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Vijaya, J. 1982. Turtle slaughter in India. *Marine Turtle Newsletter* 23: 2.

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A 16-year record of green and hawksbill turtle nesting activity at Chagar Hutang Turtle Sanctuary, Redang Island, Malaysia

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Introduction

Redang Island (5° 44' – 5° 50' N and 102° 59' – 103° 5' E) is located in the South China Sea, off the east coast of Peninsular Malaysia (Fig. 1). It has a land area of about 25 square km and is 45 km north northeast of Kuala Terengganu. It is a popular tourist destination and also home to the largest aggregation of nesting green turtles in Peninsular Malaysia. However, overall nesting density in Peninsular Malaysia is low, compared to the Sabah Turtle Islands Park (STIP) in East Malaysia. Average annual nesting density over the last five years for green turtles in the STIP was 6,500 and 2,300 for Terengganu (Chan, 2009). Total number of egg clutches deposited on Redang Island account for 50-60% of the total recorded for the whole of Terengganu State.

Turtle nesting beaches in Redang Island (Fig. 1) were declared sanctuaries only as recently as 2005. Chagar Hutang is one of the major nesting beaches and accounts for about half the total egg clutches deposited on the island. The author co-initiated a tagging and nesting research program here under University Malaysia Terengganu in 1993 and sustained the program until 2009 when she retired from the university. Prior to 1993, all egg clutches deposited in Chagar Hutang were collected by local villagers for sale and consumption.

This paper presents data on nesting activity in the Chagar Hutang Turtle Sanctuary from 1993 to 2008 and attempts to analyze the nesting data over the 16-year period. The other turtle sanctuaries in Redang Island that are managed by the Department of Fisheries are not considered in this paper as the data available are not complete.

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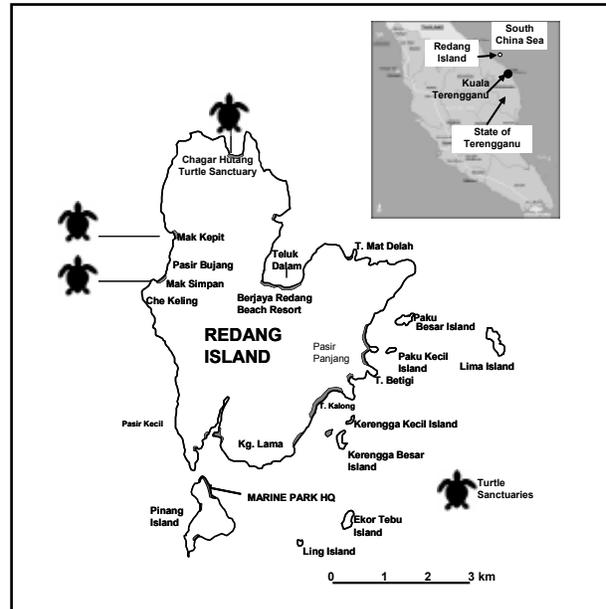


Figure 1: Map of Redang Island showing the location of turtle sanctuaries in the northern and north-western part of the island. Most of the resorts are located on the eastern part of the island.

Methods

Study Area

The Chagar Hutang Turtle Sanctuary (5° 48.778' N and 103° 0.502' E) is located in the northernmost part of Redang Island. It has a length of 350 m and is backed by virgin forest, with rocky promontories at its extreme western and eastern ends creating a secluded bay in front of the beach (Fig. 1). A stream occurs at each end of the beach and flows into the sea only after heavy rainfall.

Monitoring of Nesting Activity

Beach patrols have been conducted nightly in Chagar Hutang since 1993 by project staff assisted by a team

of volunteers. The patrols started at 2000 hours and lasted till 0600 hours the following morning. The monitoring period commenced in June and was terminated in September in 1993, but the duration was progressively prolonged over the years till 2008 when monitoring was carried out from January until December. The total number of clutches recorded in the period January to December in 2008 was used to calculate the proportion (of the yearly total) of clutches laid in each month of the year, and these monthly proportions were used to back calculate clutch data for the months in which monitoring was not carried out in the earlier years. The adjusted annual number of clutches obtained provided a better basis for trend analysis.

Turtles encountered were allowed to nest undisturbed. Nests were marked by labeled wooden stakes and covered with a 1.5 x 1.5 m square netlon mesh to afford some protection from monitor lizards. Hourly day patrols were carried out by volunteers to keep

monitor lizards at bay and to check for signs of predation by ants or crabs. If a nest was found to have been infiltrated by ants, it was excavated and eggs that were still intact were relocated. All hatched nests were excavated to determine hatching success. Hatching data will be reported in a separate paper.

Data on both actual number of clutches deposited and recorded during the monitoring period of each year and the adjusted data (calculated as described earlier) for the entire year are presented in this paper.

Results and Discussion

Data on monitoring period, actual number of green and hawksbill turtle clutches deposited over the duration of the monitoring period, and data adjusted for each entire year from 1993-2008 are presented in Table 1. The adjusted data for green and hawksbill turtles are shown in bar charts with polynomial trend lines fitted using Microsoft Excel (Figs. 2 & 3).

Table 1: Monitoring duration, number of nests recorded and number of clutches calculated for the entire year for the Chagar Hutang Turtle Sanctuary.

Year	Monitoring Period	No. of Green Turtle Clutches Deposited During the Monitoring Period	No. Green Turtle Clutches Extrapolated for Entire Year	No. of Hawksbill Turtle Clutches Deposited During the Monitoring Period	No. Hawksbill Turtle Clutches Extrapolated for Entire Year
1993	Jun - Sep	633	1002	12	21
1994	May - Oct	299	366	7	8
1995	May - Oct	576	705	4	5
1996	May - Oct	512	627	21	24
1997	May - Oct	473	579	6	7
1998	Apr - Oct	443	481	10	10
1999	Apr - Oct	687	746	11	11
2000	Apr - Oct	272	295	4	4
2001	Apr - Oct	440	478	5	5
2002	Apr - Oct	428	465	2	2
2003	Apr - Oct	240	260	0	0
2004	Apr - Oct	502	545	7	7
2005	Apr - Oct	221	240	7	7
2006	Mar - Oct	269	279	4	4
2007	Mar - Oct	358	371	9	9
2008	Jan - Dec	594	594	16	16
Total		6947	8033	125	140

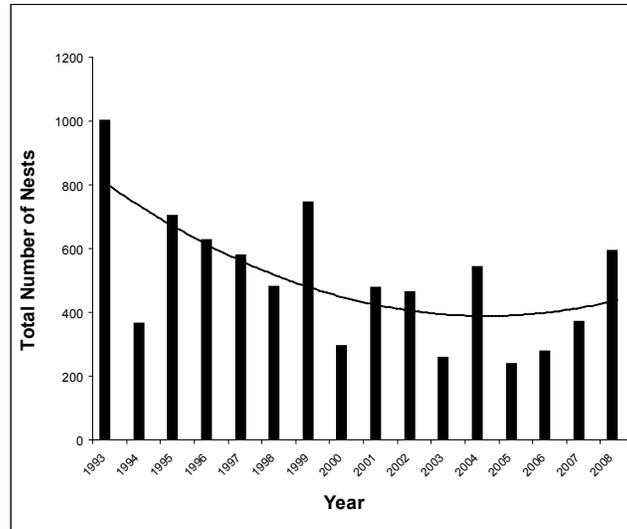


Figure 2: Total (adjusted) number of green turtle nests deposited per annum in the Chagar Hutang Turtle Sanctuary from 1993 - 2008.

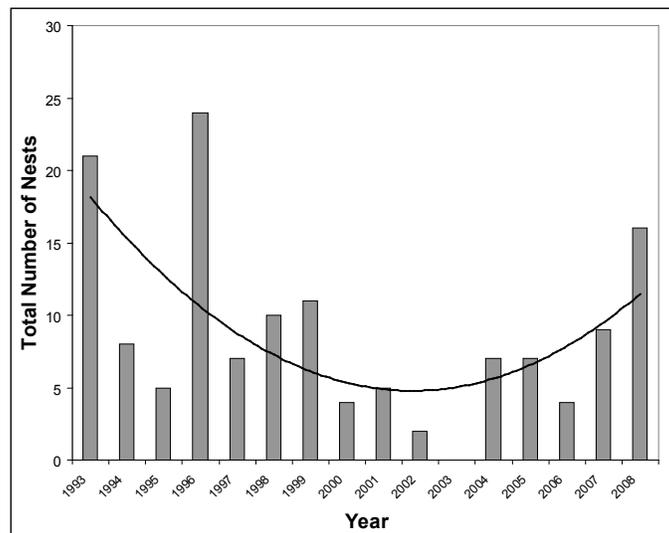


Figure 3: Total (adjusted) number of hawksbill turtle nests deposited per annum in the Chagar Hutang Turtle Sanctuary from 1993 - 2008. The figures have been extrapolated from actual number of nests deposited for periods ranging from four to 12 months each year.

The nesting data collected from 1993 to 2008 indicate that green turtles are by far the major species that nest in Redang Island. Of the total of 7072 nests that were recorded during the monitoring period from 1993 to 2008, 6947 (98.2%) were green turtle nests while 125 (1.8%) were hawksbill nests (Table 1).

The monthly nesting data that was collected for the entire year in 2008 for the first time in the 16 years

of monitoring work is given in Table 2. Green turtle nests were deposited all year round, but more activity was registered from April to September. The nesting season peaked in June and July, with these two months accounting for 40% of the nests deposited in the entire year. Hawksbill nesting occurred only from April to June and this has been found to be typical for the previous years, except for 2007 when the first hawksbill nest was deposited in August and the last in October.

Table 2. Monthly nesting data for the Chagar Hutang Turtle Sanctuary in 2008. NB: 2008 was the only year in which monitoring was carried out from January to December.

