



INDIAN OCEAN TURTLE NEWSLETTER

ISSUE - 5

JANUARY 2007

ISSN 0973-1695

The Indian Ocean Turtle Newsletter was initiated to provide a forum for exchange of information on sea turtle biology and conservation, management and education and awareness activities in the Indian subcontinent, Indian Ocean region, and South/Southeast Asia. The newsletter also intends to cover related aspects such as coastal zone management, fisheries and marine biology.

The newsletter is distributed free of cost to a network of government and non-government organisations and individuals in the region. All articles are also freely available in PDF and HTML formats on the website. Readers can submit names and addresses of individuals, NGOs, research institutions, schools and colleges, etc for inclusion in the mailing list.

SUBMISSION OF MANUSCRIPTS

IOTN articles are peer reviewed by a member of the editorial board and a reviewer. In addition to invited and submitted articles, IOTN also publishes notes, letters and announcements. We also welcome casual notes, anecdotal accounts and snippets of information.

Manuscripts should be submitted by email to: kshanker@ces.iisc.ernet.in

If electronic submission is not possible, mail hard copies to:

Kartik Shanker
Centre for Ecological Sciences
Indian Institute of Science
Bangalore 560012. India.

Manuscripts should be submitted in MS Word or saved as text or rich text format. Figures should not be embedded in the text; they may be stored in EXCEL, JPG, TIF or BMP formats. High resolution figures may be requested after acceptance of the article. In the text, citations should appear as: (Vijaya, 1982), (Silas *et al.*, 1985), (Kar & Bhaskar, 1982). References should be arranged chronologically, and multiple references may be separated by a semi colon. Please refer to IOTN issues or to the Guide to Authors on the website for formatting and style. Authors should provide complete contact information including an email address, phone and fax numbers.

Reference styles in list:

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

Silas, E.G., M. Rajagopalan, A.B. Fernando & S. S. Dan. 1985. Marine turtle conservation & management: A survey of the situation in Orissa 1981/82 & 1982/83. *Marine Fisheries Information Service Technical & Extension Service* 50: 13-23.

Pandav, B. 2000. *Conservation & management of olive ridley sea turtles on the Orissa coast*. PhD thesis. Utkal University, Bhubaneswar, India.

Kar, C.S. & S. Bhaskar. 1982. The status of sea turtles in the Eastern Indian Ocean. In: *The Biology and Conservation of Sea Turtles* (ed. K. Bjorndal), pp. 365-372. Smithsonian Institution Press, Washington D.C., USA.

This newsletter is produced with support from:



IOTN ONLINE IS AVAILABLE AT <http://www.seaturtle.org/iotn>

Monitoring of marine turtles along the Kerala and Tamil Nadu coasts

S. Bhupathy

*Sálim Ali Centre for Ornithology and Natural History
Anaikatti (PO), Coimbatore, Tamil Nadu 641108, India.
Email: sb62in@yahoo.co.uk*

Introduction

Among the five species of sea turtles distributed in the Indian region, four of them, the olive ridley (*Lepidochelys olivacea*), green turtle (*Chelonia mydas*), leatherback (*Dermochelys coriacea*) and hawksbill (*Eretmochelys imbricata*) nest on Indian coasts (Kar & Bhaskar, 1982). All these species are distributed in Tamil Nadu and in the coastal waters of Kerala. The Wildlife Institute of India (WII) recently implemented a UNDP–Government of India sea turtle conservation project. This project (2000–01) evaluated the status of marine turtles and their nesting habitats in all maritime states of India, which included an assessment of threats to turtles. Data on important nesting beaches were generated, which form the benchmark for monitoring (Shanker & Choudhury, 2006). Information on the status of marine turtles along the Tamil Nadu coast was generated as a part of this project (Bhupathy & Saravanan, 2002, 2006a; Bhupathy & Karunakaran, 2003). Among many aspects, monitoring the population trend of a species is critical for the preparation and implementation of conservation programmes. In this context, the Madras Crocodile Bank Trust (MCBT) initiated a countrywide programme for monitoring marine turtles including the islands. As a part of this programme, the Sálim Ali Centre for Ornithology and Natural History (SACON), Coimbatore undertook monitoring of sea turtles along the Kerala and Tamil Nadu coasts during 2003–05. The objective of this project was to assess the conservation status of different species of marine turtles, and to network with and provide training to government officers and non-government organisations (NGOs) in both states to enhance conservation actions. In this paper, we report the major findings of the sea turtle monitoring programme along the Kerala and Tamil Nadu coasts during November to April 2003–04 and 2004–05.

Methodology

Study area

The all-India coordinated UNDP–GOI–WII sea turtle project (2000–2001) suggested that the Nagapattinam and Chennai coasts in Tamil Nadu and the beaches of North Kerala are important marine turtle nesting areas (Bhupathy & Saravanan, 2006b). We monitored turtle nesting and mortality along the south Chennai (12°31′–12°8′N and 80°10′–79°56′E, Fig. 1) and Nagapattinam coasts (11°51′–11°30′N and 79°51′–79°46′E, Fig. 2) which are part of the Palar and Cauveri deltas respectively. The North Kerala coast (approx. Kozhikode–Kannur; 11°41′–12°38′N and 74°55′–75°38′E, Fig. 3) has many west flowing rivers and remnants of mangrove vegetation at the river mouth. The west and east coasts receive major rainfall from the Southwest (May–July) and Northeast (October–November) monsoons respectively.

Field methods

Each study sector was divided into 10–km units and surveyed each fortnight (during 0600–0830 hours) for recording nesting and mortality of turtles (Table 1). Data on nesting intensity was based on tracks found on the beach. As surveys were done at fortnightly intervals, tracks found during each survey were considered as new. Nest predation by animals or exploitation by locals was based on tracks and signs found near exploited nests. The number of carcasses found on the shore was counted as an index of turtle mortality. Carcasses of turtles were marked with paint to avoid repeat count. Researchers appointed by the project surveyed the Mamallapuram–Pondicherry (50 km) and Nagapattinam (30 km) beaches each fortnight by foot. The Chennai (6 km) and North Kerala (20 km) beaches were monitored by local

NGOs on a daily basis. Along the North Kerala coast, the availability of sandy areas for turtle nesting was assessed during February–March 2003. We also interviewed local persons to obtain information on turtle nesting and mortality.

Nesting intensity for the locality studied was calculated based on average nesting during this

study. Total nesting during the season was estimated as:

$$N = n \times d \times t,$$

where N – Estimated nesting,
 n – average nesting during sampling,
 d – number of 10 km sectors, and
 t – duration (90 days – January to March).

Table 1: Sea turtle monitoring schedules along the Kerala and Tamil Nadu coasts during 2003 - 05

Beach Sector	Distance (km)	Duration	Monitored by
Kerala			
Kozhikode	6	September–December 2003	Theeram
Kasarakod	10	September–December 2003	Naythal
Tamil Nadu			
Chennai	6	January–April 2004 January–April 2005	SSTCN
Mamallapuram-Pondicherry	50	January–April 2004	MCBT–CMS Project
Nagapattinam	30	January–April 2004 December 2004–May 2005	MCBT–CMS Project

Turtle Monitoring

Nesting

Sandy beaches suitable for sea turtle nesting were found on the North Kerala (i.e. Kannur and Kasarkod) coast. A survey conducted for documenting nesting and mortality along the 60 km coast during February–March 2003 yielded no nests. Interviews with fishermen revealed that turtles nest along the west coast largely during September–November with the peak during October. Data collected by NGOs working in this area, namely *Theeram* and *Naythal* supported this. According to them, on an average, about three nests were found per kilometer in the area. These NGOs, in collaboration with the Kerala Forest Department and local communities, especially the fisherman, collect turtle eggs and maintain hatcheries in Kolavipalam, Kozhikode (*Theeram*) and near Kasargod (*Naythal*). The hatchlings are released into the sea. Apart from collecting biological information and protecting nests, these

hatcheries are used for nature education and public awareness programmes.

The Mamallapuram–Pondicherry beach (50 km) was surveyed for only one year (2003–04). In all, 36 olive ridley nests were recorded during the fortnightly sampling from January–March 2004. Peak nesting was observed in the first fortnight of March. Estimated nesting density along this area was about 11 nests per km during January–April 2004 (Table 2).

The Chennai beach has been monitored (on a daily basis) by the Students’ Sea Turtle Conservation Network (SSTCN) since 1988 and was continued during this study as well. A total of 50 nests (8.3 per km) were recorded during January–April 2004. During 2005, they recorded 62 nests (10.3 per km; SSTCN data). Average nesting intensity for 16 years was 9.4 nests per km (Shanker, 2003). A hatchery is being maintained by the SSTCN on an annual basis.

Table 2: Nesting of ridleys along the Mamallapuram–Pondicherry coast (50 km), Tamil Nadu during January–March 2004

Fortnight	Number of nests	Average nesting/day/10km
January I	3	0.6
January II	6	1.2
February I	7	1.4
February II	7	1.4
March I	13	2.6
March II	0	0
Total	36	7.2
Average nesting/day/10km		1.2
Estimated nests		540
Nests per km		10.8

The Nagapattinam beach was monitored for turtle nesting during 2003–04 and 2004–05. On the 30 km beach monitored, a total of 17 and 30 nests were recorded during the fortnightly sampling from December–April in 2003–04 and 2004–05 respectively (Table 3). This works out to about 7.5 and 15 nests per km. Nesting along this beach was about 20 nests per km during 2000–01.

Table 3: Nesting of ridleys along the Nagapattinam coast during 2003–04 and 2004–05

Fortnightly survey	2003–04	2004–05
December II	0	0
January I	3	*
January II	3	*
February I	6	8
February II	2	9
March I	3	9
March II	0	2
April I	0	2
April II	0	0
Total	17	30
Estimated nest/ km	7.5	15

*Not surveyed due to disturbance in the area caused by the 26th December 2004 Indian Ocean tsunami.

Turtle nesting along the east coast of Tamil Nadu (Chennai and Nagapattinam) occurred during January to March, whereas it was between September and December along the North Kerala coasts. In other words, turtles nested subsequent to the major monsoon season of the area, namely the northeast and southwest monsoons. Peak nesting along the east and west coasts were during February and October respectively. The intensity of the sea turtle nesting on the Kerala and Tamil Nadu coasts is sporadic, and its density varied from 3 to 15 nests per km. The reasons for the difference in the number of nests observed along the Chennai and Nagapattinam coasts during 2003–04 and 2004–05 are unclear. These variations may be attributed to factors such as annual or cyclic changes in the nesting of turtles (for larger data set, see Shanker, 2003), which has to be investigated further.

Turtle mortality

No sea turtle carcass was observed along the west coast (North Kerala) during both years (i.e. 2003–04 and 2004–05). Interviews with fishermen in the area also revealed that dead turtles get stranded along these beaches only occasionally.

Along the east coast, 139 turtle carcasses (~3 per km) including 134 olive ridleys and five green turtles were recorded on the Mamallapuram–Pondicherry coast during 2003–04. During the same period, 92 carcasses including 90 olive ridleys and two green turtles were observed along the Nagapattinam coast (Table 4). Compared to the previous season, only 21 carcasses (20 olive ridleys and one green turtle) were observed during 2004–05, and all of them prior to the Indian Ocean tsunami on 26th December 2004. No new carcasses were observed during January–April 2005. Fishing activities were halted during this period due to the damage and loss of boats and infrastructure, and the fears and rumours of another tsunami in the area. Hence, it may reasonably be concluded that mortality of turtles in the area was largely due to fishing activities.

