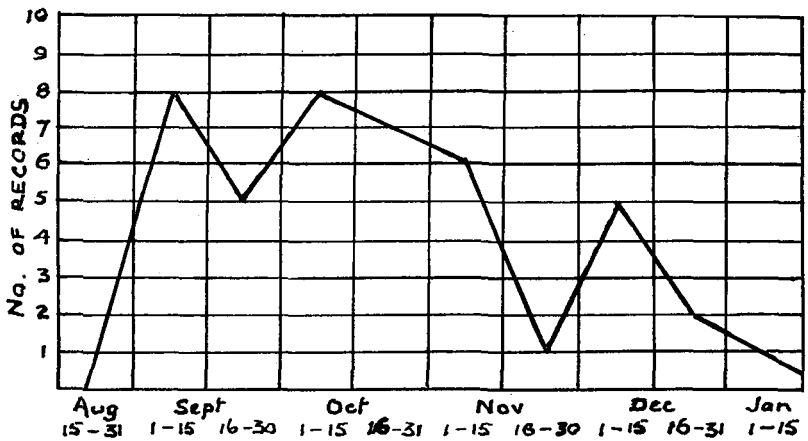
Construction begins with the plastering of wisps of dried grass, fibre, etc., to the three twigs forming the branches of the fork selected. This is effected mainly with cobweb, well wiped on with the bill; but in the case of the first nest in Table 3, following heavy rain, the hen bird was observed to supplement the cobweb with innumerable minute particles of sodden, decayed wood. Subsequent examination proved the effectiveness of this plaster. The tail is then made by joining the three lots of fibre, etc., together with cobweb, and extending the tail thus formed by joining on more fibre, bark, small chips of decayed wood, etc. The base of the nest, about 1 inch in diameter and $\frac{1}{2}$ inch thick, is then woven into the material already cemented to the three branchlets. Next come the walls, about $\frac{1}{2}$ inch thick, built up from the base, the bird at this stage working as much from inside the growing nest as from the outside. Much time and care is given to binding the rim with cobweb; and a suitable lining, frequently of root fibre, or treefern hairs, completes the structure. The shortest period occupied in construction of the nests under observation was approximately 48 hours.

Height of Nest. The height of nests in the study areas varied between 5 and 23 ft., the latter height making observation an arduous business. An examination of 68 records in the Nest Records Scheme shows a minimum height of 2 ft. 6 ins. and a maximum of 25 ft., except for one record of 50 ft., which is treated with some reserve. The following summarises the information on the cards:

	No.	%
Up to 5 ft.	13	19
6 to 9 ft.	23	34
10 to 19 ft.	25	37
20 ft. and over	7	10
	68	100

Records of First Eggs. The graph in Fig. 2 summarises the information gathered from the Nest Record cards. The two August records, and the single January record, are my own. It may be that most observers do not expect to find, and so do not look for, nests as early as August, whereas in a favourable season there is little doubt that a large proportion of the species is then nesting. Except in confined study areas such as mine, nests become progressively harder to find as the season advances, because (a) fledged young remain more or less on the territory of the parents for some weeks, usually accompanied by the male, and so confuse the issue, and (b) building by the hen is speeded up, and so this favourable opportunity for finding the nest is probably missed.

There are insufficient nest record cards (38) to give a true picture of the sequence of nesting.



Clutch Size. Oliver (1955) states the clutch as 3, which is not correct. Fifty-one records of clutch size reveal the following:

	No.	%
3-egg clutches	31	61
4-egg clutches	20	39
	51	100

A further dissection of these records to show when the 4-egg clutches occur reveals:

Up to 31st October	6 4-egg clutches	20
	24 3-egg clutches	80
		100
Average clutch 3.2		
After 31st October	14 4-egg clutches	74
	5 3-egg clutches	26
		100
Average clutch 3.7		

It is highly probable that the 6 4-egg clutches up to 31st October all relate to second nestings, as none were recorded prior to 16th September. Late nesting records are so sparse that I do not think the true clutch pattern is revealed for third and subsequent nestings. The 3 - 4 - 3 pattern clearly emerges in Tables 1 to 4, and it is perhaps significant that where there were more than three nestings, the pattern is 3 - 3 - 4 - 3. Lack (1954) says "In treble-brooded species, the second brood is larger than the first or third. Day length has perhaps some influence, for with a longer working day, the parents can collect more food, hence they can raise a rather larger brood." The probable selective advantage to the Fantail in laying 4-egg clutches is discussed under "Fledging success."