Monitoring Period	No. of Green Turtle Clutches Deposited	No. of Hawksbill Turtle Clutches Deposited	Total No. of Clutches Deposited
Jan	8	0	8
Feb	7	0	7
Mar	25	0	25
Apr	62	4	66
May	95	6	101
Jun	121	6	127
Jul	120	0	120
Aug	83	0	83
Sep	50	0	50
Oct	16	0	16
Nov	3	0	3
Dec	4	0	4
Total	594	16	610

The number of green turtle clutches deposited per year over the 16-year period ranged from 240 to 1002, with the highest density recorded in 1993, the year the project was initiated. Inter-annual variation in nesting numbers was evident, but the biennial pattern (high nesting in one year followed by a low year) of nesting numbers said to be characteristic for green turtles (Weishampel *et al.*, 2003) was not clear. Instead, years that exhibited high nesting density (1993, 1995, 1999, 2004 and 2008) were separated by intervals of one to four years (Fig. 2). This latter pattern was also observed in data presented by Broderick *et al.* (2001), Chaloupka (2001) and Sims *et al.* (2008).

The polynomial trend line fitted into the nesting trends shows a decline in the first ten years (1993 to 2003). However, an inflexion occurs in 2003, after which the curve starts to turn slowly upwards. It is too early to attribute the apparent trend reversal to the previous 10 years of dedicated nest protection on the beach. Monitoring work and nest protection must be continued over a longer term before conclusions on their effects on nesting trends can be made.

A small number of hawksbill nests are also deposited in the Chagar Hutang Turtle Sanctuary, with clutch

numbers ranging from 0 (2003) to 21 per year (Table 1). A polynomial trend line fitted into the nesting trends from 1993 to 2008 shows an inflexion point in 2001 - 2003 (Fig.3). The decline from 1993 to 2001 is quite steep, but from 2004 to 2008, a steady increase in nesting numbers is registered. The 16 clutches deposited in 2008 is the highest number seen since 1996.

Protection at the nesting beach has been recognized as an effective way to rehabilitate over-exploited sea turtle populations and has produced significant increases in nesting females in many nesting areas such as Tortuguero in Costa Rica, Archie Carr Refuge in Florida, Hawaii, Seychelles (Mortimer, 2006) and in the Sabah Turtle Islands Park (Chan & Liew, 1996; Chaloupka *et al.*, 2007). However, it must not be taken to be the only way in which sea turtles are to be protected. The life of a sea turtle is spent almost entirely in the ocean and the greatest threats logically occur in marine habitats. In recent years, the direct capture of marine turtles in South East Asian waters by illegal fishing vessels originating from neighbouring countries has emerged as the single-most serious threat that can negate all efforts in protecting nesting beaches (Pilcher *et al.*,

2008). This threat must be addressed and requires the urgent attention of marine turtle conservationists and governments in the region.

Acknowledgements

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are also accorded to the hundreds of turtle volunteers who performed the nightly beach patrols with research assistants and project staff recruited from the village in Redang Island. Participants of the “Save Our Turtles Outreach Program (STOP)” contributed to the funds to run the project. Corporate sponsors over the years are too many to name, but I thank them all sincerely. The Terengganu State Government, as a long-term partial sponsor is also acknowledged.

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Impacts of climate change on the largest green turtle population in the world: the nGBR green turtle population

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Sea turtles and climate change

Sea turtles are vulnerable to aspects of climate change because they have life history, physiological attributes and behaviour that make them extremely sensitive to environmental changes (Hamann *et al.*, 2007; Hawkes *et al.*, 2009; Poloczanska *et al.*, 2009). Arguably, the more detectable impacts of climate change to sea turtles will occur during their terrestrial reproductive phase (egg laying, egg incubation and hatchling success phase) since there are clear, and relatively straightforward, effects of increased temperature, sea level rise and cyclonic activity on sea turtle nesting sites and reproductive output (Hawkes *et al.*, 2009; Fuentes *et al.*, 2010a; Witt *et al.*, 2010).

Indeed, there has been a recent increase in research activity focusing on the potential impacts and implications of climate change to sea turtles' terrestrial reproductive phase (for reviews see Hamann *et al.*, 2007; Hawkes *et al.*, 2009; Poloczanska *et al.*, 2009; Witt *et al.*, 2010). While first identified as an issue in the mid 1980s recent studies have begun to investigate and predict how specific climatic processes will affect sea turtles' nesting habitats and reproductive output. However, most of the studies conducted to date are limited temporally, because (1) they predict how a single climatic process will affect sea turtles (e.g. Hays *et al.*, 1999, 2003; Glen & Mrosovsky, 2004; Fish *et al.*, 2005, 2008; Hawkes *et al.*, 2007; Fuentes *et al.*, 2009, 2010b, 2010c), yet processes are likely to occur simultaneously and cause cumulative effects (Fuentes *et al.*, 2010a), and (2) they typically focus only on one nesting ground used by a particular turtle population and this approach does not provide a full understanding of how a population (management unit) will be affected. Consequently,

there is a need for a structured approach to investigate how multiple climatic processes may affect the full range of nesting grounds used by a turtle population (Fuentes *et al.*, 2010a).

Vulnerability assessment

A recent study by Fuentes *et al.* (2010a) addressed the issue of cumulative impact by using a systematic and comprehensive methodology to assess how multiple climatic processes will affect the northern Great Barrier Reef (nGBR) green turtle population under a conservative and an extreme scenario of climate change for both 2030 and 2070. The study used published literature to identify how key processes: (1) change in sediment traits (Fuentes *et al.*, 2010d), (2) increased temperature (Fuentes *et al.*, 2009, 2010c), (3) sea level rise (Fuentes *et al.*, 2010b), and (4) cyclonic activity (Fuentes & Abss, *in press*) will affect the nesting grounds (n= 7) that represent the nesting habitat for 99% of the nGBR green turtle population. After the information on how each process will potentially affect the selected nesting grounds was compiled, Fuentes *et al.* (2010a) used expert opinion to gather information on the relative impact of each process on sea turtle nesting grounds. This information was then incorporated into a climate change vulnerability assessment framework.

Fuentes *et al.* (2010d) found that the sediment from each of the studied nesting grounds is predominantly composed of well sorted, medium-grained to coarse-grained, sands and are dominated by Foraminifera, molluscs or both. Dissimilarities in the contemporary sedimentology between the nesting grounds suggest that each will respond differently to environmental impacts such as increased temperature, sea level rise and ocean acidification. The implications of

changes to island sedimentology on sea turtle ecology include changes in nesting and hatchling emergence success, and reduced optimal nesting habitat. Both of these factors can influence sea turtles' annual reproductive output and thus have significant conservation ramifications (Fuentes *et al.*, 2010d).

The work on impacts from increased temperature (from Fuentes *et al.*, 2009, 2010c) on the nGBR green turtle population predicts a feminization of annual hatchling output into the nGBR green turtle population by 2030. Predictions are bleaker for 2070, when some of the nesting grounds (Bramble Cay and northern Dowar and Milman Island) used by this population are predicted to experience temperatures near or above the upper thermal incubating threshold (e.g. 33 °C) and likely cause a decrease of hatching success. Importantly, Fuentes *et al.* (2009, 2010c) identified that some nesting grounds (e.g. Raine Island, western Milman Island and Sandbank 7) will still produce male hatchlings, even under the most extreme scenario of climate change. This is crucial for future management as managers may choose to protect important male-producing regions to balance future population viability.

Further impacts to the nGBR green turtle population will potentially occur from sea level rise (SLR) (Fuentes *et al.*, 2010b). Using the predicted sea level rise values from the IPCC and CSIRO, Fuentes *et al.* (2010b) indicated that up to 34% of available nesting area across all the selected nesting grounds may be inundated as a result of predicted levels of SLR. The work suggests that low sandbanks will be the most vulnerable to SLR and nesting grounds that are morphologically more stable, such as Dowar and Raine Islands, will be less vulnerable.

More positively, the work by Fuentes & Abs (in press) indicates that as climate change progresses it is likely that impacts from cyclones to the nGBR green turtle population will be very low. The study used eleven of the latest regional climate models to investigate how cyclonic frequency will alter in a warming climate. Most models predicted a tendency for a reduction in cyclonic frequency in the future. Thus a reduction in the impacts that the nGBR green turtle population will experience from cyclones is likely.

After the predicted impacts from each climatic process was explored they were incorporated into a vulnerability assessment framework for climate change. The framework used by Fuentes *et al.* (2010a) is based on the IPCC framework for climate change and is described as a function of sensitivity, exposure and adaptive capacity. The framework allowed: (1) an assessment of how multiple climatic processes will affect the terrestrial reproductive phase of sea turtles; and (2) an investigation of how mitigating different climatic factors individually or simultaneously can influence the vulnerability of the nesting grounds. Thus, the work was able to provide informed suggestions of management options to mitigate the potential impacts of climate change to the nGBR green turtle population.

The vulnerability assessment by Fuentes *et al.* (2010a) indicated that in the short term (by 2030), sea level rise will cause the most impact on the nesting grounds used by the nGBR green turtle population. However, in the longer term, by 2070 sand temperatures will reach levels above the upper transient range and the upper thermal threshold and cause relatively more impact on the nGBR green turtle population. Thus, in the long term, a reduction of impacts from sea level rise may not be sufficient, as nesting grounds will start to experience high vulnerability values from increased temperature. Therefore, a stronger focus on mitigating the threats from increased temperature will be necessary for long term management of the nGBR population (Fuentes *et al.*, 2010a).

Management options

Some of the potential options to mitigate the impacts of increased temperature include changing the thermal gradient at beaches, nest relocation, and artificial incubation. The best management options will be site specific and dependent on a series of factors, including feasibility, risk (interaction and impact on other species and ecosystems), cost, constraints to implementation (both cultural and social), and probability of success in relation to selected sites. Thus, a “toolbox” with various strategies will be needed to address the impacts of increased temperature across the nesting sites used by the nGBR green turtle population (Fuentes *et al.*, 2010a).

