

# IRREGULAR REPRODUCTIVE CYCLES IN THE TONGALAND LOGGERHEAD SEA-TURTLE, *CARETTA CARETTA L.* (CRYPTODIRA: CHELONIDAE)

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## ABSTRACT

The concept of sea-turtles exhibiting regular reproductive cycles is widely accepted. In Tongaland, Natal, after 12 years of research 2 122 female loggerhead turtles have been tagged and the recovery rate of tagged animals back on the nesting beaches has reached 50%. From a sample of these recoveries it is clear that there is no regular reproductive cycle and thus that irregularity is characteristic of this population. The most frequent period of absence from Tongaland is two years but few animals repeat this absence cyclically. Results so far indicate that a loggerhead female can nest for at least four seasons spread over a period of at least nine years.

## INTRODUCTION

It is generally accepted, as a result of studies on the green turtle *Chelonia mydas*, that sea-turtles exhibit cyclic nesting behaviour. After laying in one particular season, a turtle female will return two or three years later to nest again (Hendrickson 1958; Carr & Ogren 1960). More recently it has been suggested that individual turtles tend to maintain a constant cycle, although ecological conditions can result in a shift in the time of absence of female turtles from the nesting area (Carr & Carr 1970). The postulation of regular cyclic behaviour for green turtles has been extrapolated to include all sea-turtles and its existence was accepted as applicable to the loggerhead turtle *Caretta caretta L.* (Hughes *et al.* 1967).

Hughes (1974:23) reported that after ten years of research in Tongaland, 1791 loggerhead females had been tagged and only 514 animals had returned to nest in seasons other than the one in which they were tagged. Thus it was noted that the remarkable aspect of the data was not the number of turtles that had returned but rather the number that had not. The main purpose of this paper is to present more recent and thorough data, adding support to Hughes' conclusion that loggerhead sea-turtle nesting behaviour is irregular or even disorderly.

## METHODS

### *Tagging*

For the first six years of the programme plastic tags of various types were used on adult nesting female loggerheads (Hughes 1974) and found to be useless. During the season monel metal tags

(Size 49, Ketchum tags, National Band and Tag Co.) came into use and one of these tags is applied to the distal edge of either foreflipper. Each season's batch is numbered sequentially and prefixed by a different letter (e.g. 1974/75 = E - prefix). Incidents of corrosion have been recorded and as soon as possible monel tags will be replaced by INCONEL tags reported to be corrosion-proof.

### *Patrols*

The Tongaland protected area is 56 km in length and the entire area is covered twice nightly by a beach-buggy patrol, while a 16 km stretch is more intensively covered by four foot patrols.

### *Contact success*

Hughes & Brent (1972:40) showed that the single contact success of patrol systems was satisfactory, viz. the emerging females were handled at least once during the season, and as patrol methods have become more efficient the contact success has improved slightly. Thus very few turtles nesting in Tongaland are not recorded at least once and this is important when assessing the pertinent data presented below. For the method used in calculating total population see Hughes (1970).

## RESULTS

### *Tagging*

Table 1 summarizes the handling and recovery results recorded in Tongaland since the inception of the research programme in 1963, and the steadily increasing percentages of remigrant turtles can be seen. Included in Table 1 are details of these recoveries and the effectiveness of monel metal tags, which replaced plastic tags in 1969, is illustrated by the sharp increase in recovery data after two years showing a total loss of plastic tags.

From these data it is obvious that the remigration rate of turtles to Tongaland is relatively high. In Figure 1 it is shown that of 1 079 individual turtles recorded in Tongaland since 1969, 589 (54,6 per cent) have nested in one season only, 376 (34,8 per cent) have nested in two seasons, 94 (8,7 per cent) in three seasons and only 20 (1,9 per cent) are known to have nested in four separate seasons. Regrettably, due to heavy losses of plastic tags, not all of these animals have been identifiable throughout their nesting careers, but sufficient recoveries of those with metal tags have been made to indicate that, although loggerhead turtles can nest up to four times (Figure 1) in their reproductive lifetime, which is at least nine years (Hughes 1974), it is far from being a regular occurrence, nor does it appear to be done on a regular cycle.

Figure 2 illustrates the records of loggerhead turtle females tagged with monel metal tags between the 1969/70 season and the 1973/74 season. The 1974/75 season has not been included because there cannot have been, as yet, recoveries from this season.

