Seasonality, Clutch Size, and Hatching Success in the Cedar Waxwing

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This paper summarizes an analysis of Cedar Waxwing (*Bombycilla cedrorum*) nesting records obtained from the North American Nest Record Card Program at the Cornell University Laboratory of Ornithology. A total of 713 cards, ranging in dates from 1892 through 1974, was examined for seasonality, clutch size, and mortality. The sample size (713 nests) is relatively small because discrepancies within or lack of information on the cards frequently makes some records inapplicable to aspects of this study. Previous similar studies have used as many as 9,000 nest cards (e.g. Myres 1955, Snow 1955) on species that are commoner and more frequently reported in other nest record programs.

The majority of the nests are from northeastern United States and southeastern Canada. Biased geographical distributions may reflect the enthusiasm of different observers (Peakall 1970), and in this case more than half the reports are from Michigan. Nevertheless, a reasonable pattern appears that suggests that waxwing breeding activity centers in three states (Wisconsin, Michigan, and New York), each with more than 51 nest records. Ontario and Quebec are next most important, followed by five states with 6–10 records each (North Dakota, Minnesota, Ohio, Pennsylvania, and Virginia). British Columbia and 17 states had five or fewer records—the areas included California, the northwestern states, and states bordering the high activity regions described above. There is good agreement between the geography of our records and that of the Cedar Waxwing reports in the North American Cooperative Breeding Bird Survey (Robbins and Van Velzen 1969).

Peakall's recent work (1970) was used to determine clutch size and various aspects of nesting phenology. However, while Peakall calculated clutch completion dates, the values given in this paper are the estimated dates when the first egg was laid. This procedure allowed the use of a maximum number of nest records. Modifications were also made for the determination of clutch size. If only 1 visit was made to the nest, the record was ignored unless 4 or more eggs or 4 or more young were present. Nests with 2 or 3 eggs were used if 1 of the eggs subsequently hatched and there was no indication of damage to the nests. All nests of only 1 egg were excluded from analysis, as they probably reflected human disturbance. We used an incubation period of 12 days (Lea 1942) and a nestling period of 16 days; Lea (1942) and Putnam (1949) give this period as 15.5 to 15.9 days.

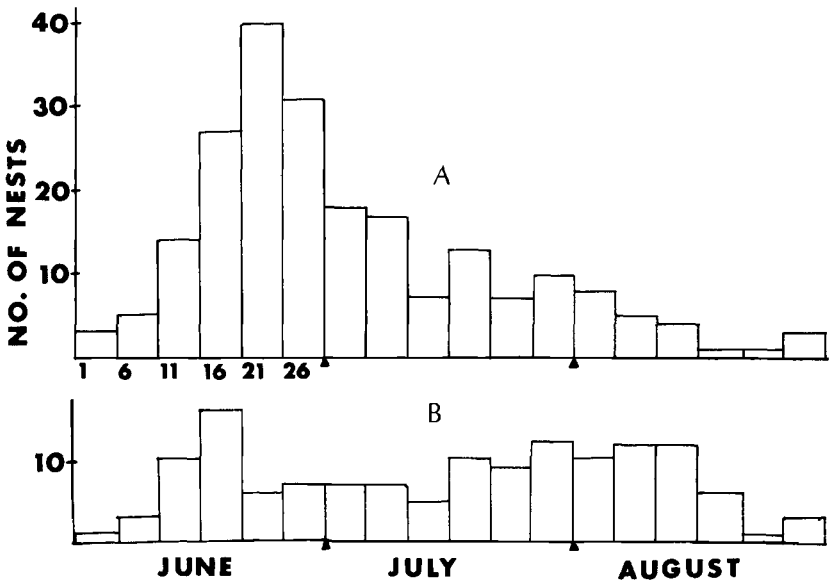

Fig. 1. Seasonality of nesting in the Cedar Waxwing. Plotted are the number of nests reported for each 5-day period, June through August. **A**. Nests prior to 1970, n = 218; **B**. Nests from 1970–74, n = 139.

TABLE 1. Annual hatching success for Cedar Waxwings.

Year	Nests	Eggs	Number hatched	Success (%)
1964	15	53	44	83
1965	17	104	75	72
1967	11	47	31	62
1968	15	55	26	47
1969	39	149	69	46
1970	10	39	14	36
1971	27	105	70	67
1972	48	165	93	56
1973	31	103	54	52
1974	28	102	59	58
Total	303	1,134	691	61

Only 357 cards could be used for analysis of the breeding season. From the pre-1970 data, 5-day groupings of clutch commencement clearly showed a 16–30 June breeding peak and a suggestion of a second peak in nest initiation at the end of July (Fig. 1A). Crouch (1936) and later researchers consider the waxwing as double-brooded. We note however, that the second "peak" is much less prominent or well defined than the first. For all years (1894–1974) only 36% of the nests recorded were started during the second part of the season, after 15 July. Thus, the term "double-brooded" should be used cautiously. Most interestingly, the pattern of post-1970 data shows a marked change (Fig. 1B). The graph of the 1970's shows little tendency towards an early peak; 44% of the nests began *after 24 July,* making the number of nests started in the first and second halves of the season nearly equal. For the pre-1970 years only 17% of the nests had the first egg after 24 July. This decline in the relative importance of the first clutch period is significant and not easily explained. We doubt that broad climatic changes are responsible. The Brown-headed Cowbird (*Molothrus ater*) frequently parasitizes the Cedar Waxwing (Rothstein 1976), and we suggest that the waxwing breeding season may be shifting away from higher parasitic pressures in the June cowbird breeding peak to a more favorable later season.

