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RENESTING INTERVALS OF THE HAWKSBILL SEA TURTLE (*ERETMOCHELYS IMBRICATA*) ON SOUTH REEF ISLAND, ANDAMAN ISLANDS, INDIA

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(with two text-figures)

ABSTRACT.- Data on 106 renesting intervals involving a total of 56 hawksbill sea turtles (*Eretmochelys imbricata*) on South Reef Island, Andamans, India were analyzed. Renesting intervals ranged from 12-17 days, averaging 14.06 days, and show a standard deviation of 1.17 days. The most frequent renesting interval was 14 days (35.8 per cent of total). Fifty instances of multiple renesting involving 32 of the 56 hawksbills were encountered. In 90 per cent of these instances, the variation in renesting of individual turtles were either 0 or 1 day. The maximum number of renesting within a season was six.

KEY WORDS.- *Eretmochelys imbricata*, **renesting interval, multiple renesting, South Reef, Andaman Islands, India.**

INTRODUCTION

Uninhabited South Reef Island, one of 94 islands designated as a Wildlife Sanctuary in India's Andaman and Nicobar Islands, is 450 m long and 90 m wide at its broadest part. It is fringed by an unbroken coral reef on all sides except off its north-eastern corner where the reef is patchy. The island is forested, and extreme spring tides frequently invade the forest edges. A dynamic cycle of erosion and deposition of the coast by the sea occurs, and is linked to the two monsoons, the Southwest (June to September) and the Northeast (October to November).

The island is among three of the most favoured sites by nesting hawksbills sea turtles (*Eretmochelys imbricata*) in the Andaman and Nicobars, with up to eight females coming ashore during a single night, although the average number during the peak nesting season is two per night. Green turtles (*Chelonia mydas*) nest is smaller numbers. Despite the existence of nesting beaches used by hawksbills on neighbouring islands, the closest of which is Interview Island (ca. 2 km distant), evidence from renesting encounters suggests that the hawksbills which nest on South Reef exhibit strong nest site fidelity.

Other than a species of *Rattus*, no vertebrate land animal prey on turtle hatchlings on South Reef, and turtles rarely encounter disturbance while nesting. Humans occasionally camp on the island, most often during the fair season (December to May).

MATERIAL AND METHODS

Each year from 1992 to 1995, a small camp manned by one or two investigators was set up on South Reef during the main hawksbill nesting season. During 1992, 1993, 1994 and 1995, the duration of the camps were, respectively, three months- 12 September to 12 December), two and quarter months- 14 September to 22 November, three and quarter months- 27 June to 9 September and 16 November to 7 December, and two months- 14 June to 18 August (Bhaskar, 1993; 1994a; 1994b; 1995; 1996).

Nesting hawksbills were tagged during these isolated periods with a minimum of disturbance: shaded flashlights were used sparingly. A single hurricane lantern, placed within a carton in order to shade and direct the light downwards, was used at the camp, which was itself concealed behind beach vegetation, primarily *Scavola taccada*. Some nesters, however, may have been disturbed by the offshore activities of local shark fishermen and of Burmese divers intent on collecting commercially valuable marine invertebrates.

Sweeps of the 1 km perimeter of the island were undertaken at about 100 minute intervals commencing at 1915 hours and ending at about 0300 hours, after which hawksbills rarely came

ashore. Tagging was delayed until oviposition commenced. Nesting turtles encountered at any stage subsequent to oviposition were allowed to complete the nest, then overturned while returning to the sea, tagged and righted again. Only one in five turtles tagged required to be overturned. Renesting intervals were rounded off to the nearest day.

Two types of tags were used. The first is a corrosion-resistant metal wore carried on a red plastic tag serially numbered AN1, AN2, etc. The second is a metallic corrosion-resistant cattle-ear tag, serially numbered CA707, CA708, etc., and the inscriptions: RETURN ANPWS GPO BOX 636 CANBERRA AUST 2601, or numbered 006X, 007X, etc., carrying the inscription: RETURN WILDLIFE BOX 155 NORTH QUAY 4002 QLD AUSTRALIA.

