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LENGTH OF THE LAYING SEASON AND CLUTCH SIZE OF GRAY CATBIRDS AT LONDON, ONTARIO

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Abstract.—The median date on which Gray Catbirds (*Dumetella carolinensis*) began laying at London, Ontario, in 1963, 1964, 1966, and 1969 ranged from 17 May in 1964 to 29 May in 1966. The average length of the 12 longest individual laying seasons in 1963 and 1964 was 47 d. The nesting period between the first egg of a clutch and fledging ranged from 24 to 29 d. The average length of the laying season in most years provides time to attempt two broods. The size of 126 clutches ranged from two to five eggs; it declined seasonally from 3.9 (13 May–2 Jun.) to 3.1 (23 Jun.–12 Jul.). A double-brooded pair could produce a maximum of 10 young/yr, but the average would be less than seven.

LARGO DE LA TEMPORADA DE PUESTA Y TAMAÑO DE LA CAMADA DE *DUMETELLA CAROLINENSIS* EN LONDRES, ONTARIO

Resumen.—La fecha media en la cual *Dumetella carolinensis* comenzó la puesta de huevos en Londres, Ontario en 1963, 1964, 1966, y 1969 varió entre el 17 de mayo en 1964 al 29 de mayo en 1966. El largo promedio de las 12 temporadas individuales más largas en 1963 y 1964 fue de 47 d. El periodo de anidaje entre el primer huevo de una camada y la etapa de volantón varió entre 24 a 29 d. El largo promedio de la temporada de puesta de huevos en la mayoría de los años provee el tiempo suficiente para intentar dos puestas de huevos. El tamaño de 126 camadas varió desde dos a cinco huevos; disminuyó estacionalmente de 3.9 (13 mayo a 2 junio) a 3.1 (23 junio a 12 julio). Una pareja que ponga dos camadas puede producir un máximo de 10 pichones/año, pero el promedio sería menor de siete.

The annual production of Gray Catbirds (*Dumetella carolinensis*) depends, in part, on the length of the laying season, which influences the number of successful nestings, and seasonal variation in clutch size. We wish to show that in southern Ontario annual and seasonal variation in the length of individuals' laying seasons make it difficult for some catbirds to be double-brooded. Also, because clutch size declines seasonally, early successful nesters, even single-brooded pairs, produce more young than birds successful only later in the season.

METHODS

We recorded data on the length of the laying season and clutch size, incidental to studies of catbirds over 5 yr (Darley et al. 1971, Scott 1977). We sought catbird nests on the campus (43°00′N, 81°16′W) of the University of Western Ontario at London, Ontario (see maps of study area in Darley et al. 1971) in 1962–1964, 1966, and 1969. Catbirds begin

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returning to London in the first two weeks of May. In 1962–1964 concurrently with our search for nests, we color-banded most resident catbirds. In 1966 and 1969, no catbirds were newly banded, except for some subjected to intensive study in 1969 (Scott 1977). Our search for nests extended through the entire breeding seasons of 1963 and 1964 (Darley et al. 1971). In the other years we sought nests only in May and part of June. Most nests were visited daily and, for nests found during laying, each egg was marked on the day of laying. Data for 1962 and 1963 were extracted from the notes and nest-record cards of Norman K. Taylor, who died in March 1964. We used the data for 1962 only in our analysis of clutch size.

To determine the beginning of the laying season for an average female, we used the dates of initiation of clutches of the first 15 nests that we found in each year (1962 excluded). Each of these 15 nests in each year was built by a different female, as recognized by her color bands or by her location relative to others. Each nest was likely the first for a bird in a particular year. We used three criteria to decide if a nest was the first nest for a bird in a particular year: (1) we watched a pair after their appearance on a territory and saw the first nest being built; (2) known first nests often had a prelaying building period longer than the 5 or 6 d usually preceding a replacement nest (Scott et al. 1987), hence, we regarded a nest in which nest building continued for more than 6 d to be a first nest; (3) laying was closely synchronized among different nests at the initiation of laying. As many of these nests were known to be first nests we assumed that other nests, similarly synchronized, were also first nests. We used only the first 15 nests, because by the time we found the 15th nest some birds were beginning replacement clutches, as our studies of 1963 and 1964 showed (see Fig. 5 in Darley et al. 1971). Our data were biased to the extent that birds beginning to lay very late may have been excluded. Thus, the true median dates of clutch initiation may be later than those indicated in Figure 1. Nevertheless, the temporal distribution around the observed median data of the first 15 nests allows comparison among years by a Kruskal-Wallis test. We used the median date, rather than the mean date, because for some nests we knew, not the exact date of clutch initiation but, only that a clutch had been started before or after the median date.

