

CLUTCH SIZE AND ONSET OF LAYING IN BACHMAN'S WARBLER

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Arthur T. Wayne had more experience with Bachman's Warbler (*Vermivora bachmanii*) on its breeding ground than anyone else. Had he been primarily an ornithologist rather than a collector, he might have left us a detailed life history of the bird. As it is, his published writings on Bachman's Warbler life history (Wayne 1907, 1910) are sketchy, and his unpublished notes and records (now deposited at the Charleston Museum) were intended for his own use and can confuse others.

I worked through this unpublished material and concluded that Wayne found 32 Bachman's Warbler nests, all in F'On Swamp, about 12 miles NE of his Mt. Pleasant, S.C., home (Shuler 1977). Paul B. Hamel, Robert C. Hooper, and Lewis M. Wright (1976) wrote that Wayne found no fewer than 25 nests; and Hooper and Hamel (1977) later maintained they know of 35 nests that Wayne found. They offered to provide "A List of the Known Nests of Bachman's Warbler" to those requesting it. I believe that Nests 18 and 21 on that list are the same nest, that data for Nest 20 are insufficient to establish that it is not duplicated elsewhere, and that Nests 27 and 29 are the same one. I do not think that Hooper and Hamel can demonstrate without ambiguity that Wayne found more than 32 nests.

For nests with sets of eggs collected for sale, Wayne's data are more straightforward than for observations unrelated to specimens. Clutch size and the approximate date of the onset of laying (the day the first egg in a clutch was laid) may be calculated from 24 of these.

Four nests contained 3 eggs (two with clutches so fresh as to raise doubt they were complete); 12 held 4 eggs (three sets fresh); and 8 contained 5 eggs (three sets fresh). The average of the 24 clutches is 4.16.

The incubation period for Bachman's Warbler is unknown—a statement that applies to some of the more abundant warbler species as well. Many of the earlier records, including some listed by Bent (1953), may not have been determined by methods presently accepted. Nice (1953) questioned the accuracy of any incubation period of 10 days or less, and established a working definition of the incubation period as the elapsed time between the laying of the last egg in a clutch and the hatching of that egg. Many modern workers use the Nice definition in their studies.

Edgar M. Reilly Jr. (1968) listed periods for warblers that range from 11 to 13 days for the Common Yellowthroat (*Geothlypis trichas*) to 14 to 15 days for the Kirtland's Warbler (*Dendroica kirtlandii*). Warren M. Pulich (1976) in two nests of the Golden-cheeked Warbler (*D. chrysoparia*) determined periods of 11-plus and 12 days. To assume a period of 12 days for Bachman's Warbler seems to be in line with known periods for other small warblers.

Wayne (unpub. records) expressed a judgment, usually qualitative, as to the degree of incubation in each set of eggs he collected (Table 1). For some clutches he offered both qualitative and quantitative assessments. By applying the assumed incubation period of 12 days, Wayne's judgments may be translated into the number of days that incubation probably had progressed in each case (Table 1) and thus may be used for calculating the approximate dates for the onset of laying (Table 2).

For example, a nest Wayne (1910) found on 3 April 1907 held 5 eggs with large embryos. In Table 1 "large embryos" is translated to 8 days of incubation, which takes the nest back to 26 March. Another 4 days are allowed for the laying of all but the first egg, which brings the nest to 22 March, the date on which the first egg probably appeared. Similar calculations for the remaining 23 nests serve for the construction of Table 2.

A final element of uncertainty should be considered. Incubation is assumed to begin with the laying of the last egg, but Pulich (1976) found that incubation for the Golden-cheeked Warbler began with the second egg in clutches of 3, and probably with the

Table 1. Estimated degrees of incubation in 24 Bachman's Warbler clutches from I'On Swamp (1906-1919).

<i>Wayne's description</i>	<i>Estimated days incubation</i>	<i>Number clutches</i>
Fresh	0	6
First egg laid on March 27	0	1
One day	1	1
Two days	2	1
Very slightly incubated	2	2
Slightly incubated	3	2
Very small embryos	3	1
Four days	4	1
Small embryos	4	1
Five or six days	6	1
Large embryos	8	1
Very large embryos	9	2
Almost ready to hatch	10	1
Nearly ready to hatch	10	1
Ready to hatch	10	1
Pipped	11	1

penultimate egg in larger clutches. If this is true for Bachman's Warbler, the calculated time between the laying of the first egg and the date of collection should be shortened by 1 day in some instances. Despite this and other uncertainties, I believe that Table 2 demonstrates within reasonable bounds the duration and peak of the onset of laying of Bachman's Warbler in I'On Swamp. Data more accurate than those Wayne left us are unlikely to become available in the future; so we must learn whatever we can from them.

The earliest date estimated for the onset of laying is 18 March; the latest is 24 April. By 31 March more than half (14) of the 24 clutches were under way. The clutch apparently begun on 24 April may have been an attempt at renesting. Wayne (unpub. records) wrote, "Shot male to this pair on April 6. Female obtained another mate shortly after."

Clearly, the nesting cycle of Bachman's Warbler begins and ends early, perhaps earlier than that of any other passerine in the area. Wayne (unpub. records) saw and heard three males singing in I'On Swamp on 14 March 1908. He speculated (1910) that Bachman's Warbler may arrive on the breeding ground as early as 28 February. He allowed 2 weeks for nest building, which is, perhaps, excessive.

Might Bachman's Warbler have arrived and nested even earlier than Wayne thought? Not likely.

In addition to an abiding and passionate interest in ornithology, Wayne depended upon the sale of ornithological specimens for a livelihood. Nests and eggs of common birds brought him a few dollars each, but a nest with a set of eggs of Bachman's Warbler may have fetched him as much as \$150 (letter, Charleston Museum). He was strongly motivated to determine exactly the season when such precious specimens could be collected.

ACKNOWLEDGMENTS

I thank E. Burnham Chamberlain, John V. Dennis, Paul B. Hamel, Julian R. Harrison, Paul A. Opler, and Jay Sheppard for reading and commenting upon an earlier draft of this article. The Charleston Museum permitted access to Wayne's unpublished papers.

Table 2. Clutch size and estimated onset of laying in Bachman's Warbler nests from I'On Swamp (1906-1919).

<i>Estimated date for first egg</i>	<i>Number eggs in clutch</i>	<i>Estimated date for first egg</i>	<i>Number eggs in clutch</i>
18 March	5	1 April	4
18 March	5	4 April	4
22 March	5	5 April	4
23 March	4	6 April	5
26 March	4	7 April	3
26 March	5	11 April	4
27 March	4	13 April	5
28 March	3	14 April	3
28 March	4	16 April	5
28 March	4	24 April	4
29 March	4		
30 March	4		
30 March	5		
31 March	3		

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