Nesting biology and conservation of the olive ridley sea turtle (*Lepidochelys olivacea*) in the State of Sergipe, Brazil, 1990/1991-2000/2001

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The olive ridley sea turtle (*Lepidochelys olivacea*) has a nearly circumglobal distribution in tropical oceans. In Brazil, the most important nesting area for this species is on the northeastern coast, in the state of Sergipe (around latitude 10°30'): about 85% of olive ridley nesting in Brazil occurs in that state. Nesting occurs mainly at Santa Isabel Biological Reserve, on the northern part of the state, and, in smaller numbers, at the Environmental Protection Area in the south (see Map). Sergipe is also a nesting ground for loggerheads (*Caretta caretta*) and, in smaller numbers, hawksbills (*Eretmochelys imbricata*) and green turtles (*Chelonia mydas*).

Projeto TAMAR-IBAMA, the Brazilian sea turtle conservation program, has been working in the state of Sergipe since 1981, initially on Pirambu beach and at Santa Isabel Biological Reserve and gradually extending the scope of its activities. Nowadays, TAMAR maintains three stations in Sergipe, monitoring 125 km of nesting beaches. Moreover, since the beginning of its activities TAMAR has been conducting environmental conservation and educational activities with the coastal communities in that region, and has also been involved in their socio-cultural life through the promotion of alternative sources of income, like oyster culture (an alternative to fishing) and embroidery, and of local cultural activities, like dance and folklore groups.

In this poster we present data gathered from 1990/1991 to 2000/2001 regarding the nesting biology of olive ridleys and the management of their nests in Sergipe: nest temporal distribution, distribution of nests by method of management, incubation time, hatching success, and size distribution of the nesting turtles. Finally, a review of the conservation status of olive ridley turtles in Sergipe is presented. A more complete report, currently in preparation, will be published elsewhere.

METHODS

Study Area and Duration. — The state of Sergipe has a 163 km long coastline, of which 125 km are monitored by TAMAR. Three TAMAR stations are located in Sergipe: Abaís, Pirambu and Ponta dos Mangues. The coastline is made up of high energy beaches with open offshore approaches; there are no beds of rocks in the foreshore, and no rocky shores. The nesting season for olive ridleys in Brazil is around the summer, generally from September to March, an thus each season is denoted here by a two-year code, e.g., 1994/1995. Although TAMAR began its activities in the state of Sergipe in 1981, only data from 1990/1991 to 2000/2001 will be analyzed.

Field methods. — Projeto TAMAR's field methodology has been described in detail by Marcovaldi and Laurent (1996), and Marcovaldi and Marcovaldi (1999). TAMAR's goal is to leave every nest *in situ*, which is not always possible: clutches under risk of tidal flooding, human or animal predation, beach illumination or habitat alteration are relocated to open beach hatcheries in the same nesting area, or, not so often, to another spot on the beach - here, only nests left *in situ* or relocated to hatcheries will be analyzed (see Figure 3). Furthermore, due to management decisions, clutches found in some specific areas are always relocated. Beaches are daily patrolled in the morning by fishermen hired by TAMAR, who work under the supervision of TAMAR's technical staff. Fishermen locate the nests, mark those left *in situ*, and bring the clutches to be relocated to hatcheries. About 94% of the clutches are relocated in less than 12 h after laying. The clutches are planted in hatcheries, are later excavated, and the species are identified (through the examination of hatchlings or embryos) by TAMAR's technical personnel. *In situ* nests serve as controls for nests in hatcheries, where incubation parameters are closely monitored.

Females encountered when nesting are double tagged on their front flippers with monel tags (National Band and Tag Co., style 681), and curved carapace length (CCL) and width are recorded with flexible plastic tapes. Nesting females are found only opportunistically on the beaches, during regular fieldwork. Regular beach night patrolling is not carried out by TAMAR in Sergipe.

CONSERVATION STATUS

Around 1981, sea turtle eggs were heavily poached by local people in Pirambu,. At that time, local inhabitants said that sea turtle hatchlings had not been seen for more than 15 years. Nowadays, due to TAMAR's educational activities with the community, local people are generally integrated into the conservation work and are aware of the importance of conserving sea turtle nests. Although human predation on nests continues to happen, it occurs at a level much lower than those observed in the past. Between 1990/1991 and 2000/2001, only about 3% of the nests were depredated by humans.