Table 4: Olive ridley mortality along select beaches of Tamil Nadu and Kerala during 2003–04

Location	Beach monitored (km)	Turtle Mortality*	Nest predation (%)	Remark
North Kerala	60	Low	Unknown	Single survey
Nagapattinam	30	90 (2)	100	Fortnightly survey
Mamallapuram-Pondicherry	50	139 (5)	69.4	Fortnightly survey
Chennai	6	Low	Low	Daily survey

Number in parenthesis indicate number of green turtles

* total count

Turtle mortality was highest during January on the east coast (Table 5). Prior to and during January, turtles aggregate in the shallow nearshore waters to breed. These areas are also important gill net fishing grounds. Fishermen in the area largely used small (mechanised) boats and *catamarans* for fishing. The density of fishing vessels (both mechanised and non-mechanised) was 26 and 28/km on the Mamallapuram and Nagapattinam coasts respectively. Gill nets were set in shallow

waters for about 8–10 hours. Turtles entangled in the nets died due to drowning, as indicated by the prolapsed internal organs through body openings. The fishermen in the area also chopped off the flippers or clubbed the head of live turtles found entangled in the net. This was done for removing turtles without damage to the nets and fishermen themselves. In all, 70% of the fresh carcasses found on the shore had one or two missing flippers and shell or head injuries.

Table 5: Mortality of olive ridleys along the Chennai and Nagapattinam coasts during 2003–2005 based on carcasses found along the beach

Fortnightly survey	Mamallapuram – Pondicherry	Nagapattinam
December II	0	0
January I	29	26
January II	61	22
February I	19	9
February II	20	14
March I	2	6
March II	3	9
April I	0	4
April II	0	0
Total	134+5*	90+2*

* Green turtles

Exploitation

Inhabitants of these study areas (Chennai, Nagapattinam and North Kerala) do not consume turtles, but they consume turtle eggs. Locals on both Nagapattinam and Mamallapuram–Pondicherry coasts collected eggs of a large number of nests. As the Chennai and North Kerala coast beaches were monitored on daily basis by the SSTCN and other NGOs, exploitation of eggs by

humans were negligible. These NGOs collected turtle eggs to maintain hatcheries with the involvement of students and local communities.

Along the Nagapattinam coast, all the nests found during 2003–04 were predated; 14 (82.5%) by humans and 2 (17.5%) by domestic dogs. Professional poachers traversed the beach extensively on foot during the night to collect eggs. Of the 36 nests observed during January–April

2004 along the Mamallapuram–Pondicherry coast, 25 (69.4%) were predated (Table 6). Among the predated nests, jackal and domestic dog contributed 54.2% and 33.3% respectively. Inhabitants of the area depredated about 12.5 % of the total nests observed in the area. Native

communities such as *Irulas* consume turtle eggs occasionally. Locals collected eggs from almost all nests along the Nagapattinam coast, whereas inhabitants took only 12.5% of them along the Mamallapuram coast. This indicates that the latter beach is relatively less disturbed.

Table 6: Exploitation of turtle eggs along select beaches of Kerala and Tamil Nadu

Location	Beach monitored (km)	Nest predation / exploitation (%)	% of predation		
			Humans	Domestic dog	Jackal
North Kerala	20	Low	Unknown	–	–
Nagapattinam	30	100	82.5	17.5	–
Mamallapuram–Pondicherry	50	69.4	12.5	33.3	54.2
Chennai	6	Low/ Unknown	–	–	–

Suggestions for Conservation

Annual closed season for fishing

As over 50% of the adult turtle mortality occurred during January, a closed period for gill net fishing is suggested in the area for a month (January) along the east coast. During this period, alternate fishing techniques to be used by the fisherman should be explored. Discussions with the concerned departments (mainly Forest and Fisheries Departments) and other stakeholders are required for active participation and effective implementation.

Control of egg depredation

The depredation of turtle eggs is widespread along the entire olive ridley nesting range, and in some areas it is very severe. Depredation is more common where no protected areas or NGO activities are present. Poaching has almost stopped in select sectors of North Kerala, where NGOs such as *Naythal* and *Theeram* are active. These NGOs use the local fishermen to collect eggs for hatcheries. Enhanced beach patrolling by the Forest Department and other agencies during the peak turtle nesting season is crucial for the long-term survival of marine turtles. Intensive beach patrolling for two months (February–March) on the turtle nesting beaches of the east coast of Tamil

Nadu may save as many as 65–90% of the nests from poachers. Beach patrolling during September–October is suggested along the west coast for the conservation of turtles.

Community participation

Awareness programmes and community participation in the conservation efforts are important for getting desired results. Hatchery programmes involving the public with incentives and alternate livelihoods may increase the success of the sea turtle conservation initiatives many fold. Regular egg poachers of an area may be identified and used in the hatchery programme. In this direction, supporting the efforts made by SSTCN (Chennai), Students' Sea Turtle Network (SSTN)(Nagapattinam), *Theeram* (Kozhikode) and *Naythal* (Kasaragod) with both technical and financial inputs are essential.

An ideal location among the current study areas for starting a sea turtle hatchery programme is the Tranquebar–Poompuhar (Nagapattinam) coast. This programme has a network in place with the involvement of Forest Department and local community, and could act as a model nature education and conservation initiative. A hatchery programme is particularly necessary for the Nagapattinam coast, as local people collect the eggs of almost all nests.

Research

The data on turtle nesting along the east coast during 2000–01, 2003–04 and 2004–05 showed high fluctuation in the nesting density. For instance, along the Nagapattinam coast, it varied from 7.5 (2003–04) to 20 (2000–01) nests per km. Data generated for about two decades by the SSTCN on the Chennai coast also showed similar variations (2.8 to 17.5 nests per km, Shanker, 2003). Reasons for these fluctuations need to be investigated. It is necessary to continue the monitoring of turtle nesting and mortality along important areas such as Chennai and Nagapattinam. The nesting season of sea turtles along the east and west coasts was different, and it would be interesting to examine whether the same population nests along both coasts. Tagging programmes along both these coasts simultaneously may provide important information such as breeding stock and movement pattern of turtles.

Acknowledgements: This study was funded by the UNEP–CMS–MCBT project, and I thank Dr. Kartik Shanker, Mr. Harry Andrews (MCBT) and Dr. V. S. Vijayan (SACON) for their support and encouragement. I am grateful to the Chief Wildlife Wardens, Tamil Nadu and Kerala for issuing permits to undertake surveys along the coastal areas of the respective states. The District Forest Officers of both states were supportive and provided logistic support when required. I thank Mr. A. Baruah, Wildlife Warden, Point Calimere Wildlife Sanctuary for his valuable suggestions and support. I thank the volunteers and students of this project (R. Karunakaran, J. Gokulakrishnan, M. Vijay, J. Subramanian, Dr. A.M.A. Nixon) for data collection at various levels. I am thankful to several government institutions (Forest Department, CMFRI and colleges) and NGOs (SSTCN, *Theeram* and *Naythal*, SSTN) who took part in the project. I appreciate the help and cooperation extended by the fishermen and other local communities to the research team.

Literature Cited

- Bhupathy, S & S. Saravanan. 2002. Status of sea turtles along the Tamil Nadu coast, India. *Kachhapa* 7: 7-13.
- Bhupathy, S. & R. Karunakaran. 2003. Conservation of olive ridley sea turtle *Lepidochelys olivacea* (Reptilia/Chelonia) along the Nagapattinam coast, southeast coast of India. *Indian Journal of Marine Science* 32 (2): 168-171.
- Bhupathy, S. & S. Saravanan. 2006a. Marine turtles in Gulf of Mannar. *Chelonian Conservation and Biology* 5 (1): 139-141.
- Bhupathy, S. & S. Saravanan. 2006b. Marine turtles of Tamil Nadu. In: *Marine turtles of the Indian subcontinent* (Eds. K. Shanker & B.C. Choudhury), pp. 58-67. Universities Press, Hyderabad, India.
- Kar, C. S. & S. Bhaskar. 1982. Status of sea turtles in the Eastern Indian Ocean. In: *Biology and conservation of sea turtles* (Ed. K.A. Bjorndal), pp. 365-372. Smithsonian Institution Press, Washington DC, USA.
- Shanker, K. 2003. Thirty years of sea turtle conservation on the Madras coast: a review. *Kachhapa* 8: 16-19.
- Shanker, K. & B.C. Choudhury. 2006. *Marine turtles of the Indian subcontinent*. Universities Press, Hyderabad, India.