Cedar Waxwings typically lay a clutch of 3–5 eggs. From a New York State subsample (88 nests), clutches were: 2 eggs, 1%; 3 eggs, 13%; 4 eggs, 53%; and 5 eggs, 33%. (Six-egg clutches were reported rarely, from both and the United States and Canada.) The mean clutch size of a total sample of 338 nests was 4.2. There was no significant geographic variation; we examined the data for both north-south gradients in clutch size and for possible increases in clutch size toward the center of the breeding range. There was, however, a marked decrease in mean clutch size through the season, as shown for the monthly average clutch: June, 4.4 eggs (n = 136, s = 0.7); July, 4.3 eggs (n = 110, s = 0.7); August, 3.9 (n = 87, s = 0.6); and September, 3.8 (n = 5, s = 0.5). This decline is significant (for example, August vs. June, $P < .01$ with Student's t-test). Such decreases in clutch size with the breeding season are common for birds (Lack 1947, 1948); usually this decrease is assumed to be associated with a general decline in food supply toward the end of summer.

A total of 303 nest records could be used to determine hatching success rate. Overall hatching success for 1,134 eggs was 61%. Sixty-five records contained detailed information through the end of the fledging period. The percent of young that hatched and fledged was 55%. Geographic variation in breeding success was slight or statistically insignificant because of small sample size. Though no regional differences in nesting success were discernible, annual hatching percentages differed significantly (Table 1; $P < .05$, χ^2). Such yearly fluctuations in success are most reasonably attributed to weather differences. Clutch sizes showed no significant annual differences in this same 11-year period, so total recruitment was directly dependent on survival rates alone.

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The Nest and Eggs of the Black-and-yellow Silky-flycatcher (*Phainoptila melanoxantha*)

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The striking Black-and-yellow Silky-flycatcher (*Phainoptila melanoxantha*) is the only member of a genus confined to the mountains of Costa Rica and western Panamá. Although not rare, its habits are poorly known, and there exists no detailed account of its nest and eggs.

I found a nest of a Black-and-yellow Silky-flycatcher on 2 May 1972 at an elevation of 2,400 m on Volcán Poás, Alajuela Province, Costa Rica, while accompanied by F. G. Stiles and B. K. MacKay. The nest was located 1.5 m high in the central crotch of a 2-m sapling growing in the center of a dense thicket between the road and a large stand of montane forest. It contained two eggs. As our itinerary did not permit us to make further observations at the site, the nest and eggs were collected and are now in the collection of the Western Foundation of Vertebrate Zoology (No. 68,023).

The nest was a large, compact, open cup composed mostly of green moss interspersed with a few slender stems and fern fronds. It was lined with fine rootlets and plant stems. The outer diameter of the nest measured 22 × 16 cm, and it was about 12 cm in depth. The inner cup was 7 cm in diameter and 5 cm deep.

The two eggs measure 27.84 × 20.30 and 27.19 × 19.20 mm with empty dry shell weights of 0.274 and 0.260 g, respectively; they were subelliptical in shape (Preston *in* Palmer 1962, p. 13) and slightly glossy. They had a grayish-white ground color with a dense sprinkling of fine light gray, purplish brown, and dark brown spots over their entire surfaces. Each egg contained a slightly developed embryo.

I found an additional Black-and-yellow Silky-flycatcher nest on 26 April 1974 about 4 km E of Monteverde, Cordillera de Tilarán, Guanacaste Province, Costa Rica, while accompanied by H. Cernicek, M. Kiff, and C. Sumida. The nest was located in cloud forest within the Monteverde Cloud Forest Preserve at an elevation of 1,700 m. As in the case of the Volcán Poás nest, a male *Phainoptila* was perched on the top of a low shrub near the Monteverde nest. While I checked the nest contents, a female flew to within 2 m.

The Monteverde nest was empty, but apparently nearly completed. It was an open cup composed almost entirely of green moss; a lining had not yet been added to the inner cup. The nest was situated about 2 m high in the central crotch of a 3-m sapling growing in a thicket adjacent to a little-used trail. Unlike the Volcán Poás nest, which was located in such dense vegetation that it could not be seen from above or from the sides, the Monteverde nest was not well concealed and could easily be detected at a distance of 10 m.

M. Gochfeld (in litt.) informed me of another *Phainoptila* nest found by him, G. Tudor, and M.