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**THE ATLANTIC LOGGERHEAD SEA TURTLE, CARETTA  
CARETTA CARETTA (L.), IN AMERICA**

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Abridged and annotated by David K. Caldwell



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## II. MULTIPLE AND GROUP NESTING BY THE ATLANTIC LOGGERHEAD TURTLE<sup>5</sup>

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and ROBERT A. RAGÓTZKIE<sup>7</sup>

**SYNOPSIS:** Tagging results and studies of unlaidd eggs in dissected females demonstrate that individuals of the Atlantic loggerhead sea turtle nest several times on the same stretch of beach in a summer, but it is not yet known whether each individual lays every year. Individual turtles can locate these places with some precision. Tagging results show groups of turtles nest together several times, and it is believed they stay together during the periods between the nesting emergences.

Although fishermen, turtle poachers, and conservation officers commonly believe that the Atlantic loggerhead sea turtle, *Caretta caretta caretta* (Linnaeus), lays more than once during a season and that groups of turtles remain together during the season to nest together, no detailed observations on these points appear to have been made by biologists. Recent evidence of tagging studies proves multiple emergence and suggests group adherence of individuals. Further evidence that the eggs of a season are laid in two or more batches has been the finding of unlaidd eggs in discrete size groups in female turtles dissected during the nesting season. Counts and measurements of such eggs are included in the present paper.

### GROUP NESTING EMERGENCE

In examining their tagging data on the green turtle, *Chelonia mydas mydas* (Linnaeus), for possible evidence of group travel, Carr and Giovannoli (1957: 9) found cases in which individuals that emerged together tended to return to reneest together later the same season. We have clumped tag returns that suggest similar group movements in nesting *Caretta*.

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Our first evidence for grouped emergence resulted from limited tagging studies conducted in 1957 at Hutchinson's Island near Fort Pierce, Florida. While not so impressive as the results obtained at Jekyll Island near Brunswick, Georgia, in 1958, to be described below, they nevertheless suggest that group movements may be the rule in loggerheads.

On 27 May 1957 seven nesting loggerheads were tagged on Hutchinson's Island with monel cow-ear tags (Carr and Caldwell, 1956:3) fixed to the front flipper, including one numbered 78. On 28 May 1957, 11 turtles were tagged, including one numbered 23. Number 23 was released within 2 miles of the release point for number 78.

At 0115 hours on 30 June 1957, 34 days after the first tagging date, Agent Robert S. Pfister of the Florida State Board of Conservation found number 23 nesting "7 miles south of the Ft. Pierce Inlet," at approximately the same place where she had been tagged. At 0120 hours only a short distance away, a few hundred yards at most, he found number 78 nesting. In spite of the small size of the sample, the fact that this double return involved two out of a group of only 18 turtles tagged makes it highly improbable that the dual recovery was due to chance. This double return and a long-range recovery in the northern Gulf of Mexico from the 27 May tagging (Caldwell, Carr, and Ogren, 1959, herein) are the only reports to date from 72 turtles tagged on Hutchinson's Island during the 1957 season. This lends significance to the dual recovery and enhances its value as evidence of concurrent movements.

TABLE 1

NUMBERS OF TURTLES TAGGED AT JEKYLL ISLAND, GEORGIA, IN 1958 WITH  
MONEL COW-EAR TAGS, AS DESCRIBED BY CARR AND CALDWELL (1956).

early June					
(date uncertain)	5	9-11 July	4	22 July	1
6 June	6	11 July	5	23 July	1
10 June	4	15 July	6	24 July	2
13 June	7	16 July	7	25 July	3
9 July	4	17 July	6	29 July	1
10 July	1	18 July	6	31 July	3
				Total	72

The results of the 1958 tagging studies on Jekyll Island clearly show this phenomenon of group nesting emergence by loggerheads (table 2). Eight turtles, numbers 125, G43, G47, G103, G105, G107,

G108, and G111, show such close agreement in their dates of first and later emergences that they may be considered as one group. Though our records are indefinite on the point, it is presumed that all laid on the night of tagging or very shortly thereafter. This presumption is based on findings (presented below) that show a turtle emerging and failing to nest one night will return the same or suc-

TABLE 2

RETURNS OF LOGGERHEAD SEA TURTLES TAGGED AT JEKYLL ISLAND, GEORGIA, IN 1958. (ld) DENOTES TURTLE LAID; (dnl) DENOTES TURTLE DID NOT LAY, (nd) DENOTES NO DATA ON NESTING ACTIVITY.