The most pressing threat is the incidental capture in trawl fisheries. The coast of the state of Sergipe is an important shrimping area, where a sizeable fishing fleet operates, causing a great deal of interaction between sea turtles and trawl nets, frequently right in front of nesting beaches. As a result, a significant mortality of adult olive ridleys during the nesting season has been observed. Approximately 185 trawl boats operated in the area in 2000, about 30% of them coming from Sergipe's neighboring states. The boats are 10 to 15 m long, and employ mechanical means to haul the nets aboard. Boats that are longer than 11 m and that haul their nets through mechanical means are required by Brazilian governmental rules to use Turtle Excluder Devices (TED's). However, due to deficient law enforcement by governmental agencies responsible for fishing operation regulations, those rules have not been complied with, and so trawl boats operating in Sergipe are not equipped with TED's. Since 1993, TAMAR has maintained educational campaigns regarding the rehabilitation of turtles drowned in nets. Since 1999, TAMAR personnel make boat trips around the Sergipe coast, to assess the magnitude of incidental captures, and also to orient trawl boats to operate outside a 3 nautical mile exclusion zone around nesting beaches, aiming at lowering their impact on sea turtles. TAMAR has also worked closely with governmental environmental agencies to look for solutions to the incidental capture problem.

Other threats to sea turtles in the state of Sergipe posing a lower level of risk than the incidental capture in fishing gear, are: (1) artificial lighting near nesting beaches, (2) building of houses on beaches, mostly in environmental protection areas (the houses are generally made by people from outside the local communities), and (3) vehicle traffic on the beaches. Although there are local laws regarding artificial lighting near nesting beaches and vehicle traffic, the lack of proper enforcement makes these human activities a continuing threat to sea turtles in that state.

ACKNOWLEDGMENTS

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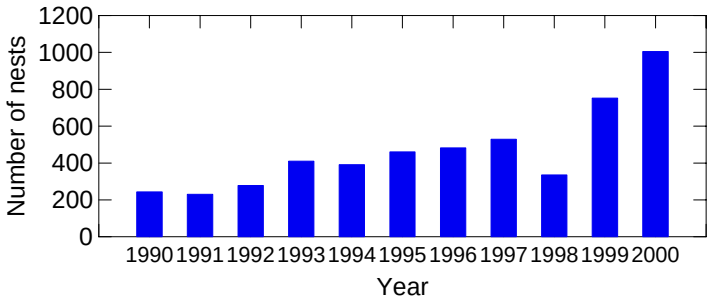

Figure 1. Number of estimated nests by season (n = 5115). The first year of each nesting season is shown, e.g., 1994 = 1994/1995. In the construction of this figure, nests for which the species was not identified were assigned to olive ridleys in the same proportion as olive ridley nests were to the total number of nests with a known species (in all other figures, only nests for which the species was identified as *Lepidochelys olivacea* entered into the analyses). The apparent increase in the annual number of nests has two components: a possible variation in the number of olive ridleys nesting in Sergipe, and an uneven coverage by TAMAR of the nesting beaches in the study region.

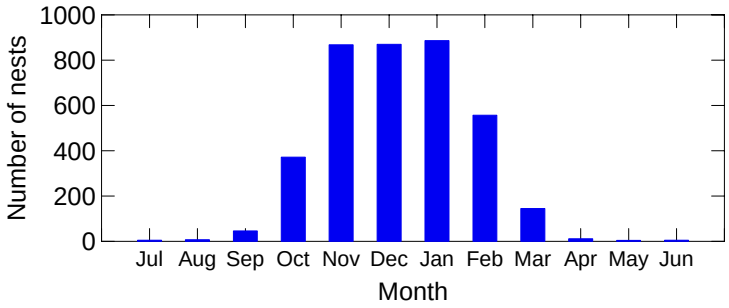

Figure 2. Distribution of the nests by month (n = 3776). 94.1% of the clutches are laid between October and February.

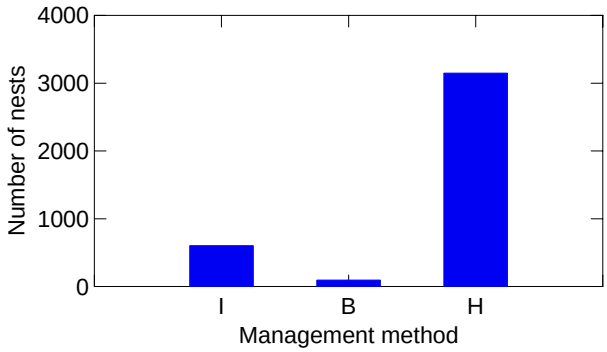

Figure 3. Distribution of nests by management method (n = 3847). I = in situ, B = relocated to another spot on the beach, H = relocated to the beach hatchery. Only 2.5% of the nests (n = 96) were relocated to another spot on the beach. These nests will be dropped from the analyses regarding hatching success and incubation period.