All tags were inserted through the first and/or second and/or third large scale of the trailing edge of the left fore flipper closest to the turtle's body. Double or multiple tagging was employed in cases where tags were thought to have failed to lock securely. Turtles encountered renesting were found to have never lost tags.

RESULTS

Of 106 renesting intervals recorded for 56 hawksbills, 14 days was the most frequent (35.8 per cent or more than one-third of the total). About four of five (79.2 per cent) renesting intervals fell within the range 13-15 days and 98.1 per cent within the interval of 12-16 days. The range was therefore 12-17 days. Renesting intervals averaged 14.06 days and showed a standard deviation of 1.17 days.

Only three of 286 nestings documented occurred during daylight. A hawksbill that stranded at 1545 hours on 1 October, 1992 and nested was never encountered again on South Reef; another female that nested by daylight was missed by the investigator; a third stranded at 1845 hours on 18 July, 1995, nested, and was seen stranding twice again, at intervals of 15 days 7.5 hours and 15 days 17.5 hours, nesting on both occasions. Thirty-two females were each encountered on three or more occasions, giving a total of 50 renesting intervals. For each turtle, the variation in renesting interval

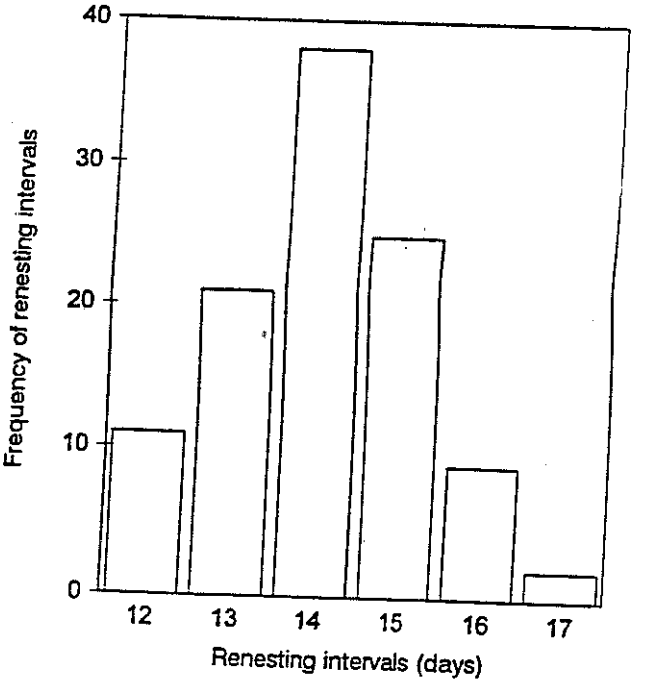

FIGURE 1: Frequency of renesting intervals in hawksbills on South Reef Island.

TABLE 1: Year-wise and cumulative frequencies of renesting intervals for hawksbills on South Reef Island. Abbreviations: RI = renesting interval; f = frequency; n = sample size.

RI (days)	Frequency of renesting interval									
	1992 (n = 15)		1993 (n = 35)		1994 (n = 31)		1995 (n = 25)		Overall (n = 106)	
	f	%	f	%	f	%	f	%	f	%
12	1	6.7	6	17.1	1	3.2	3	12.0	11	10.4
13	5	33.3	11	31.4	3	9.7	2	8.0	21	19.8
14	3	20.0	9	25.6	15	48.4	11	44.0	38	35.8
15	4	26.7	7	20.0	9	29.0	5	20.0	25	23.6
16	1	6.7	2	5.7	3	9.7	3	12.0	9	8.5
17	1	6.7	0	0.0	0	0.0	1	4.0	2	1.9

TABLE 2: Illustration of method used in calculating variation in renesting interval (days) for individual hawksbills on South Reef Island. Abbreviation: RI = renesting interval; SI = serial number of turtle.