The main strengths of the framework by Fuentes *et al.* (2010a) is that it can easily be adapted when information is obtained, and it can be transferable to different sea turtle populations and sea turtle life cycle phases provided the necessary data exist. The framework provides key information for managers

to direct and focus management and conservation actions to protect turtle populations in the face of climate change. Thus, future work should use a similar approach and assess the impacts of multiple climatic processes on sea turtles to provide realistic information to managers.

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Observations of juvenile green and hawksbill turtles along the southern Orissa coast, India

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Studies on sea turtle life history suggest that individual turtles occupy a series of different habitats during different ontogenetic stages. Based on ontogenetic stages these are broadly categorised into the oceanic stage of the early juveniles and the neritic stage of the larger juvenile and adult stages (Bolten, 2003). Far less is known about the oceanic habitats of the early juvenile stages than about adult foraging and breeding habitats.

Five of the world's seven species of sea turtles have been reported in Indian waters: the olive ridley (*Lepidochelys olivacea*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) (Kar & Bhaskar, 1982). With the exception of the olive ridley that nests throughout the region, other species nest on select beaches (Shanker & Choudhury, 2006). The hatchlings that originate from these beaches are thought to occur in epipelagic waters of the region, though there are only few records of such occurrences and little information on juvenile habitats. In this note we report on the sightings of juvenile green and hawksbill turtles off the Rushikulya mass nesting beach on the Orissa coast of the Bay of Bengal. The nearest known nesting sites for the two species are at least about 1000 km distant across the Bay of Bengal to the southeast in the Andaman and Nicobar Islands, or about 1200 km to the south in Sri Lanka. The following observations were made along the southern Orissa coast to determine the offshore distribution of olive ridley turtles.

On 3rd March 2007, while on a routine survey of the offshore waters about three km off the Rushikulya mass nesting beach, we sighted what appeared to be mating pair of olive ridley turtles about 150 m distant. We approached within 20 m and to our

surprise found instead an adult ridley swimming with a juvenile green turtle. The juvenile turtle was one-third the size of the adult ridley (approx. 30 cm in curved carapace length [CCL]). The smooth reddish brown scutes on the carapace and head were distinct and identified the smaller individual as a green turtle. Interestingly, the ridley turtle floated at an angle with part of the carapace and one flipper held above the water surface. We observed the green turtle repeatedly biting something from the carapace of the ridley as the latter drifted gradually in a circle. It appeared that the green turtle was removing epibionts growing on the neck and carapace of the ridley, and that the latter appeared fully aware of it. We observed the green turtle perform this for a few more minutes but then the green turtle dived and disappeared while the ridley continued to float on the surface. This observation is unique for there is no report of such an interaction between the two species of turtles.

On the 24th of March one of our local assistants spotted a juvenile green turtle in the area not very far from the coastline. On 19th April 2007, one of the local fishers brought a juvenile turtle to us that he caught in a shore seine net while fishing at the Rushikulya river mouth. This turtle was unlike the juvenile green turtle that we had earlier seen; it had a dark brown carapace with overlapping scutes and a distinct, protruding beak typical of a hawksbill turtle. On detailed examination the presence of two pairs of frontal scutes and two claws present in each forelimb clearly showed this to be a hawksbill. Measuring just 13.5 cm in CCL (mass estimated at about 250 gm) this turtle appeared to be in its early juvenile stage, and was possibly a yearling. The centre of the plastron was depressed all along the length and appeared not fully calcified. After a day in captivity

the turtle was released back at the river mouth. The occurrence of a sub-adult hawksbill in the State has previously been reported from the Gahirmatha Marine Sanctuary (Kar, 1986), which is about 300 km north of the Rushikulya river mouth.

Later the same year, on 23rd August, a local fisherman brought to us yet another juvenile turtle, which was caught in his shore-seine net when fishing at the Rushikulya river mouth. This turtle appeared to be a juvenile measuring 44.0 cm in CCL and weighed 9.5 kg. It was identified as a green turtle from the

smooth reddish brown scutes and from the single pair of frontal scutes. After detailed examination the turtle was released near the capture site. This record confirms our earlier observations of the species occurring in the near-shore waters off the Rushikulya rookery. Previously, a juvenile green turtle was reported captured in a monofilament gill net in the Rushikulya waters (Pandav & Choudhury, 2000), while sub-adult green turtles were reported near Visakhapatnam in northern Andhra Pradesh (Tripathy & Choudhury, 2002), which is about 200 km south of the Rushikulya river mouth.



Figure 1: The juvenile hawksbill turtle captured off the ‘Rushikulya Olive ridley mass nesting beach’ in southern Orissa, India
 Photos: R. Suresh Kumar



Figure 2: The juvenile green sea turtle captured off the ‘Rushikulya Olive ridley mass nesting beach’ in southern Orissa, India
 Photos: R. Suresh Kumar

The following year no juvenile turtles were seen while during the subsequent year, (2009) on February 11th a juvenile turtle was spotted swimming at the surface. The turtle was located about one km offshore and about two km north of the river mouth. On approaching closer the carapace of the turtle was found covered with a thick growth of algae. And, it appeared to be struggling to swim and possibly injured. Using a sweep net the turtle was quickly captured and brought onboard. The turtle had no external injuries and the carapace was cleaned of the algae. The turtle was identified as a hawksbill. This turtle also appeared to be an early juvenile stage whose CCL measured 16 cm (mass estimated at 250 g). The turtle was released back at the place of capture after a few hours in captivity even though it appeared unhealthy as there was no facility to treat it. Later, in April the same year two dead hawksbill turtles (size not available) were recorded near the Devi river mouth, which is located about 200 km north of Rushikulya (*pers. comm.* Subrata Behera).

The repeated sightings of the green and hawksbill turtles in the Rushikulya waters across the years suggest that this area may represent a juvenile developmental habitat for these two species. Moreover, local fishermen know of the occurrences of these juvenile turtles and say that they arrive in the area with the southerly currents during February-March each year. All juvenile sea turtles

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except flatback turtles *Natator depressus* are said to spend time drifting within circular current systems, leading a largely pelagic life for the first few years, and at a later stage are known to move into more localised neritic developmental habitats (reviewed by Musick & Limpus, 1997). One such area in the form of a submerged beach ridge is reported off the Gopalpur coast at a depth of 25 to 30 m, supporting extensive live sedentary fauna such as sponges, gorgonians, soft and hard corals (Rao *et al.*, 2001). This submerged beach ridge is only about 25 km south of the Rushikulya river mouth and may possibly be a feeding ground for juvenile green and hawksbill turtles.

Interestingly, we did not observe any juvenile olive ridley turtles in the Rushikulya area, though there are records of the occurrence of sub-adult ridleys in the near-shore waters of the Gahirmatha Marine Sanctuary (Pandav & Choudhury, 1995), and from northern Andhra Pradesh (Tripathy *et al.* 2003).

Acknowledgements

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Notes

Kharg DOE officers rescue two green turtles

Mahmood Moghimi & Reza Namdar

On 25 November 2009 the officers of Iran's Kharg Department of Environment of Bushehr Province (Persian Gulf) rescued two green sea turtles (*Chelonia mydas*) from the Kharg Petrochemical reservoir located in the south part of Kharg Island. They released the turtles to the sea from the north part of the island (Fig.1).

Multi-lateral conservation efforts are needed within Kharg and Kharko islands to protect sea turtles, coral reefs and their habitats. We hope to speed up the development of this by enlisting support from the private sector such as oil and gas companies on Kharg Island.



Figure 1: Green turtles rescued from the Kharg Petrochemical reservoir
Photo: Moghimi, 2009

Records of loggerhead turtles on the Makran Coast, Pakistan

Ahmad Khan

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The Makran Coast is not only recognized as a beautiful landscape but a rich biodiversity hotspot within Pakistan. There are fascinating marine and terrestrial wildlife on this coast including marine turtles. The coast's local community members have a strong association with the sea for their livelihood, which is fishing dependent. They catch fish, drive boats, trade in fish and fishing associated gears, or work in fish processing industries.

Marine turtles, predominantly green turtles (*Chelonia mydas*), nest on several beaches of the Makran Coast, including the famous nesting sites at Hingol, Ormara, Ganz and Dharan. According to records, green turtles nest abundantly on the Makran Coast, while olive ridleys (*Lepidochelys olivacea*) are rarely seen here. A team of surveyors from WWF Pakistan recorded one dead hawksbill turtle (*Eretmochelys imbricata*) on the Makran Coast near Gwadar (Arshad, 2002).

Recently Mr. Dad Karim, a fisherman from Gwadar, caught a loggerhead turtle (*Caretta caretta*) in his net. Mr. Dad Karim, who is an experienced fisherman



Figure 1: A rescued loggerhead turtle being released off the coast of Gwadar
Photo: Pakistan Wetlands Programme, 2008

from Gwadar is a strong supporter of the Pakistan Wetlands Programme. He, convinced with the need for conserving marine life, safely released the turtle back to the sea after taking pictures of it. This record indicates the occurrence of a fourth marine turtle species in the waters around Gwadar. There is a need for extensive surveys of the marine turtles in this area, not only on the nesting beaches but also in the sea, to further explore their abundance and distribution.

