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Juvenile *Eretmochelys imbricata* and *Chelonia mydas* in the Archipelago of Fernando de Noronha, Brazil

TAISI MARIA SANCHES[1] AND CLAUDIO BELLINI[2]

[1]*Fundação Pró-TAMAR, C.P. 50, Fernando de Noronha, PE 53990-000, Brazil [Fax: 55-81-6191269; E-mail: protamar@e-net.com.br];*
[2]*Projeto TAMAR-IBAMA, C.P. 50, Fernando de Noronha, PE 53990-000, Brazil*

ABSTRACT. – **Since 1987, Projeto TAMAR-IBAMA has been monitoring areas of major concentrations of juvenile hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*) turtles in the Archipelago of Fernando de Noronha, Brazil. Using snorkeling, juvenile turtles were captured, tagged, and their biometric and behavioral data recorded. A total of 186 individuals have been captured, of which 125 (67.2%) were *E. imbricata* and 61 (32.8%) were *C. mydas*. A total of 54 (21%) individuals have been recaptured from 1 to 91 times. Data obtained include curved carapace length, carapace width, and weight (*E. imbricata* range: length 30.5–84.0 cm, width 26.0–68.0 cm, weight 1.5–42.0 kg; *C. mydas* range: length 32.0–83.0 cm, width 26.5–73.0 cm, weight 3.8–31.0 kg). Behavioral and dietary observations are also presented.**

KEY WORDS. – **Reptilia; Testudines; Cheloniidae; *Eretmochelys imbricata*; *Chelonia mydas*; sea turtle; juveniles; developmental habitat; feeding grounds; Brazil**

The Archipelago of Fernando de Noronha is one of Projeto TAMAR-IBAMA's monitoring areas that was created in 1980 to protect and study the five species of sea turtles that occur in Brazil (Marcovaldi and Marcovaldi, 1985). Besides the management of nests and monitoring of nesting females, a study of the juvenile populations of hawksbills (*Eretmochelys imbricata*) and green turtles (*Chelonia mydas*), which find good feeding, resting and growing conditions in the archipelago, has been conducted since 1987 (Bellini and Sanches, 1996). The management of this TAMAR-IBAMA station has been difficult, mostly as a result of logistic support for an island situated far from the Brazilian coast. Since 1993 consistent data have been collected with systematic techniques (Bellini and Sanches, 1993).

Study Site. — The Archipelago of Fernando de Noronha (Fig. 1) is situated 215 nautical miles (approximately 380 km) from the northeastern coast of Brazil (3°50'S, 32°24'W). It includes one main island and twenty small islands, all of volcanic origin, comprising a total area of 26 km^2 (Almeida, 1958). Part of this area (70%) was declared a Marine National Park by IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis) in 1988. It is washed by the south equatorial current which carries warm and calm waters, creating an environment rich in coral, sponges, algae, and other organisms that constitute the diet of two species of marine turtles.

We systematically investigated 8 areas around the island (Fig. 1) and turtle concentrations were found to be highest at Sueste Bay. This site has been the main study site since it is an important concentration area for juvenile *E. imbricata*. It is close to the TAMAR-IBAMA station and hosts a rich diversity of fish and a high concentration of coral (of the species *Siderastrea stellata*, *Mussismilia hispida*, *Favia gravida*, and *Porites asteroides*) and algae (most common genera: *Caulerpa*, *Halimeda*, and *Lithothanium*). It also contains several species of sponges and colonial ascidia common to the shallow reefs of the northeastern Brazilian coast (Maida et al., 1995). This bay is sheltered and therefore has calm waters during most of the year. The water in the bay usually has low visibility (5 m) in relation to other areas of the archipelago since it is close to a mangrove area - the single insular mangrove colony of the South Atlantic (Almeida, 1958). The average depth of the bay is 4 m during high tide and 2 m during low tide.

METHODS

The main concentration areas of marine turtles have been monitored using snorkeling. Weekly observations were made through the hand-capture of individuals, tagging, and collecting biometric data (length and width of the carapace, and weight). Collection was always carried out by a minimum of two divers, so that while one held the turtle the other registered the data collected. When researchers were close to the beach captured turtles were taken to land for weighing and quickly released. Rarely was scuba used since it reduces the agility necessary for such capture. However, scuba was used for collecting video and photo images, used as supplementary sources of information and visual documentation (Marcovaldi et al., 1998b).

