Sea turtles of Lakshadweep Islands, Arabian Sea, India

Tripathy Basudev, B.C. Choudhury, and Kartik Shanker

Wildlife Institute of India, Dehradun - 248 001, India

INTRODUCTION

Four of the seven species of sea turtles occur in Indian waters. These include the olive ridley (*Lepidochelys olivacea*), green turtle (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and leatherback turtle (*Dermochelys coriacea*). All are reported to nest along the mainland and island beaches of India. The first survey in Lakshadweep which was conducted during 1976 (Bhaskar 1978, 1979) and stray records by the team of CMFRI team (Silas 1984, Lal Mohan 1989) indicated that these four species of sea turtles occur and nest in the Lakshadweep Islands but no detailed information was available on status or threats. Lakshadweep lies on the 2500 km long North-South aligned submarine Laccadive, Maldives and Chagos Archipelagoes, which form a continuous submarine bank. The migration of the turtles to this area from Seychelles, Maldives and Madagascar for nesting and feeding is therefore possible.

In the light of major lacunae in information, the Government of India and United Nations Development Programme's sea turtle project felt it appropriate to conduct a detailed survey of this group of islands and document the problems and prospects for sea turtles of Lakshadweep. The Wildlife Institute of India conducted a survey of sea turtles in the Islands from July 2001 to February 2002. Here we present the results of the survey.

METHODS

Study area. The Lakshadweep Islands are irregularly scattered in the Arabian Sea between 80 to 120°30' north latitude and between 710 to 740 east longitudes. There are 36 islands including 12 atolls, 3 reefs and 5 submerged banks covering an area of 32 km^2 land and 40,000 km^2 of oceanic zone. Among the 36 islands, only 10 are inhabited and the rest are partially inhabited or uninhabited (Mannadiar 1977)

Interviews. Extensive interviews with islanders and fishermen was carried out in all inhabited Islands. The standard questionnaire suggested by Schroeder and Murphy (1999) was followed. Approximately 25 people were interviewed in each island ranging from biologists to fishermen.

Foraging ground survey. The distribution of turtles in foraging areas was determined by surveys of lagoon and foreshore water by country boat and snorkeling. The presence of sea grass in shallow waters was documented.

Nesting beach survey. The direct procedure used was ground surveys of all Lakshadweep Islands. All beaches were covered by foot several times during the survey. The species nesting on the coast was confirmed from nesting pits, crawl marks, eggs, hatchlings and carcasses and remains (Shells and carapace) washed ashore. Threats to turtles and nesting beaches were determined by the presence/absence of habitation, beach vegetation, beach substratum, beach armoring and other developmental activities.

RESULTS AND DISCUSSION

Although there is some confusion in identifying the olive ridley and green turtle, the leatherback and hawksbill are clearly recognized in Lakshadweep waters. Nesting beaches in Lakshadweep were dominated by green turtles, followed by olive ridleys and hawksbill turtles (Fig.1). However, the nesting season of each species could not be ascertained. Most interviewees in Agatti Island stated that green turtles occur in the lagoon throughout the year whereas hawksbills are commonly seen during pre-monsoon and olive ridleys after December and rarely after April. Different size classes of green and hawksbill turtles are often caught in gillnets during lagoon fishing. During our survey, we also found juvenile, sub-adult and adults of both species in the lagoons of Agatti, Kavaratti and Minicoy.

Approximately 65 km of total coastline was surveyed and all sandy beaches with beach vegetation were found to be suitable for sea turtle nesting. All the beaches where turtle nesting was observed were narrow (5-10 m) with dense beach vegetation of *Scaevola sericea*, *Thespesia* sp. and *Pemphis acidula*. During the survey, nesting of three species was documented and the encountered number of nests in different Islands is presented in Table 1. This includes old and new nests and live nesting observed. The Green turtle nests were maximum in Suheli Valiakara followed by Tinnakara and Parali I Island, all uninhabited Islands.