SI	RI	Variation in RI
A	14, 14	0
B	12, 13, 14	1, 1
C	12, 13, 13	1, 0
D	12, 15	3
E	16, 15, 15	1, 0
F	14, 14, 13	0, 1
G	13, 13, 14, 14, 14	1, 1, 0, 0
H	12, 13, 17	1, 3

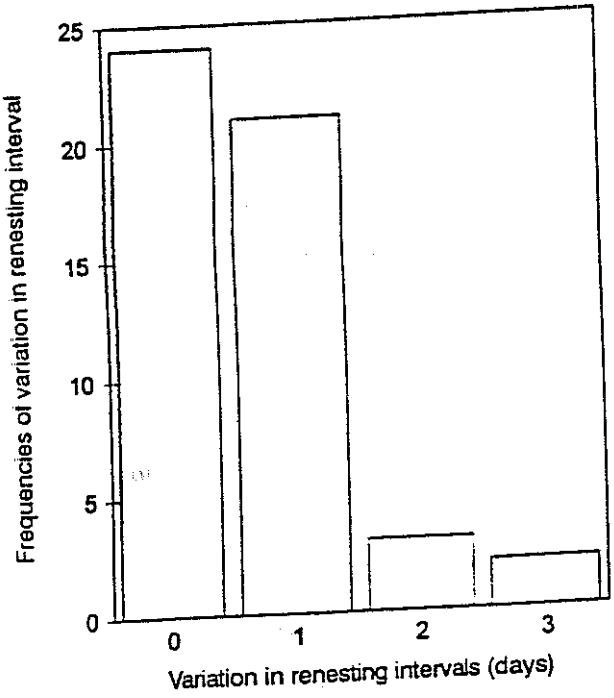

FIGURE 2: Frequencies of variation in renesting interval for mulitple renesting hawksbills on South Reef Island.

TABLE 4: Frequencies of variation in renesting interval (days) for multiple renesting hawksbills on South Reef Island, excluding the 1992 data. Abbreviations: RI = renesting interval (days); n = sample size.

Variation in RI	Frequency of variation in RI	
	Cumulative figures for 1993, 1994 and 1995	%
0	23	52.3
1	18	40.9
2	2	4.5
3	1	2.3

was calculated as in the following examples provided in Table 2.

Using this method, the average variation in the 50 multiple renesting intervals was 0.66 days with a range of zero to three days, standard deviation 0.77 days and a mode of zero days. Ninety per cent of the renesting intervals varied by either zero days (48 per cent) or one day (42 per cent).

The maximum number of times an individual hawksbill was seen nesting was six, at intervals of 13, 13, 14, 14 and 14 days, spanning 68 days. Many hawksbills were encountered only once while nesting. In no year did the study period cover the entire nesting season for the species, and several instances of nesting were missed by the investigators even during the study period.

DISCUSSION

A knowledge of renesting intervals, together with renesting frequencies will reveal the length of time during which a nesting sea turtle is susceptible to predation at or near a nesting beach, or to drowning in fishing nests. It will also facilitate the

TABLE 3: Frequencies of variation in renesting interval for multiple renesting hawksbills on South Reef Island. Abbreviations: RI = renesting interval (days); n = sample size.

Variation in RI	Frequency of variation in RI					
	1992 (n = 6)	1993 (n = 14)	1994 (n = 18)	1995 (n = 12)	Overall (n = 50)	%
0	1	5	11	7	24	48
1	3	8	6	4	21	42
2	1	0	1	1	3	6
3	1	1	0	0	2	4

tagging of nesters by limiting the number of nights of search needed.

While the published information mention that renesting interval of the hawksbill is 15-19 days (Carr and Stancyk, 1975; Diamond, 1976; McKeown, 1977: see also Hirth, 1980; Groombridge and Wright, 1982: 191, for a review), and one worker has even reported a mean of 24.5 days (Vaughan, 1981), the present study gave the range of 12-17 days. The difference obviously relates to geographically distinct populations. It is also possible that the low level of human-engendered disturbance to nesting turtles on and around South Reef Island resulted in the prevalence of near-natural renesting interval, as observed in this study.

However, disturbance may not have been negligible during the first year of the study (1992), when a parallel study on sea kraits (*Laticauda* spp.) necessitated more frequent use of a flashlight on the nesting beach at South Reef. With the data from 1992 deleted, a variation of zero days in renesting interval occurred in over half (52.3 per cent) of the 44 instances of multiple nesting by the hawksbills recorded, and was either zero or one day in 93.2 per cent of these instances.

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