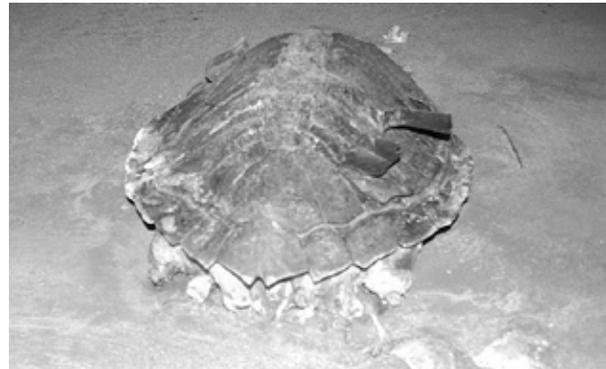


Figure 2: A washed up carcass of a loggerhead turtle at West Bay, Gwadar

Photo: Pakistan Wetlands Programme, 2008

In February 2010, a couple of washed up carcasses of loggerhead turtles were recorded at West Bay in Gwadar. This provided more evidence of the occurrence of the species in the coastal belt of Makran. These rare records do not support the claim of a large nesting population of loggerhead turtles on the Makran Coast made by a non-governmental organisation in Pakistan. The organisation mentioned Dharan but the 60 nests protected there are green turtle nests protected by the Pakistan Wetlands Programme. Despite the recent incidental records of loggerheads occurring in coastal waters, there is still no firm evidence of nesting loggerhead turtles on the Makran Coast.

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Research Summaries

Understanding bycatch in coastal net fisheries

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Gilman, E., J. Gearhart, B. Price, S. Eckert, H. Milliken, J. Wang, Y. Swimmer, D. Shiode, O. Abe, H. Peckham, M. Chaloupka, M. Hall, J. Mangel, J. Alfaro-Shigueto, P. Dalzell & A. Ishizaki. 2010. Mitigating sea turtle by-catch in coastal passive net fisheries. *Fish and Fisheries* 11: 57-88.

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Moore, J.E., T.M. Cox, R.L. Lewison, A.J. Read, R. Bjorkland, S.L. McDonald, L.B. Crowder, E. Aruna, I. Ayissi, P. Espeut, C. Joynson-Hicks, N. Pilcher, C.N.S. Poonian, B. Solarin & J. Kiszka. 2010. An interview-based approach to assess marine mammal and sea turtle captures in artisanal fisheries. *Biological Conservation* 143: 795-805.

Fisheries related bycatch has been, and will likely continue to be, regarded as one of the main impacts on marine turtle populations. As such, it remains a critical issue worthy of attention (see Hamann *et al.*, 2010). In particular there is growing concern that, collectively, small-scale coastal fisheries are one of the most significant threats to some marine turtle species or populations. Similar to other fisheries, understanding and mitigating bycatch from coastal net fisheries is problematic because in addition to the variable ecological components there are significant social and economic issues that need to be considered. This is especially the case in developing nations where fishers are often in the lower social-economic grouping.

Two recent papers recognise the impacts of coastal net fisheries on marine turtles and offer insight into steps that can be undertaken to minimize these impacts. Moore *et al.* (2010) seek to better understand the magnitude of the impact and Gilman *et al.* (2010) review potential mitigation measures to gill net fisheries, which are a common artisanal fishing method.

Moore *et al.* (2010) developed survey methods that

would allow a cost and time efficient assessment of bycatch of marine turtles and mammals in artisanal fisheries. The study cost less than 50,000 USD and involved surveying over 6000 fishers in seven countries to investigate types of fishing methods (and the characteristics of each method) and species-specific bycatch rates (individuals per year). The survey essentially found that artisanal fisheries are likely to have a substantial impact on marine wildlife, particularly those using gill nets. However, the real strength of the study is in both the survey technique the authors have used and their retrospective comments about how to improve it. While the authors acknowledge the challenges of using surveys to collect reliable bycatch data, the survey is cost and time efficient. It can therefore provide a monitoring tool that can be undertaken over spatial scales large enough to collect comparative, reliable data on bycatch at fishery, species and population levels. It can also be used together with other initiatives to substantially improve regional management the fishery impacts on marine wildlife species.

Gilman *et al.* (2010) conduct a comprehensive review of turtle interactions in the coastal net fisheries and experiment-based assessments of mitigation

measures. Their review highlights the challenges of understanding and managing bycatch in small scale fisheries and describes several methods that can be used by both gill net and pound net fisheries to mitigate bycatch without impacting catch rates of target species. Importantly, however, the authors also highlight the need to undertake cost-benefit risk assessments to understand population specific impacts from bycatch mortality and in doing so provide details of the information needed to permit

realistic risk based assessments.

Taken together, the two bycatch studies above highlight the significance of the collective impact of coastal artisanal and net based fisheries on marine turtles are. Further, they highlight the need for an inter-disciplinary approach, including engaging the fishing industry, to design and apply cost effective mechanisms to understand and manage bycatch of marine wildlife species.

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Better estimating how many clutches females lay in a season

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Tucker, A.D. 2010. Nest site fidelity and clutch frequency of loggerhead turtles are better elucidated by satellite telemetry than by nocturnal tagging efforts: Implications for stock estimation. *Journal of Experimental Marine Biology and Ecology* 383: 48-55.

How many clutches does an individual sea turtle lay in a nesting season? It is a simple question to ask, but not simple to accurately answer. Of course, we know that individual turtles lay several clutches during a single nesting season, but discovering the exact clutch frequency (number of nests laid in a season) is logistically challenging. Traditionally, the tried-and-true method for determining clutch frequency has been to conduct “saturation” tagging projects, where patrollers monitor a nesting beach all night, every night, during the nesting season, in order to find and record all individual turtles nesting on the beach.

However, datasets from nighttime beach monitoring usually have at least a few gaps in information, because a) some turtles nested before or after the monitoring project was active; b) some turtles nested on a non-monitored beach near (or even far) from the monitored beach; c) some turtles emerged, nested and returned before the patrollers saw her; etc. Thus, a tagging project may be able to calculate the “Observed Clutch Frequency” (OCF) for the turtles in the study area, but most sea turtle researchers see OCF as an underestimate (e.g. Reina *et al.*, 2002). Many workers have applied a correction factor to the OCF.

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Researchers at Casey Key beach, including Tony Tucker who authored the article above, have been placing satellite tags on nesting loggerhead sea turtles for several years, to study postnesting migrations (Girard *et al.*, 2009). They also have used the satellite tags to count how many clutches individual turtles have laid during the nesting season. This was possible because the satellite tags were placed on the turtles early in the nesting season – presumably during the first time the turtles emerged to nest on Casey Key. Then, the researchers were able to watch for patterns in the satellite tag data for subsequent nesting emergences made by the females: essentially, when a turtle with a satellite tag nests, the tag sends repeated high-accuracy

locations from up on the beach. At Casey Key, the beach patrollers often were able to verify the satellite data because they saw the turtles on the beach during subsequent nest emergences. In addition, there were nests made by turtles that the patrollers did not see, often (but not only) when the turtles chose to nest on beaches different from Casey Key. In the end, the mean clutch frequency derived from satellite tag information was 5.4 clutches/turtle, vs. the mean clutch frequency of 2.2 clutches/turtle calculated only from night patrol data.

The difference is not academic, it in fact has major management and conservation importance, precisely because most places count the overall number of clutches (nests) observed, but not the number of individual females laying the clutches. Thus, to calculate population size and to assess population trends, it is necessary to divide clutch totals by average clutch frequency, to get the number of females. The number of females calculated this way is sensitive to differences in clutch frequency, as Tony Tucker discussed eloquently over two decades ago (Tucker, 1989). Clearly, he has been thinking about this issue for many years! It is interesting that this information breakthrough was facilitated by technology (satellite tags); there were other fascinating kinds of information produced during this study, including confirmation that one turtle was able to lay two clutches of eggs only six days apart.

Of course, more studies like this one will be needed to ensure that an accurate value for clutch frequency is assigned to each nesting beach or aggregation. In addition, it is also possible that average clutch frequency for a rookery can change over time. For instance, larger females may lay more clutches than smaller females (e.g. Tucker & Frazer, 1991), and if the nesting population has an increased percentage of larger females over time, the clutch frequency may also change. Also, regional environmental factors can have profound implications on the average reproductive output of females (e.g. Saba *et al.*, 2008).

Overall, it is likely that clutch frequency changes over time. This also has implications for assessing trends in turtle nesting, if nothing else than to rule out the possibility that an observed increase or decrease in clutch numbers over a short period is due solely to

changes in clutch frequency rather than to changes in absolute numbers of reproductive females. In the end, the Casey Key study has set a benchmark for

future research on sea turtles, and reminds us why it is so important to have accurate measures of basic life history measures.

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Report

30th Annual Symposium on Sea Turtle Biology and Conservation 24 - 30 April, 2010, Goa, India

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For the first time in 30 years, the International Sea Turtle Society's Annual Symposium was held in south Asia, a region home to globally significant populations of marine turtles, and a diverse range of organisations, community based groups and institutions involved in sea turtle research and conservation. The symposium provided an excellent opportunity to participants from countries in South and Southeast Asia underrepresented in previous symposia to attend the event.

The theme of the symposium 'the world of turtles'

drew attention to the wide range of ecosystems that sea turtles inhabit including coastal, nearshore and oceanic ecosystems, from sandy beaches to coral reefs and seagrass meadows, and pelagic habitats. An important focus of the symposium was also to draw attention to the human communities that sea turtles interact with, in particular resource dependent coastal fishing communities.

With over 500 participants from over 60 countries, the success of the symposium was reflected in the coming together of ideas in research and lessons in

conservation from a diverse range of individuals and groups, representing the diverse habitats that the world's turtles inhabit, together with the diversity of the social aspects of conservation and its impacts on people, both at the local and regional / global scale.

Over 400 abstracts were received and a total of 376 were presented after a careful review process by the Programme Committee, overseen by Programme Chairs Matthew H. Godfrey and Brendan Godley and the Programme Coordinator DuBose Griffin.

The symposium was held at the Kala Academy in Panaji, Goa's renowned centre for performing arts, situated on the banks of the Mandovi River. The venue was ideal for hosting main symposium sessions in addition to parallel and satellite meetings and workshops. A few workshops were also held at the Taj Vivanta Hotel situated across the road from the Kala Academy. All evening social events were held at the Cidade de Goa hotel at Vainguinim beach in Dona Paula.