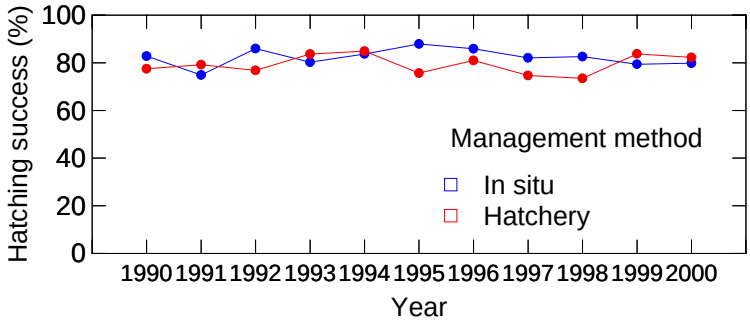

Figure 4. Hatching success by season, by management method (n = 560 *in situ* nests, 3074 relocated to the hatchery). The first year of each nesting season is shown, e.g., 1994 = 1994/1995. Average hatching success between 1990/1991 and 2000/2001 is 81.7% for *in situ* nests, and 79.7% for nests relocated to the hatchery. Hatching success is the percentage of eggs that produced live hatchlings, including live hatchlings encountered in the nest during excavation.

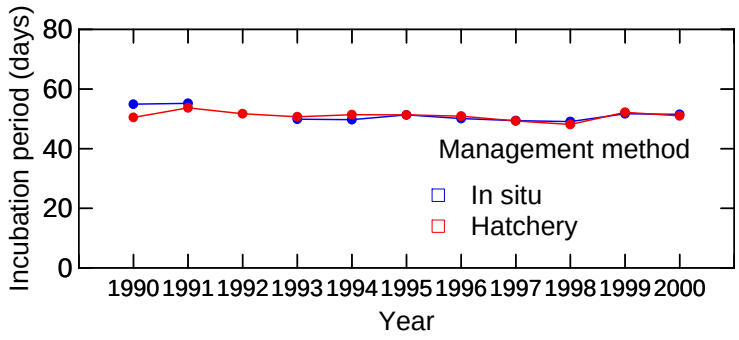

Figure 5. Incubation period by year, by management method (n = 279 *in situ* nests, 2692 relocated to the hatchery). The first year of each nesting season is shown, e.g., 1994 = 1994/1995. There are no incubation period data for *in situ* nests in 1992/1993 (n = 10 nests). Average incubation period between 1990/1991 and 2000/2001 is 50.6 days for *in situ* nests, and 51.1 days for nests relocated to the hatchery. Incubation period was calculated as the number of days between oviposition and time of emergence of the first hatchlings.

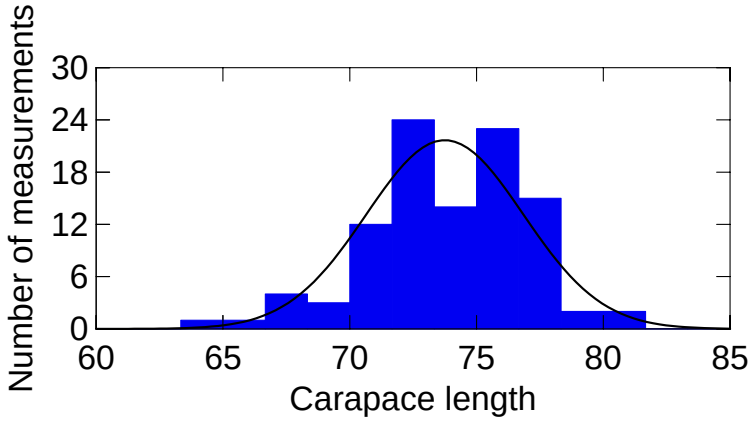

Figure 6. Curved carapace length (CCL) distribution of nesting females (n = 101). Average CCL = 73.7 cm, SD = 3.1 cm, range = 64-81 cm. For each turtle, only the first CCL measurement in each year was included in the calculations. A normal curve with the same average and standard deviation is superimposed. The CCL distribution is not significantly different from that normal one (Kolmogorov-Smirnov one sample test, p = 0.407).