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NEST MORTALITY IN HOUSE SPARROWS

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The nest life of eggs and young birds is not free from mortality. By regular examination of nesting histories, the time of mortality can be fixed. During observations on House Sparrows (*Passer domesticus*), I have gathered data on daily mortality rates. In this present analysis, differences in season and habitat are examined for their effect on mortality rates of House Sparrow nest contents.

Methods and Materials

The breeding biology of House Sparrows has been the subject of a four-year study carried out near Lawrence, Kansas by Edward Murphy (1978a, 1978b) and myself (Lowther 1979, 1983) between 1975 and 1978. Data gathered during the 1977 breeding season are used in this paper.

From 15 to 33 nest boxes were located on 7 farms within a 4.8 x 3.2 km area of southwest Leavenworth County. Nest boxes were checked once every 3 days; this frequency of checking permitted accurate determination of nest contents and of the dates of egg laying, hatching, and when the young left the nest. Daily contents of each nest were recorded from day 1 (when the last egg was laid) until predation or abandonment killed eggs or young or until young fledged. Mortality was assigned to known dates or to dates intermediate to nest checks. The total number of active nests and contents were tabulated for categories of season, study farm, and initial clutch size. Active nests are those nests with 1 or more incubated eggs or live young. On the basis of these tabulations, life table mortality rates were calculated.

General mortality rates were calculated from counts of nest contents at four stages of nesting activity: egg in the nest at the start of incubation, maximum number of young that may have hatched, number of young known to have hatched, and number of young that successfully left the nest. Mortality rates were calculated for these stages and daily mortality rates were found by dividing by the mean length of the incubation period (= 12 days) or by the mean length of the nestling period (= 14 days). The incubation period is defined here as the time from when the penultimate egg is laid until hatching starts (mean = 11.8, s = 1.2, n = 298); the nestling period is measured from the hatching date until the last young leaves the nest (mean = 13.8, s = 2.0, n = 220). Tests for statistical differences between seasons, farms, or clutch sizes mortality rates were made using chi-square tests on actual losses during the four general stages of nest life.

Results

The general daily mortality pattern (see Fig. 1) is initially high and drops shortly after incubation starts. Mortality increases at hatching, and again drops to a rate similar to that during incubation. As young leave the nest, the "mortality rate" increases towards 1.00 since "mortality" is based on counts of nest contents. The mortality of active nests follows a pattern similar to that of nest contents, but is lower since partial loss of a clutch or brood does not reduce the number of active nests.

Variation in mortality among clutch sizes.—There are differences in general mortality patterns due to variation in initial clutch size (Table 1). Clutch sizes different from the modal size (= 5 eggs) show greater mortality at the time of hatching. Clutch sizes smaller than the modal size have a higher daily mortality rate during incubation. Mor-