Of the 1 079 turtles 839 (77,8 per cent) have been recorded once only, viz. the season of tagging, and have not been seen subsequently within this five-year period. This figure is probably slightly higher than it should be because undoubtedly some monel tags have been lost and the

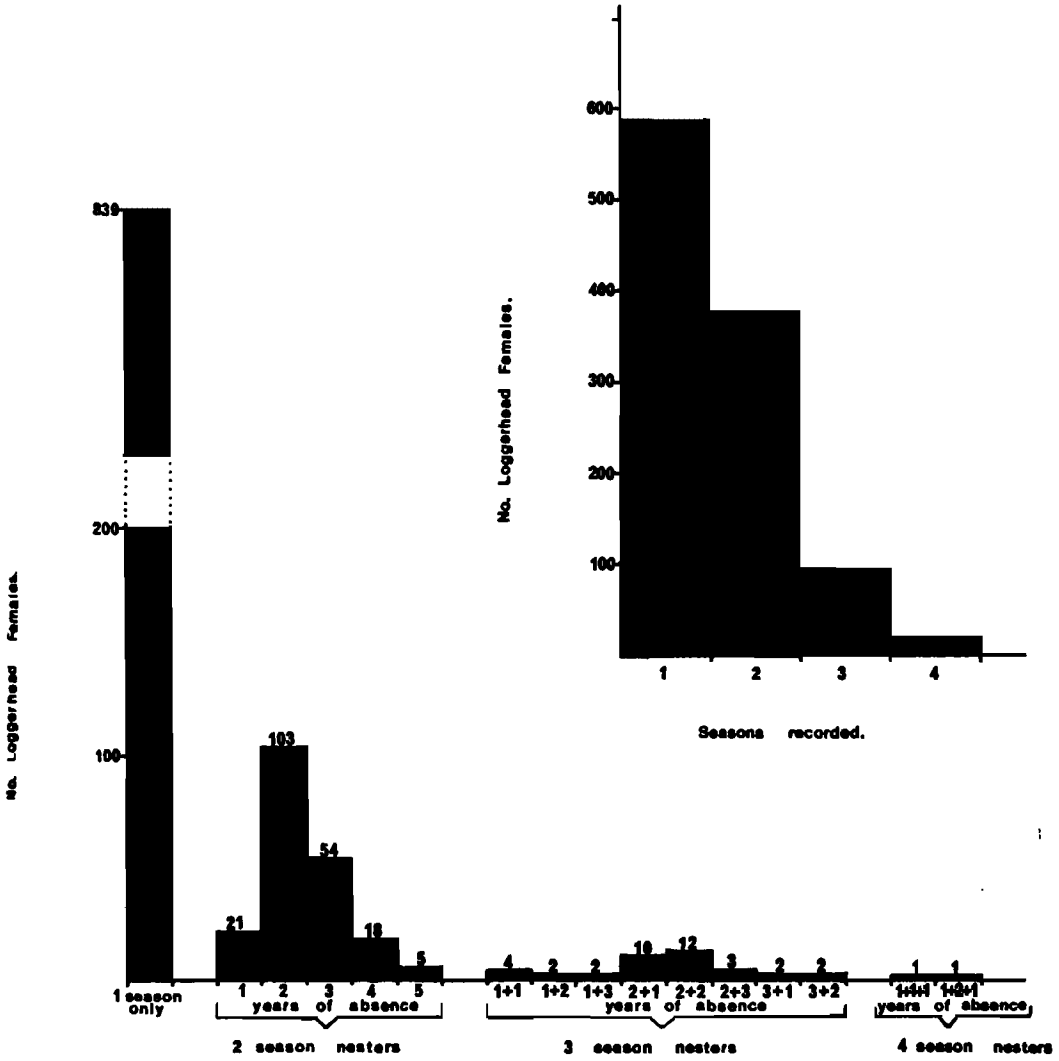


FIGURE 1 (Inset)

The frequency of seasonal nesting recorded from a sample of 1 079 loggerhead females in Tongaland, Natal.

FIGURE 2

The nesting frequencies and remigration intervals recorded from 1 079 loggerhead females tagged in Tongaland, Natal since 1969.

animals recorded as callussed, but these callussed turtles constituted today only some 19 per cent of the overall recoveries (Table 1). It should be stressed that from the callusses examined these are still, in the main, callusses resulting from the loss of plastic tags, those resulting from the loss of monel tags being recognizably different.