Tag Number <sup>s</sup>	Date Tagged	First Return	Second Return	Third Return
110	June 6 (ld)	July 10 (nd)		
111	June 10 (dnl)	June 16 (ld)	July 5 *	
114	June 10 (ld)	July 23 (ld)	July 29 (dnl)	
117	June (?) (nd)	July 18 (nd)		
118	June 13 (dnl)	June 28 (ld)		
120	June (?) (nd)	July 11 (nd)		
121	June (?) (nd)	July 10 (nd)		
123	June 13 (dnl)	July 29 (ld)		
125	June 13 (dnl)	July 16 (ld)	August 1 (ld)	
136	early June (nd)	June 28 (ld)	July 11 (ld)	
144	June (?) (nd)	July 26 (ld)		
147 } G35 } <sup>10</sup>	July 11 (nd)	July 14 (dnl)	July 26 (dnl)	
G30	July 10 (dnl)	July 11 (ld)		
G33	July 11 (dnl)	July 23 (ld)		
G37	July 11 (dnl)	July 15 (nd)		
G43	July 15 (dnl)	July 28 (dnl)	July 29 (dnl)	July 30 (ld)
G47	July 16 (ld)	July 31 (ld)		
G49	July 16 (dnl)	July 17 (ld)		
G102	July 16 (dnl)	July 17 (dnl)	July 18 (nd)	
G103	July 17 (ld)	July 30 (ld)		
G105	July 17 (ld)	July 30 (ld)		
G107	July 17 (ld)	July 31 (ld)		
G108	July 17 (ld)	July 30 (ld)		
G111	July 18 (ld)	July 31 (dnl)	August 1 (ld)	
G115	July 22 (dnl)	July 23 (ld)		
G119	July 25 (ld)	August 7 (ld)		

<sup>s</sup> Tags bearing no letter prefix are marked for return to the University of Florida; those bearing a "G" prefix are marked for return to the Georgia Game and Fish Commission.

\* Turtle found dead on beach. Oviduct contained shelled eggs.

<sup>10</sup> Turtle re-tagged when original tag pulled out during first recapture.

cessive nights until she nests successfully. Thus these turtles returned together as a group to lay again after approximately 2 weeks.

As turtle 125 presumably laid in mid-June, her record suggests that the group nested at least four times that summer, in mid-June, in late June, in mid-July when most were tagged, and in early August. The probability that the grouping shown by this series occurred by chance alone, especially with so few turtles tagged, is so slight that coincidence need not be considered. Possibly another aggregation on Jekyll is the group made up of numbers 110, 120, 121, 147-G35, and G30, but the data for this and possible other groupings are not conclusive.

Aggregate nesting is also suggested by observations William W. Anderson, United States Fish and Wildlife Service, made during a shrimp study for the Service in Georgia from 1930 to 1938. The investigation involved considerable field work and afforded him the opportunity to observe turtles from a small slow-moving boat. Anderson noticed that during the nesting season turtles were not present at all times in great numbers, but rather that they seemed to arrive in the area in groups. Correlated was the general observation that nesting turtles likewise tended to arrive together on the beach.

Later studies conducted at Jekyll Island by Caldwell and Berry showed a similar phenomenon of groups of turtles on the beach at one time, then periods with only an occasional individual present before another group appeared. Thus, while there was a general congregating of turtles in the area during and just before the nesting season, it appears likely that the turtles did not remain in the immediate vicinity between nesting times, but perhaps moved elsewhere to await their time for returning to renest.

Anderson further noted that at no time during the season were turtles abundant in Georgia waters other than those immediately surrounding the rookeries at Jekyll and Little Cumberland Islands. It seems unlikely that the turtles return to their wintering grounds between nestings and regroup before returning for the next nesting venture. There remains for the loggerhead, as for the green turtle (Carr and Giovannoli, 1957; Carr and Ogren, Ms.), the stubborn problem of where they go in the interim. They may go offshore, but observations do not support this.

#### MULTIPLE NESTING AS SHOWN BY TAGGING RESULTS

We referred earlier to a return to the Hutchinson's Island beach by two turtles that had nested there about a month before. In the

Atlantic green turtle the interval between the nesting ventures of a season is 12 to 14 days (Carr and Giovannoli, 1957; Carr and Ogren, Ms.). A similar interval was suggested for the loggerhead by Lewis (1940: 62), which our recoveries at Jekyll Island corroborate. Presumably the recovery of the two turtles at Hutchinson's Island after a month's absence must have been preceded by an unrecorded return 2 weeks earlier.