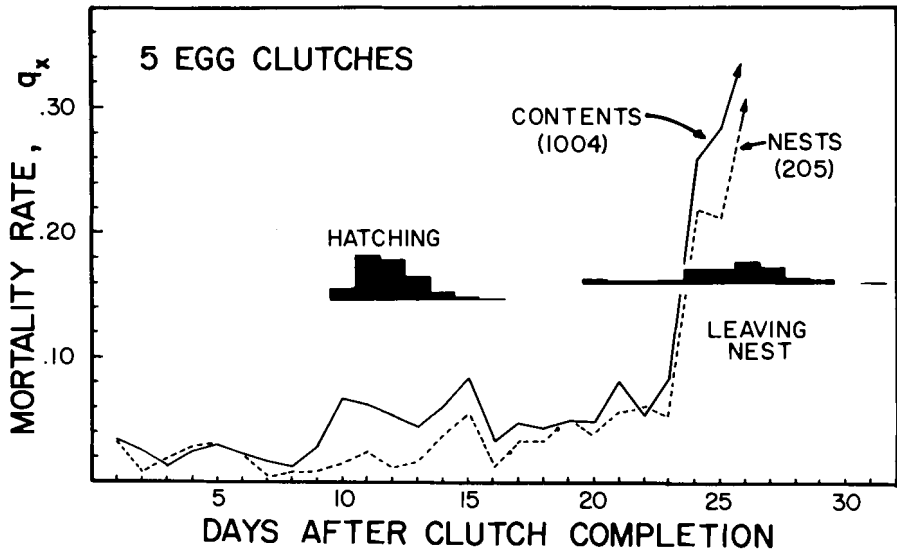


Figure 1. Daily mortality rates, q_x , for contents and nests of 5 egg clutches. Initial number of eggs (= 1004) are the number of eggs in the nest at start of incubation; there were 205 initial nests. The mean, range, and most frequent times of hatching and leaving the nest are also indicated.

tality during the nestling period seems fairly constant over clutch size. A general comparison of mortality recorded for different clutch sizes show significant differences ($\chi^2 = 46.47$, $df = 12$, $P < 0.01$).

TABLE 1. Mortality rates for different clutch sizes.

Clutch Size	Total		Mortality rates during:		Nestling		
	Eggs	Nests	Incubation	Hatch	Total	Daily	
			Total	Daily			
3	45	16	.533	.044	.095	.316	.023
4	216	58	.454	.038	.042	.434	.031
5	1004	205	.304	.025	.037	.404	.029
6	670	114	.363	.030	.080	.425	.030
7	151	23	.358	.030	.124	.365	.026

Notes: Any discrepancies between number of nests and initial number of eggs (= clutch size x number of nests) is due to egg loss during the egg laying period. This loss is distributed proportionately among all nests.

Daily mortality during incubation is Total rate/12; the daily mortality during the nestling period is Total rate/14.

Seasonal variation in mortality rates.—I partitioned the nesting season into quarters: clutches completed prior to 30 April, from 1 May to 30 May, from 31 May to 29 June, and 30 June and later. The first period showed low egg mortality while the last half of season had higher egg mortality rates. Hatching losses were low the first half of the season and higher the last half. Nestling mortality is highest early in the season and lower in the last half of the season. Young remain in the nest for a longer nestling period early in the breeding season than they do later. Figure 2 shows daily rates and Table 2 presents general mortality rates. There are significant differences in mortality rates between the different segments of the breeding season ($\chi^2 = 195.02$, $df = 12$, $P < 0.001$).

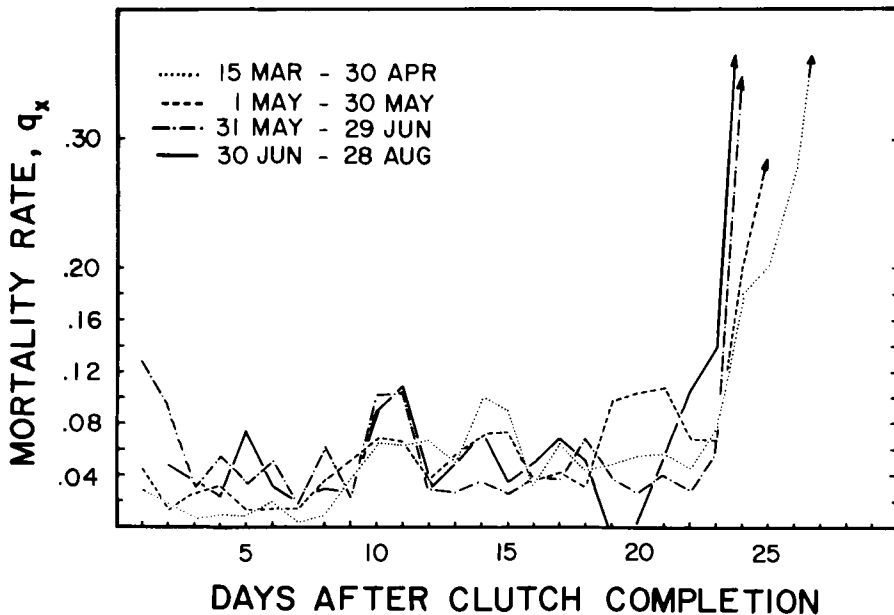


Figure 2. Daily mortality rates, q_x , for clutches initiated during different portions of the 1977 breeding season.