Figure 1: Map showing the Chennai–Pondicherry coast and prominent villages

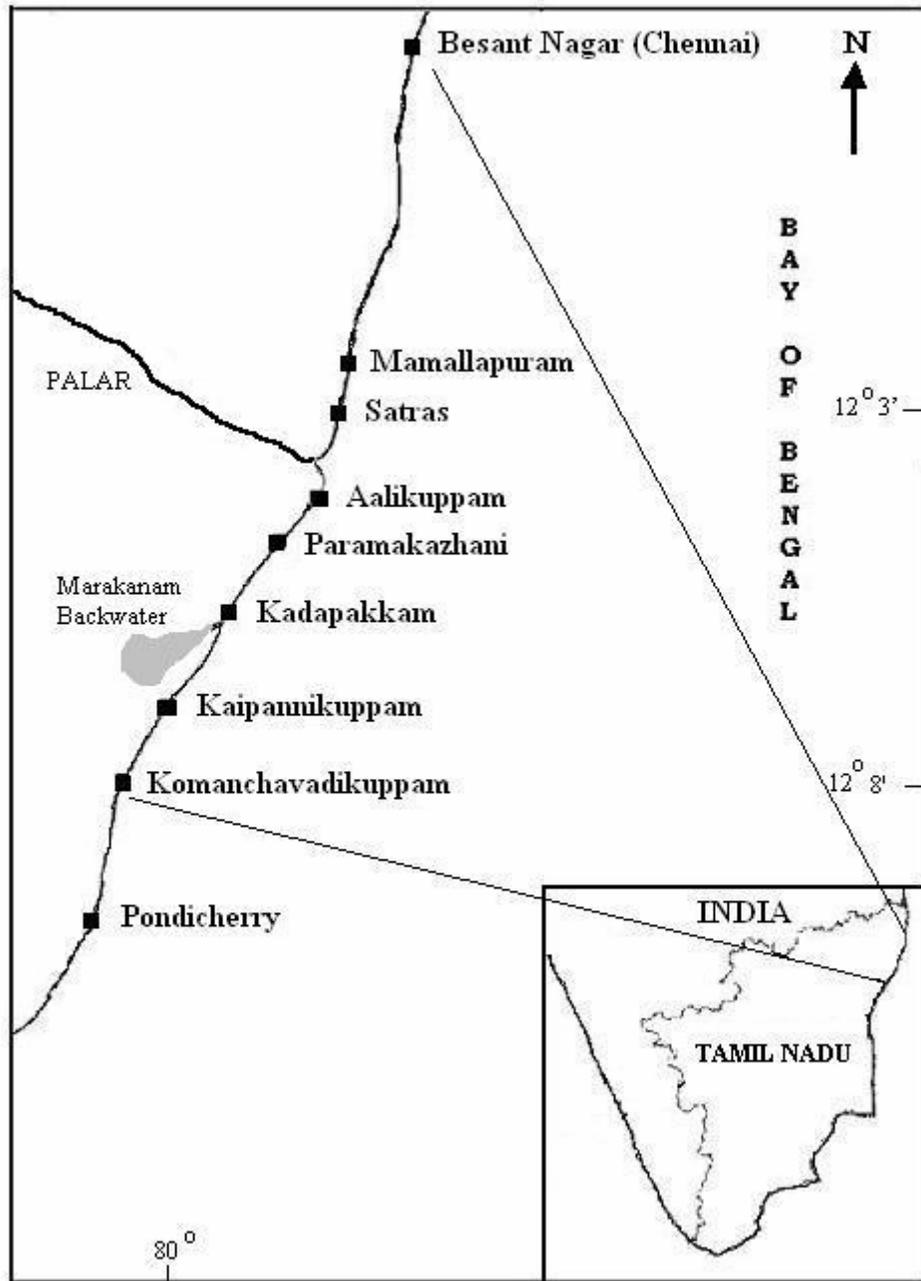


Figure 2: Map showing the study area along the Nagapattinam coast

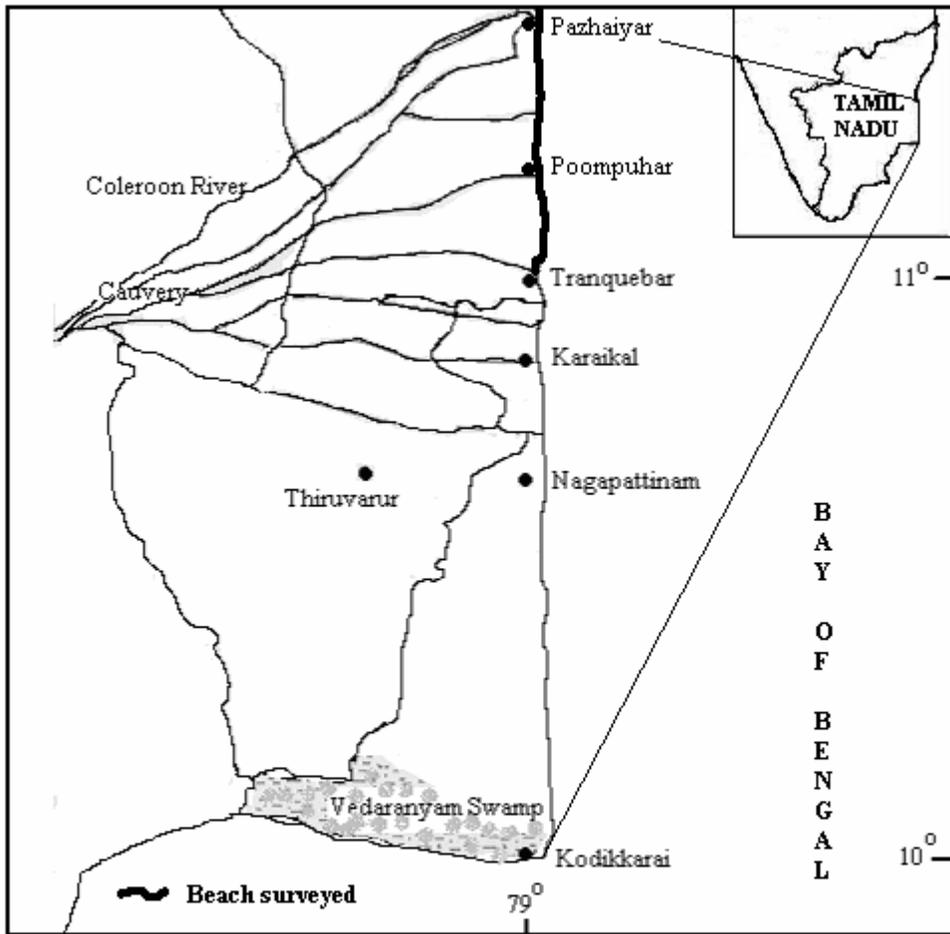
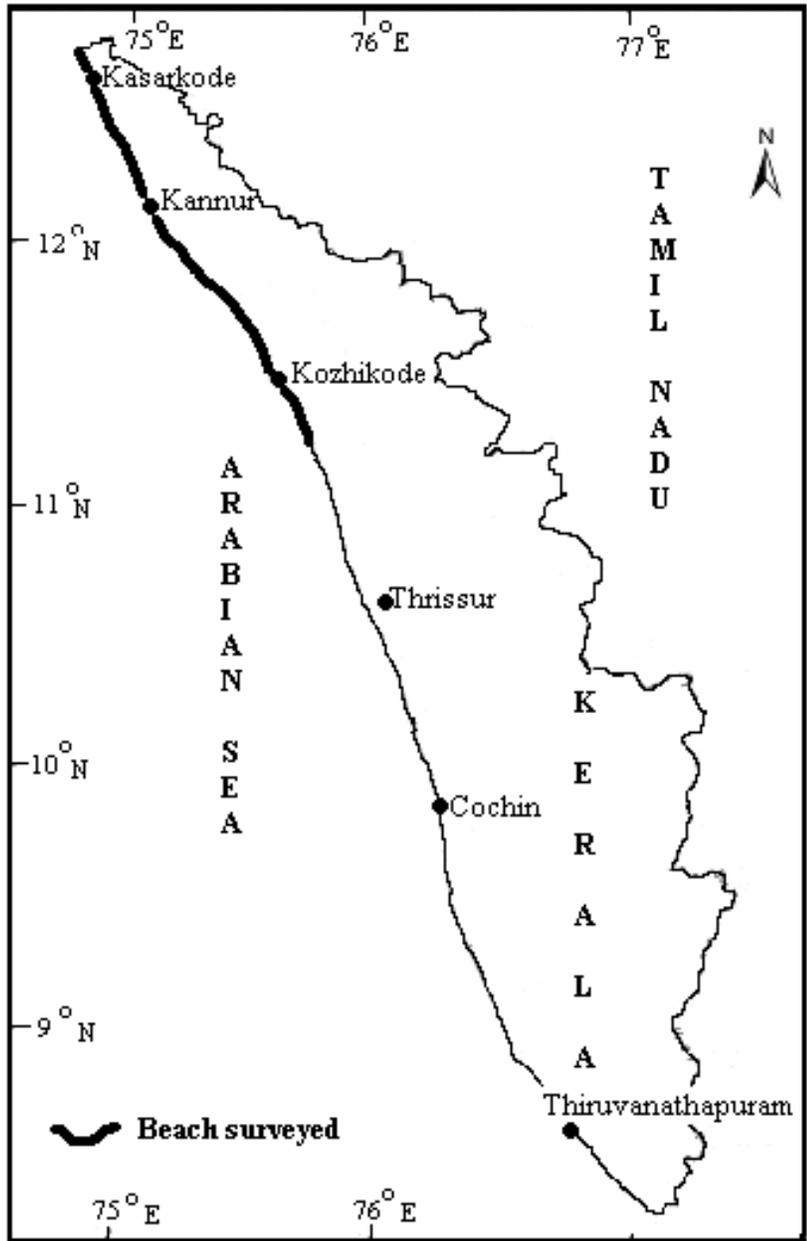


Figure 3: Map of Kerala showing the study area



Marine turtle conservation efforts in Udupi District, Karnataka

Paul McCann

*Department of Marine and Tropical Biology, James Cook University
Townsville, Queensland, Australia.
Email: paul.mccann@jcu.edu.au*

Introduction

Despite the sporadic nature of sea turtle nesting along the coast of Karnataka, a number of non-government organisations (NGOs) acknowledge the impacts that threaten olive ridley turtles (*Lepidochelys olivacea*) and have taken action. These groups are currently providing community awareness programmes and pursuing conservation strategies to mitigate the factors which are contributing to a severe decline in local populations. However, in spite of these voluntary efforts, much of the beachfront habitat along this coastline has already been rendered unsuitable for nesting due to the construction of sea walls, interference from artificial illumination, and noise pollution on nearby coastal highways.

Previous surveys of marine turtle populations in Karnataka are limited to a handful of studies that have taken place over the last 20 years (see Kar & Bhaskar, 1982; Appayya, 1985; Madhyastha *et al.*, 1986; Rajagopalan *et al.*, 1996; Sharath, 2006). Recent reports suggest that the harvest of turtle eggs by humans (Sharath, 2006) and enhanced adult mortality caused by incidental capture in fishing nets (Rajagopalan *et al.*, 1996) are the most significant yet preventable threats facing sea turtles in Uttara Kannada. In addition, a number of other factors negatively impact the survival and reproductive success of adult sea turtles in both inshore and offshore coastal zones. Pollution from terrestrial sources (i.e. run-off in the form of marine debris and toxic chemicals), sand mining, eutrophication from mariculture, and the destruction of ecologically important habitats such as mangrove stands and other riparian zones alters the sensitive areas between river mouths that were once frequently visited nesting sites for sea turtles. Moreover, the collection of turtle eggs by humans and nest depredation by feral animals, in combination with the pressures of habitat

destruction due to unsustainable fishing practices, is leading to a potential loss of sea turtles from the Karnataka coast (Sharath, 2006).

Although there are a number of environmental protection laws which prohibit the exploitation of sea turtles and their eggs throughout India (*see the Wildlife Protection Act, 1972; the Coast Guard Act, 1978*) and across the world (*the Convention of International Trade in Endangered Species of Wild Flora and Fauna; the Convention on the Conservation of Migratory Species of Wild Animals; The United Nations Convention on the Law of the Sea*) top-down national legislation has little effect in the absence of consultation and cooperation at the community level (Upadhyay & Upadhyay, 2002). Field Services and Intercultural Learning (FSL) India¹ (Kundapur) and the Canara Green Academy (Honnavar) operate throughout Uttara Kannada, with the explicit aim of protecting turtle eggs from consumption and conducting awareness campaigns within coastal communities. These NGOs work closely with members of the local artisanal fishing community to implement environmentally friendly strategies for coastal development and to assist in the protection of key turtle nesting habitats.

FSL's marine turtle conservation project

The Udupi District is located on the western coast of Karnataka and is punctuated by a number of river systems, which flow into the Arabian Sea. There are many small fishing communities situated on this 260 km long coastline and numerous commercial trawlers operate in the offshore waters. Beach surveys indicate that the olive ridley nesting season occurs across Udupi from September until

¹ Contact person: Rakesh Soans (Email: fsl_rakesh@rediffmail.com)

February, with some seasonal variability in the peak nesting season.

The conservation strategies currently in operation mainly focus on enhancing awareness amongst local communities and empowering members of coastal villages to take an active role in the protection of their environment. Each year, up to 30 international volunteers are coordinated by 3 or more FSL staff; they also receive assistance from members of local youth groups and colleges to protect and locate nests, and conduct sea turtle conservation awareness programmes. A major role of the organisation is to prevent the harvest of turtle eggs by offering 2–3 times the market price; although the market price has apparently remained stable for the last three years at Rs. 1 per egg, prices can climb as high as Rs. 2.5 during times when fishing is poor. Once a nest has been located, care is taken to excavate and transport eggs to a nearby hatchery where specially appointed contact people from the local community can watch over them until hatching.

Information flyers are produced in the local language (Kannada) and distributed during weekly awareness campaigns. During each week of the breeding season, volunteers visit a number of nesting areas, reinforcing existing relationships with contact persons and forging new relationships with other representatives from surrounding villages. Local schools are also visited in order to conduct education and awareness programmes. In previous years, these visits have included presentations and student art exhibitions that depict the threats affecting sea turtles in Karnataka; theatre performances are also conducted by international volunteers to engage pupils and transcend differences in culture and language.

After the nesting season is underway volunteers actively build temporary information centers (one for every 5 kms of beach) and hatcheries in strategic nesting locations. These temporary structures contain information posters that describe the impacts facing sea turtles, the ecological importance of effective conservation practices, and the FSL contact number in the event that nesting tracks are discovered. The information presented in the following report is based on informal

discussions and observations during November–December 2006 along the Udupi coast.

Results and Discussion

FSL India has been coordinating a turtle conservation volunteer project since November 2004. Since its inception, approximately 2348 turtle eggs have been collected from beaches across the Karnataka coast (Table 1). Koravadi, Bijadi, Kodi, Maravanthe and Navunda beaches are currently recognised as the most frequently visited nesting sites in the region 60 kms north of Kundapur.

Table 1: Data summary for FSL’s turtle project history in Karnataka over the past three years.

Year	Eggs collected	Hatchlings
2004	570	470
2005	823	584
2006*	955*	90*

* - as of 19/12/06

Changes to land use and riparian habitat management, combined with incidental capture during commercial fishing and the harvest of turtle eggs by humans, is having a severe effect on the population of marine turtles that breed on this coast (Sharath, 2006).

