

SHORT COMMUNICATIONS

Nest Grouping and Productivity in the House Sparrow

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Accounting for variation in reproductive output among individuals of a species is difficult. A variety of factors can affect reproductive performance, and few of these operate independently of the rest. Except for a controlled experiment, a large sample size is the best tool for the researcher investigating such life-history phenomena. A large population of House Sparrows (*Passer domesticus*) on a ranch near Calgary, Alberta provided a suitable sample for the investigation of nesting strategies. Nests at the site were not randomly distributed. The general pattern was one of high-density sites scattered throughout the ranch. Summers-Smith (1963) and Dawson (1972) commented that House Sparrows usually space their nests. The question that arose here was why did the sparrows prefer to nest in groups when other sites appeared vacant? To answer this, knowledge of the relative reproductive success of pairs nesting in groups and in open sites was needed.

Although House Sparrows are efficient users of artificial nest sites, the vast majority of nests built on the ranch were in rows of blue spruce (*Picea pungens*). For this study, nests in two parallel rows of trees about 80 m apart were used (Table 1). A total of 146 nests was found and assigned two-dimensional coordinates, with the assumptions that both the rows and the trees were straight. Because 97% of the nests were built against the main trunk of a tree, these assumptions were reasonable. From the coordinates (x = distance along the row, y = nest height), nearest-neighbor distances and the degree of grouping were assessed.

Field techniques of gathering data and most data analyses have been described elsewhere (McGillivray 1978, MS; see also Murphy 1978). A new variable used in this study, called parental efficiency (E), is defined as

$$E = \sum_{i=1}^n \sum_{j=1}^m \frac{F_{ij}}{T_{ij}},$$

where i = number of successful clutches (i.e. hatch at least one young), j = number of nestlings, F_{ij} = fledging weight of the j th individual in the i th clutch, and T_{ij} = fledging weight, or the last recorded nestling weight before death or disappearance, of the j th individual in the i th clutch. E measures the ability of the parents to raise young. It is a measure of the parental investment that produced successfully fledged young divided by the total investment in the brood. If all nestlings fledge, $E = 1$. Productivity is used in the specific sense of the number of young fledged through the season. Fledging weight is an important component of reproductive success, because it correlates with fledgling survivorship (Dawson 1972). In this study, fledgling weight was not affected by grouped nesting, but it did increase throughout the breeding season and was negatively related to nest height.

An attempt was made to determine the relationship between clutch initiation dates and the grouping of nests in the west row (the east row had a relatively even distribution of nests, with only two trees having more than two nests). Each tree in the row containing at least two nests was used in the comparison. Every clutch attempt was assigned a deviation value equal to the absolute value of the number of days separating the date of clutch initiation from the initiation date of another clutch in the same tree. These deviation values were summed over all successful clutches, and the mean deviation and the variance of deviations were calculated to assess synchrony. When all nests were perfectly synchronized, both the mean deviation and the variance would equal zero.

Results are summarized in Tables 2 and 3 and in Fig. 1. The maximum number of nests found in one tree was 14, 10 of which were within a sphere of radius 1 m. Numerous other instances were noted when two or more nests were in direct contact. Occasionally, these nests were coalesced into a compound structure that obscured individual nest outlines. Dawson (1972) noted that House Sparrow nest sites were maintained a minimum of 30 cm apart; this was clearly not the case in this study. Although the observed densities were lower than those reported for the Spanish Sparrow (*Passer hispaniolensis*, Gavrillov 1963), the nests were unusually tightly packed for the House Sparrow (Summers-Smith 1958).

The average level of nest clumping (number of nests within 1 m of a given nest) in the west row was significantly higher than in the east row (3.43 to 0.76, $P < 0.01$, $n = 146$, Mann-Whitney U -test), and structurally the rows were quite different (Table 1). These differences were not accompanied by variation

TABLE 1. Some characteristics of nest sites in the east and west rows.

Variable	West row	East row
Total length (m)	94	81
Total number of trees	34	24
Total number of nests	110	36
Mean tree height (m) ^a	5.61	4.50
Mean nest height (m) ^a	3.87	3.27
Mean distance to nearest neighbor (m) ^a	0.66	1.52
Mean number of nests within 1 m ^a	3.43	0.76

^a Significant difference between rows, $P < 0.01$, Mann-Whitney U -test.

in nesting productivity, which suggests that, at the row level, nest packing and substrate diversity do not affect the reproductive performance of House Sparrows.