Therefore in a five-year period only 240 turtles have returned to nest in Tongaland and their various absences are illustrated in detail in Figure 2. Of the turtles recorded twice (two-season nesters,  $n = 201$ ) there have been absences recorded from one to five years with the most frequent being the two-year absence.

Of the turtles recorded in three seasons (three-season nesters,  $n = 37$ ) there have been more variable absences than regular absences, the latter representing 43,1 per cent of the total number which is, in comparison with the overall number of turtles tagged, very small indeed.

Only two turtles have been identified four times within this five-year period and one of them exhibited a regular annual cycle.

#### *Contact success and efficiency*

As much depends on the acceptance of the belief that the patrol methods in Tongaland are efficient it is perhaps pertinent to record that the single contact success is high: 84,8 per cent (1971/72); 87,3 per cent (1972/73); 91 per cent (1973/74); and 87,5 per cent (1974/75). Further, some extracts from the logbook of the 1973/74 season are indicative of the normal trend each season, viz. that as the season progresses fewer and fewer previously unrecorded turtles are encountered:

TABLE 1  
Details of loggerhead remigrations to the Tongaland beaches

| Season  | Number of turtles encountered | Period of absence (years) |     |    |      |    |     |    |     |   |     |   |     | Callussed | %    | % remigrants |      |
|---------|-------------------------------|---------------------------|-----|----|------|----|-----|----|-----|---|-----|---|-----|-----------|------|--------------|------|
|         |                               | 1                         | %   | 2  | %    | 3  | %   | 4  | %   | 5 | %   | 6 | %   |           |      |              |      |
| 1963/64 | 82                            | —                         | —   | —  | —    | —  | —   | —  | —   | — | —   | — | —   | —         | —    | —            | —    |
| 1964/65 | 223                           | 3                         | 1,4 | —  | —    | —  | —   | —  | —   | — | —   | — | —   | —         | —    | —            | 1,4  |
| 1965/66 | 200                           | 5                         | 2,5 | 9  | 4,5  | —  | —   | —  | —   | — | —   | — | —   | —         | —    | —            | 7,0  |
| 1966/67 | 221                           | 3                         | 1,4 | 16 | 7,2  | 3  | 1,4 | —  | —   | — | —   | — | —   | —         | —    | —            | 10,0 |
| 1967/68 | 293                           | 5                         | 1,7 | 12 | 4,1  | 4  | 1,4 | 9  | 3,1 | — | —   | — | —   | 11        | 3,8  | 14,0         |      |
| 1968/69 | 184                           | —                         | —   | 3  | 1,6  | 3  | 1,6 | 5  | 2,7 | 1 | 0,5 | — | —   | 16        | 8,7  | 15,2         |      |
| 1969/70 | 285                           | —                         | —   | —  | —    | —  | —   | 1  | 0,4 | 1 | 0,4 | 4 | 1,4 | 68        | 23,9 | 26,0         |      |
| 1970/71 | 241                           | 8                         | 3,3 | —  | —    | —  | —   | —  | —   | 1 | 0,4 | 2 | 0,8 | 70        | 29,1 | 33,6         |      |
| 1971/72 | 321                           | 10                        | 3,1 | 18 | 5,6  | —  | —   | —  | —   | — | —   | 1 | 0,3 | 101       | 31,5 | 40,5         |      |
| 1972/73 | 262                           | 6                         | 2,3 | 41 | 15,7 | 9  | 3,4 | —  | —   | — | —   | — | —   | 67        | 25,6 | 47,0         |      |
| 1973/74 | 332                           | 13                        | 3,9 | 46 | 13,9 | 26 | 7,8 | 6  | 1,8 | — | —   | — | —   | 66        | 19,9 | 47,3         |      |
| 1974/75 | 310                           | 17                        | 5,5 | 35 | 11,3 | 27 | 8,7 | 13 | 4,2 | 3 | 1,0 | — | —   | 59        | 19,0 | 49,7         |      |

|   | <i>Recorded</i> | <i>Unrecorded</i> |
|---|-----------------|-------------------|
| 13 November 1973: Total turtles encountered: 6  | 0,0%            | 100,0%            |
| 15 December 1973: Total turtles encountered: 13 | 61,5%           | 38,5%             |
| 15 January 1974: Total turtles encountered: 5   | 80,0%           | 20,0%             |

Coupled with the above is the total nest record which, each season, is consistently compatible with the numbers of females calculated to have been nesting in the protected area (Hughes 1974).

