

SECOND BROODS IN THE EUROPEAN STARLING
IN NORTH AMERICA

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FOR years ornithologists have debated whether the European Starling (*Sturnus vulgaris*) raises one or two broods during a breeding season. European observers have recorded a few instances in which marked individuals are definitely known to have raised two broods in one season—Berndt (1939) in Helgoland; Creutz (1939), Freitag (1936, 1937, 1939), and Sunkel (1931) in Germany; Kluijver (1933, 1935) in Holland; and Jourdain (1913) and Ticehurst (1913) in the British Isles; but a review of the literature reveals only one such instance reported in North America, by Brackbill (1949) in Maryland.

Intensive observations of the starling during five breeding seasons (1947–1951) at Ithaca, New York, however, clearly indicate that many starlings in this region regularly raise two broods in a season. Song and courtship activities are renewed about the nest sites almost immediately after the young of the first brood have fledged. Many of the same nesting sites are used twice in one season. And the simultaneous egg-laying by a large number of starlings in mid-June, about a week after the first brood has fledged, resembles the simultaneous layings of the beginning of the first brood, and not the scattered layings of intermediate nestings.

The ultimate proof of second broods comes from marked birds that have been observed to raise and fledge two broods in a season. Over 193 females were banded in nesting boxes at Ithaca from January through July, 1947–1951; 40 of these were definitely found to have undertaken the raising of second broods after the successful completion of a first. Ten of these females raised two broods in each of two consecutive years; one raised two broods in each of the breeding seasons of 1948, 1949, and 1951. There were undoubtedly more instances of second broods, and of second broods in consecutive years, but because it was not possible to capture all the nesting females on the study area during both nesting periods each year, complete statistics are not available.

Although no reference to second broods by first-year females has been found in the literature on the starling, several such instances were observed at Ithaca in 1950 and 1951. Two first-year females, banded as nestlings in 1949, both successfully fledged a first brood in 1950, and each undertook to raise a second brood. Unfortunately neither second brood was fledged; one female deserted the nest when the young were three days old; the other was killed by a Cooper's

Hawk when the young were thirteen days old. Three other first-year birds, which were not banded as nestlings, but were aged by hackle feathers (*cf.* Kessel, 1951) and banded during the first nesting period, were known to begin second broods. The eggs resulting from two of these second nestings were deserted before hatching, and the young of the third died before leaving the nest.

Second broods apparently occur throughout the breeding range of the starling in eastern North America, with the exception of the extreme northern part. (The breeding biology of the starling has received little study west of 95° W. Long.; hence no statement can be made on second broods from this region.) An analysis of the egg-laying dates available in the literature, and of those found in the Bird Distribution File of the Fish and Wildlife Service, shows conclusively that throughout eastern United States, north of 30° N. Lat. (the southern limit of the breeding range), breeding occurs over a long enough season to include second broods. It also shows that the majority of egg-laying dates at each latitude falls into two definite periods, the pattern of these periods corresponding with the periods of the first and second broods at Ithaca, and with those proved by Brackbill (1949) in Maryland.

Egg-laying follows a seasonal clinal pattern, being about thirty days later for each 10° of latitude northward. Egg-laying for first broods begins as early as March 15 in the south (30° 30' N. Lat.), but not until June 15 in the extreme north (50° 12' N. Lat.). The egg-laying for second broods follows about forty-five days after that of the first brood. McMillan, Michigan (46° 20' N. Lat.) is the northernmost area where available data definitely indicate the occurrence of second broods. Here the young of the first brood left the nest June 11, 1935; and on August 1 of that year more young were found in the nest (Fish & Wldf. Serv. Bird Dist. File). At Kamouraska, Quebec (47° 35') young were found in the nest on July 16, 1927. These were probably second-brood young, too, but because the dates of the first brood of that year are not known, one can not be sure (Fish & Wldf. Serv., *ibid.*). No evidence of second broods has been found north of 48° N. Lat., east of 95° W. Long. in North America. North of 48° N. Lat. egg-laying for the first brood does not begin until May 15 or later, and either the short season or the physiological condition of the bird this late in the season apparently precludes second broods this far north.

There is some evidence that the frequency of second broods may vary with several factors. As noted above, geographic distribution may determine the presence or absence of two broods. Even within

the normal range of second broods, geographic locality probably affects the number of second broods, though the North American data are too sparse to prove this. The earliness of the season may affect the number of broods. Creutz (1939), Berndt (1939), and Kluijver (1933) found that second broods varied from 35 per cent of the first brood to zero per cent, with the greater percentage of second broods occurring in the years when the season was early, enabling first broods to get underway early. Berndt (*op. cit.*) indicates that moisture, too, may be an important factor in the occurrence of second broods. He records that the year 1934 had an early season with the usual number of first brood layings, but that the season was unusually dry and no second broods were observed.