Programme

Pre-symposium meetings and workshops commenced on 24 April and included workshops on: Marine Invasive Species, Bayesian Statistics, Stable Isotopes and Conservation of Marine Turtles and Dugongs. Regional meetings including the Indian Ocean and Southeast Asia, Africa, Mediterranean and Latin America (RETOMALA) meetings were held on the three days prior to the symposium. Workshops on Satellite Telemetry and Turtle Rehabilitation, and the IUCN SSC Marine Turtle Specialist Group – Annual General Meeting were held on 30 April.

Two special meetings were held at this year's symposium: the Fisheries Forum on 25 April and the South Asia Mini-Symposium on 26 April. The Fisheries Forum drew attention to the various dimensions of interactions between fisheries and conservation. The participation of a diverse range of participants, including representatives of resource dependent livelihood communities and conservationists, was instrumental in achieving the objectives of conducting the forum; that of enabling greater interaction between participant groups with

species conservation objectives and those with an interest in fisheries and highlighting the culture and diversity of various South Asian fisheries to promote awareness of its multifaceted complexity. The Organising Committee of the Fisheries Forum comprised a range of partner organisations including Dakshin Foundation, Bangalore, Foundation for Ecological Research, Advocacy and Learning (FERAL), Pondicherry, FishMarc, Trivandrum, International Collective in Support of Fishworkers (ICSF), Chennai, Kalpavriksh, the Tata Institute of Social Sciences and Duke University Marine Laboratory (USA). Aarthi Sridhar from Dakshin Foundation and Gomathy N.B. of the Tata Institute of Social Sciences facilitated the proceedings of the Forum. Dakshin Foundation and FERAL also organised a Culture of Fisheries Exhibition with financial assistance from Fisheries Survey of India, SACEP, VJSMF and Sir Ratan Tata Trust.

The South Asia Mini-Symposium was held to fulfill a 'need to initiate integrated and coordinated conservation actions, and an opportunity to share and learn from each other'. The mini-symposium brought together stakeholders and representatives of conservation groups and research organisations from across the region. Invited presenters included participants from Bangladesh, India, Maldives, Pakistan and Sri Lanka. In addition to presentations made under thematic sessions, a review of existing platforms and opportunity to initiate fresh strategies towards collective regional action plans was undertaken by a panel of experts including representatives from key organisations from across the region.

Complementing the objectives of the mini-symposium to "promote regional cooperation in sea turtle conservation in South Asia", the Maldives government ratified the Indian Ocean –South-east Asian Marine Turtle Memorandum of Understanding (IOSEA), becoming the latest signatory to the memorandum.

Main Symposium Programme

The main symposium sessions were held between 27-29 April at the Kala Academy, with parallel

sessions running at the adjacent hall within the Academy complex. Symposium session titles, which were intended to reflect the theme of the symposium included: Ecosystem function, Conservation and Management, Foraging Biology, Fisheries and Bycatch, Health and Physiology, Research in Social Science, Environmental Impacts, Reproduction Biology, and Migration and Navigation. There were 119 oral, 30 speed (oral) and 222 poster presentations during the symposium. Dedicated “meet the author” poster sessions were held between 3:30 and 4:00 pm on 27 and 28 April.

The main symposium was opened by Kartik Shanker, and the sessions commenced on 27 April with a keynote address by Romulus Whitaker on ‘A brief history of sea turtle conservation in India’. Brian Bowen delivered the second keynote address on the afternoon of 27 April on the ‘Comparative phylogeography of sea turtles and marine fishes’. The sessions concluded on 29 April with a keynote address by Jack Frazier entitled ‘Marine turtle ecology and Heraclitus’ river’.

Lunch meetings held during the days of the symposium included an informal discussion group on sea turtle genetics coordinated by Nancy Fitzsimmons, a meeting on ports and shipping coordinated by Teri Shore and the IOSEA MoU meeting conducted by Douglas Hykle. Rod Kennet from North Australian Indigenous Land and Sea Management Alliance (NAILSMA) held a workshop over lunch about the working of the software CyberTracker. This is being used by a network of indigenous ranger groups across northern Australia supported by NAILSMA and partners, for sharing experiences, learning and tools across northern Australia.

Petitions

The venue and programme also allowed groups and individuals to present petitions on issues that were of immediate and serious concern. The objective of providing such a space was to enable groups to showcase causes that they have been working towards and garner the support of the international community present at the event. A petition by a collective of individuals and organizations

addressed to the Minister for Environment and Forests, Government of India, Mr. Jairam Ramesh expressed serious concern over the proliferation of large-scale coastal development in the close vicinity of ecologically critical coastal areas, and called for protection of such areas by introducing effective legal safeguards. In particular, it asked that no ports be permitted within 25 km of olive ridley turtle mass-nesting areas and other important feeding, migratory and refuge habitats. The other key demand was for a no-development zone for all industrial activities for at least a 10 km radius around the olive ridley mass nesting beaches in Orissa. Over 300 participants present at the symposium signed this petition. The copy of the letter enclosing the petition was uploaded by the Ministry of Environment & Forest on its website. The Minister has acknowledged receipt of the petition in a meeting with president of the ISTS and promised to look into the issues and concerns raised and to take action in this regard.

The Archie Carr Student Awards

Eight out of a total of 109 student presentations were selected for the Archie Carr Student Award under the categories of best (and runner-up) oral presentations in biology and conservation and best (and runner-up) poster presentations in biology and conservation. The student awards this year were sponsored by the Marine Turtle Conservation Act Fund of the US Fish and Wildlife Service and the National Centre for Biological Sciences, India.

Media

The event was covered by both local and national level newspapers and television channels. A press conference held on 29 April provided the opportunity for the ISTS to voice its concerns with regard to sea turtle conservation in India and the importance of convening this symposium in India. Jack Frazier and B.C. Choudhury, Programme Advisors of this year’s symposium, were present at the press conference and provided important insights highlighting the relevance of the theme of the symposium and the need to broaden approaches to sea turtle conservation in the region to include eco-system and social dimensions of conservation interventions. A number of articles in newspapers

and online magazines have appeared since the symposium and we are hopeful that this will help draw attention to issues that were highlighted at the event.

Vendors

Vendor and exhibition stalls were set up at the poster exhibition venue. International vendors included CLS-ARGOS, Telonics, Wildlife Computers, Marine Life Alliance, Sirtrack and SWOT. Exhibition stalls were also set up by local organisations like the TREE Foundation, Foundation for Ecological Research, Advocacy and Learning (FERAL), Visakha Society for Protection and Care of Animals, the Wildlife Institute of India, Dakshin Foundation and others.

Social evenings

The ISTS welcomed participants to the symposium on the evening of 26 April at the out door venue of the Hotel Cidade de Goa. A local Goan band played popular Goan music adding their own flavour to the local hospitality in welcoming participants from all over the world. Drinks were sponsored on all evenings by the hotel. The farewell banquet was held at the Grand Sala at the Hotel Cidade de Goa. The evening commenced with the distribution of the Archie Carr Student Awards and the ISTS Special Awards. The President's farewell speech and vote of thanks was followed by the handing over of the Presidential trowel to the incoming ISTS President Jeffrey A. Seminoff.

The Chronic Blues Circus Band, an ensemble band from Bangalore, added the final twist of fun and colour to the day's events. Despite the sweltering heat and the packed schedule of the preceding days of the events, spirits were kept high and a special thanks is due to the managing staff of the Cidade de Goa hotel for their service and for the Indian and traditional Goan cuisine and refreshments.

ISTS Awards

The ISTS President's Award to an organization was presented jointly to the Trust for Environmental Education (TREE Foundation) in recognition of their work with fishing communities and sea turtle

conservation in south India and the Students' Sea Turtle Conservation Network in recognition of their work on sea turtles in Chennai and for inspiring students to work in ecology and conservation. The individual awards went to Saw Agu in recognition of his work on sea turtle monitoring and conservation in the Andaman and Nicobar Islands, to Kalakar 'Kalia' Behera and Dambarudhara Behera in recognition of their work on sea turtle monitoring and conservation in Orissa, representing the contributions of the field assistants at the three mass nesting beaches in Gahirmatha, Rushikulya and Devi River Mouth.

The ISTS Champion's Awards were presented to Daniel William, in recognition of his contributions and lasting impact on sea turtle conservation in French Guiana, Satish Bhaskar, in recognition of his pioneering surveys and research on sea turtles in South and Southeast Asia and the Turtle Conservation Project, Sri Lanka, in recognition of their contribution to sea turtle conservation and their work with coastal communities in Sri Lanka.

The ISTS Lifetime Achievement Award was presented to Dimitris Margaritoulis for his significant impact on sea turtle biology and conservation through the course of his career.

The Awards Committee, comprising elected members of the society, and chaired by Karen Arthur, worked hard to consider deserving individuals and organisations that were nominated for the ISTS Awards this year.

Silent and Live Auction

As is a tradition of the ISTS's fund raising efforts at each year's symposium, a silent and live auction event was held at this year's symposium. A spectacular range of items which included showpieces, mobiles, items of clothing, etc. were brought by participants from around the world were displayed at the silent auction, held at the Kala Academy during 27-28 April, and the live auction night held on the evening of 28 April at the Cidade de Goa hotel.

Spirits were not dampened by an unexpected downpour on the evening of the live auction, and the venue had to be shifted indoors. Special thanks are

due to Jennifer Homcey and Narissa Bax and their dedicated team of volunteers for this outstanding effort, and to Rod Mast, our live auctioneer.

Travel grants

The ISTS raised \$ 113,700 towards travel grant support this year. \$ 49,916 was disbursed as cash awards to 172 participants and free accommodation for the entire duration of the symposium was provided to 327 participants, the most at any symposium thus far. The tireless efforts of Hoyt Peckham (Travel Chair) and the regional travel chairs made sure that all deserving participants could avail of the travel award. Brian Wallace did an excellent job of coordinating travel award disbursements between regional travel chairs and travel award recipients on site. The regional travel committee comprised of Aliko Panagapolou (Europe), Angela Formia and Manjula Tiwari (Africa), Nicolas Pilcher (Asia/Pacific), Karen Eckert (Caribbean), Alejandro Fallabrino (Latin America), Kartik Shanker (India/South Asia) and Bryan Wallace (USA/Canada).