Incubation Period. As stated by Cunningham (1954), there is an almost complete absence in the literature of data relating to the incubation period. Oliver (1955) states that this period was recently determined by J. M. Cunningham as almost exactly 15 days; but Cunningham says ". . . if it is assumed that eggs were in fact laid before 8 a.m., and that hatching took place about the same time, the period was almost exactly 15 days." Skutch (1952) found that many song-birds such as finches, wrens, tanagers, wood-warblers and hummingbirds lay around sunrise; and Weidmann (1964) states the time interval between the laying of successive eggs is 20 to 24 hours for most but not all passerines. Many more careful observations are required to establish a definite time and pattern of laying; and such observations are difficult, for one is loth to disturb even so accommodating a bird as the Fantail when it is likely to be performing this important function. I have 10 clear records of a bird being on the nest at 10 a.m. after having laid that morning; and the hen will quite usually be found still on the nest in the afternoon subsequent to laying in the morning. On the other hand, I have two records of eggs being laid after 9 a.m., and three clear records of laying in the afternoon. I have also several observations of hatching occurring in the afternoon.

In stating the period of 15 days, Cunningham (1954) gives a tolerance of up to 19 hrs., and in this I am inclined to agree, in the light of the following table:

In these examples it is fairly assumed that the laying of the last egg took place at 7 a.m. or 6 a.m. according to season, and that brooding began at that time.

TABLE 5 — Incubation Periods

Reference	Table 1	Table 1	Table 2	Table 3	Table 3
	1st nest	2nd nest	2nd nest	1st nest	3rd nest
Brooding began	25/8/59 a.m.	16/10/59 a.m.	22/9/59 a.m.	28/9/64 a.m.	10/12/64 a.m.
Hatching occurred	8/9/59 p.m.	30/10/59 3 p.m.	6/10/59 4 p.m.	13/10/64 7 a.m.	24/12/64 2 p.m.
Brooding period	14 days 8 hrs.	14 days 8 hrs.	14 days 10 hrs.	15 days	14 days 9 hrs.

I cannot say with certainty that the male takes no part whatever in the incubation of eggs subsequent to the first clutch, but the evidence points that way. Changing over at the nest is a frequent and obvious occurrence with first nests, and with the second if there are no surviving fledged young from the first, such as with the second nests in Tables 2 and 4. But on no occasion did I record a change over when there were fledged young in the territory.

Hatching Success. Some 53 nest record cards give sufficient detail to allow a fairly accurate assessment of hatching success:

Of 19 4-egg clutches (76 eggs) 58 hatched, or 76 per cent.

Of 34 3-egg clutches (102 eggs) 80 hatched, or 78.5 per cent.

These figures give an overall percentage of 77.25.

The low fertility of the pair on No. 1 Territory in 1964 (see Table3) led me to seek a cause for their lack of hatching success. I have already mentioned the isolation of this study area from other Fantails. The Fraser Darling (1938) effect would have provided one answer to the problem, for he believed that sociality, expressed in display and song, has survival value, and had this to say concerning territory: "One of the important functions of territory in breeding birds is the provision of periphery" i.e. the border along which the bird is in relation with a neighbour. And I quote Fisher (1954) at some length on this subject: "The effect of the holding of territory by common passerines is to create 'neighbourhoods' of individuals which are the masters of their own definite and limited property, but which are bound firmly, and *socially,* to their next door neighbours by what in human terms would be described as a dear enemy or rival friend situation, but which in bird terms should be more safely described as mutual stimulation." But Dr. John Gibb (*pers. comm.*) considers that this lack of fertility may have been due to some unsuspected deficiency in the territory, or perhaps to the age of the birds (if they were both young, born late in the previous season), or even to chance.