Inconel tags were applied with standard applicators. Earlier, monel tags were used, but later were replaced by inconel tags due to the short life-time of the monel tags, especially on *E. imbricata*. Within a few months of application the monel tags became totally encrusted with algae and briozoids, which corroded the surface and weakened the hook that seals the tag, making the tags extremely vulnerable to loss. Limpus (1992) and Chaloupka and Musick (1997), in their analysis of tag loss, recommended using inconel and titanium tags for long-term studies. Limpus' (1992) recom-

Figure 1. Map of Brazil locating the Fernando de Noronha Archipelago, the Marine National Park, the 8 localities investigated, and the main study site at Sueste Bay.

mendation was followed that the tags be placed between the first scale and axillary scale of each front flipper, or between the first scale after the axillary and the second scale.

Curved carapace length and width was taken with a plastic tape. Weight was taken with the use of 20 and 50 kg spring-scales, with 100 and 200 g precision points, respectively.

Other data recorded included time, date, place, depth of observation, duration of the dive, and any other particular observations. We entered data using a universal data sheet and database created for recording sea turtles in feeding grounds, not only in Fernando de Noronha, but for all areas monitored in Brazil (Marcovaldi et al., 1998a).

RESULTS AND DISCUSSION

During the 10 years of the study 781 captures of 186 individual turtles were made at the Archipelago of Fernando de Noronha (Fig. 2). Of these, 701 (89.8%) were *E. imbricata* and 77 (9.9%) were *C. mydas* (the remaining 3 were single individuals of *Lepidochelys olivacea, Dermochelys coriacea,* and *Caretta caretta*). Eight juvenile turtles were found dead: 3 *E. imbricata* and 4 *C. mydas,* and 1 *L. olivacea* which was caught in a fishing net. The single *D. coriacea* recorded was a male found entangled in a shark fishing cable in open sea and brought to the archipelago by a fisherman (Bellini and Sanches, 1997), and the single *C. caretta* recorded was probably migrating through the area (Bellini and Sanches, 1998).

Of the 186 individuals that were captured and tagged, 132 (71.0%) were not recaptured (Fig. 3). Of the remaining 54 (29.0%), 19 (10.2%) were recaptured once, 11 (5.9%) were recaptured twice, 5 (2.7%) were recaptured three times, 2 (1.1%) were recaptured four times, 4 (2.2%) were recaptured five times, 1 (0.5%) was recaptured six times, and 12 individuals (6.0%) were captured ten or more times. The greatest number of recaptures of the same individual was 91. Of the 186 individuals captured, 125 (67.2%) were *E. imbricata* and 61 (32.8%) were *C. mydas*. Of these, 47 (37.6%) *E. imbricata* were recaptured, but only 7 (11.5%) *C. mydas* were recaptured. The number of hawksbill captures was greater than the number of green turtles because the latter, though present in large numbers in the area, were more difficult to approach and capture.

The depths of the observation and capture locations ranged from 0.5 to 23 m, but there were some captures by scuba at greater depths. Sueste Bay was the area with the greatest number of records (79.0% of the 781 records). Other

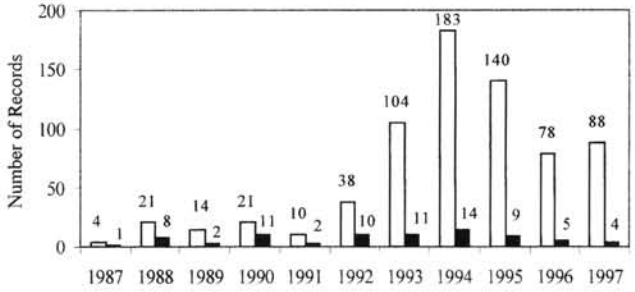

Figure 2. Numbers of *Eretmochelys imbricata* (open bars) and *Chelonia mydas* (black bars) captured and recaptured per year.

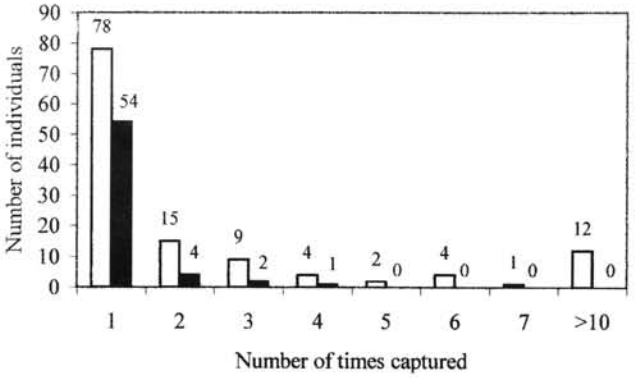

Figure 3. Number of captures and recaptures for *Eretmochelys imbricata* (open bars) and *Chelonia mydas* (black bars).