Although our knowledge of the functional interactions that facilitate ecological relationships is limited, sea turtles are believed play a pivotal role in the transport of energy between terrestrial and marine ecosystems, and their continuing decline provides an indication of coastal health and our ability as resource managers to utilise the environment in a sustainable manner (Shanker & Pilcher, 2003; Shanker *et al.*, 2005).

From surveys conducted with commercial and artisanal fishermen it is widely acknowledged that the population of olive ridley turtles in Karnataka has declined over the past two decades. In the last five years national legislation preventing the sale or harvest of turtle products has been enforced in large harbours; however reports suggest that turtle eggs can still be purchased clandestinely in seaside communities and small sea ports. Most of the fisherman operating in Malpe harbor appear to be

aware of the laws prohibiting the sale of turtle products, however the rate of incidental capture during commercial fishing is still high (0 to 4 adults captured per day of fishing effort in purse seine boats) and unlikely to be mitigated by simply returning the severely stressed animals back to the water. If the introduction of turtle excluder devices (TEDs) cannot occur due to cultural, social or economical reasons, then other methods of reducing adult mortality need to be devised. Of the 34 fishermen interviewed in Malpe, approximately half had been involved in the commercial fishing industry across Karnataka over the past 10–20 years and all of these men commented decisively on the noticeable decline in the abundance of sea turtles that were encountered while fishing. Some even remarked that numerous dead turtles could be seen floating in offshore zones approximately 12–20 kms off the Karnataka coast, presumably those discarded from nets.

In addition to the loss of functional resilience and ecological imbalance which accompanies the decline of olive ridley turtles, future economic opportunities in the nature based tourism industry may also be jeopardised. Dolphins, whales, turtle nesting sites and coral islands can all be found on the coast of Karnataka in close proximity to the highly diverse forests of the Western Ghats. Ecotourism opportunities in this area have barely been explored and, if managed appropriately, are likely to yield fruitful opportunities for local employment, economic growth and sustainable development.

Recommendations

Data collection – the locations of all nesting sites across the Karnataka coast should be mapped using GPS coordinates. A database with the dates that eggs were laid and hatched, as well as the clutch size and hatching success, should be maintained.

In situ protection – It is desirable to avoid moving eggs from their initial location, maintaining the optimal natural sex-ratio and incubation success rate of the nest *in situ*. As most egg predation appears to occur as a result of humans actively excavating turtle nests for sale or personal consumption (pers. obs), protecting the eggs *in situ* for two weeks after deposition so that embryonic

development can take place may be an effective deterrent against egg poaching.

Habitat viability – The trend of erecting sea-walls across the coast of India should be used only as a last resort. These structures have been shown to be ineffective as a means to prevent beach erosion in other countries and appear only to serve only as a short-term solution (pers. obs). Using introduced species (such as *Casuarina*) as a means to combat erosion is also undesirable when it causes reduced productivity and biodiversity as a by-product. At the very least, a protocol which prescribes the planting of *Casuarina* at a minimum distance from the mean high water mark is necessary. Ideally, the progressively replanting of coastal areas with native plants that mimic natural states in succession should be adopted. Implementing light and noise reduction strategies for coastal highways during the breeding season (e.g. use red visors on beach lights to minimise nesting interference from September to February) is also desirable.

Community consultation – Community awareness programmes that incorporate local youth groups and college students are perhaps the most interactive and effective means of introducing conservation values into the forefront of social consciousness. Groups like FSL make a significant contribution to sustainable development within local communities and should continue to work in an educational capacity by providing programmes that highlight the importance of the conservation and biodiversity while offering incentives for economically viable solutions to non-sustainable industrial practices.

Forging networks – A nation-wide communication network is required to link all NGOs and environmental agencies so that information and expertise can be shared and distributed in an easily accessible and scientifically rigorous manner. Including representatives from local industry in policy making processes and providing the opportunity for local business operators to assist those running conservation programmes is one strategy to draw support from the grass roots level.

Future directions – Conferences and annual workshops can be conducted with the aim of sharing information and providing opportunities

for participation and education. These meetings should also allow NGOs, governmental departments and stakeholder groups the opportunity to voice concerns and deliver progress reports concerning the state of conservation efforts in their local areas.

Conclusion

Despite the limited nests recovered throughout Uttara Kannada, the efforts undertaken by various NGOs to mitigate nest predation and increase community awareness are not in vain. This work is crucial for sea turtle conservation in the coastal waters of Karnataka where multiple factors impact all aspects of sea turtle life history. Certainly the achievements being made here at a local level have effects which can permeate across socio-cultural

boundaries and empower local communities to work in coordination with conservationists and governments for a common goal.

Acknowledgements: Many thanks to the long- and short-term volunteers who worked so hard to ensure that the 2006 marine turtle conservation project was creative and well managed. I also extend my appreciation to Abraham Chacko of the Turtle Bay Resort for giving me a wholistic perspective of the natural beauty on offer in Karnataka, and to Rakesh Soans and Praveen Pereira for their guidance and support throughout the project. To Kartik, Chaitra, Rohan, the FSL staff team, and the Canara Green Academy – your work in India is invaluable and I wish you all the greatest success in future conservation efforts.

Literature cited

Appayya, M.K. 1985. Sea turtle conservation with particular reference to Karnataka. *My Forest* 21(2):89-90.

Kar, C.S. & S. Bhaskar. 1982. Status of sea turtles in the Eastern Indian Ocean. In: *Biology and conservation of sea turtles* (Ed. K.A. Bjorndal), pp. 365-372. Smithsonian Institute Press Washington D.C., USA.

Madhyastha, M.N., B.K. Sharath & J.J. Rao. 1986. Preliminary studies on marine turtle hatchery at Bengre Beach, Mangalore. *Mahasagar* 19(2):137-140.

Rajagopalan, M., E. Vivekanandan, S.K. Pillai, M. Srinath & A.B. Fernando. 1996. Incidental catch of sea turtles in India. *Marine Fisheries Information Services T & E Series* 143:8-16.

Shanker, K., A. Hiremath & K. Bawa. 2005. Linking biodiversity conservation and livelihoods in India. *PLoS Biology* 3(11):1878-1880.

Shanker, K. & N.J. Pilcher. 2003. Marine turtle conservation in South and Southeast Asia: Hopeless cause or cause for hope? *Marine Turtle Newsletter* 100: 43-51.

Sharath, B.K. 2006. Sea turtles along the Karnataka coast. In: *Marine Turtles of the Indian subcontinent* (Eds. K. Shanker & B.C. Choudhury), pp. 141-146. Universities Press, Hyderabad, India.

Upadhyay, S. & V. Upadhyay. 2002. International and national instruments and marine turtle conservation in India. *Journal of International Wildlife Law and Policy* 5: 65-86.

A bibliography on the marine turtles in the Andaman and Nicobar archipelago

Harry V. Andrews

Centre for Herpetology/Madras Crocodile Bank Trust,
Post Bag 4, Mamallapuram, Tamil Nadu 603104, India.
Email: mcbtindia@vsnl.net
www.madrascrocodilebank.org

The bibliography of marine turtles in the Andaman and Nicobar archipelago includes material that deals specifically with turtles or historical records and documents that contain particular information on marine turtles. Many papers that deal with sea turtles in India refer to the islands, and these are included in the bibliography in Issue 2 of the

Indian Ocean Turtle Newsletter. This compilation also does not include proceedings of small workshops, training programmes or meetings, since most of them do not constitute full or reviewed papers, and are largely either brief or extended abstracts.

Bibliography

Andrews, H.V. 2003. *Marine Turtles Around the Andaman and Nicobar Islands: Their Current Status and Distribution*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India, 12pp.

Andrews, H.V. & I. Das. 1998. Addenda to the bibliography of the herpetology of the Andaman and Nicobar Islands. *Hamadryad* 3(1): 84–85.

Andrews, H.V. & K. Shanker. 2002. A significant population of leatherback turtles in the Indian Ocean. *Kachhapa* 6: 17.

Andrews, H.V. & A.P. Tripathy. 2004. *Status and Population Dynamics of Leatherback Sea Turtle (Dermochelys coriacea), with Observations on Other Species, Around the Andaman and Nicobar Archipelago, India*. Report to Marine Conservation Society, UK. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India, 20pp.

Andrews, H.V. & A. Vaughan. 2005. Ecological impact assessment in the Andaman Islands; including observations in the Nicobar Islands-Post 2004 tsunami. In: *The Ground Beneath the Waves: Post Tsunami Impact Assessment of Wildlife and Their Habitats in India* (eds. R. Kaul & V. Menon), Vol. 2, pp. 78–101. Wildlife Trust of India, New Delhi, India.

Andrews, H.V., S. Krishnan & P. Biswas. 2001. *The Status and Distribution of Marine Turtles Around the Andaman and Nicobar Archipelago*. GOI–UNDP National sea turtle project, IND/97/964, 30pp.

Andrews, H.V., S. Krishnan & P. Biswas. 2002. Leatherback nesting in the Andaman and Nicobar Islands. *Kachhapa* 6: 13–16.

Andrews, H.V., S. Krishnan & P. Biswas. 2005. Marine turtles around the Andaman and Nicobar Islands—their current status and distribution. In: *Marine Turtles of the Indian Subcontinent* (eds. K. Shanker & B.C. Choudhury), pp. 33–57. Universities Press, Hyderabad, India.

Andrews, H.V., A. Tripathy, S. Aghue, S. Glen, S. John & K. Naveen. 2006. The status of sea turtle populations in the Andaman and Nicobar Islands. In: *Towards an Integrated and Collaborative Sea Turtle Conservation Programme in India: A UNEP/CMS–IOSEA Project Report* (eds. K. Shanker & H.V. Andrews). Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India.

Andrews, H.V., M. Chandi, A. Vaughan, J. Aungthong, S. Aghue, S. Johnny, S. John & S. Naveen. 2006. Marine turtle status and distribution in the Andaman and Nicobar Islands after the 2004

- M 9 quake and tsunami. *Indian Ocean Turtle Newsletter* 4: 3–11.
- Andrews, H.V., R.S.C. Jayaraj & S. Mundoli (eds.). 2005. *State of the Environment—Andaman and Nicobar Islands*. Universities Press, Hyderabad, India, 145pp.
- Anon. 1986. Saving the Andamans and Nicobars. *Hamadryad* 11(1&2): 35.
- Bhaskar, S. 1979. Sea turtle in the South Andaman Islands. *Hamadryad* 4(1): 3–5.
- Bhaskar, S. 1979. Sea turtle survey in the Andamans and Nicobars. *Hamadryad* 4(3): 2–26.
- Bhaskar, S. 1979. Letters from the Andaman. *Hamadryad* 4(2): 3–6.
- Bhaskar, S. 1981. *Sea Turtle Survey of Great Nicobar and Little Andaman Islands*. WWF, India, 5pp.
- Bhaskar, S. 1981. Preliminary report on the status and distribution of sea turtles in Indian waters. *Indian Forester* 107(11): 707–711.
- Bhaskar, S. 1981. Travels in the Andaman and Nicobar Islands: 1979. *Hamadryad* 6(1): 2–7.
- Bhaskar, S. 1984. Sea turtles in North Andamans and other Andaman Islands. WWF, India, 46pp.
- Bhaskar, S. 1984. Locating and conserving sea turtle nesting grounds in the Andamans. In: *Spirit of Enterprise*, pp. 190–193. The Rolex Award. Aurum Press, London.
- Bhaskar, S. 1984. The distribution and status of sea turtles in India. In: *Proceedings of the Workshop on Sea turtle Conservation* (eds. E.G. Silas), pp. 21–35. Central Marine Fisheries Research Institute, Cochin, Special Publication 18.
- Bhaskar, S. 1993. *Andaman & Nicobar Sea Turtle Project, Phase II—South Reef Island*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1993. *Andaman & Nicobar Sea Turtle Project, Phase III—Surveys*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1993. *The Status and Ecology of Sea Turtles in the Andaman and Nicobar Islands*. ST 1/93. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India, 37pp.
- Bhaskar, S. 1994. *Andaman & Nicobar Sea Turtle Project, Phase IV*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1994. *Andaman & Nicobar Sea Turtle Project, Phase V*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1994. *Andaman & Nicobar Sea Turtle Project, Phase VI*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1995. *Andaman & Nicobar Sea Turtle Project, Phase VII*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1995. *Andaman & Nicobars Sea Turtle Project, Phase VIII*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1995. *Andaman & Nicobar Sea Turtle Project, Phase VI A*. Centre for Herpetology/Madras Crocodile Bank Trust, Tamil Nadu, India (unpublished report).
- Bhaskar, S. 1996. Renesting intervals of the hawksbill turtle (*Eretmochelys imbricata*) on South Reef Island. *Hamadryad* 21: 19–22.
- Bhaskar, S. & H.V. Andrews. 1993. Action plan for sea turtles in the Andaman and Nicobar Islands, India. *Marine Turtle Newsletter* 60: 23.
- Bhaskar, S. & G.C. Rao. 1992. Present status of some endangered animals in Nicobar Islands.