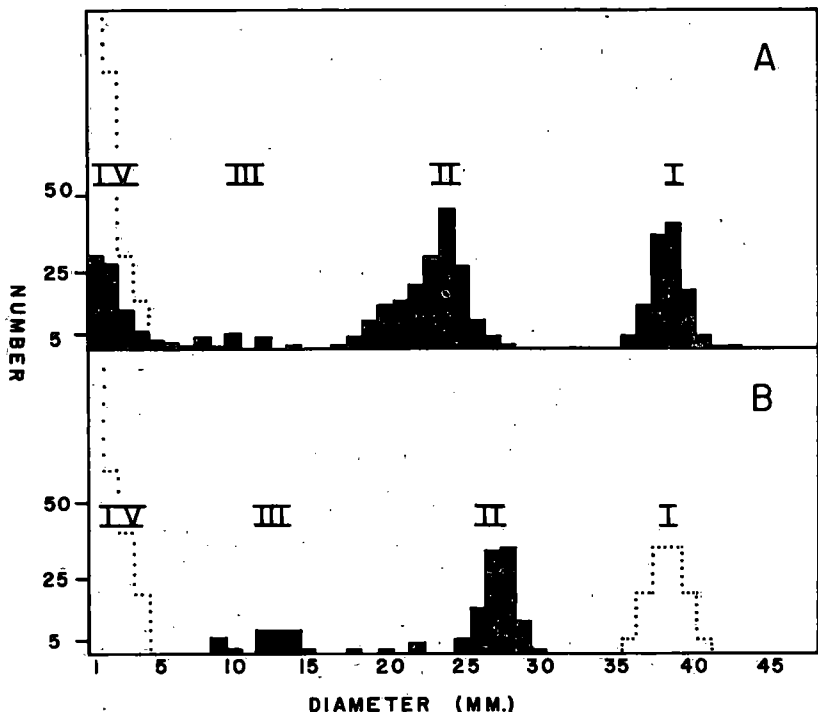


Figure 20.—Diameter-frequencies of freshly laid and ovarian eggs of the Atlantic loggerhead turtle at Jekyll Island, Georgia, in 1957. Solid areas indicate eggs actually measured. Dotted lines indicate estimated numbers of eggs within the indicated ranges of diameters.

From the first week of June through the last week of July 1958, 72 loggerheads were tagged at the Jekyll Island rookery (Table 1). Of these, 26 were recaptured one or more times (Table 2). In addition to these definite records, tourists reported seeing about 10 more tagged turtles on the beach. As no data accompanied these reports they are of no value in piecing out laying schedules.

From our observations, and from those on injury-marked turtles made by others, we believe that a turtle interrupted in her nesting will return either later that night or on successive nights until she has fulfilled her mission. Carr and Giovannoli (1957: 24) reported for green turtles a similar "singlemindedness of the nesting drive," borne out by turtles number 111, G30, G37, G49, G115, and particularly by G43 and G102 (Table 2).

Thus a turtle tagged on a given date but not known to have laid then, can be assumed to have laid within the following few days, and any recovery of a turtle more than a week after the time of tagging theoretically constitutes an example of second nesting (see, for example, turtles number 118, 123, G33, G43, 147-G35 in Table 2).

In every case for which data are adequate, all the instances of multiple nesting on Jekyll Island took place at intervals of 12 to 15 days, with the single exception of number 114. With the 2-week interval between laying emergences shown so convincingly to be standard, it can be presumed that the other tagged animals would have shown comparable intervals had they been caught each time they nested. For example, recoveries of turtles 117 and 144, like the Florida returns noted above, probably represent second nesting emergences after tagging. Turtle 123 may have returned a third time. Turtle 136 definitely laid twice, and the interval between the time of tagging and first corroborated laying is long enough to have permitted a third nesting in the interim, or four nestings for the season. It seems likely that the turtles in the group discussed in the section on Group Emergence laid four times.

Sapelo Island, Georgia, is not considered a "good turtle island," and is not part of the Jekyll rookery. The minimum straight-line distance between the north end of Jekyll and the south end of Sapelo is approximately 19 miles. In 1958 three turtles were tagged on Sapelo Island, one of which (G23) was recaptured there 31 July, two nights after being tagged. She did not nest either time, but the return supports the popular assumption that each turtle nests on a single island, and only on that island, even though concentrated nesting may be going on at a nearby rookery. Another turtle, not tagged but bearing distinctive marks, apparently laid twice on Sapelo, on 18 and 28 June. The interval is short, but the evidence that the same turtle was involved is convincing, and we believe this to be another instance of multiple nesting on an island other than Jekyll. Little Cumberland Island, immediately south of Jekyll, seems from concentrations of tracks seen from the air to be part of the Jekyll rookery, but there is



no road to Little Cumberland, and no practical means were available to visit the island at night to look for turtles tagged at Jekyll, or to tag turtles for possible recovery at Jekyll.

Data extracted from a hitherto unpublished report (see Caldwell, 1959, herein) prepared in 1940 by William P. Baldwin, Jr. and John M. Lofton, Jr. show similar results for loggerheads tagged on a rookery at Cape Romain, South Carolina. These workers tagged 18 turtles as they came ashore to nest. Turtle number 4 was tagged but did not lay on 12 June; she was recaptured as she laid on 27 June. It is assumed that she laid soon after the 12th, and the expected 2-week interval between nesting ventures is indicated. Turtle number 13 was tagged but did not lay on 6 July. She was recaptured again not laying on 28 July. The elapsed time clearly indicates attempts at multiple nesting, perhaps three times in the 22 days. Turtle 10 was tagged on 3 July and recaptured on 4 July, nesting neither time. Turtle number 4 returned to a point 1000 feet north of the point of initial emergence; number 13, 950 feet southward; and number 10, 300 feet southward.