The male of this particular pair was observed on occasions to display to the female under circumstances when copulation could have been expected as a climax . But the female appeared to me unresponsive, either because of some lack in the male's display, or perhaps, to anthropomorphose the situation, because she "took him for granted." The end result was that the male completely deserted the territory 2 days 7 hrs. before the single nestling of the third nest fledged; and thus dashed my hopes of a fourth nest in the study area.

Nestling, or Fledging Period. Oliver (1955) gives the fledging period, on the authority of Wilkinson (1952), as 15 days, and Cunningham (1954) recorded it from his observation as 14 days. It is of interest to note that Serventy and Whittell (1962) give the hatching and fledging periods of the Australian race of *Rhipidura fuliginosa* each as 15 days. I have found the period to fluctuate from almost exactly 14 days to almost exactly 15, even with successive clutches of the same parents. But this period only applies to a full clutch. There were three cases of single fledglings in my study areas, and the periods in the nest were 13 days (table 2), 11 days 17 hrs., and 13 days (table 3). These young appeared extremely immature when first out of the nest, but all survived for at least several weeks after fledging, and finally left the areas. There may be two contributing causes to the early fledging of single nestlings: (a) The food supply develops them more quickly; or (b) The lack of companionship causes premature departure from the nest.

The faecal sac ceases to be produced just before fledging, so that typically two or three fresh droppings will be found in a nest from which the young have just flown.

For three or four days after fledging, the young remain mostly in a tight group, which then tends to break up, but reforms at times, particularly towards evening, for two or three days longer.

Fledging Success. It is interesting to note that the nest record cards provide evidence that the percentage of fledging success from 4-egg clutches is almost identical with that from 3-egg clutches.

Of 13 4-egg clutches (52 eggs) 47 hatched and 37 fledged.
Percentage of fledged to hatched 79
Percentage of fledged to eggs 71

Of 21 3-egg clutches (63 eggs) 60 hatched and 47 fledged.
Percentage of fledged to hatched 78
Percentage of fledged to eggs 75

The nestling mortality in 4-egg clutches is therefore 21 per cent., and 22 per cent. in 3-egg clutches. Thus, whilst the percentage of fledged to eggs is rather higher in the 3-egg clutches, the difference is so slight that there would appear to be a definite selective advantage to the species in the production of 4-egg clutches in the second nesting. But as Dr. Gibb (*pers. comm.*) points out, this advantage is not to be measured solely by the number of young fledged, their subsequent survival being just as important.

Survival after Fledging. Young surviving for more than one week after fledging should have a reasonable chance of reaching maturity. Records of such survival are almost impossible to make under normal conditions, so the record cards contain none. However, no difficulties were experienced in my study areas, the fledged young remaining on territory for some weeks as a rule, and normally being fed by the male. The records of survival from Tables 1 to 4 are as follows:

12 clutches (43 eggs) from which 30 fledged, and 26 survived to the stage of independence.
Percentage of survival to fledged birds 87
Percentage of survival to eggs 60

Thus 4 pairs of birds had 26 surviving young in the two nesting seasons, averaging 3.2 young per pair per season. If the species is maintaining its population at a fairly constant level, as it appears to be, this result would indicate that the average life span of a Fantail is extremely short; but it would be reasonable to assume that survival of young in the rather protected study areas was considerably above the average for the species. Added to this, as stated by Dr. Gibb (*pers. comm.*), judging from other birds, there is likely to be specially heavy mortality immediately after the young become independent.

Effect of Weather Conditions on Nesting. The early nesting of the two pairs in August, 1959, compared with the late nesting in September, 1964, naturally leads one to seek a cause of the variation of more than 4 weeks. Rowan (1925) was the first to discover that increasing daylight leads to the development of a bird's gonads. All things being equal, one would expect sexual activity and nesting to begin at about the same time each season. The only variable factor would appear to be the weather, with its consequent effect upon food supply. The year 1959 was remembered as having a wet winter and early spring, while in 1964 the winter and spring were exceptionally dry, later developing into drought conditions. So meteorological records were examined, and the following information extracted:

TABLE 6 — Meteorological Data, 1959 and 1964

	1959				1964			
	June	July	Aug.	Sept.	June	July	Aug.	Sept.
Days with rain	14	15	18	11	23	16	17	14
Hours of sunshine	146	158	160	165	97	128	175	185
Rainfall	1.01	6.22	6.31	2.34	7.05	0.86	1.58	2.35

The heavy rainfall of July and August, 1959, was possibly the main factor leading to the early nesting that year, or it may have been that the rain combined with many hours of sunshine led to a substantial increase in the food supply. Conversely, the lack of rain in July and August, 1964, may have delayed nesting by decreasing the food supply. In this connection, Serventy and Whittell (1962) are quoted at some length: "Light is by no means the only probable activator and among land and fresh water birds other external factors are capable of stimulating the pituitary; among those which have been suggested are temperature, humidity, rainfall and water levels, and food supply. It is difficult to isolate the effective factor out of a number which might be acting simultaneously." Referring to rain in particular as a factor, they say, "It might be the sight of drenching rain itself . . . acting through the eye as the receptor organ. . . . The process is quite involuntary and outside the control of the will of the individual." Our Fantail is the Australian Grey Fantail represented here by a distinct sub-species, which Fleming (1962) suggests has developed within no more than 20,000 years. In Australia, rainfall is recognised as a major factor in the breeding of very many species, and our Fantail

could possibly retain an ancestral response to factors other than increasing hours of daylight in the control of its breeding season. I put these suggestions forward more with the idea of provoking thought on this interesting subject, rather than providing the probable cause of the early or late beginning of the nesting season.

DISCUSSION

It would appear that 4 nests, excluding renesting, are quite a normal number for the Fantail in a season, with a minimum of 3, and under most favourable circumstances, 5. Both sexes share in the construction of the first nest and in brooding the first clutch, and thereafter it appears that the male mainly cares for the fledged young, while the female does most of the nset-building and brooding. It appears quite usual for the female to commence building a subsequent nest on the day the young fledge, and even earlier on occasions. Many more detailed records are required to define accurately the normal time of the laying of eggs, and consequently of the time when brooding begins. From the evidence available, the hatching period varies between 14 days 8 hrs. and 15 days.

Nests of one pair are constructed of identical materials throughout the season, and it would be interesting to know whether this characteristic is carried on from on season to another. Banding may provide the answer. The provision of a tail to the nest seems to depend on its situation, no tail being made when the nest is in an enclosed position; but more observations are required. The fledging or nestling period varies between 14 and 15 days, but where there is only one fledgling, this period may be less than 12 days, without prejudicing its survival.

The Nest Record cards have been of considerable assistance in writing this paper, but are lamentably few in number for such a common species. So members of the Society are urged to give the system its full value by supplying records wherever possible. In observing the nests of tree-nesting birds, and in particular in a series of observations, the use of a mirror on an extensible rod is strongly recommended, as making easy many observations which would otherwise be impossible, causing a minimum disturbance of the nesting bird, and reducing or totally removing the risk of predation which so often follows human interference.

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REFERENCES

BERGER, A. J. (1961): Bird Study, 202.
BULLER, W. L. (1888): A History of the Birds of N.Z. I, 70-71.
CUNNINGHAM, J. M. (1954): Three observations of Fantails, Notornis VI, 47.
DARLING, F. Fraser (1938): Bird Flocks and Breeding Cycle, Cambridge U.P.
FLEMING, C. A. (1962): History of N.Z. Land Bird Fauna, Notornis IX, 270.
FISHER, J. (1954): Evolution and bird sociality, in Evolution as a Process, 73.
LACK, D. (1954): The evolution of reproductive rates, in Evolution as a Process, 146.
OLIVER, W. R. B. (1955): New Zealand Birds, 492.
ROWAN, W. (1925): Relation of light to bird migration and developmental changes. Nature 115: 494/5.
SERVENTY, D. L., & WHITTELL, H. M. (1962): Birds of Western Australia, 3rd Ed. 8/9, 344.
SKUTCH, A. F. (1952): On the hour of laying and hatching of birds' eggs, Ibis 94: 49-61.
WEEDMAN, U. (1964): Laying, in A New Distionary of Birds, 422.
WILKINSON, A. S. (1952): Kapiti Bird Sanctuary, 63.