TABLE 2. Seasonal variation in survivorship of House Sparrow eggs and nestlings.

Season	Initial Eggs		Mortality rates during:		Hatch	Nestling	
			Total	Daily		Total	Daily
15 Mar- 30 Apr	714	696*	.217	.018	.088	.487	.035
1 May- 30 May	622	607*	.311	.026	.110	.376	.027
31 May- 29 Jun	457	440*	.552	.046	.041	.275	.020
30 Jun-	375	361*	.424	.035	.072	.285	.020

*Total number of eggs present in nests at start of incubation; this value is less than total number of eggs laid and it is this value that provides the initial cohort from which survivorship rates are calculated. Daily rates calculated as in Table 1.

Variation between farms in mortality rates.—Among farms, most differences result from variation in the number of young that survive nest box life. The significant chi-square ($\chi^2 = 114.87$, $df = 18$, $P < 0.001$) results from the contribution of one farm with an especially low rate of survivorship of nestlings and of two farms with high rates of survival. Figure 3 shows the changes in survival for general phases of nest life among study farms.

Discussion

On the study farms, known nest predators include black snakes (*Elaphe obsoleta*), raccoons (*Procyon lotor*), farm cats (*Felis catus*), and Norway rats (*Rattus orvegicus*). Mite infestations (probably by *Dermanyssus gallinae*) may have been responsible for deaths of some nestlings. House Sparrows are also parasitized by fleas (commonly *Ceratophyllus gallinae*), but in 1977 no large numbers were noted.

Besides losses to predators, eggs may be infertile or embryos may die during incubation. Eggs that fail to hatch were conveniently included in the mortality occurring on

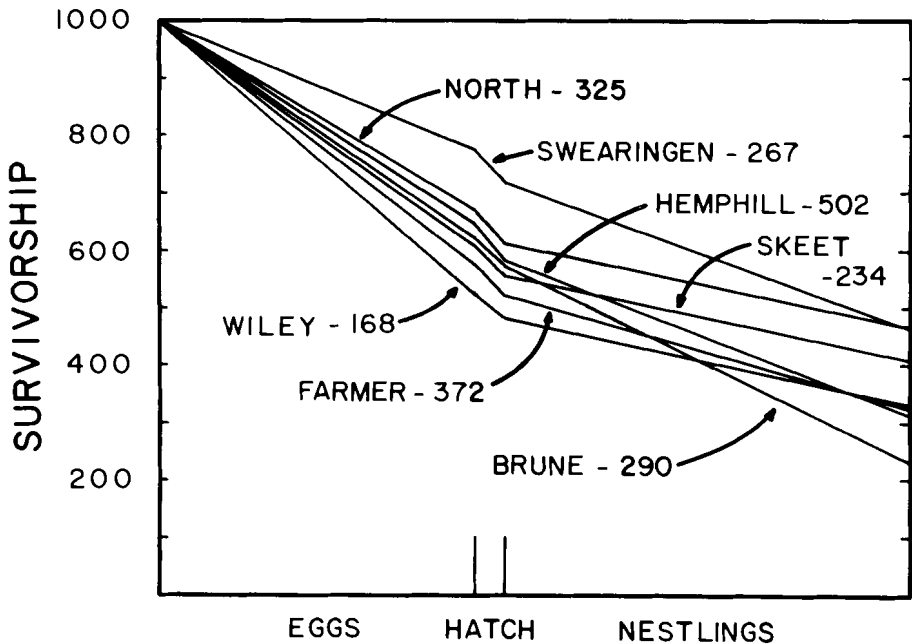


Figure 3. Survivorship of cohorts of 1000 for the seven study farms. Identity of each farm and total number of eggs in the nest at the start of incubation are indicated.

hatch day rather than the actual date of death. Nest abandonment, due occasionally to observer disturbance, is an additional cause of mortality for both eggs and young.

Observations at some nests suggest that eggs or young may disappear or are injured and occasionally killed by other House Sparrows. Male sparrows will select a nest box to defend and from which to display and, if the nest site is already occupied, may try to evict the current occupants.

