

NESTING BIOLOGY OF THE SEA TURTLE *Caretta caretta* AT PRAIA DO FORTE, BAHIA, BRAZIL

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Praia do Forte (12 35'S, 38 00'W) is a beach located **about 80** km north of **Salvador**, the capital of the state of Bahia, on the northeastern coast of Brazil. It is about **13** km long and is a nesting ground to four species of sea turtles: *Caretta caretta*, *Eretmochelvs imbricata*, *Chelonia mydas* and *Lepidochelvs olivacea*. Projeto **TAMAR - IBAMA**, the Brazilian Sea Turtle Conservation Program, has its national headquarters at Praia do Forte, where it has been working since **1982**. Projeto **TAMAR's** activities at this beach include protection of nests and hatchlings, tagging of nesting females and environmental education aimed at fishermen, **schoolchildren**, tourists and the communities of the nearby villages in general.

The nesting season for all four species of sea turtles is generally from September to March. The loggerhead sea turtle, *C. caretta*, is the most common species nesting on Praia do Forte. The nestings recorded at Praia do Forte since the season **1987-88** through the season **1994-95** are distributed according to species as follows: 83% belong to *C. caretta*, 15% to *E. imbricata*, 1% to *Chelonia mydas* and 1% to *L. olivacea*. This paper presents data about *C. caretta* nesting on Praia do Forte between the seasons **1987-88** and 1994-95.

METHODS

Every night from late August to the end of March the beach is patrolled by a team of biologists on a four-wheel-drive-vehicle, during a variable period. Each turtle found on the beach is identified to species, measured (curved carapace length and width) and double tagged with monel tags (National Band and Tag Co., #681), one tag on each fore flipper. Early every morning, the beach is patrolled on foot by two experienced fishermen, former **turtlers** who are hired by Projeto TAMAR. These fishermen locate every nest placed on the beach the preceding night. All nests have their exact location marked by Projeto **TAMAR's** biologists by means of numbered stakes. Nests at risk either by natural or human caused factors were, up to **1993-94**, transferred to a beach hatchery. Since **1994-95**, nests considered to be threatened are transferred to suitable locations on the beach itself, to incubate under natural conditions. In situ, nests are excavated within 24 hours of hatchling emergence to get a count of the clutch size. All nests are excavated after emergence to identify the species, in case the turtle itself was not observed while nesting. Species identification is made by examination of dead hatchlings or embryos. A more detailed description of Projeto **TAMAR's** field methodology may be found in Marcovaldi and Laurent (1996).

At Praia do Forte, South American gray foxes (*Dusycion vetulus*) are strong predators of sea turtle nests. All predated nests were excluded from clutch **size**, hatchling success and emergence period calculations. A small number of nests with less than 40 eggs (4 nests in 1993-94, 3 in **1989-90** and 2 or less in the other seasons) were excluded from calculations because were believed to have undergone predation, even if this putative predation was not recorded in the data file.

The emergence period for each nest is calculated as the period between oviposition and time of emergence (when most of the hatchlings emerged from the nest onto the sand surface). Hatchling success is calculated as live hatchlings divided by clutch size.

For the calculation of the average curved carapace length, turtles that were found on the beach more than once in a season had only the first measurement made in the season included in the calculations.

To know the new and remigrant turtles for each season we use data gathered in the seasons 1982/1983 through 1994-95. In **1982-83**, 3 new *Caretta caretta* turtles were tagged, 9 in **1983-84**, 8 in **1984-85**, 3 in

1985-86 and 11 in 1986-87. These turtles were included in the calculation of the number of remigrant turtles in the seasons 1987-88 through 1994-95.

The frequency distribution of the remigration intervals was calculated using data for all turtles tagged since the 1982-83 season.

An "observed turtle" is a turtle found on the beach while nesting. An "observed nest" is a nest whose mother-turtle is known, that is, this nest can be identified with a particular turtle, which is only possible if the turtle was found while nesting.

