RELATIVE CONTRIBUTIONS OF MALE AND FEMALE PURPLE MARTINS TO FEEDING OF YOUNG

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Widmann (1922), quoted by Allen and Nice (1952), found that in a colony of 16 pairs of Purple Martins, females delivered 55.5% of the food items over a period of 16 hours of continuous observation. I could find no evidence that Widmann's data were ever subjected to statistical analysis, so there is no way of knowing the role played by experimental error in determining the outcome. However, the contribution of females seems sufficiently robust to lead one to believe that the difference between feeding rates of the sexes was, indeed, significant. Moreover, there is some question as to whether the males worked at a normal rate, since most of Widmann's broods consisted of two or three young, well below average for martins.

Casual observations at my colony in Raleigh, N.C., have led me to believe that male and female martins contribute equally to feeding of young, particularly if broods are large. I have recorded brood sizes ranging from one to eight, with a modal number of six. However, in the larger broods it is rare for more than four to survive until old enough to leave the nest. Earlier I showed that adult birds, those 2 years old or older, reared an average of 3.4 young per nesting attempt over a multi-year span (Lee, 1967).

Broods in the spring of 1973 were larger than usual, and nesting among pairs synchronous to a higher degree than in the past 3 years. Thus it seemed an excellent opportunity to study in more depth the role of the sexes in supplying food to young.

PROCEDURES

Four pairs, each with broods of six, were selected for study. The broods ranged in age from 4 to 7 days at the beginning of the observations. All parents were believed to be adult birds, since the males were black, and the females in question arrived along with their mates in March and early April. Sub-adult birds commonly arrive 3 to 4 weeks after adults have settled (Allen and Nice, 1952; Lee, 1967). These martins were housed in gourds about 8 inches in diameter suspended about 15 feet above the ground.

No efforts were made to mark the parents for purposes of identification. However, at least one member of each pair was naturally marked in some way, such as broken flight feather, gap in tail, or differences in breast color of females. None of the naturally marked birds were observed to engage in promiscuous feeding, so there was reason to believe that this source of potential bias was not present.

Total time of observation was 5 hours. This was broken into 10 periods of 30 minutes scattered through the diurnal span, from 23 May through 31 May. Half the time blocks were after 17:00 hours, but there was one before 09:00, and one during the noon hour.

Data were taken on the number of food deliveries by each parental bird during the 5-hour span. All young survived to the end of the experiment, but a few were noticeably retarded in growth, suggesting that they would probably succumb, eventually, to competition.

RESULTS AND DISCUSSION

The unprocessed data are given in Table 1. A total of 352 prey items were delivered during the 20 pair-hours of observation. Thus each brood received food, on the average, every 3.4 minutes. The highest rate of feeding was recorded between 12:30 and 13:00 on 31 May when 54 total prey items were delivered. This time block also saw the highest

TABLE 1. Food deliveries by pairs over blocks of time.

	Block Number									Total items by
	1	2	3	4	5	6	7	8	9	10 sex, within pairs
Pair number										
1 male	3	3	7	3	4	2	5	4	10	2 43
female	3	3	5	2	2	7	4	3	5	2 36
2 male	7	2	3	2	7	2	5	3	7	4 42
female	5	4	2	3	3	2	4	5	5	3 36
3 male	5	4	3	4	3	3	6	3	7	2 40
female	4	5	5	3	1	5	8	3	6	9 49
4 male	7	4	5	7	4	5	5	4	8	3 52
female	7	6	5	4	7	5	4	4	6	6 54
Total items per block	41	31	35	28	31	31	41	29	54	31 352

rate of delivery by an individual when Male 1 brought in 10 dragonflies. The lowest rate was recorded between 08:00 and 08:30 on 25 May when only 28 items were procured. The lowest yield per bird, per time block, was by Female 3 between 17:30 and 18:00 on 25 May, when she delivered 1 butterfly (*Vanessa* sp.)

If the contribution of pairs over all time blocks is taken as the primary observation, and the contribution of sexes within the various pairs as a secondary observation, the data can be analyzed as the contribution from a split plot experiment with 10 replications (time blocks). The detailed statistical anaylisis is given in Table 2.

Under effects deriving from the primary observation, differences between pairs was not significant at the 5% level, but approached significance. This result may be interpreted to mean that pairs of martins with broods of six, over the age range of 4 to 15 days, work with equal, or nearly equal, effort to keep their broods fed.

The difference between deliveries per block was significant. This is not suprising since martins are likely to capture prey in relation to its abundance, and insect activity is apt to vary over the diurnal span. For example, two periods were at dusk when large numbers of a big mayflies were brought in. Each of these blocks yielded 41 items. The noon-hour of 31 May was the most productive of all with 54 items, 48 of which were dragonflies, indicating a time of high activity for this favored prey. It is, of course, possible that martins are more active at certain times of the day for reasons not related to available food supply.

Evidently the age of young did not relate directly to rate of food procurement. The time block data were recorded in Table 1 in the precise order taken, and the procurement rate is not linear over the 5-hour span.

Under effects deriving from secondary observations, the performance of pairs was not significantly different with males procuring 177 items to 175 for females.

As for interaction of primary and secondary effects, comparison of the relative productivities of sexes within each of the pairs led to no detectable difference. Thus it may be that some pairs work harder than others, but within a given pair male and female seemed to work with equal effort over the 5-hour span.

Did males and females work with equal effort within each of the time blocks? Perhaps not, since the sexes by period interaction approached significance at the 5% level. My observations suggest that parents do not coordinate their activities to any great extent when feeding young. At times both are very active, at other times neither is, and occasionally one or the other is busily bringing in food. Examination of the data in Table 1 will reveal the evidence for this conclusion. Perhaps a given parent feeds the young

TABLE 2. Analysis of the feeding data.

Sources of variation	Sums of squares	Degrees of freedom	Mean Squares	F ratio	Significance level
Pairs	25.30	3	8.43	2.91	0.10 – 0.05
Periods	72.70	9	8.08	2.78	0.05 – 0.01
Pairs by period (Error 1)	78.20	27	2.90		
Sexes	0.05	1	0.05	0.00	NS
Sexes by pair	8.45	3	2.82	1.41	NS
Sexes by period	38.45	9	4.27	2.12	0.10 – 0.05
Sexes by pair by period (Error 2)	54.05	27	2.01		

until it becomes hungry, thirsty, or tired. After refreshment it commences feeding the young once more.

The only evidence of coordinated activity was noted when both parents approached the nest with food. In every case the male deferred to the female, allowing her to enter the nest first. In fact the male would defer to his mate when she was 10 to 15 feet from the nest and he was closer. While I don't comprehend the significance of this behavior, it does suggest that a given male can recognize his mate from a distance.

In summary, four pairs of martins with broods of six each, ranging in age from 4 to 7 days at the beginning of the experiment, were observed for a total time of 5 hours, broken into 10 time intervals of 30 minutes each, scattered through the diurnal span. During this time males and females supplied virtually equal numbers of prey items. While food gathering activities were not equal in all time blocks, the sexes performed equally well, though some pairs may have gathered more food than others. These martins delivered food at what I consider a high rate, at 3.4-minute intervals, and males and females apparently performed with equal vigor.

LITERATURE CITED

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