- Journal of the Andaman Science Association* 8: 181–186.
- Bhaskar, S. & M. Tiwari. 1992. *Andaman and Nicobar Sea Turtle Project, Phase I*. Great Nicobar Island. Centre for Herpetology, Madras Crocodile Bank Trust, Tamil Nadu, India, 20pp.
- Bhaskar, S. & R. Whitaker. 1983. Sea turtle resources in the Andaman and Nicobar Islands. *Bulletin of the Central Marine Fisheries Research Institute* 34: 94–97.
- Biswas, S. & D.P. Santal. 1977. Notes on the reptilia collection from the Great Nicobar Islands during the Great Nicobar expedition in 1966. *Records of the Zoological Survey of India* 71: 107–124.
- Biswas, S. & D.P. Santal. 1980. A report on the reptilia fauna of Andaman and Nicobar Islands in the collection of Zoological Survey of India. *Records of the Zoological Survey of India* 77: 255–292.
- Bonington, M.C.C. 1931. *Census of India—The Andaman and Nicobar Islands*. Government of India Central Publication Branch, Calcutta.
- Blyth, E. 1863. The zoology of Andaman Islands. In: *Adventures and Research Among the Andaman Islanders* (ed. F.M. Mouat), pp. 345–367. *Journal of the Asiatic Society of Bengal* 32.
- Caddel, V.C. 1888. The Andamans and Andamanese. *The Scottish Geographical Magazine* 5: 57–73.
- Chandi, M. 2003. Konghueveh the Payuh. *Herpinstance* 1(1): 7–10.
- Cutting, C.S. 1932. Natives of the Andaman Islands. *Journal of the American Museum of Natural History* 32(5): 521–530.
- Cooper, Z. 2002. *Archaeology and History—Early Settlement in the Andaman Island*. Oxford University Press, New Delhi, India, 307pp.
- Chief Wildlife Warden. 2005. *Status Report on Marine Turtles in Andaman and Nicobar Islands*. Andaman & Nicobar Department of Environment & Forests, Port Blair, Andaman and Nicobar Islands, India, 12 pp.
- Daniels, R.J.R. & P.V. David. 1996. The herpetofauna of Great Nicobar Island. *Cobra* 25: 1–4.
- Daniels, R.J.R., P.V. David, M.V. Ravikumar & G. Anuradha. 1997. *Patterns and Distribution of Vertebrate Diversity in the Great Nicobar Biosphere Reserve*. Final Technical Report. M.S. Swaminathan Research Foundation, Chennai, India, 47pp.
- Das, I. 1994. A checklist of the amphibians and reptiles of the Andaman and Nicobar Islands. *Journal of the Andaman Science Association* 10(1 & 2): 44–49.
- Das, I. 1999. Biogeography of the amphibians and reptiles of the Andaman and Nicobar Islands. In: *Tropical Island Herpetofauna—Origin, Current Diversity and Conservation* (ed. H. Ota), pp. 43–77. Elsevier Science, Amsterdam, The Netherlands.
- Das, I. & H.V. Andrews. 1997. Bibliography of the herpetology of the Andaman and Nicobar Islands. *Hamadryad* 22(1): 68–72.
- Davis, T.A. & R. Altevogt. 1976. Giant turtles and robber crabs of the South Sentinel. *Yojana* 20(13 & 14): 75–79.
- James, D.B. 1985. Some observations and remarks on the endangered marine animals of Andaman and Nicobar Islands. In: *Proceedings of the Symposium on Endangered Marine Animals & Marine Parks, Cochin* (ed. E. G. Silas), pp. 242–247. Marine Biological Association of India, Cochin, 505pp.
- Kannan, P. & M. Rajagopalan. 2005. Sighting of sea turtles in the Andaman Sea and Bay of Bengal. *Indian Ocean Turtle Newsletter* 2: 7–9.
- Kar, C.S. & S. Bhaskar. 1982. Status of sea turtles in the Eastern Indian Ocean. In: *Biology and Conservation of Sea Turtles* (ed. K.A. Bjorndal),

- pp. 365–372. Smithsonian Institution Press, Washington, DC, USA.
- Khan, I.H. 1983. Wildlife. In: *Hundred years of Forestry in the Andamans, 1883-1983*, pp. 53–60. Issued on the Occasion of the Centenary Celebration of the Forest Department, Andaman and Nicobar Islands. Port Blair, Andaman and Nicobar Islands, India.
- Khan, I.H. 1987. Conservation of endangered marine species in the Andamans. In: *Proceedings of the Symposium on Management of Coastal Ecosystems and Oceanic Research in the Andamans*, pp. 66–70. Andaman Science Association, Port Blair.
- Mackey, S. 1847. Notice of the Nicobars. (Extract sent to the Directors of the East India Company by S. Mackey, Calcutta, 6th February 1847. Authored by Rev. Dr. P. Barbe), 23pp.
- Man, E.H. 1883. *On the Aboriginal Inhabitants of the Andaman Islands*. Reprint, 1978, Prakashak, New Delhi, India, 223pp.
- Maxwell, F.D. 1911. *Report on Island and Sea Fisheries in the Thongwa, Myawngmya and Bassein District and the Turtle-Banks of the Irrawaddy Division*. Office of the Superintendent, Government Printing, Rangoon.
- Maxwell, F.D. 1930. *The Nicobar Islands and Their People*. Billing & Sons Ltd, Guildford, England (for the Royal Anthropological Institute of Great Britain & Ireland).
- Misra, A. 1990. Olive ridley turtle—breeding and behaviour. *Tigerpaper* 17(4): 29–32.
- Misra, A. 1993. Leatherback turtle—breeding and behaviour. *Tigerpaper* 20(2): 15–21.
- Mout, F.J. 1863. *Adventures and researches Among the Andaman Islanders*. Hurst and Blackett, London, 126pp (reprinted 1979 as ‘The Andaman Islanders’. Mittal Publication, New Delhi).
- Portman, M.V. 1899. *The History of our Relations with the Great Andamanese*. Calcutta: (2 Vols.). Office of the Superintendent of Government Printing, India, 875pp.
- Rao, G C. & I.H. Khan. 1989. On the present status of marine fauna of the Andaman Sea. *Zoologiana* 5: 29–42.
- Sankaran, R. 2005. Impact of the earthquake and the tsunami on the Nicobar Islands. In: *The Ground Beneath the Waves: Post Tsunami Impact Assessment of Wildlife and Their Habitats in India* (eds. R. Kaul & V. Menon), Vol. 2, pp. 10–77. Wildlife Trust of India, New Delhi, India.
- Sekhsaria, P. 2000. Turtle tales. *Frontline* May 26: 66–70.
- Shanker, K. & M.A. Oommen. 2002. Nesting of a small hawksbill turtles at Indira point, Great Nicobar Island. *Kachhapa* 7: 21.
- Shanker, K. & M.A. Oommen. 2003. The edge of the world. *Sanctuary Asia* 28(6): 22–27.
- Sivakumar, K. 2002. Sea turtles nesting in the south bay of Great Nicobars Island. *Marine Turtle Newsetter* 96: 17–18.
- Silas, E.G. & K. Alagaswami. 1983. General considerations of mariculture potential of Andaman and Nicobar Islands. *Bulletin of the Central Marine Fisheries Research Institute* 34: 104–107.
- Singh, S J. 2003. *In the Sea of Influence. A World System Perspective of the Nicobar Islands*. Human Ecology Division, Lund University, Lund, 333pp.
- Singh, A., H.V. Andrews & K. Shanker. 2003. Report on the GOI–UNDP sea turtle Workshop, Andaman and Nicobar Islands, India. *Kachhapa* 9: 19–20.
- Sivasundar, A. 1996. *Studies on the nesting of leatherback sea turtle (Dermochelys coriacea) in the Andaman Islands*. M. Sc. Dissertation. Salim Ali School of Ecology, Pondicherry University, Pondicherry, India, 47pp.
- Sivasundar. A. & K.V. Devi Prasad. 1996. Placement and predation of nests of leatherback

- sea turtles in the Andaman Islands, India. *Hamadryad* 21: 36–42.
- Smith, M.A. 1941. The herpetology of the Andaman and Nicobar Islands. *Proceedings of the Linnean Society (London)* 153(1): 150–158.
- Tikader, B.K. & A.K. Das. 1985. *Glimpses of Animal Life of Andaman and Nicobar Islands*. Zoological Survey of India, Calcutta, 170pp.
- Tikader, B.K., A. Daniel & N.V. Subba Rao. 1986. *Sea Shore Animals of the Andaman and Nicobar Islands*. Zoological Survey of India, Calcutta, 188pp.
- Tiwari, M. 1991. *A Follow up Sea Turtle Survey in the Southern Nicobars*. Report to Madras Crocodile Bank. Trust/Centre for Herpetology, Tamil Nadu, India, 8pp.
- Whitaker, R. 1978. Herpetological survey in the Andamans. *Hamadryad* 3: 9–16.
- Whitaker, Z. 1979. The Editors Note. *Hamadryad* 4(3): 1.
- Whitaker, R. 1984. Recovery and management programmes for sea turtles in India; their value, logistics and problems. In: *Proceedings of the Workshop on Sea Turtle Conservation* (eds. E.G. Silas), pp. 69–75. Central Marine Fisheries Research Institute, Cochin, Special Publication 18.
- Whitaker, R. 1985. *Endangered Andamans*. Environmental Service Group, WWF/MAB-India and Department of Environment, Government of India, New Delhi, 49pp.
- Whitaker, R. 1985. Rational use of estuarine and marine reptiles. In: *Proceedings of the Symposium on Endangered Marine Animals & Marine Parks, Cochin* (ed. E.G. Silas), pp. 298–303. Marine Biological Association of India, Cochin, 505pp.

Sea turtle hatcheries in Kachchh, Gujarat

R.L. Meena, J.V. Vyas and R.S. Jadeja

Forest Department, Government of Gujarat,
Mandvi, Kachchh-Bhuj, Gujarat 371001, India.
Email: <mailto:cfkut Chad1@sancharnet.in>

Gujarat State has the longest coastline in the country covering more than 1600 km. Olive ridleys and green turtles nest on the Gujarat coast (Sunderraj *et al.*, 2006a), with a predominance of olive ridleys on the Kachchh coast (Sunderraj *et al.*, 2006a,b). Though incidental mortality is low on this coast, turtles face a significant threat from depredation of nests by animals and humans, and from coastal development (Sunderraj *et al.*, 2006a, b). Given the importance of these marine reptiles and the threats they face, *in-situ* hatching and *ex-situ* conservation programmes have been in operation in Gujarat since 1985-86. Hatcheries were established at Mandvi and Nalia, but the programme was strengthened after surveys by the Gujarat Institute of Desert Ecology (GuIDE) as part of the GOI-UNDP sea turtle project (Sunderraj

et al., 2006a). The eggs are currently collected by the forest department staff and hired trained personnel. These eggs are being buried in the hatchery under the same conditions as the wild. A total of 8546 olive ridleys, 182 green turtle and 50 leatherback hatchlings have been successfully hatched and released into the sea from hatcheries in Mandvi and Nalia in Kachchh district.