At hatching the fate of some eggs may be unknown. Either these eggs failed to hatch and were removed, or young did hatch, died and were removed by adult birds. The comparison of columns indicating maximum hatch (where missing individuals were assumed to have hatched) and minimum hatch (where missing individuals were removed as eggs) gives some indication of mortality on the hatch day.

Daily mortality throughout a nesting has three periods of relatively higher mortality. These are an initial period soon after the start of incubation, when eggs are hatching, and as young leave the nest. The first of these reflects an initial desertion period. Other additional clutches have been excluded from this data set since I could not be sure all eggs of the clutch had been laid. These clutches would add to the early losses due to desertion. Thus, predation or disturbance during egg laying causing abandonment is not included in the initial mortality. Hatching, the second period of high mortality, is another time of higher nest desertion. Mortality at this time is also increased by including infertile eggs and early embryo deaths. The third period of high "mortality" merely measures the rate at which young House Sparrows successfully leave the nest. Actual mortality at this time is low, while birds are in the nest box, but is expected to increase sharply once the young birds leave the nest box and begin their transition to complete independence. Mortality rates for young birds after their independence (for a 6 month period after 1 October) is about 0.26% per day; for older birds during this same period, mortality is 0.19% per day (Beimborn 1967). Summers-Smith (1956) gave mortality rates that are very similar to these for sparrows in Great Britain.

Among clutch sizes, there is little variation from a common pattern of nest mortality. Mortality rates for eggs and young of all clutch sizes is about 3% per day. Brood reduction, if it occurs, happens at or soon after hatching, and, less importantly, after

completion of the clutch. Since House Sparrows usually start incubating before the last egg of the clutch is laid, not all eggs hatch at the same time. If these last eggs do hatch, their nest mates may be 2 to 3 times larger. Frequently these late hatching young disappear (= die) soon after hatching.

Comparison of early season nests with later nests show higher survivorship early in the season while eggs survive better later in the season. While not measured, incubation constancy might be expected to be higher early in the season during cooler weather. During 1977, the mean monthly temperatures were 8.7 C for March, 14.5 C for April, 20.7 C for May, and 24.0 C for June. Survival of young early in the season is less successful, however. Later in the season there is less thermoregulatory stresses for young nestlings and, perhaps, food is more abundant than earlier in the breeding season.

Variation among individual farms is perhaps most interesting. Major contribution to the significant chi-square value among farms (see Fig. 3) is due to three study farms: the Brune farm with especially low survival of young; the Swearingen farm with low expected number of eggs laid (actually indicating high survivorship of eggs and young); and the North farm with high survivorship of nestlings. Both the Brune and North farms had around 50 cattle at the farm. These cattle were pastured and did not appear to receive much grain feed. Most of the land around the Brune farm was used as pasture or for hay. About the North farm were soybean fields, pasture and an apple orchard. The Swearingen farm is also bordered by soybean fields and pasture; in addition about 25 horses, 25 cattle, and 50 chickens were kept through the summer. One explanation for differences in mortality at study farms is that insect abundance was greater at the latter two farms than at the Brune farm. During the breeding season House Sparrows seldom forage more than 100 m from the nest (Dawson 1972), differences in survivorship of sparrows at areas about 1 km apart (the Brune and Swearingen farms) might be attributed to differences in the amount of food — such as spilt grain and insects — available close to nesting sites. Dawson (1972) concluded this, also, in comparison of his two study sites.

In summary, a unifying explanation for variation in mortality rates in the nest is not evident. May nestings showed the least nest mortality. Egg mortality is lowest early in the season; nestling mortality is lowest late in the season. The area immediately surrounding study farms vary in suitability for sparrow production. This suitability might be explained in terms of abundance of food for nestlings. Most mortality occurs at the start of incubation and at the time of hatching. Losses of eggs or young does not differ greatly according to clutch size.