Nest clumping was higher, and (particularly for the west row) the average number of successful clutches initiated at a nest site was lower, in the southern half of the rows (Table 2). For both rows, the correlation between the number of successful clutches and the average nest density was negative ($0.05 > P > 0.10$). For the west row alone, the correlation was significant ($r = -0.63$, $P < 0.01$, $n = 110$).

Significant differences between sets of grouped nests and of dispersed nests were found when reproductive variables were used as discriminators in a discriminant function analysis. Of 42 nests, 83.3% were correctly classified by total number of clutches, total number of eggs laid, number of young fledged, total nestling weight, and average clutch size. Table 3 shows a list of these variables for both grouped and dispersed nests. Although only two are significantly different, the trends (detected by the discriminant analysis) for higher seasonal productivity for dispersed nests and higher per clutch output for grouped nests are consistent. Intuitively, one would expect birds laying more successful clutches to fledge more young. The lower per clutch output, however, suggests inefficiency in the raising of young. This was examined in a regression of parental efficiency on number of successful clutches. Parental efficiency decreases significantly with an increasing number of clutches ($r = -0.385$, $df = 106$, $P < 0.01$).

Overall patterns of clutch initiation suggest that synchrony might be associated with groupings of nests. Mean deviations from perfect synchrony and variance of deviations are plotted in Fig. 1. The decrease in mean deviation with an increase in nest number ($r = -0.845$, $df = 5$, $P < 0.05$) would be anticipated by chance factors alone. The decrease in variance with an increase in nest density ($r = -0.945$, $df = 5$, $P < 0.01$), however, implies that greater synchrony of nesting activities results from nest grouping.

Colonial nesters generally show higher nesting productivity at greater nest densities (Horn 1968, Coulson 1968). Close pair proximity, however, might be disadvantageous for a species that typically is non-colonial (Kluyver 1951). The smaller number of clutches initiated at grouped nests implies that close pair proximity somehow acts to lower productivity. Yet there are positive aspects to nest clumping. Synchrony of nesting activities may increase postfledging survivorship by providing flock mates for recently-fledged juveniles. A higher efficiency suggests greater reproductive return per unit of parental effort and perhaps a longer reproductive life.

The evolution of colonial nesting is usually ascribed to two causes—a patchy, i.e. temporally or spatially variable, food resource, and predator avoidance (Horn 1968). At the ranch, no clear instance of nest predation was noted, probably because of human activity and a lack of natural nest predators. Food resources of House Sparrows are not known to be patchy, although this has not been critically tested. The availability of nest sites used in previous years suggests that high population density did not force grouping of nests. In addition, personal observations and those of Summers-Smith (1958) show that

TABLE 2. Intrarow variation of nest clumping and the number of successful clutches initiated at a site.

Portion of row	Clumping coefficient (nests within 1 m)		Number of successful clutches	
	East row	West row	East row	West row
North periphery	0.28	2.67	2.28	2.29
North middle	0.55	2.44	2.00	2.50
South middle	1.11	4.50	2.00	1.85
South periphery	0.92	4.20	2.00	1.86