Local participation

With over 250 participants from India, and 53 from our neighbouring countries of Sri Lanka, Myanmar, Bangladesh and Pakistan, this year's symposium achieved one of its primary objectives, that of enabling the participation of as many individuals as possible from the region. The registration fee for students and the low-income category was substantially reduced, and travel grants were provided to support travel of as many as 80 participants from south Asia (including India).

Partners

Unique to this year's symposium was the range of partner organisations that helped to host the event. The Turtle Conservation Project in Sri Lanka, Marine Life Alliance and Centre for Advanced Research in Natural Resources and Management (CARINAM) in Bangladesh, WWF-Pakistan and Marine Research Centre in Maldives were regional partners at the event. Apart from their efforts at raising funds towards travel support for participants from their respective countries, these organisations

also helped in spreading information about the symposium, and ensuring adequate representation of individuals and organisations who had not previously had the opportunity to attend the ISTS's annual symposium.

Over 25 organisations in India partnered in the event. The National Centre for Biological Sciences, FERAL, the Centre for Ecological Sciences at the Indian Institute of Science and Dakshin Foundation contributed significantly to the planning and hosting of the event. A special mention must be made of the staff at the Madras Crocodile Bank Trust, a key local partner organisation, for their consistent support and for Dr. Gowri Mallapur's excellent assistance with the administrative tasks both prior to and at the symposium.

Sponsors and donors

The International Sea Turtle Society and the local organizing committee is grateful to the support provided by our international donors and sponsors, including many of our annual sponsors who supported us despite the economic recession. In particular, we thank the Western Pacific Regional Fishery Management Council (WestPac), the Marine Turtle Conservation Act Fund of the US Fish and Wildlife Service, National Oceanographic and Atmospheric Administration (NOAA, USA), NAILSMA and Disney's Animal Programs for support towards travel and accommodation grants provided to grant recipients. Wildlife Computers, Sirtrack, Telonics and the UNEP – Abu Dhabi provided support towards associated workshops and regional meetings.

The Ministry of Environment and Forests contributed our largest grant this year. We are particularly grateful to Minister for Environment and Forests Jairam Ramesh for supporting the symposium. The Council for Scientific and Industrial Research and the Departments of Science and Technology and Biotechnology of the Ministry of Science and Technology, Government of India also contributed towards travel awards, venue rentals and printing expenses. The Department of Science and Technology of the State Government of Goa and the Goa Tourism Development Corporation Ltd. were

also key supporters and sponsors of the event.

Our major corporate sponsors included Reliance Industries Ltd., USV Limited, Sesa Goa, the Indian Farmers Fertilisers Cooperative Ltd (IFFCO), Ambuja Cements and ABG Shipyard. Institutions and organizations that provided generous donations included National Centre for Biological Sciences, Navajbai Ratan Tata Trust, Fishery Survey of India, South Asia Cooperative Environment Programme (SACEP), Ashoka Trust for Research in Ecology and the Environment, Vasanth J. Sheth Memorial Foundation and Foundation for Ecological Security. Our tea and coffee break sponsors included EID Parry (India) Ltd., Unibic India and CLS-America. We are also grateful to various individuals who contributed through room and coffee break sponsorships. In particular we thank Kellie Pendoley, Nancy FitzSimmons and Wildlife Computers for their generous contributions towards room sponsorships.

ISTS Business meeting

The ISTS Business Meeting held on the afternoon of 29 April was attended by about 134 members. The opening statement by the President was followed by presentations of the Treasurer's Report by Terry Meyer and Michael Coyne, the Travel Committee Report by Bryan Wallace (standing in for the Travel Committee Chair, Hoyt Peckham) and the Awards Committee Report by Nancy Fitzsimmons (standing in for the Awards Committee Chair, Karen Arthur). The Director of Information Technology, Michael Coyne was reappointed by the President to serve another five year term.

ISTS Elections: The following candidates were announced as winners of the ISTS elections: Ana

Barragan for President Elect (2010 – 2011), Roldan Valverde and Cynthia Lagueux for the two Board of Directors positions, Terry Meyer for Treasurer (currently serving as Interim-Treasurer), Manjula Tiwari for Secretary, and Pam Plotkin and Kate Mansfield for the Nominating Committee. Jeff Seminoff, President of the ISTS for 2010 - 2011 announced details of the upcoming 2011 Symposium in San Diego, USA.

Resolutions: There were no resolutions passed at the 2010 Business Meeting.

Acknowledgments

Several individuals contributed countless hours of time and effort to ensure the success of this symposium. Aarthi Sridhar and Meera Anna Oommen were instrumental in raising funds for the event and overseeing organizational aspects. Individual contributions from Anand Pakkurti, Chico D'Lima, Donna Kwan, Elena Finkbeiner, M.M. Venkatachalam, Michael D'Souza and Wesley Sunderraj towards raising funds from various sources deserve special thanks. Maya Ramaswamy & Arjun Shanker provided beautiful artwork and design for the symposium. The students at the Centre for Ecological Sciences made a fantastic team and ensured that the programme went off without a glitch. BC Choudhury and Jack Frazier guided the entire symposium, and Brendan Godley and Matthew Godfrey chaired the programme. Michael Coyne and Manjula Tiwari were stellar in their roles as always, and all my colleagues at the ISTS supported us in conducting a successful symposium. Finally, we thank Seema Shenoy and Naveen Namboothri for being the backbone of all the planning and execution for the symposium.

Special Profile: Satish Bhaskar

Kartik Shanker

Satish Bhaskar is a pioneer of sea turtle biology and conservation in India. Satish conducted the first surveys in the Andaman and Nicobar islands, the Lakshadweep, in Orissa and in fact, most parts of the mainland coast of India. His surveys and sojourns on many uninhabited islands in Andaman, Nicobar and Lakshadweep provided the first (and in some cases, only) information on sea turtle nesting on these beaches. His published and unpublished reports have formed the basis for current sea turtle conservation initiatives and it is thanks to his data that interventions were made possible to protect beaches in the Andaman Islands which were otherwise slated for tourism development.

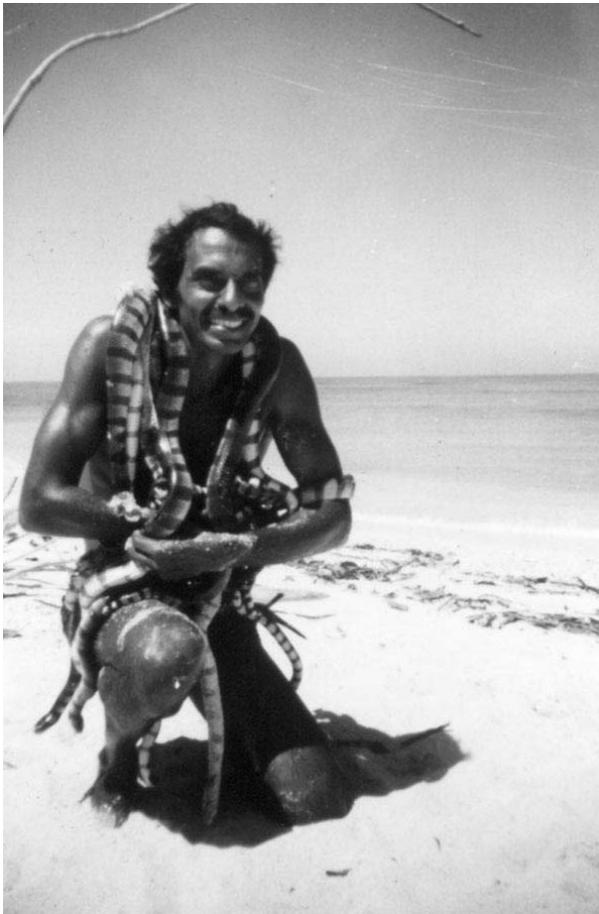


Photo: After punching tags on several sea kraits' tails, Satish was sure they were incapable of biting people!
Photo courtesy: Atma Reddy / Hufreesh Dumasia

Satish started with a survey of the Gulf of Mannar, Tamil Nadu in 1977. In 1978, He visited the Lakshadweep and surveyed several islands. He then surveyed the coast of Gujarat, and later that year, visited the Andamans for the first time. Over the next few years he would survey most of the mainland coast of India, including the states of Kerala, Goa, Gujarat, Andhra Pradesh and Orissa. In 1982, he revisited the Lakshadweep islands, spending several weeks alone on an uninhabited island. In 1984-85, he spent some months in West Papua, then Irian Jaya, and was the first outsider to visit some of the villages on that coast; he was of course the first to survey Jamursba Medi and Wermon beaches. In the early 1990s, Satish focused his work on the Andamans and monitored the hawkbill population on South Reef Island for several years.

In 2000-01, the Wildlife Institute of India coordinated a large UNDP-funded project on sea turtle conservation in India. Sea turtle surveys were conducted in every state by different institutions. Remarkably, in most instances, these surveys provided the first update on Satish's original work done a decade or two before. Satish and CS Kar from the Orissa Forest Department attended the first world conference on sea turtles. Kar and Bhaskar's paper in the *Biology and Conservation of Sea Turtles* (edited by Karen Bjorndal) serves as a comprehensive and still relevant account of sea turtles in south Asia. Satish was an intrepid explorer and untrained biologist, but inspired a generation of researchers and conservationists. He has set a so far unmatched example of tireless, passionate effort to fill our huge gaps of knowledge in sea turtle status, distribution and biology in India.