It has been shown (Hughes 1974) that, as in the green turtle (Carr & Carr 1970), the Tongaland loggerhead has a well-developed orientation mechanism and it can return consistently to a zone 10 km in width. With some notable exceptions (Bustard 1972) no loggerhead tagged on any one beach has ever been recorded nesting on other nesting beaches and no loggerhead tagged in Tongaland has been recorded nesting away from Tongaland. In fact even the numbers of females killed during their non-nesting periods appear relatively small (See Table 2 for known kills from tag returns).

### *General*

Taking these points into consideration, it is worth looking at the recovery rates from each individual batch of tags used since 1969 and to see how each group of tags can be accounted for. These data are presented in Table 2, where it can be seen that over the five-year period being reviewed, an almost linear relationship exists between the percentage of tags accounted for and the number of years that have elapsed since tagging.

The percentage recovery in years subsequent to the year of tagging (Table 3) indicates that this is consistent from season to season, and this would suggest that there are relatively fixed proportions of each nesting assemblage that reach nesting preparedness in each year, but that this need not involve the same animals.

### CONCLUSION

If the results presented above are accurate, it is clear that the return of loggerhead females to Tongaland is hardly a chance occurrence and unless loggerhead females move extensively from one nesting area to another, and there is no evidence for this in south-east Africa, and unless the mortality rate in the non-nesting periods is much higher than anticipated, then it must be concluded that between 40 and 50 per cent of loggerhead turtles nest only once in their lifetime.

At least 50 per cent of the loggerhead turtles recorded nesting in Tongaland in any one season will return to nest in subsequent seasons; a high proportion of these will nest at least twice in their lifetime, a lesser proportion three times and a very few, but extremely small, proportion will lay in four separate seasons. Further these remigrations are marked by their irregularity, regular patterns being noticeable neither in the population as a whole nor, except in rare instances, in individual turtles.

Nesting behaviour in loggerhead females appears to be dependent on genetic capability and/or ecological conditions which dictate the ability of each individual turtle to sustain the

TABLE 2

## Overall recoveries of tag groups used in Tongaland

| <i>Season</i> | <i>Series</i> | <i>Total number</i> | <i>Subsequent recoveries</i> | <i>Years elapsed</i> | <i>Known number killed</i> | <i>Total</i> | <i>Percentage accounted for</i> |
|---------------|---------------|---------------------|------------------------------|----------------------|----------------------------|--------------|---------------------------------|
| 1969/70       | A             | 85                  | 42                           | 5                    | 1                          | 43           | 50,6                            |
| 1970/71       | A             | 239                 | 86                           | 4                    | 5                          | 91           | 38,9                            |
| 1971/72       | B             | 302                 | 71                           | 3                    | 2                          | 73           | 24,2                            |
| 1972/73       | C             | 213                 | 35                           | 2                    | 1                          | 36           | 16,9                            |
| 1973/74       | D             | 263                 | 5                            | 1                    | 1                          | 6            | 2,3                             |
| 1974/75       | E             | 233                 | —                            | —                    | 1                          | 1            | 0,4                             |

TABLE 3

## Percentages of tag groups recovered in seasons following that of the initial tagging

| <i>Tag series</i> | <i>Season</i> | <i>% recoveries subsequent years</i> |               |               |               |               |
|-------------------|---------------|--------------------------------------|---------------|---------------|---------------|---------------|
|                   |               | <i>Year 1</i>                        | <i>Year 2</i> | <i>Year 3</i> | <i>Year 4</i> | <i>Year 5</i> |
| A                 | 1969/70       | 6                                    | 21            | 12            | 13            | 8             |
| A                 | 1970/71       | 3                                    | 18            | 13            | 10            | —             |
| B                 | 1971/72       | 2                                    | 15            | 11            | —             | —             |
| C                 | 1972/73       | 5                                    | 16            | —             | —             | —             |
| D                 | 1973/74       | 4                                    | —             | —             | —             | —             |

physiological drain of a nesting season.

Even with the future use of inconel tags it will be at least five or six seasons before a final assessment of loggerhead reproductive behaviour is possible. However, the results gathered so far indicate that irregularity is characteristic of the nesting behaviour of the Tongaland loggerhead.

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