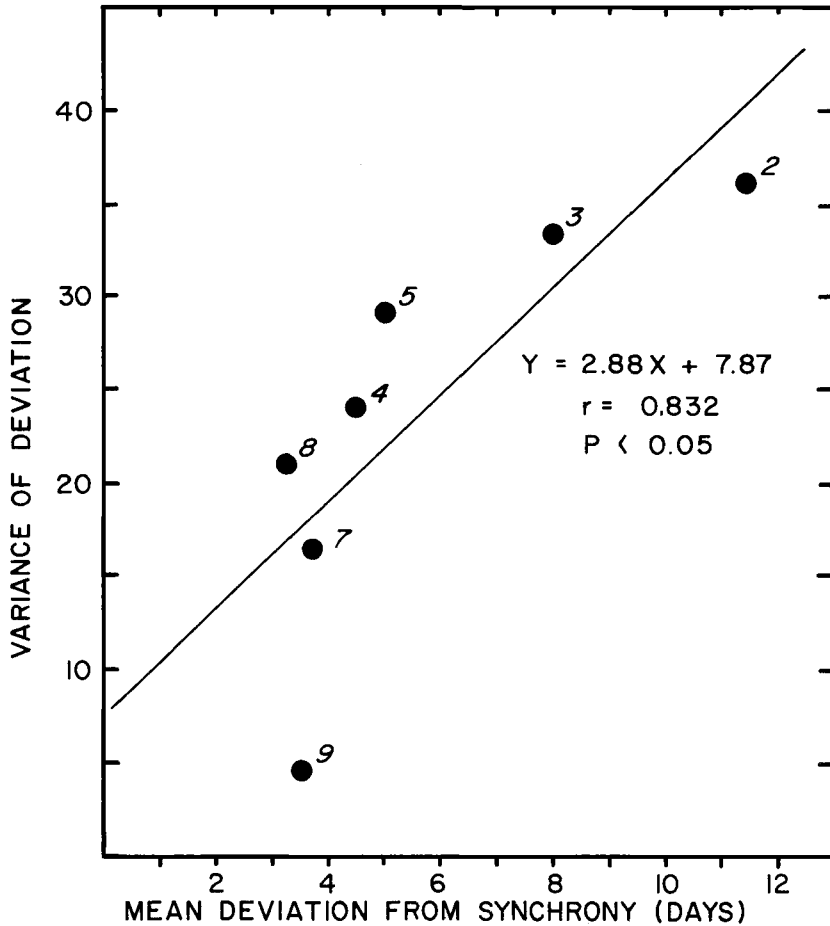


Fig. 1. Relationship between deviation from synchrony and the variance of deviations from synchrony with numbers of nests per tree (*italic number*) in the west row.

House Sparrows do not tolerate strangers near their nest, particularly during nest building. Why then were nest sites very close to existing nests considered suitable by the birds?

No clear answer is forthcoming. Even so, there is good evidence that minimizing the detrimental effects of weather is vital to the nesting success of these sparrows (McGillivray 1978, MS). Strong northerly winds and cool temperatures combine to create stressful conditions throughout the breeding season. In

TABLE 3. Comparison of reproductive output in grouped and dispersed nests.

Variable	Dispersed	Grouped
Number of clutches ^a	2.36	1.82
Number of eggs laid	10.84	9.47
Number of young hatching ^a	6.32	4.76
Number of young fledging	3.76	3.17
Parental efficiency	0.72	0.80
Hatching success	0.58	0.50
Fledging success	0.59	0.67
Mean clutch size	4.59	5.20
Number hatching per clutch	2.67	2.61
Number fledging per clutch	1.59	1.74

^a Significant difference between groups, $P < 0.05$ by t -test.

Calgary in June the average daily minimum is 6.9°C (44.5°F) and in July it is 9.5°C (49°F). The unusual nest clumping, although common in the family Ploceidae and in the Spanish Sparrow, which hybridizes with *P. domesticus* (Meise 1936), may provide for a warmer nest microclimate. This would be particularly true for nests that were housed within the same structure. In some cases only a thin wall separates the nest chambers, through which some heat transfer is inevitable. If the clumping phenomenon is related to climate, then other high latitude sites should show similar House Sparrow nesting dispersion.

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Louisiana Herons Gleaning Dragonflies^a

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In review of the feeding behaviors of herons, Kushlan (1978, *Wading Birds*, Natl. Audubon Soc. Res. Rep. No. 7: 249) found that gleaning was recorded in only two species of American herons—the Great Egret (*Casmerodius albus*) and the Cattle Egret (*Bubulcus ibis*). Clark (Florida Field Nat., in press) noted Green Herons (*Butorides striatus*) gleaning honeybees (*Aphis mellifera*).

While making observations in 1979 from a blind at the Haulover Canal Heronry (28°44'N, 80°45'E) on the Merritt Island National Wildlife Refuge in Brevard County, Florida, I noted nesting adult Louisiana Herons (*Hydranassa tricolor*) foraging for dragonflies (species unknown) in patches of glasswort (*Salicornia virginica*). After leaving the nest site, which was in white mangrove (*Laguncularia racemosa*), a bird would land at the edge of a glasswort patch and slowly walk into the plants with its body crouched low and head retracted. Insects were stalked to a distance of 25-35 cm before being seized after a quick dart of the heron's neck.

Adults from three of the six nests under study were observed stalking dragonflies, and one was seen feeding the insects to its young. Eleven stalks and strikes by the birds were noted, of which nine (82%)

^a Merritt Island Ecosystems Studies Contributions No. 22.