Unfortunately some of the people at Jekyll who furnished enthusiastic cooperation in tagging and in recording returns kept only dates of tagging and return and did not record the exact spots involved. It is of particular interest to note that in all cases where exact data were available for tagging and return, the turtle involved returned not only to Jekyll Island, but to the same portion of the island, within  $\frac{1}{4}$  mile of the initial point of tagging on the 10.5-mile beach. None of the many turtles tagged at Jekyll Island was found by observers on Sapelo Island, nor were any of the few turtles tagged at Sapelo recorded as nesting later at Jekyll. The only returns on each island were turtles tagged on that island. Similar homing was noted by Carr and Giovannoli (1957) and by Hendrickson (1958) for the green turtle.

#### EVIDENCE OF MULTIPLE NESTING BASED ON UNLAID EGGS

Data on egg size groups afford further evidence of multiple nesting and corroborate the tag return data.

Early in the 1957 season an individual designated as turtle A (Figure 20) that emerged on Jekyll Island 23 May was killed for study before being allowed to nest. She contained 120 shelled eggs of mature size (Carr, 1952: 391) she presumably would have laid that night. In addition to the mature eggs, a second group (II) of 182 eggs consisted of large yellow yolks, and a third group (III) consisted of

about 25 much smaller yellow yolks. Eggs of size group IV were tiny (4 mm. in diameter or less) white or yellowish spheres and occurred by the thousands. These tiny eggs presumably serve as a reservoir and may be present at all times in mature females. Since the 182 eggs in group II were more than the expected complement for a single laying, it was probable that some of the smaller ones in this group and the larger ones in group IV would have gone to build up the small group III to about the expected 125.

Another individual, designated as turtle B (Figure 20), was killed in mid-season on 1 July, also on Jekyll Island, just after nesting. She had deposited 144 eggs. The groups of smaller eggs in this individual were better defined than those in turtle A. The mature eggs of both turtles (group I in Figure 20) furnish definite evidence for one nesting that season. Considering the two turtles A and B as one composite animal, and postulating that nesting takes place at 2-week intervals, it is reasonable to assume that a laying by this hypothetical single turtle probably occurred between 23 May and 1 July. The group III eggs in turtle A might well have reached mature size in the elapsed month to become group I in turtle B. The fact that the nodes of egg diameters of groups II and III of turtle B are further advanced than corresponding ones in turtle A is further evidence that eggs develop continuously during the season to replace laid clutches of group I eggs.

While these data strongly suggested that multiple nesting occurs in loggerheads, they did not furnish firm grounds for calculating the number of times an individual might nest in a season, nor do the tagging results. One female might not come to the rookery until mid-season or later, and might nest only once or twice. Another might nest very early and thus have time to complete three or more additional layings. Turtle B in Figure 1, for example, might not have nested in early summer, and her egg-groups II and III may forecast two more nestings to take place late in the season. Or if she did nest early, they may represent a third and fourth nesting for the season. Conversely, her group III eggs might have been reabsorbed after the 1957 nesting season. Her group II eggs were large enough to have been destined for laying in the 1957 season, and it does not seem likely that any of her eggs of group IV would have reached maturity by the end of the 1957 season. Possible evidence that reabsorption of eggs occurs is the fact that some of the group III eggs in turtle B were dark purple or black in color as if vascularized for reabsorption.

In another instance turtle number G119 (Table 2) was killed after laying the second time. She had deposited 90 eggs in a normal fashion. Her oviducts contained 57 large yellow eggs approximately 14-30 mm. in greatest diameter which could have forecast a third laying for the season. There is no reason to believe she had not also laid 2 or more weeks before she was tagged. In addition to the large yellow eggs, she also contained about 200 whitish-yellow eggs 5-10 mm. in greatest diameter, and several thousand eggs less than 5 mm. in diameter.

Still another possibility is that the individual might complete a fixed number of nestings at 2-week intervals, no matter when she first arrives at the rookery. Thus, one group of turtles may nest early in the season (say 3 or 4 times during the first 6 weeks), another during the middle 6 weeks, and a third group during the final 6 weeks. As the laying season lasts only about 12 to 15 weeks, the groups of turtles surely overlap in their periods of stay, which could account for the larger number of turtles nesting in mid-season (see Caldwell, 1959, herein). More than three groups of turtles, or one turtle nesting more than three times, which our tagging studies suggest occurs, would further complicate such a nesting regime, but not make it impossible.

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