The efforts being made by the forest department need to be strengthened. *In-situ* protection needs to be more effective with proper protection at site and regular monitoring by the field staff. Public awareness programmes for the fisherfolk and other coastal inhabitants regarding the conservation significance of these threatened species will reduce the predation of nests.

Table 1: Collection of eggs and hatching success from 1985 to 2006 at Mandvi and Nolia hatcheries

Year	Site	No. of eggs collected	No. of Successful hatchlings			Success Rate (%)
			Olive ridley	Green turtle	Leatherback	
1985-86	Mandvi	—	—	—	—	—
	Nalia	65	43	—	—	66.00
1986-87	Mandvi	—	—	—	—	—
	Nalia	134	100	—	—	74.62
1990-91	Mandvi	1271	778	—	—	61.25
	Nalia	—	—	—	—	—
1991-92	Mandvi	2038	1230	—	—	60.35
	Nalia	—	—	—	—	—
1992-93	Mandvi	3391	2251	—	—	66.39
	Nalia	—	—	—	—	—
2000-01	Mandvi	4399	1963	110	—	40.00
	Nalia	321	105	—	50	48.00
2001-02	Mandvi	1273	404	—	—	31.73
	Nalia	210	138	—	—	65.00
2004-05	Mandvi	1446	750	—	—	51.00
	Nalia	533	368	—	—	69.00
2005-06	Mandvi	556	416	—	—	75.00
	Nalia	135	—	72	—	53.33
Total		15637	8546	182	50	54.50

Table 2: Collection and hatching of the turtles during the year 2005 – 06 and 2006 – 07

Site	Collection of eggs		Survival of hatchlings		Survival percentage	Remark
2005-06						
Mandvi	Date	Number	Date	Number		Survival is more if
Seashore	26.07.05	96	05.09.05	93	96.87	collection
-do-	28.07.05	138	05.09.05	134	97.10	is in July.
-do-	09.08.05	112	23.09.05	67	59.82	
-do-	20.08.05	102	03.10.05	58	56.86	
Nana-Layja	21.08.05	108	04.10.05	64	59.25	
Sub-total	–	556	–	416	74.82	
Naliya	08.12.05	135	28.01.06	72	53.3	
Total		691		488	70.62	
2006-07						
Mandvi	23.07.06	124	15.09.06	68	54	

Literature Cited

- Sunderraj, S.F.W, J. Joshua & V.Vijaya Kumar. 2006a. Sea turtles and their nesting habitats in Gujarat. In: *Marine turtles of the Indian subcontinent* (Eds. K. Shanker & B.C. Choudhury), pp. 156-169. Universities Press, Hyderabad, India.
- Sunderraj, S.F.W. & J. Joshua. 2006b. Status report on UNEP – CMS sea turtle project on the Gujarat coast, India. *Indian Ocean Turtle Newsletter* 3: 6-10.

Some observations on exploitation of sea turtles on the Kanyakumari coast

S. Krishnapillai and S. David Kingston*

7-49F, Deivakam Pilliyar Koil Street, N.G.O. Colony, Kottar (p.o),
Nagercoil, Tamil Nadu 629002, India.

* Veterinary University Training and Research centre (Fisheries),
Parakkai, Tamil Nadu 629601, India.
Email: davidkingstonin@yahoo.co.in

Tamil Nadu, situated in peninsular India, has a coastline of about 920 km. The southern most district of Kanyakumari has a 70–km coast along the Arabian Sea and a 3–km coast along the Bay of Bengal. This district receives rainfall from the south-west monsoon for about 4 months from the middle of May to middle of September and north-east monsoon for about 3 months from end of October to December. There are about 46 fishing villages in Kanyakumari District (Table 1). Turtle fishing has been practiced along the Kanyakumari coast historically and there have been estimates of catches of several thousands of turtles per year in

earlier decades. During recent years, the turtle catch was estimated to be about 1000 turtles per year (Kangappan & Wesley, 1998). The apparent decline in landing of turtles may be due to incidental catch in fishing gear, and illegal take of nesting female turtles. Turtle eggs are also collected for consumption and sold in fish markets. Information regarding the accidental catch and mortality of sea turtles due to fishing operation is restricted to the report of olive ridley turtles *Lepidochelys olivacea* at Kanyakumari (Krishna Pillai, 1998) and leatherback turtles *Dermochelys coriacea* at Colachal (Ebenezer and Joel, 1992).

Kanyakumari, Colachal, Kodimuni and Thoothur are important trawler operation centres of Kanyakumari District, with about 350 trawlers operating daily out of Kanyakumari harbour. The Government of Tamil Nadu has sanctioned the construction of a fishing harbour at Colachal. Thengaipattinam is an important fishing village with primarily shore-seines. The Thamiraparani River, locally known as Kuzhithurai River empties into the Arabian Sea near Thengaipattinam. The proposal to construct a harbour at Thengaipattinam is under consideration by the Tamil Nadu government, because of the repeated demand and request of the people of Thengaipattinam and nearby coastal villages.

On April 10, 2004, a female olive ridley turtle was caught in shore seine at Thengaipattinam near the mouth of the estuary. The turtle was 59 cm in length and weighed about 48 kg. It was auctioned

for Rs. 400 and taken to the Thengaipattinam fish market, where it was sold. This was brought to the notice of the local Forest Department, following which a forest officer came to the market and made detailed enquiries. The department officers attempted to create awareness among the fishermen about the endangered status of sea turtles and necessity for their conservation. Enquiries revealed that sea turtles are caught in shore seines and taken on the beach while nesting. Enquiries also revealed that sea turtles are caught regularly in fishing nets and tied in the estuaries of Mankudy, Thenkaipattinam and Kadiapattinam for slaughtering on Sundays, when there is no fishing. Olive ridleys are caught regularly in Keezha Manakudy, Mela Manakudy and Arokiyapuram near Kanyakumari. Accidental catch of olive ridleys were also noticed in the trawler catch at Chinna Muttom.

Table 1. Fishing villages of Kanyakumari coast, Tamilnadu where marine turtles are caught.

S.No	Name	S.No	Name
1.	Arokiyapuram	24.	Puthoor
2.	Leepuram	25.	Kotilpadu
3.	Chinna Muttom*	26.	Colachel*
4.	Kanyakumari *	27.	Simoncoloney
5.	Vavuthurai	28.	Kodimunai *
6.	Kovalam	29.	Vaniyakudi
7.	Keezha Manakudy	30.	Kurumbanai
8.	Mela Manakudy	31.	Keelamidalam
9.	Amali Nager	32.	Malamidalam
10.	Pallamthurai	33.	Enayam
11.	Puthenthurai	34.	Enayam china thurai
12.	Kesavanputhenthurai	35.	Enayam Puthenthurai
13.	Pozhikkurai thurai	36.	Ramanthurai
14.	Periakadu	37.	Thengapattinam
15.	Rajakkamangalam thurai	38.	Eramanthurai
16.	Azhikaithurai	39.	Puthuari
17.	Pillaithoppu	40.	Thoothoor*
18.	Melathurai	41.	Chinnathurai
19.	Muttom	42.	Puthenthurai
20.	Sivathamam	43.	Vallavilai
21.	Kadiyapattinam	44.	Marthandam thurai
22.	Chinnavilai	45.	Neerodi
23.	Periyavilai	46.	Colankodu

Literature cited

Ebenezer, I.P. and J.J. Joel. 1992. On the landing of leather back turtle *Marine Fisheries Information Service T & E Series* 118: 20.

Kangappan M. and G. Wesley. 1998. Distribution of chelonids in Kanyakumari coastal waters. *ZoosPrint*. 8: 64-66.

Krishna Pillai S. 1998. On the landing of a Olive ridley turtle at Kanyakumari, Tamil Nadu, and updated record of incidental catches of sea turtles in India. *Marine Fisheries Information Service T & E Series* 157: 17-19.

Interaction between the Sea Turtle Protection Force and trawler owners and workers at Kasimedu fishing harbour, Chennai

Supraja Dharini

*Trust for Environment Education (TREE) Foundation,
63, First Avenue, Vettuvankeni, Chennai, Tamil Nadu 600041, India.
Email: treefoundation2002@yahoo.com
www.treefoundationindia.org*

Coastal gillnet fishing and other fisheries conducted from a multitude of smaller vessels are of increasing concern on the Indian coast. These fisheries practices can collectively have a very great impact on local sea turtle populations especially the olive ridley turtle. Turtles get entangled in gillnets, pound nets, and other fishing gear. Turtles entangled in these types of fishing gear may drown and often suffer serious injuries to their flippers from constriction by the lines or ropes. Trawls that are not fitted with Turtle Excluder Devices (TEDs) do not allow turtles to escape, which may result in mortality through drowning.

Since the number of dead turtles on the Chennai coast rose to 74 in the month of March 2006, Kadal Aamai Padhukavalargall (KAP) (Sea Turtle Protection Force) felt that Kasimedu fishing harbour should be targeted for spreading awareness about the importance of turtle conservation. Kasimedu fishing harbour is Chennai's largest mechanised and trawl boat fishing community.

The size of the fishing trawlers ranges from the smallest to very big commercial trawlers. In total, there are about 680 trawlers operating on daily basis and more than 5700 persons working on the

trawls. On conducting a series of meetings with the 4 major local unions of trawl owners and workers, the following information was collected by TREE Foundation's Kadal Aamai Padhukavalargall (Sea Turtle Protection Force).

Turtles get caught in bottom trawl nets, gill nets and ray fish nets. Many turtles caught in bottom trawl nets are still alive, very few turtles are caught in gill nets, but get entangled and die, and turtles that get entangled in ray fish nets always die. Small trawl boats operate from 6 km onwards as the cost of diesel escalates their cost. Most turtles are seen and caught incidentally in trawl nets near Pulicat (Pazaverkadu) area. Traditionally fishermen would not want a turtle to get caught in their nets, so if there is a device that would prevent a turtle entering the net, they would welcome it

The unions were all aware of the cleaning of the harbour by the KAP for the Coastal Cleanup Day which was organised by the India Coast Guard on September 16th 2006. KAP members used 5 fibre boats and 3 catamarans and cleaned the sea around the harbour and bridge areas for 2 hours, removing more than 2 tons of marine debris. The upkeep of the cleanliness of the harbour by KAP was appreciated by the unions.

Juvenile green and hawksbill turtles in the waters of Nainarkuppam, Chennai

Supraja Dharini

*Trust for Environment Education (TREE) Foundation,
63, First Avenue, Vettuvankeni, Chennai, Tamil Nadu 600041, India.
Email: treefoundation2002@yahoo.com
www.treefoundationindia.org*

After the routine morning turtle walk for the protection of the olive ridley turtles on 4 January, 2007 in Nainarkuppam, the Kadal Aamai Padhukavalargall (KAP) (Sea Turtle Protection Force) of TREE Foundation and the Nainarkuppam Turtle Guard of the Forest Department saw a rare turtle caught in the large shore net (*peru valai*) about 600 m from the shore. The juvenile green turtle (picture below) had a carapace length of 62 cm. There were barnacles on the head, neck, plastron and carapace of the turtle. The turtle was released safely into the sea by KAP members (C. Mahesh, S. Dhayanithi, S. Arivazhagan, M. Amarakavi and C. Gnana Sekar) and Tree Foundation (T. Raja and Supraja Dharini).