Most of the juvenile, sub-adult and adult turtles (green and hawksbill) were seen in the lagoon and outside the reef between the depths of 2-5mts. The proportion of green to hawksbill in the lagoon was 1:10 where as olive ridleys were observed occasionally out side the reef. Most of the young green turtles were found swimming at the surface. Among the different Islands, Agatti had the maximum number of green turtles in the lagoon followed by Minicoy and Kadmat.

Green turtle carcasses were found in uninhabited/partially inhabited Islands of Tinnakara, Parali I and II, Suheli Valiakara and Cheriyam. According to fishermen, Green turtles are generally caught during nesting and slaughtered for extraction of oil, which is used for painting country boats as it works as an excellent waterproofing agent. Many people differentiate green and olive ridley by the quality and quantity of oil and the former is preferred because of its oil content. There is no consumption of turtle meat and eggs due to religious taboo. However, stuffing of juvenile hawksbill turtles is still in practice in many Islands. The stuffed specimen fetch about Rs. 500/- (US$ 12) to Rs. 1500 (US$ 36) and is sold by Islanders to the tourists or in the mainland. There is no incidental fishing related mortality, as the fishing method is very different from the mainland coast. The only method used for tuna fishing is pole and line, which pose no threat to the turtles. However, the immediate threat to sea turtles and their nesting beaches in Lakshadweep is beach armoring, human habitation close to the beach, lighting and clearing of beach vegetation for coconut plantation. Among all, the beach armoring is the most serious threats as no or limited spaces available to turtles for nesting once the concrete tetrapods are placed on the beach to check erosion. Tourism pressure is slowly becoming an additional pressure for sea turtles due to disturbance during the time of nesting.

CONCLUSIONS

All species of sea turtles occurring in Indian waters are listed as endangered and included in schedule I of the India Wildlife (Protection) Act, 1972. The Department of Environment and Forests, Lakshadweep has banned killing and poaching of turtles but is ineffective. The developmental activities such as human habitation, lighting and beach armoring need to follow the coastal zone management plan Act, 1997 of Lakshadweep. An effective, education campaign should be started in all islands on the importance and benefit of turtles to islanders. Tourism has a bright future in Lakshadweep, which in turn could benefit the islanders but it should be monitored properly. The turtle nesting intensify areas such as Suheli Valiakara, Tinnakara and the most important Green turtle foraging grounds and the lagoon of Agatti should be declared as protected areas with permission to artisanal fishing practice only.

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Table.1. Sea turtle nesting in different islands of Lakshadweep.

Island	No. of nests	Species
Kavaratti	2, 3	Green turtle, Olive ridley
Agatti	80, 16, 6	Green turtle, Olive ridley, Hawksbill
Kalpitti	4	Green turtle
Kiltan	3	Green turtle
Chetlat	7	Green turtle
Bitra	6	Green turtle
Androtт	2,6	Green turtle, Olive ridley
Kalpeni	8,6	Green turtle, Olive ridley
Kadmat	11,6	Green turtle, Olive ridley
Amini	8	Green turtle
Minicoy	10, 2	Green turtle, Olive ridley
Suheli Valiakara	358	Green turtle
Karingikuppu	5, 48	Green turtle, Olive ridley
Suheli Cheriyaka	4	Green turtle
Tinnakara	54	Green turtle
Parali I	38	Green turtle
Parali II	18	Green turtle
Bangaram	6, 2	Green turtle, Hawksbill
Viringili	2	Green turtle

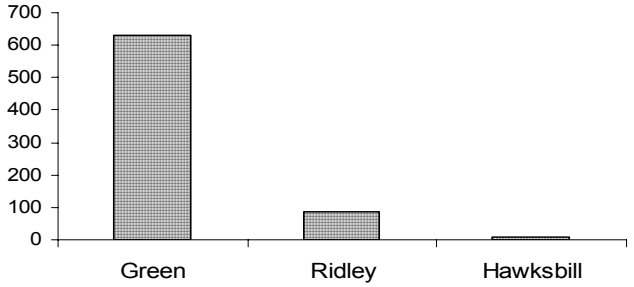

Fig. 1. Nesting of sea turtles observed in Lakshadweep (2002).