He retired a few years ago and is no longer active, but deserves to be recognised for his lasting impact on sea turtle biology and conservation in the region and beyond. In April 2010, the International Sea Turtle Society awarded its annual Sea Turtle Champions Award to Satish *in recognition of his pioneering surveys and research on sea turtles in South and Southeast Asia.*

In this profile, we include a tribute to Satish from Rom Whitaker and Janaki Lenin, a list of his publications, and a list of his surveys.

Satish “Batagur” Bhaskar

Rom Whitaker (as narrated to Janaki Lenin)

Email: kingcobra@gmail.com, janaki@gmail.com

In the early ‘70s the Madras Snake Park became a local hangout for young folks from nearby campuses like Indian Institute of Technology (IIT), AC College of Architecture and Madras Christian College. Thirty years later I run into some of these guys, sometimes in strange places. They’re now mostly as paunchy and balding as I am and we trade a few stories and get into laughing fits over “the good old days”.

One of the characters who showed up back then was a soft-spoken engineering student named Satish Bhaskar. He was a teetotaling non-smoker, a real ascetic compared to the rest of us. His passion was the sea, and he spent more time swimming than in the IIT classroom. It’s not for nothing that his hostel mates called him Aquaman (privately)!

I was concentrating on crocs at the time, and whenever I could get away from Snake Park it was to survey gharial, mugger and saltwater crocodile habitat across India. At the same time, we also wanted to know sea turtle status: which species come to Indian shores, where, when and in what numbers. So, we really needed a full time sea turtle man.

Opportunely (for the turtles), Satish was getting disenchanted with his IIT course (after finishing most of it) and yearned to be a field man with a mission. The Snake Park had a tiny research budget, but it was enough to hire Satish as Field Officer (Rs. 250 a month, approx. US\$ 28 based on exchange rates of that time) and get him out on his first few survey trips. When the fledgling WWF-India saw the good work he was doing for endangered sea turtles, Satish landed his first grant which really set him in motion.

About this time, the Madras Crocodile Bank was being born and Satish was its first resident. He helped to build the place (in between the sea turtle trips) but funds were so tight and sporadic that there were times when he had no work. So what did he do?

He kept in shape by filling a bag of sand, carrying it to the other end of the Croc Bank, dumping it and starting again! Villagers still remember Satish hoisting a 50 kg sack of cement over his shoulder casually as if it were no more than a sleeping bag. This was the training that made him so tough in the field; it enabled him to walk most of India’s entire coastline, more than 4,000 km, over the next few years looking for sea turtles, their tracks and nests! He loved going to remote places which few Indians have the stamina or stomach for. “To him, swimming in shark infested waters was the most normal thing to do,” declares Shekar Dattatri, who has known him since the early Snake Park days.

Old Jungle Saying: Satish is incredibly kind to people. If he has anything that someone wants, he gives it away.

In 1977, Satish conducted the first surveys in Lakshadweep and zeroed in on an uninhabited island, Suheli Valiyakara, as the place for a focused green sea turtle study. The only problem was that the main nesting period is during the monsoon and no one goes there when the sea is so rough. In 1982, Satish left his young wife and three month old daughter, Nyla to maroon himself on Suheli for the whole monsoon, from May to September. It meant making elaborate preparations, like calculating the amount of food he would need. We sat with Satish and talked about things that could go wrong during this isolation – chronic toothache, appendicitis, malaria were just a few sobering thoughts. The Coast Guard provided some signal flares and there was talk of a two-way radio but eventually Satish just set sail and that’s the last we heard of him till September.

Actually that’s not true. A few months later, his wife Brenda back in Madras, received a loving letter from him. He had launched his message in a bottle on July 3rd and 24 days and more than 800 km later it was picked up by a Sri Lankan fisherman, Anthony



Photo: The village of Kondul, Great Nicobar (2001). Satish first visited the Great Nicobar island in 1979, and then subsequently in 1981, 1992 and 1994.
Photo courtesy: Kartik Shanker

Damacious, who very kindly posted it to Brenda along with a covering letter, a family picture and an invitation to visit him in Sri Lanka. The ‘bottle post’ was very romantic, but of course Satish’s spin was that he was trying to see if he could study ocean currents using this technique!

An emergency situation did arise on the deserted isle, and one that none of us could have predicted: a huge dead whale shark washed up on Satish’s little island and started rotting. The nauseous stench became so overpowering that our intrepid sea turtle man had to move to the extreme other end of the tiny island to a somewhat precarious, wave lashed spit of sand.

That year the monsoon abated late. So though Satish was packed and ready to go home by September 1st, (after 3 ½ months with only turtles and a radio for company), the relief boat from Kavaratti Island, over 60 km away did not arrive. Satish had run out of rations and legend has it that he survived on milk powder, turtle eggs, clams and coconuts for weeks. Fortunately, the lighthouse on neighbouring Suheli Cheriyakara needed servicing and a Lighthouse Department ship, the MV Sagardeep, arrived on

October 11th. As Satish clambered aboard, Capt. Kulsreshta’s first words were, “Take him to the galley!”

For a person with a gargantuan appetite, Satish could live on very little. On a trip to the Nicobars, Indraneil Das and he ran out of rations and water and they still had a day’s walk ahead of them. The former was half-dead when they ran into a party of Nicobarese who tried to feed them but Satish politely and firmly declined saying they had just eaten and didn’t allow Neil to eat either. Later he pointed out that they had nothing to repay the poor people’s kindness! (This trip yielded five new species – two frogs, two lizards and a snake.)

On another occasion, on Little Andaman, Satish had again run out of rations and was surviving on “only biscuits and vitamins for 4 days.” He came upon an empty Onge tribal camp with some freshly barbecued turtle meat. He took some of the meat and left two biscuit packets in exchange mainly to avoid a spear through his back! Just counting the number of times he ran out of food in remote areas, we suspect that he deliberately starved himself to see how far he could take it.

Old Jungle Saying: Satish always travels with a kerosene stove and a pressure cooker. The former is to avoid burning wood as it is bad for the environment and the latter for cooking efficiency. He also carries an automobile inner tube to raft his supplies from canoe to shore and vice versa.

Through the 1980s, again thanks to WWF and other funds, Satish visited many of the islands of the Andamans. His were the first recommendations on sea turtle nesting beach protection. These helped give the Andaman and Nicobar Islands Forest Department a solid conservation basis to resist the efforts of big business and other Government Department interests in “developing” beaches for tourism.

Amongst all this serious work, he had time for research of another kind. Writing in Hamadryad, the Croc Bank Newsletter, he wonders if the sea krait was attracted to light, feigns dismay that this may be true and proceeds to try to make one climb his leg by playing with his torchlight!

By this time, Satish’s work was being appreciated by sea turtle biologists worldwide. Papers on the species inhabiting this region were very scarce indeed and his publications helped to fill that big gap. In 1979 Satish was invited to give a paper on the status of sea turtles of the eastern Indian Ocean at the World Conference on Sea Turtle Conservation, in Washington D.C. In recognition for his contributions to sea turtle conservation, Satish received a fancy watch and award from Rolex in 1984.

When Ed Moll came to India to do a freshwater turtle study, Satish became a key collaborator. He surveyed extensively for a highly endangered *Batagur baska* which nests on coastal beaches along with olive ridleys. Sadly the Bengalis have eaten the terrapin to near extinction and there are no known wild nests in India. It was at this time that he was nicknamed “Batagur Bhaskar”.

Old Jungle Saying: Satish has no sense of direction. He gets lost easily.

He spent many months, over several years, studying the hawksbill and green turtle nesting biology on tiny South Reef Island on the west coast of North

Andaman. He described this island as “one of ten sites most favoured by nesting [g]reen turtles in India”. Saw Bonny, a Forest Department Range Officer stationed on Interview Island, regularly risked his life ferrying supplies to Satish on South Reef Island, even during stormy monsoon weather. Bonny deputed a department staff member from his camp to assist Satish who was working alone. Emoye spent a few days on South Reef, got fed up and wanted to return. Since the currents were strong and Satish was an accomplished swimmer, Emoye requested him to go along with him.

Over the years shark fishermen regularly hauled in sharks from this very channel. The sea was rough, it was after all the monsoon season. Being a modest and understated narrator, Satish rated his swimming skills as “below par” and claimed that his snorkeling flippers gave him confidence. To keep warm during the more than two kilometre swim, he wore two shirts. Emoye rested frequently on Satish to catch his breath and together the two of them swam across the channel.

A party of shark fishermen were camped on the beach in Interview when our intrepid swimmers landed. One of them remembered meeting Satish earlier and enquired, “Still loafing around? Still jobless?” He thought Satish was an ambergris-hunter. It was already dark when Satish and Emoye set out across the island to the forest camp. Half way, a bull elephant in *musth* trumpeted his warning from just 30 metres away and started to chase them. The two men ran for their lives. Later Satish would recount, “I had done some distance running in college but the penalty for losing was never as dire.” Already exhausted from their long and arduous swim, they couldn’t continue running and the elephant showed no signs of relenting. Remembering a Kenneth Anderson story, Satish threw his shirt down while continuing to run and was gratified to hear the pachyderm squealing with rage moments later. With the animal distracted, the men could finally stumble onwards to the forest camp. They made a pact – if the shirt was intact, it was Emoye’s; if not, then Satish’s. The next morning they found the shirt in three pieces completely smeared with muddy elephant footprints, while one bit had to be recovered from a tree. He later posted the pieces back to Brenda with a reassuring note.

Old Jungle Saying: Satish trusts people implicitly and they, in turn, don't let him down.

In the mid 1980's WWF-Indonesia contracted Satish to study the huge, intensely exploited leatherback sea turtle rookeries on the beaches of the Vogelkopf, the western most peninsula of the island of New Guinea, in Irian Jaya. This was a logistically tough place to work. First of all, there was no access from the landward side and one couldn't even land a boat on the beach. This was why it had remained protected for so long. Then the people from neighbouring areas started taking tens of thousands of leatherback eggs. People swam ashore with jerry cans and sacks and floated the eggs back to boats.