RESULTS AND DISCUSSION

Peak nesting for loggerhead turtles at Praia do Forte occurs between October and December. There is not much variation in the number of nests laid each season (maximum of 149 nests in a 1987-88 season; minimum of 113 nests in the 1991-92 season) unlike what is observed for other populations of the loggerhead sea turtle (Richardson 1982, Limpus 1985).

Since 1988-89 most nests have been kept in situ. Projeto TAMAR's objective is always to keep the nests in as natural a condition as possible. However, the necessity of transferring nests laid nearby the village, where there is a great movement of people, and nests laid in naturally risky locations place an upper limit (about 65-80%) on the proportion of nests that can be left to incubate in situ.

Clutch size, which averages 123.8 eggs (maximum of 198 and minimum of 40), is within the range reported for other *Caretta caretta* populations (Hirth 1980, Limpus 1985, Dodd 1988).

Mean curved carapace length (measured over the curve from the precentral scute in the carapace midline to the posterior margin of the postcentrals) for the loggerhead turtles at Praia do Forte is 1.03 m (maximum 1.14 and minimum 0.87 m), and it seems to be somewhat greater than the means generally reported for other populations of this species, although the observed range of carapace length (1.03 + or - 0.05) is within the range usually reported for this kind of measurement (Dodd 1988).

Hatchling success for in situ nests (average of 73.5%) is also within published limits for *Caretta caretta* sea turtles (Hirth 1980, Dodd 1988). An analysis of variance shows a significant difference among the season means of hatchling success ($p < 0.01$). The emergence period for in situ nests (average of 52.6 days) is also within published limits (Dodd 1988), and the mean emergence periods are also significantly different among the seasons (analysis of variance, $p < 0.01$). It would be interesting to correlate hatchling success and emergence periods with temperature and other climatic data.

The distribution of "observed turtles" according to the number of "observed nests" varies somewhat (maximum of 5 observed nests/turtle, only happened twice, in the 1987-88 and in the 1989-90 seasons). The turtle that had 5 observed nestings in 1987-88 can be inferred to have laid at least 6 nests, if we accept, as loggerhead researchers usually do (Richardson 1982, Limpus 1985), that there was a non-observed nesting between two observed nestings within a 25-day interval, which is about twice the estimated mean interesting interval for *Caretta caretta* turtles on Praia do Forte. If we accept that intervals greater than 18 days are composites of lesser intervals, the mean interesting interval (mean of intervals less than or equal to 18 days) is estimated to be 14.9 days. The tagging survey coverage of Projeto TAMAR at Praia do Forte, as measured by the proportion of Nests related to an individual turtle relative to the total number of nests laid in the season, has been typically low, ranging from about 35% in 1987-88 and 1990-91 to as low as about 10% in 1991-92 and 1992-93. Given this low tagging survey coverage, it is to be expected a high proportion of turtles with only one observed nest (109 turtles in a total of 147), since rarely is a turtle observed on the beach more than once.

Remigrant turtles are a relatively small proportion of the turtles observed arriving each season (average of 0.31 remigrant turtles/season). One possible reason for this low proportion of remigrant turtles is tag loss, which has not been evaluated at Praia do Forte. Another possible reason is mortality at sea, either by natural or human caused factors, but there is no data about this subject in Brazil. The relatively low

tagging survey coverage may also contribute to the observed small proportion of remigrant turtles. Low remigration rates are also found in other sea turtle populations, a phenomenon that is not completely understood (Carr et al. 1978, Carr 1980, Hughes 1982, Limpus 1985).

One year remigration intervals are a relatively common feature of the **Caretta caretta** population nesting on Praia do Forte ($11/54 = 20.4\%$ of the recorded intervals). This observed percentage of **1-year intervals** is greater than the percentages presented in Dodd (1988) for other **C. caretta** populations. The percentage of 1-year remigration intervals found at Praia do Forte may be an artifact of the low tagging survey coverage, besides the omnipresent problem of tag loss. The highest proportion of remigration intervals occur at 2 years ($22/54 = 40.7\%$), a characteristic **also** found in other **C. caretta** populations (Dodd, 1988).

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