Effects of the earliness or dryness of the season on the number of second broods are not evident from the studies at Ithaca. In the few years for which full data are available (1948, 1950, and 1951) the dates of the first eggs of the first brood were April 20, April 29, and April 27, respectively; these dates show no significant correlation with the number of second broods. (In 1951 all the nestlings were collected before they left the nest. Because the nestlings were taken close to the end of the nestling period, and the sexual cycle was apparently not seriously interrupted, the 1951 data are incorporated in these analyses.) There were no abnormally dry periods during the study, monthly rainfall of all three seasons varying from 1.69 to 4.18 inches (except June, 1951, when it was 6.11 inches); hence no comparative data are available.

Most of the female starlings in the vicinity of Ithaca that are physiologically capable of undertaking a second brood apparently do so. It was noted during the present study that any birds that have their first nesting attempt of the season broken up apparently can not fledge their re-nest brood in time to lay eggs for the regular second brood while it is physiologically possible. Two successful broods, therefore, are to be expected only from those females whose first brood was raised successfully and without interruption. It is of interest, then, that in Ithaca, when the three complete years are taken as a unit, over 93 per cent of the first broods that were begun with the early layings and were successfully completed, were followed by second broods. (For this percentage, each year's total data were used, rather than just the few data available from marked birds; that is, all the layings that occurred during the simultaneous layings for second broods, and that occurred at the time the banded females were laying for second broods, also were assumed to be second broods. In view of studies of the sexual cycle of the starling, this assumption

appears to be safe.) In 1948, 65 first brood nests were begun, but because of desertions and deaths (caused almost entirely by human disturbances), the young of only 43 of these early nests were fledged. Forty-one second broods were begun that year. In 1950, 57 first broods were begun, but for the reasons mentioned above, only 39 were fledged. Thirty-nine second broods were begun in 1950. In 1951, 61 first broods were begun, and 47 were fledged; 41 second broods were begun.

No proof of three successive broods has ever been established, nor is there any evidence in the tempo of the reproductive cycle to indicate the occurrence of third broods. Apparently the casual references to three broods that one finds in the literature are the result merely of a few observations of starlings nesting at abnormal times of the year, for the starling has been recorded nesting in every month of the year by one observer or another. In view of the precision and relative shortness of the starling's normal breeding season, these abnormal nestings are not easy to explain (*cf.* Bullough, 1942). Whatever the reason, however, the occurrences of autumn and winter breeding are rare, and, in light of our present knowledge, they should not be considered third broods.

SUMMARY

Intensive observations of the starling during the breeding seasons of 1947 through 1951 at Ithaca, New York, have resulted in data that now prove that many starlings regularly raise two broods in a season. These data, along with the records of other observers, indicate that in eastern North America, between northern Florida and the Great Lakes, many starlings raise two broods in a season.

In Ithaca most of the female starlings that are physiologically capable of undertaking second broods do so; and in 1950 and 1951 several instances were noted in which even first-year females attempted second broods. Because of relatively uniform seasons during the study, the effects of the earliness or dryness of the season on the frequency of second broods were not apparent. No evidence of third broods was detected; apparently the casual reference to third broods are the result of a few observations of starlings nesting at abnormal times of the year.

LITERATURE CITED

- BERNDT, RUDOLF. 1939. Untersuchungen über die zweite Brut beim Star (*Sturnus v. vulgaris* L.) im Braunschweiger Hügelland. *Vogelzug*, 10: 7-16.
- BRACKBILL, HERVEY. 1949. Two-brooded starlings. *Bird-Banding*, 20: 186-187.
- BULLOUGH, W. S. 1942. The reproductive cycles of the British and Continental races of the starling (*Sturnus vulgaris* L.). *Philos. Trans. Roy. Soc. (London)*, Series B, 231: 165-246.

- CREUTZ, G. 1939. Biologische Beringungsergebnisse bei Staren, *Sturnus v. vulgaris* L. Mitt. Ver. Sächs. Ornith., 6: 18-26.
- FREITAG, F. 1936. Aus dem Leben beringter Stare zur Fortpflanzungszeit. Vogelring, 8: 8-15.
- FREITAG, F. 1937. Aus dem Leben beringter Stare zur Fortpflanzungszeit II. Vogelring, 9: 43-49.
- FREITAG, F. 1939. Aus dem Leben beringter Stare zur Fortpflanzungszeit. Vogelring, 11: 1-9.
- JOURDAIN, F. C. R. 1913. Are starlings double or single-brooded? Brit. Birds, 6: 371.
- KESSEL, BRINA. 1951. Criteria for sexing and aging European starlings (*Sturnus vulgaris*). Bird-Banding, 22: 16-23.
- KLUIJVER, I. H. N. 1933. Bijdrage tot de biologie en de ecologie van den spreeuw (*Sturnus vulgaris vulgaris* L.) gerurende zijn voortplantingstijd. Versl. Meded. Plantenziekt. (Wageningen), 69: 1-145.
- KLUIJVER, I. H. N. 1935. Waarnemingen over de levenswijze van den spreeuw (*Sturnus vulgaris*) met behulp van geringde individuen. Ardea, 24: 133-166.
- SUNKEL, W. 1931. Zweite Brut beim Star. Beitr. Fortpfl. Biol. Vogel, VII.
- TICEHURST, NORMAN F. 1913. Are starlings double or single-brooded? Brit. Birds, 6: 337-338.

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