However, Satish found a way to keep in touch. He would swim 100 m out to a passing longboat that was headed to Sorong, and hand his letters to someone on board with enough currency for stamps. There was one boat every 20 to 30 days. By late August 1985, he had tagged about 700 leatherbacks almost single-handedly.

Rather uncharacteristically, Satish never wrote up his report for WWF-Indonesia. I have no explanation why this happened nor did we ever discuss this. After a year had passed and there was no sign of the report, I was embarrassed as I had recommended him for the job. The document was sorely needed to put some laws in place very soon. I had my sense of justice as well so I wrote the report in his name.

Sadly, the 13,360 nests that he recorded in 1984 was probably the highest ever in recent years. Ever since then, the average number of nests has hovered way down around 3200. And this has resulted in yet another 'Satish myth' – the local people believe that Satish tagged the female leatherbacks with metal tags, and using a giant magnet drew all the turtles to his country! The local elders have refused to permit any more tagging of turtles on this beach.

Old Jungle Saying: He doesn't like to crawl into a sleeping bag on cold nights; instead he wears all his clothes. Sometimes, he buries himself, except his face which is covered by a mosquito net, in the sand to get away from inquisitive island rats, mosquitoes and sand flies at night. He usually sleeps out of sight

of others at camp, after playing a few riffs on his harmonica.

In 1993, while chugging past Flat Island, a small spit of land off the west coast of the Jarawa Tribal Reserve in the Andamans, Satish and his companions saw a pair of human footprints emerging from the sea and disappearing into the vegetation. Satish had evaluated this island as a prime green turtle nesting beach, and despite the others cautioning him of Jarawas (the hostile tribe who routinely finished off trespassers with arrows), Satish swam ashore. His companions watched in horror as he followed the footprints into the forest. While his friends feared the worst, he emerged from another side crouching behind a green turtle carapace, holding it like a shield. The fearsome tribals never showed themselves and Satish returned safely.

On a subsequent trip, some Jarawa came aboard the canoe. Satish later recalled admiringly that the Jarawa were powerful swimmers and he had been very impressed by the bow-wake their breast-stroke created. Everyone else cowered in the back while Satish calmly interacted with the tribals. The crew had already hidden the machetes and other metal objects that the Jarawa coveted for making arrow heads. Eventually the tribals left without harming anybody but did take some spoons.

Old Jungle Saying: Satish likes to catch everything.

Local intelligence was that the Galathea river, Great Nicobar, had a lot of crocodiles. After dark one night standing on the bridge spanning the river, Satish played his torch over the water. Suddenly his flashlight caught some small eye shines along the waters' edge and he got very excited thinking they were baby salt water crocs. So he crept down to the edge of the river to catch them, but they turned out to be large spiders! But he did have encounters with crocodiles. Once while lying asleep on a beach on Trinkat Island, Nicobars, he woke up to a rustling noise. He found a young croc looking at him through the mosquito net. In mock seriousness he later wrote, "I'm overlooking it this time but if the crocs that wake me get any bigger I'm headed back to Madras."

The Karen of the Andamans are particularly fond of Satish. He earned their respect by treating young and old

with courtesy and respect, and also with such exploits as swimming from Wandoor in Middle Andaman to Grub Island (a distance of about 1.6 km) and back, walking the entire coastline of Little Andaman even crossing swift streams such as Bumila and Jackson Creeks and doggedly surveying beaches no matter how big the obstacles. But that didn't stop the Karen from teasingly nicknaming Satish, *Cheto* (Karen for 'basket', as it rhymes with Bhaskar!). Several older Nicobarese remember "the man who came looking for turtles" even today, many years after his last visit. He was perhaps the only man to ever find a reticulated python on the tiny island of Meroe (between Little Nicobar and Nancowry). The Nicobarese, who frequent the island, had never seen this species there before and were duly impressed. This python was later handed over to the Forest Department in Port Blair.

Satish notched identification marks on the carapaces of turtles that came ashore to lay eggs. Later, a bunch of titanium tags was sent by the Australian National Parks and Wildlife Service for tagging hawksbills on South Reef. In Vogelkopf, he tagged more than 700 leatherback turtles. There is no information on tag returns from any of these turtles. One reason may be that subsequent night surveys (after Satish left) were inconsistent on Andamans, Nicobars and Irian Jaya. Secondly, the English lettering which provides the return address means little to local people. Karen tribals have mentioned finding tags on turtles they ate but not knowing the significance of the metal, simply threw it away into the bush.

For not being a religious person at all, he has the morals of one. He doesn't like anyone to tell him what to do, which made my job as boss difficult. (But he was conscientious about sending reports so he didn't need to be reminded.) I clearly remember once when I suggested that he store his things in a tin trunk as they were being destroyed by termites, he took umbrage. "Would I tell you what to do, Rom?" he asked in his low pitched gruff voice with a touch of menace. I never made that mistake again! He is a perfectionist - wanting to do everything right and better than anybody else. He also has an exaggerated sense of justice - always rooting for the downtrodden (probably why he

got along well with tribals, villagers and field people). In many ways, he is very un-Indian.

Old Jungle Saying: Nothing is useless; anything "useless" was just something for which you haven't yet found a use.

Once while running to catch a bus to Mayabunder, his chappal broke. On being asked if he'd like to buy a new pair, he responded, "Only one broke - surely another one will wash up with the high tide". He tried very hard to keep South Reef clean of trash. On one occasion, he arrived in Madras with two sacks stuffed with rubber chappals that had washed ashore on the island. Legend has it that he took it to the recyclers.

After twenty years of doing some of the first baseline sea turtle surveys in the country, Satish retired to spend more time with his family. Soon thereafter, an UNDP (United Nations Development Program) - Wildlife Institute of India project did a more extensive survey of turtle nesting beaches. But since then, the 2004 tsunami has changed the profile of many Andaman and Nicobar beaches and we don't yet know where new beaches are forming, or how the turtles have responded to this change. We desperately need a new Satish Bhaskar to continue the work.

Satish now lives in Goa with his wife Brenda (who was by the way, the Snake Park and Croc Bank's secretary for many years!) and their three children (Nyla, Kyle and Sandhya). Satish is the man who kicked sea turtle conservation in India into high gear. There's a strong lesson in all this and an inspiration to young naturalists who wonder, "What can I do to help?" Satish's single-minded quest for sea turtles in his quiet, often unorthodox way, set the stage for the major conservation efforts being made today. Here's a prime example of how one person's passion for an animal and its habitat can help make the difference between survival and extinction.

Inputs from Aaron Savio Lobo, Allen Vaughan, Arjun Sivasundar, Atma Reddy, Manish Chandi, Manjula Tiwari, K. Munnuswamy, Nina and Ram Menon, Shekar Dattatri are gratefully acknowledged.

Satish Bhaskar's publications and surveys

Compiled by Kartik Shanker & Janaki Lenin

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*A chronological list of Satish's surveys
(See Fig. 1 for an illustrated map)*

1977: Mar1-22, 1977: Gulf of Mannar
Sep 1977 to Jan 1978: Lakshadweep
1978: Jun to Jul, 1978: Gulf of Kutch
1979: Sep 1978 to May 1979: Andamans
(See Table 1 for details)
1980: Dec 1980: Gujarat
1981: Jan to Mar 1981: Andamans (See Table 1 for details)
Apr to May 1981: Kerala
Jul 1981: Goa
Aug to Dec 1981: Gujarat
1982: Jan & Feb, 1982: 45 km in southern Orissa;
209 km of northern AP, 16km between Kakinada
and Uppada.
May to Oct 1982: Suheli (Lakshadweep)
1983: Feb 1983: West Bengal and Sunderbans
Nov 1983 to Jan 1984: Andamans
(See Table 1 for details)
1984 –1985: Irian Jaya
1988 –1990: Monitoring of Chennai beaches with the
Students' Sea Turtle Conservation Network
(Dec to Mar, 1988-89 and 1989-90)
1990: April – May, 1990: *Batagur baska* surveys in
Orissa and Sunderbans
1991 – 1995: Andamans (See Table 1 for details)

Table 1: Details of the Andaman surveys

Year of publ.	Phase	Period of survey	Area
1979		09/78 – 05/79	South Andamans, Little Andamans, and most islands in Andamans group (except North), central Nicobar and Great Nicobar
1981		17/01/81 – 14/03/81	Great Nicobar and Little Andaman Islands
1984		16/11/83 – 18/01/84	North and other Andaman islands (WWF report)
1992	I	15/11/91 – 17/05/92	Great Nicobar Island (with M. Tiwari)
1993a			Status and Ecology of Sea Turtles in the Andaman and Nicobar Islands (A review)
1993b	II	07/07/92 – 12/12/92	South Reef Island
1993c	III	05/02/93 – 15/04/93	37 islands, Andaman coast; Coffeeder, Karamatang, Cuthbert Bay
1994a	IV	08/08/93 – 03/12/93	South Reef, Interview, Latouche
1994b	V	10/02/94 – 24/04/94	Little Nicobar, Great Nicobar, Cuthbert Bay
1994c	VI	21/06/94 – 18/09/94	South Reef and other Islands
1995a	VIA	05/11/94 – 16/12/94	Snark, Kwangtung, Latouche; South Reef
1995b	VII	24/03/95 – 25/04/95	South Sentinel, North and South Brother, Sisters, Twin
1995c	VIII	24/05/95 – 03/11/95	South Reef



Figure 1: Satisch Bhaskar's sojourns between 1977 and 1995

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Cover photograph: (L - R): Dhruvajyoti Basu, Satish Bhaskar, Rom Whitaker and Allen Vaughan, after a lobster hunting expedition off the coast of Mahabalipuram. With hands protected by socks they pulled up these spiny creatures while Basu collected them in a snakebag while afloat on an automobile inner tube. (Photo Courtesy: Rom Whitaker).

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