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THE BREEDING SEASON OF FERAL PIGEONS IN KANSAS

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Feral Pigeons (*Columba livia*) colonized eastern North America following introduction of dove-cote pigeons to Nova Scotia in 1605 and Virginia in 1621 (Schorger 1952). Pigeon husbandry moved west with North American settlers and in time became a part of the European cultural life of Kansas; feral birds probably have been living in eastern Kansas since the 1840's. We lack details concerning the early varieties of pigeons and of where and how often they managed to escape, but there is no doubt that they provided the escapes that gave rise to the pigeons now so common nearly everywhere in Kansas.

Dovecote pigeons have a high reproductive capacity (Levi 1974), a direct result of thousands of years of artificial selection by humans. Dovecote birds can be expected to have eggs and young in every month of the year, even at relatively high latitudes. Feral Pigeons, no longer subject to human constraints, show tendencies toward shorter breeding seasons, presumably reflecting natural selection for characteristics other than high reproductive rate. Even so, some pigeons at high latitudes still show capability for continuous breeding (Murton, Westwood, and Thearle 1973, Häkkinen 1973, Antikainen 1975). This report outlines aspects of the breeding season of Feral Pigeons at Lawrence, Kansas, in 1983 and 1984.

Studies were begun in January, 1983, at Dyche Hall on the campus of the University of Kansas, initially to follow the progress of one juvenile pigeon that fledged in the middle of the month. The program was gradually expanded in order to understand wintertime breeding relative to that for an entire year. Seventy-four nests were studied in 1983, and 162 in 1984; all were on the outer face of Dyche Hall (cf. Johnston 1984).

Early reports on the nesting season of Feral Pigeons in Kansas (e.g., Johnston 1960:28) claimed egg-laying occurred all year round, but documentary support was lacking. However, data from the Dyche Hall colony for 1983 (Johnston 1984), showed egg-laying for all 12 months. The capability of the birds to lay in mid-winter was clearly less than

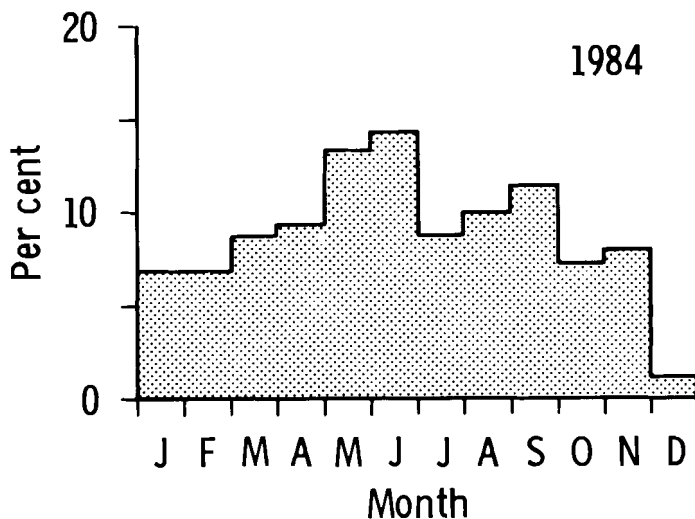


Figure 1. Percent frequency distribution of Dyche Hall nests in 1984.

at other times, but at least one clutch was produced each winter month. The record for 1984 is similar (Fig. 1), although a larger number of wintertime nests was found.

Most of the Feral Pigeons at Lawrence do not nest in winter, which is to say they have a reproductive schedule resembling those of the other wild birds of the mid-continental region of North America. In 1984, for example, some pairs of pigeons began nesting in early March, and continued until July or August, in which time they had 3 to 5 clutches of eggs and reared perhaps 3 squabs. Schedules like this are found regularly for multiple-clutching species of wild birds (e.g., Welty 1982).

Other pairs of pigeons were reproductively active throughout the entire period of time they were observed. We cannot yet say what fraction of the total number of birds is continuously involved with nesting, but it is small — perhaps 10%. Such birds are wholly remarkable in that they actually can rear squabs to independence under stressful winter conditions. In December, 1983, 6 pairs were attending eggs or young during one of the coldest early winter periods on record for eastern Kansas. Local daytime high temperatures averaged less than 20° F for the period 1 - 25 December, one overnight low of -17° F was recorded, and a snowcover of perhaps 6 inches was maintained for most of that period. Four squabs from 3 nests were successfully fledged on or about 1 January 1984.