Changes in loggerhead demography after 25 years of nesting on the east coast of Florida

Mario Mota[1], Karen Holloway-Adkins[1], and Jane Provancha[2]

[1] NASA, Dynamac Corporation, NASA, Kennedy Space Center, Florida 32899, USA
[2] ESC, Dynamac Corporation, ESC, Cape Canaveral Air Force Station, Florida 32899, USA

Population demographic studies of nesting loggerheads at Canaveral National Seashore, Kennedy Space Center and Cape Canaveral Air Force Station beaches began in the late 1970s by Ehrhart. Since 1979, however, data have not been systematically collected on nesting individuals, until the present study that aims to document the status and demographic changes in this rookery that stretches 40 km along the east Coast of Central Florida. Morphometric data were collected from the 2001 nesters and their size classes were compared to those of the late 1970s to see how, and if, they changed. This project is slated to run for at least 3 years. Because we started it in 2001 and it was a low nesting year for green sea turtles, the data presented here are only for loggerhead sea turtles. Data were collected for carapace length (OC/SL), greatest carapace length (not collected in the 1970s), carapace width (OC/SL), and head width. Individuals were also biopsied for genetic analysis, flipper and PIT tagged. On a subsample of nests we also collected data on clutch size, egg weight, min/max diameter and hatching success. Results compare the 1976-78 data to the 2001. Nesting loggerhead sample sizes from the late 1970s (313, 247, 648, respectively), are larger than that of 2001 (157), however, the latter sample size is sufficient for sound statistical comparisons. Mean carapace length (straight-line) is statistically smaller (< 0.05) in 2001 than 1977, and 56% of the 2001 turtles were in the 85-94.9 cm class range. Overcurve carapace length also differed, and the 2001 was statistically smaller than those of 1976-77. Mean carapace width (straight-line) from 2001 nesters was smaller than those of all three past years, but only differed significantly from those of 1977. Approximately 73% of the 2001 turtles were in the 65-74.9 cm class range. Mean overcurve carapace width from 2001 was statistically smaller than all three years, and 73% of the 2001 turtles were in the 85-94.9 cm class range. Mean head width data show that the 2001 turtles were not significantly different from any others, however, 1978 turtles were smaller that those of 76 and 77. Although measurement errors could exist between the generations of sea turtle biologists, the sample sizes are large enough to accommodate any discrepancies. Also, the accuracy of the 2001 measurements was checked and calibrated by comparing repeated measurements and those from recaptured sea turtles. These data were also categorized depending on whether there was ample time to measure the individual sea turtle or if measurements were made in a hurry such as during a false-crawl. The overcurve measurements that were taken over barnacles were not included in statistical analysis. Therefore, we are confident in the accuracy of the 2001 data. Mean clutch sizes were not statistically significantly different amongst the 4 years. Minimum egg diameter was collected in the 1970s and differences were found between 1977 and all others. We collected maximum egg diameter in 2001, but we don't have 70s data for comparison. Average incubation time and percentage hatching success appear smaller in 2001, however, these comparisons must be carefully scrutinized because 1976-78 clutches were often incubated in protected hatcheries. Six turtles were recaptured twice and one on three occasions. Although the 2001 sample size is relatively small, average internesting intervals were slightly longer than those observed in the 1970s. Two noteworthy observations included 1) One turtle previously tagged in Florida Bay was observed nesting here; 2) Two nesting loggerhead turtles were afflicted with the fibropapilloma virus. Although these trends are based on one nesting season, and further sampling is required before solid conclusions can be made, the results can provide valuable information for regulatory agencies to assess trends in population stocks and viability of sea turtles nesting in Florida.