A juvenile hawksbill turtle was washed ashore at Nainarkuppam, Chennai, during the early hours of 1 December 2006. KAP members saw the little turtle slowly crawling near a boat on the shore. It

was found to be a hawksbill with a total length of 38 cm.

Green and hawksbill turtles are usually found in the Gulf of Mannar and Andaman and Nicobar Islands, and do not frequent the waters of the Chennai coast. However, members of KAP say that they have seen different turtles foraging at the rock formations in the waters near Nainarkuppam village. Two dead juvenile hawksbill turtles were washed ashore near Reddykuppam and Nainarkuppam on 1 February, 2006 and 10 May, 2006, respectively. Both were judged to have been killed in gill nets from the wound marks.

The Wildlife Wing of the Forest Department has appointed one turtle guard from each of the villages, which has strengthened the community conservation of the olive ridley turtle.



Photo: Supraja Dharini

Creating awareness about sea turtles at Pulicat-Pazaverkadu (North Chennai)

Supraja Dharini

*Trust for Environment Education (TREE) Foundation,
63, First Avenue, Vettuvankeni, Chennai, Tamil Nadu 600041, India.
Email: treefoundation2002@yahoo.com
www.treefoundationindia.org*

The Pulicat Sanctuary, an estuary to the north of Chennai, has many migratory birds and marine organisms. There are approximately 5000 people living in over 16 fishing villages located in this area. The region is gifted with many natural attributes such as a sand barrier within the sea popularly known as the 'Saami Thittu' which prevents the trawl boats from entering into this part of the sea. The region is a breeding ground for many birds, marine organisms and olive ridley turtles.

Mating and individual turtles in the sea are often seen by fishermen in this region. With minimal population in each hamlet and not much commercial activity on the beach front, Pulicat could be preserved as a suitable habitat for turtles to nest. TREE Foundation felt the need to educate the people in this region in order to preserve the beach habitat for the future. A six member team headed by the author and members of TREE Foundation's Kadal Aamai Padhukavalargall (KAP) (Sea Turtle Protection Force) made a visit on 27th December 2006 to some of these villages in the Pulicat region and briefed the local people

about sea turtles, their significance and certain basic scientific details about the turtles and why the conservation of this endangered species is essential.

An eager and interested local public assured us that they would cooperate in any effort to save turtles as they worship turtles and do not hunt turtles or destroy their eggs. Except for a few individuals who are said to be involved in selling turtle eggs for the past ten years, others do not disturb the turtles or the eggs. The locals, the village youth and the children were requested to report on live or dead turtle and were also instructed to safeguard the turtle nests by vigilant patrolling on the beach front and keeping away miscreants from causing damage to turtle nests. The introductory visit should lead to better efforts for sea turtle conservation in the region. PLANT, a local non-government organisation working in this region for livelihood empowerment, has promised to spread awareness to children in the schools with the resource materials provided by TREE Foundation. Two youth from Sattan Kuppam and Vairan Kuppam have volunteered to be part of KAP.

Proceedings of the workshop on the conservation of sea turtles and mangroves at Honnavar, Karnataka

N.D. Bhat

*Canara Green Academy,
#163, Sri Krishna Shree Vananagara,
Hubli Road, Sirsi, Karnataka 581402, India.
Email: mail@greenacademy.org*

Canara Green Academy was started in October 2005 principally to conserve sea turtles and mangroves in Karnataka on the west coast of India, especially in Uttara Kannada District. The academy started its work in sea turtle conservation with the Apsarakonda fishermen of Kasarkod beach. The fishermen have been persuaded to protect the nests of sea turtles on this beach. In addition, the academy conducted surveys of mangroves in the rivers Aghanashini and Sharavati.

After surveying the area, the need for a workshop including government and other stakeholders was felt necessary. The workshop was conducted on 11th December, 2006 at Honnavar, Karnataka. The workshop was entirely funded by the Academy.

The workshop was inaugurated by Shri B. Shivanagouda, IFS, Chief Conservator of Forests (Development), Bangalore, Shri Shanmugha Sundaram, IFS, Retd. Chief Conservator of Forests, Tamil Nadu and G. Satish, IFS, Conservator of Forests, Kanara Circle, Sirsi. The formal opening speech was delivered by B. Shivanagouda, IFS and G. Satish, IFS. Seven persons from the local community were honoured for their contribution towards the conservation of sea turtles and mangroves.

The session on sea turtles began with a presentation on sea turtle biology and conservation by Kartik Shanker. Annie Kurien made a presentation on the distribution of sea turtles on the Karnataka coast. Paul McCann, a volunteer with Field Services and Intercultural Learning (FSL),

shared his experience in India and Rakesh Soans, President of FSL, presented FSL's work on the conservation of sea turtles.

The afternoon session began with a presentation by Dr. V. N. Nayak, Chairman and Reader in Ocean Sciences, Department of Studies in Marine Biology, Karwar, on the ecology, distribution and threats to mangroves. Shri Shanmugha Sundaram, IFS, Retd. CCF of Tamil Nadu state, also a Technical Advisor to Canara Green Academy, made a presentation on mangroves in Tamil Nadu. Dr. C.R. Elangovan, Director of Centre for Green Philosophy, Chidambaram presented an overview of the ecology of Pichavaram mangroves. Dr. Radhakrishna, Professor, College of Fisheries, Mangalore presented a quantitative analysis using time series remote sensed data & Geographical Information Systems. There were also presentations by Rajashekhar, IFS, Deputy Conservator of Forests, Kundapura Division, Kundapur, Edwin D'Souza, Assistant Conservator of Forests, Wildlife, Dandeli, H.S.S. Murthy, IFS, Deputy Conservator of Forests, Honnavar Division, Honnavar and M.D. Kanagil, Assistant Conservator of Forests, Karwar Division, Karwar.

This workshop was attended by Forest Department officials, staff and students of Marine College, Karwar, Fisheries College, Mangalore, Forestry College, Sirsi and different colleges of North Kanara District, scholars, research fellows, representatives of Indian Institute of Science, Centre for Environmental Education and other non-government organisations.

NEWS AND UPDATES

This section is compiled by Sudarshan Rodriguez, Coordinator of WAVES, a weekly marine and coastal news compilation. You can submit news items via e-mail and subscribe to WAVES by writing to Sudarshan Rodriguez

(sudarshanr@yahoo.com). News items are taken directly from various media sources and do not necessarily reflect the views or opinions of the editorial members of the IOTN.

INDIA

Mangrove research centre planned

Ignatius Pereira

KOLLAM: The Fisheries Department has taken the initiative to start a Mangrove Eco-system Research and Demonstration Centre at Ayiramthengu, near here.

An ad hoc proposal will be submitted to the State Government soon. If the project materialises, it reportedly will become the first mangrove research centre in the country.

The 50-acre mangrove forest owned by the department at Ayiramthengu is an environmental hot spot. Many species of animals feed and breed here. The forest provides a glimpse of how the mangroves function as a habitat for many marine species, a safe haven for otters and a favourite destination of migratory birds. While the demand to conserve mangrove forests to protect the environment has been raised for years, it was after the tsunami in December 2004 that the need for mangrove-protected waterfronts as a dependable defence against the waves gathered serious momentum.

The fact that mangrove forests enhance the fish wealth also began to get recognition. Mangroves are also a traditional social link with coastal human communities dependent on the sea for their livelihood. They preserve wildlife and provide precious food for livestock. Yet no serious efforts have been made to protect them.

The Ayiramthengu mangrove forest was also threatened with extinction. In 1996, the Fisheries Department stepped in with a programme to preserve it.

The success of the programme has now prompted the department to put forth the proposal to start a mangrove research centre. The department will provide the facilities for research.

M.K. Prasad, chairman and executive director, Information Kerala Mission, and an authority on mangroves, says Ayiramthengu is an ideal location for research on mangroves and the Fisheries Department is the best agency to promote it.

Dr. Prasad says that with the mangrove forests in the State disappearing by the day, a research centre can work wonders in augmenting mangrove forests.

Source: The Hindu, Monday, 8 January, 2007, available at <http://www.hindu.com/2007/01/08/stories/2007010811650400.htm>

Olive ridleys washed ashore

Special Correspondent

NAGAPATTINAM: More than a dozen olive ridleys (sea turtles) have been washed ashore at Nagapattinam, Vedaranyam and Point Calimere in the last two days.

Fisheries and Forest department officials believe mechanised trawlers might have killed them. Forest department officials are taking steps to remove the carcasses. The Wildlife department is investigating the cause of death.

Olive ridley, an endangered species, weighs about 50 kg. They feed on crabs, shrimp, rock lobsters, sea grasses, algae, snails and fish. Sometimes they feed on jellyfish in shallow waters.

The beaches of Orissa are nesting grounds of olive ridleys. Their population continues to dwindle in the Atlantic Ocean but is rising in the tropical regions of Pacific and Indian oceans.

Source: The Hindu, 11 January, 2007, available at <http://www.hindu.com/2007/01/11/stories/2007011107170400.htm>

Remove the ban on exports of marine species: Experts

Ashok B. Sharma

CHIDAMBARAM, JAN 10 : Experts have urged the government to lift the ban on export of marine species having medicinal value - seahorses and pipefishes.

Many experts have cited that these marine creatures are no longer in the category of endangered species. A good number of them have bred and cultured and kept safe in the sanctuary – Gulf of Mannar.

The breeding of seahorses and pipefishes are being undertaken in the Centre of Advanced Study in Marine Biology of the Annamalai University located in the remote village, Parangipettai.

“We bred 10,000 species of seahorses and pipefishes and handed over to the Gulf of Mannar. We have trained 40 Tsunami-affected women fisher folks in two batches in the art of breeding,” said the professor in marine biology, S Rajagopal.

Two years back the government-banned exports of two species of seahorses – Hippocampus kuda and hippocampus trimaculatus and also pipefishes as they were considered ‘endangered.’ These marine creatures have high medicinal value and are usually exported to China.

Traditional Chinese medicines use extracts of these species to cure a number of chronic ailments.

SM Raffi of the Centre said that these marine species are priced around Rs 2,400 per kg.

“It will immensely benefit the Tsunami-affected families, if the government considers lifting the ban on exports.”

When asked as to why these marine creatures cannot be of use in the country for preparing medicines, Raffi said, “In India no one has this knowledge. The knowledge of preparing medicines from these marine creatures is only in the traditional Chinese system.”

Rajagopal said that the world has recognised the Centre’s effort in breeding these once endangered species. India has been invited to partner in the International Project on SeaHorse Breeding, based in the Philippines.

Source: The Financial Express, 11 January, 2007, available at http://www.financialexpress.com/fe_full_story.php?content_id=151353

Aquaculture to be developed in coastal States

Our Bureau

CHENNAI , JAN. 10: The Marine Products Export Development Authority (MPEDA) is pushing for development of aquaculture in coastal States such as Gujarat, Maharashtra and Orissa through a mission mode programme, according to its, Director (Marketing), Mr Kuruvilla Thomas.

Mission mode programme

Addressing a press conference on the eve of the inauguration of Indaqua 2007, a conference and exhibition of the aquaculture industry to be held here from Thursday, he said the mission mode programme was part of an action plan for the development of aquaculture industry.

Development of coastal aquaculture and use of waste and barren lands for freshwater shrimp farming were among the components of the master plan. The mission mode programme would target bringing under aquaculture over 50,000 hectares in Gujarat over the next five years, 30,000 hectares in Maharashtra and over 10,000 hectares under freshwater prawn farming in Orissa.

Tech tie up

MPEDA will also sign an agreement with the Swiss Import Promotion Programme for

consultancy and technical collaboration on organic aquaculture in India. Exclusive sessions to promote ornamental fish culture and exports will also be conducted.

The event will showcase and promote aquaculture products and services, address technical issues in aquaculture and highlight practices like good seed

INTERNATIONAL

Hot waters make it hard for fish to breathe

Climate change causes eelpout population to crash from suffocation.