To relate the onset of laying to weather conditions, we used daily temperatures extracted from meteorological summaries for 1941–1970 for London obtained from Environment Canada, Atmospheric Environment Service.

We estimated the end of the laying season from (1) the mean date of the last eggs of the last 12 clutches in 1963 and 1964 (pooled data) and (2) the proportion of females still laying in late June and July.

We found 166 nests containing eggs. Forty clutches disappeared or were deserted before completion. Ninety-one of the remainder were found before completion, 65 before laying had begun. We divided this sample of 126 nests into three periods of 20 or 21 d to cover the 61 d (13 May

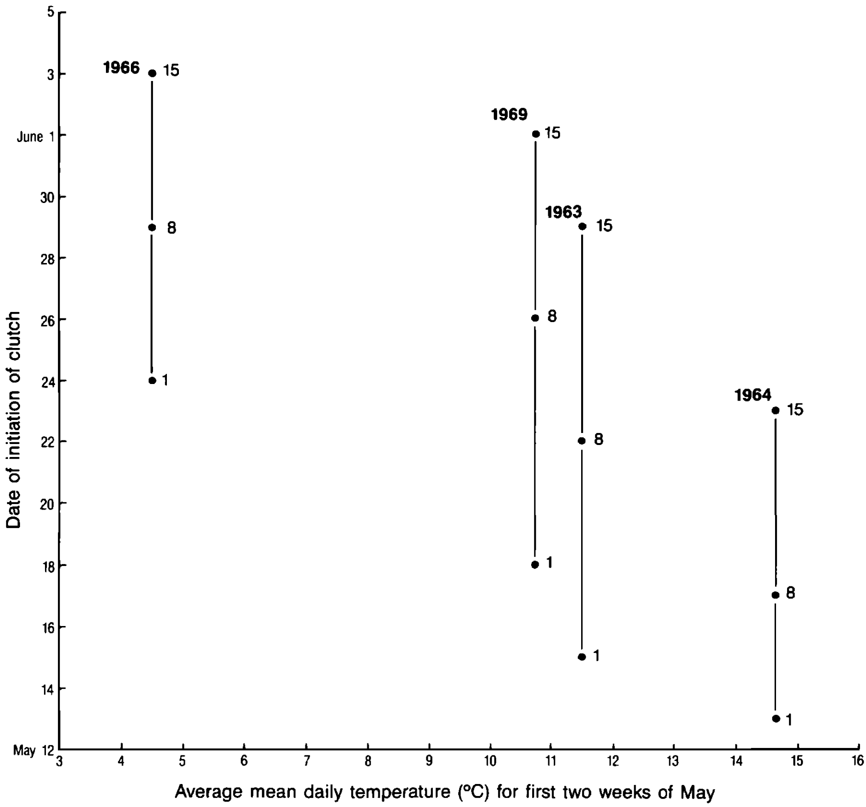

FIGURE 1. Relationship between dates of initiation of clutches of Gray Catbirds in 1963–1964, 1966, and 1969 and the average mean daily temperatures for the first two weeks of May 1941–1970. The 1st, 8th (median), and 15th clutches are plotted for each year.

to 12 Jul.) measured between the first eggs of the first and last clutches. The data were biased towards small clutches for the reasons presented by Nolan (1978: 168) and also because we used some nests found after laying had begun and some eggs may have disappeared. To assess the extent of the bias towards small clutches, we also determined clutch size by using only the 58 nests found before the first egg and visited daily until incubation was well underway and there was no increase in clutch size. Individual clutch sizes were not entirely independent of each other as several birds contributed more than one clutch to the sample.

RESULTS AND DISCUSSION

The initiation of laying ranged from 13 May 1964 to 24 May 1966 (Fig. 1). The distribution of the dates for the first 15 nests varied significantly among the 4 yr studied (Kruskal-Wallis test, H = 31.2, $P <$

0.001). The difference between the earliest year, 1964, and the latest, 1966, was 11 d; the lack of overlap in the initiation dates emphasizes the difference between these years. In 1964, daily mean temperatures were the highest for the first two weeks in May (Fig. 1) for the four years studied. In contrast, laying began 11 d later in 1966, when early May was exceptionally cold (Fig. 1 and Scott and Ankney 1980:679).

The laying season ended by mid-July in 1963 and 1964. The dates of the last eggs of the last clutches ($n = 12$) ranged between 7 and 14 Jul. inclusive around a mean of 9 Jul. At least 8 of 11 birds that lost nests in the last week of June renested. Two of three birds renested following nest loss in the first week of July, but none of 10 females that lost nests in the second week of July was known to have renested.

The length of the 12 longest laying seasons of individual females, ranged between 37 and 54 d, averaging 47 d. The median length of the laying season was less in 1963 than in 1964, but not significantly so (Mann-Whitney U-test, $P > 0.10$).