Table 1. Minimum and maximum measurements of curved carapace length and width and total body weight obtained for each species (n = number of measurements).

	Length (cm)			Width (cm)			Weight (kg)		
	min	max	n	min	max	n	min	max	n
E. imbricata	30.5	84.0	395	26.0	68.0	287	1.5	42.0	277
C. mydas	32.0	83.0	71	26.5	73.0	35	3.8	31.0	40

areas (Fig. 1) had less frequent records: 4.2% at Porto, 2.2% at Boldró, 2.0% at Sancho, 1.4% at Sapata, 1.3% at Leão, 1.2% at Pepino, and 1.0% at Abreu. As suggested by Meylan (1984), there is evidence that *E. imbricata* may inhabit areas close to mangroves and estuaries, which are characteristics of Sueste Bay. The frequency of turtle sightings in this area is noteworthy and is the reason why local guides use this area to take tourists for snorkeling. Access to the east portion of the bay, which has an extensive reef bank, has been closed to tourists to avoid degradation since it becomes too shallow during low tide (Bellini et al., 1995).

The minimum and maximum values for weight, curved carapace length, and curved carapace width recorded for captured turtles corresponded to juvenile and subadult individuals for both species (Table 1; Fig. 4).

The turtles were generally seen feeding on benthic algae banks. Hawksbills were frequently seen feeding on urchins and crushing corals and sponges, sometimes using their flippers to assist with the hard substrate.

Hawksbills were mostly solitary, whereas green turtles were often seen in groups of two or more individuals. At Sueste Bay, for example, during several years a certain degree of site fidelity was observed for some individual hawksbills. Also of note is that, when two individual hawksbills were captured at the same time, we could not place them close together because they demonstrated aggressive biting behavior towards each other.

Several times, turtles of both species were observed resting in crevices in the reef or with their entire body inside the crevice and with only the front of their body outside. Only a few times were turtles observed with only their hind flippers outside a crevice. In some of the resting turtles it was possible to observe small fish feeding on organisms found on the turtle's carapace, as if they were cleaning, with no movement or response by the turtle. In general, algae and briozoids have been observed colonizing the carapace. On two occasions crabs were observed close to the cloaca and the posterior marginals of the carapace of hawksbills and in these instances the ventral epidermis of the turtle had an unusual reddish color. As stated by Witzell (1983) there have been records of numerous parasites and commensals on hawksbill turtles at several locations, but we have not found any previous reference to crabs.

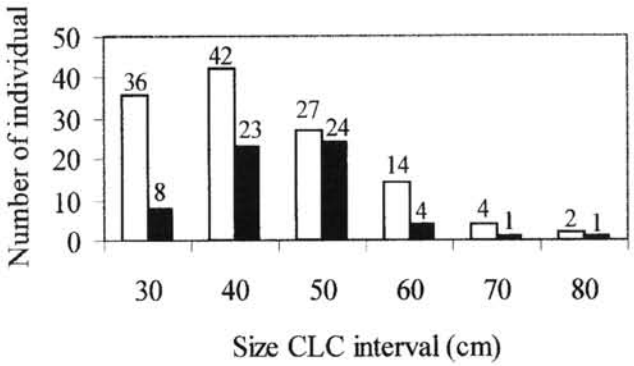

Figure 4. Size class distribution of captured *Eretmochelys imbricata* (open bars) and *Chelonia mydas* (black bars); CLC = curved carapace length.

Conservation Issues. — The research work carried out by Projeto TAMAR-IBAMA in this archipelago is greatly enhanced by the environmental education efforts that have been established for both tourists and the community. Research activities and results are continuously presented to these audiences through daily presentations and the field work activities that are available to the public under guidance of the biologists. This aspect of the program will also continue to be developed hand-in-hand with the research program. Since Fernando de Noronha is one of the most visited tourist centers of Brazil, which generates considerable development pressure, TAMAR-IBAMA believes that this dual approach is crucial for conserving sea turtles in the area.

This marine turtle feeding ground, and also neighboring areas such as Atol das Rocas, may be a developmental habitat for populations of other nations (Marcovaldi and Filippini, 1991) as well as elsewhere within Brazil. For example, the juvenile *E. imbricata* at Fernando de Noronha may eventually nest in the northern state of Bahia, including the main reproductive areas in the Praia do Forte region (Marcovaldi and Laurent, 1996), where extensive resources have been invested in the conservation of this species.

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