Following the protracted cold period, sunny and mild wintertime conditions occurred on 26 December and persisted for 3 weeks. Many pairs of pigeons began courtship and nest-building behavior at that time, and egg-laying began in 6 nests on 12 January 1984, in 2 nests on the 13th, and in 1 on the 14th. One banded female laid a pair of unfertilized eggs with deficient shells that broke under her weight. Three other pairs had at least 1 infertile egg each, and 2 others lost eggs to freezing.

This instance is cited at some length to suggest the intensity with which some of the birds pursue reproductive activity in the face of adverse conditions. Throughout that December some of these birds had been responsible not only for their own care and feeding, but in addition had assumed the burden for 1 or 2 offspring; one of these pairs then attempted to nest in January, and the birds were apparently in poor enough physiological condition that their eggs were unfertilized (suggesting results of stress on the male) and lacked sufficient calcium for adequate shells (suggesting stress on the female). Other pairs likewise laid infertile eggs, and others were unable to effectively incubate under conditions of freezing temperatures.

Events such as those outlined just above are significant enough that, over more than 100 wintertime seasons, they have modified the tendency of most descendants of dove-cote pigeons to have eggs and young the year round. The capability to breed in midwinter is nevertheless still present in Feral Pigeon populations, and is likely to remain a feature of the life history of these birds for the foreseeable future.

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First Nesting Record of the Ash-throated Flycatcher in Kansas and an Additional Nesting Record for the Black-billed Magpie. — The Ash-throated Flycatcher (*Myiarchus cinerascens*) is considered a "probable" summer resident, in open woodland and edge, at least in Morton County (Johnston 1960. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 23:1-69). J. D. Rising collected 2 specimens; the first in Morton County (Rising and Kilgore 1964. Kansas Ornithol. Soc. Bull. 15:23-25) and the second in Meade County (Rising 1965. Kansas Ornithol. Soc. Bull. 16:25-27). But no evidence of nesting was obtained.

On 5 July 1983, while exploring Wolf Canyon on the XIT Ranch, about 29 km S and 26 km W of Meade, W. Stark, T. Wagner and I observed 2 adults carrying food into an American elm (*Ulmus americana*) that was about 20 cm dbh and had a broken top about 6 m above the ground. The surrounding vegetation was dense. Upon approaching the tree, 3 young flew out. Their flight was not labored, but it was easy to tell that they were recently fledged by their rough plumage. These birds were located in the east branch of the canyon, just barely within Meade County.

Another visit was made to Wolf Canyon on 28 and 29 June 1984. One pair was seen in the east branch, but no nesting activities were noted. A third bird was seen calling from an elm tree several hundred meters up the west branch in Seward County. This bird was later observed carrying food into a dense clump of trees, but the terrain prevented closer inspection.

In 1985 the site was investigated by Roger and Jon Boyd, D. Stout and J. Crossley on 2 and 3 July. A pair of Ash-throated Flycatchers was seen in the east branch for about 20 minutes. The pair was inspecting tree cavities while we watched from as close as 9 m. They obviously were not actively nesting at that time. Later in that morning a single bird was seen in the top of an elm in the west branch of the canyon, from which it periodically called and sallied out to capture insects. These sightings document the first nesting records for this species in Kansas.

In 1985, while walking up the west branch of the canyon in Seward County, we flushed 3 recently fledged Black-billed Magpies (*Pica pica*). The birds were not accompanied by an adult, but were determined to be young due to their very stubby tail feathers. Upon closer inspection of the tree, a dome-shaped nest was located next to where the birds had flown out. The nest was in good condition, indicating this year's construction. Even though Johnston (1964. Univ. Kansas Publ. Mus. Nat. Hist. 12:575-655) considers the magpie a common resident in western Kansas, no nesting records are documented for Seward County.

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