As we visited the nests only once daily, we could not determine precisely the dates of fledging. Hence, we regarded the period from the beginning of laying to fledging as terminating on the first day on which a successful nest was found empty. This period ranged between 24 and 29 d. It was 24 ($n = 1$) or 25 d ($n = 3$) for three-egg clutches, 26 ($n = 2$), 27 ($n = 3$), or 28 d ($n = 1$) for four-egg clutches, and 29 d for one five-egg clutch.

Twenty-two pairs of catbirds fledged at least one brood in either 1963 or 1964. The six earliest broods fledged from first nests of the season and it was not until 23 Jun. that a replacement clutch gave rise to fledglings. With that exception, fledglings from replacement clutches did not appear until early July. Only three pairs attempted second broods; these pairs were among the four earliest pairs to produce first broods. In two cases, 19 d elapsed between fledging and the first egg in the next nest and in the third case, 7 d elapsed. The low frequency of double-broodedness here seems atypical as it is common elsewhere (Johnson and Best 1980, Zimmerman 1963).

In a double-brooded species the interval between the onset of a successful nesting and the initiation of laying in the next nest is composed of the time from laying to fledging plus the time between fledging and laying again; the length of the former period is relatively fixed but that of the latter period is not. For catbirds, we observed that the time for laying to fledging was about 27 d for a four-egg clutch, and that there were 15 d in between fledging and laying again. As the latter value was based on three cases only, we also use values from larger samples from elsewhere: 7.6 d in Iowa (Johnson and Best 1980) and 10.8 d in Michigan (Zimmerman 1963). The combined average is about 9 d and, thus, it takes about 36 d for females to produce the first brood and prepare for another laying. Given our estimate of 47 d for the laying seasons of 1963 and 1964 there is ample time to attempt two broods, provided that the first nest is successful. If the first nest is unsuccessful, then the total time

TABLE 1. Seasonal change in frequency distributions of clutch sizes of Gray Catbirds at London, Ontario. Data from 1962–1964, 1966, and 1969 are pooled.

Clutch size	Date		
	13 May–2 Jun.	3–22 Jun.	23 Jun.–12 Jul.
2	1 (0)[a]	2 (0)	2 (0)
3	9 (2)	26 (15)	14 (9)
4	36 (17)	24 (13)	2 (1)
5	7 (1)	3 (0)	0 (0)
Mean	3.9 (4.0)	3.5 (3.5)	3.1 (3.1)

[a] First column includes all nests found before hatching. Numbers in parentheses are nests found during building and visited daily until the clutch was complete.

devoted to that nest plus the 5 or 6 d preceding a replacement nest (Scott et al. 1987) would make it difficult for such catbirds to be double-brooded.

Clutch size ranged from two to five eggs (Table 1). As no two-egg clutch was recorded in our sample ($n = 58$) of clutches found before laying began, two-egg clutches in our larger, less-restricted sample probably indicate partial loss of a clutch.

Clutch size did not vary annually within the three periods: 13 May–2 Jun., 3 Jun.–22 Jun., 23 Jun.–12 Jul. (Kruskal-Wallis tests, $P > 0.05$). Accordingly, we pooled the annual data to compare the clutch size among the three periods (Table 1). Clutch size decreased by about one egg between May and July (Kruskal-Wallis test, $H = 21.4$, $P < 0.001$). Four was clearly the modal clutch size until early June, but throughout June it changed from four in the period 3–12 Jun. to three in the period 13–22 Jun., when five-egg clutches were not found, four-egg clutches were uncommon, and three-egg clutches composed 78% of the sample of 18.

Average clutch size did not change abruptly from about four in May to three in July because some birds had second clutches of the same size as their first, but others declined from four in first clutches to three in second clutches. Of 15 pairs for which we have records of consecutive complete clutches, nine showed no decline in clutch size between the first and second clutches, but six declined from four to three eggs. Neither the length of the interval between the first and second clutches nor the date of initiation of the second clutch accounted for the decline in June (Mann-Whitney U-tests, $P > 0.10$). Similarly, not all birds showed a decline in clutch size between the second and third clutches. Indeed, one female increased from a three-egg second clutch to a four-egg third clutch. Elsewhere, clutch sizes of catbirds also decline seasonally: in Iowa (Johnson and Best 1980), southern Michigan (Nickell 1965), and Kansas (Johnston 1964).

The annual production of catbirds depends in two ways upon the success of the first nesting: (1) success of the first nest may allow a pair time to attempt another brood and (2) if there is only one successful attempt then an early successful attempt will on average produce more fledglings than a late attempt. For a double-brooded pair of catbirds at London, the maximum annual production could be 10 young but the average would be less than seven, given that there is often partial loss of eggs or young from a nest.

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