Katharine Sanderson

The warming of the oceans is having a cruel effect on some fish: they can't breathe fast enough to survive in a hotter home.

Hans Pörtner and Rainer Knust from the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven, Germany, studied the viviparous eelpout (*Zoarces viviparus*), a fish that lives in the northern Wadden Sea. When summer water temperatures were about 20 degrees C the fish were fine, but after a hot summer of 25 degrees C, the fish population crashed to nearly zero.

The reason, the team concluded after lab studies of the fish, is that the animals' cardiovascular systems were working at the limits of their comfort zone. As the fishes' metabolism speeds up in higher temperatures, they need more oxygen, but their hearts can't pump fast enough to provide it.

Every species has a temperature range, or 'thermal window', within which it can breathe comfortably. The eelpout of the Wadden Sea are now butting up against the upper limits of their window, says Pörtner. The fish don't like to move too far from their natural habitat, so are unlikely to swim north to cooler waters. The alternative is suffocation.

The largest of the species die off first, says Pörtner, because it takes even more energy to pump oxygen around a large animal than a smaller one.

What makes things worse is the fact that warmer waters contain less dissolved gas, including oxygen. And warm conditions may become more

cultivation and quality of output. Over 120 exhibitors including hatcheries, feed mills, input suppliers, machinery manufacturers and services providers will put up stalls.

Source: Business Line, 11 January, 2007, available <http://www.thehindubusinessline.com/2007/01/11/stories/2007011103731200.htm>

common in the future: these waters have warmed by 1.13 degrees C over the past 40 years.

Combined, the future looks bleak for fish struggling to catch a breath, they report in Science1.

Hotting up

Michael St John, an oceanographer at Hamburg University's Institute for Hydrobiology and Fisheries Science in Germany says that Pörtner's physiology experiments are first rate. But he suspects there are a raft of different effects causing the eelpout crashes.

Other factors to do with warming waters can spell bad news for fish, such as new predators or competing species that arrive in their habitat. But Pörtner says that the physiological process of oxygen demand is the first thing to respond to warmer seas, and is the major mechanism to blame for the decline of the eelpout.

The notion that animals have a thermal window within which they are comfortable is not new. But the eelpout study is unique in showing how climate change can cause a species to cross the upper limits of their window and crash.

Tobias Wang, a zoophysiologicalist at Aarhus University, Denmark, is impressed that Pörtner has linked observations of populations declining with this physiological explanation. Both he and Pörtner suspect that this mechanism will cause many other species to crash too.

The eelpout will need to shift their thermal window if they are to survive the higher temperatures of their habitat. But there is no sign of that happening,

says Pörtner. "They may be able to adapt over long times but the current speed of global warming won't allow that."

References

Pörtner O., Knust R., et al. *Science*, 315. 95 - 97 (2007).

Source: Nature News available at <http://www.nature.com/news/2007/070101/full/070101-5.html>

Sea Snakes Conquered by Salt

By Elizabeth Pennisi

ScienceNOW Daily News, 5 January 2007

PHOENIX, ARIZONA--Shipwrecked sailors shouldn't drink ocean water no matter how thirsty they get. And neither should sea snakes. Contrary to the current dogma, at least some of these serpentine mariners must have freshwater to survive. Research shows that without it, at least one group of sea snakes--and likely others--will gradually waste away, researchers reported here yesterday at the annual meeting of the Society for Integrative and Comparative Biology. The need for access to fresh water may limit where these snakes can live, explaining their patchy distribution along certain coastlines.

All organisms must work to keep dehydration in check. Kidneys concentrate urine to conserve water, and many marine animals have special adaptations for getting rid of the excess salt taken in from the surrounding environment. Sea snakes--dozens of species of which live in the open ocean, while a few others hang out inshore--have a gland under their tongues for this purpose. Researchers have long assumed that this gland worked so well that the snakes could get away with sipping salt water whenever they needed a drink.

But Harvey Lillywhite, an ecological physiologist at the University of Florida in Gainesville, began to suspect otherwise when he had trouble keeping file snakes, which live almost fulltime in the ocean, alive in his lab. He discovered the snakes did fine once he put them in fresh water and began to wonder if the same was true of other marine snakes.

With the help of Ming Tu from the National Taiwan Normal University in Taipei, Lillywhite and his colleagues collected three species of sea kraits, snakes that live in the coastal waters of islands off Taiwan but, at the very least, come ashore to lay their eggs, usually in rocky caves close to the intertidal zone. Two of the species also visit land occasionally. All have the brine-secreting gland, suggesting they are well adapted to constant immersion in salt water.

For their experiments, the researchers first took the snakes out of water long enough to allow them to dehydrate. They then put the snakes in different concentrations of seawater. None of the dehydrated snakes tried to drink anything that was 50% or more salt water (They live in full-strength seawater.) But they did gulp down water fresh water and imbibed 25% saltwater concentrations, Lillywhite reported.

In a second study, Lillywhite's team tracked the weight of the snakes for 10 days. For the experiment, they kept the snakes in the seawater without food. The researchers placed half of the snakes in fresh water every other day for an hour. All the snakes experienced dehydration and lost weight, but the ones exposed to fresh water lost significantly less, says Lillywhite.

The results help explain the demographics of these Taiwanese snakes, Lillywhite says. They tend to be most plentiful along the shore, where there are springs or other sources of fresh water nearby. Furthermore, there are more sea snake species in areas with higher mean annual rainfalls, notes Lillywhite. Under calm conditions, thin layers of rain will float on top of the salt water, apparently providing ample supplies for the snakes.

It's a "major finding," says Harold Heatwole, an ecologist at North Carolina State University in Raleigh. Physiologist Lisa Hazard from Montclair State University in Upper Montclair, New Jersey, agrees. "He shows pretty clearly that [sea snakes] have to have access to fresh water," she says.

Source : Science Now News, available at <http://sciencenow.sciencemag.org/cgi/content/full/2007/105/1>

ProFauna's Annual Reflection on Turtle Trade in Indonesia

A new modus in smuggling turtles

The year 2006 was "the Year of Turtles" proclaimed by IOSEA (Indian Ocean and South East Asia) Secretariat and signed in agreement by the Indonesian government. Indonesia with its shoreline and vast seas possess 6 out of 7 of the world's turtle species. All turtle and parts of turtles are protected under statutory law in Indonesia. According to Act. No. 5/1990 on Biodiversity and Ecosystem Conservation, conduct of protected wildlife trade, including turtles, are subject to a maximum sentence of 5 years in prison and a fine up to Rp. 100 million.

Although regulated by law, turtle and parts of turtle trade is still frequently taking place in many places around the country. Turtles are traded in the form of meat, eggs, shell, and souvenirs made from parts of the turtle's body.

Since 1999, ProFauna Indonesia has worked on a campaign for turtle protection and a campaign against all manifestations of turtle trade. The following are ProFauna's records on turtle trade in Indonesia during the year 2006.

Turtle smuggling into Bali

In 1999, ProFauna proved that Bali is a center for turtle meat trade. At that time, 27,000 turtles were slaughtered every year to get the meat. Following ProFauna's campaign to halt turtle trade in Bali in 2001, the police conducted mass-scale confiscation to stop turtle trade in Bali. The operation resulted in four turtle traders brought to court and sentenced to prison for a period of 6 months up to 1 year. Since then, turtle trade in Bali has decreased to 80%.

Although turtle meat trade in Bali has significantly been reduced, it does not mean that turtle trade has stopped altogether. Smuggling of turtles into Bali is a frequently sighted activity. Today, ProFauna estimates that there are around 1000–2000 green turtles (*Chelonia mydas*) being smuggled every year to Bali. This is proven by the fact that in the

last 3 years (2004–06) there were 12 cases in which ship vessels carrying turtles into the island had been seized.

In the year of 2006, the local Bali marine police managed to capture 2 vessels carrying turtles to Bali and 1 vessel was caught by the West Nusa Tenggara police. The seized vessels had been found to be carrying 7–200 green turtles each. This is evidence that smuggling of turtles is still happening in Bali until today.

Those turtles are of Banyuwangi, Madura and Sulawesi dan Flores seas origin. The relatively high demand for turtle meat in Bali has caused smugglers to take chances in breaking into the island despite strict law enforcement by the police. If previously the turtle traders smuggled live turtles, now they are more keen on smuggling turtle meat. Along the journey, those turtles are slaughtered in the middle of the sea, chopped into small pieces to disguise their cargo, and later make it hard for the officers to inspect and identify.

To meet the needs for turtle meat in Bali, people often come to the seas in Merubetiri and Alas Purwo National Parks in East Java to obtain catch. Turtles are caught one by one through diving, no longer using nets as were used in previous years.

Turtle trade in the southern Java beaches

According to ProFauna records, roughly 1000 turtles are slaughtered each year to create stuffed turtles and sold along the shores of the Southern Java beaches. In addition, 60 turtles are accidentally caught in random fishermen's nets every year. Those accidentally caught turtles are then slaughtered and consumed for their meat.

Turtle trade in the shores of the Southern Java Beaches occurs particularly at the following locations: Teluk Penyu Beach, Cilacap, Central Java; Puger Banyuwangi Beach; Pangandaran Beach, West Java; Pelabuhan Ratu Beach, West Java; and Pangumbahan Beach, Sukabumi, West Java.

Current progress to curb turtle trade can be seen through the fact that the number of turtle material-

derived merchandise have decreased to as low as 90% following ProFauna's publication of the organisation's investigation report on turtle trade in Cilacap in 2005. Now 'turtle stock' that had once been in Cilacap has been moved to Pangandaran Beach in West Java.

The trade of turtles and its parts in the Southern Java beaches is now hard to find due to the impacts of the tsunami several months ago that hit the shores of Southern Java quite hard.

Trade of merchandise sourced from hawksbill turtle shells

Positive developments have taken place in Kota Gede, Yogyakarta. Kota Gede, once renowned as the centre for souvenirs made from Hawksbill turtle shells (*Eretmochelys imbricata*), by the end of 2006 has managed to decrease the trade by 90%. After receiving reports from ProFauna, officials from the Conservancy of Natural Resource Council (BKSDA Yogyakarta) carried out awareness and law enforcement efforts at Kota Gede. This resulted in a rapid decline in sales of merchandise of hawksbill turtle shells, and the area is proclaimed to be nearly free of illegal products.

It is a shame that the positive results achieved in Kota Gede were not followed by the same developments of hawksbill turtle souvenir trade in Malioboro Road, Yogyakarta. Although the number has declined, trade of souvenirs made from Hawksbill turtle shells still takes place in several outlets along Malioboro Road. At the end of 2006,

ProFauna recorded that there were 500 souvenirs made from Hawksbill turtle shells.

Turtle egg trade in Sukabumi, west Java

Although turtle egg trade is regulated and protected nationally, it is still legalised by a few regional governments, such as what is happening in Pangumbahan Beach, Sukabumi, West Java. Previously in 2001, the Sukabumi local government released Regional Law (Perda) No. 2/2001 regulating turtle egg trade conducted by private businesses.

Luckily, the law was cancelled by Domestic Affairs Minister the following year through Domestic Affairs Minister Decree No. 9/2005 on Cancellation of Perda No. 2 year 2001. Agreement on the legislation of the decree was achieved due to the hardwork done by the Animal Advocacy Institute (LASA) supported by ProFauna Indonesia.

At the moment, Sukabumi police is handling a law case regarding turtle egg trade. Although proceeding very slowly, ProFauna is hoping that this case will be handed over to court and more law will be enforced strictly in the hope that turtle egg trade will not occur again in Sukabumi.

*Source: I. Wayan Wiradnyana
ProFauna Indonesia
PO BOX 3435 Denpasar, Bali 80034, Indonesia.
Email: profaunabali@indo.net.id*



Film: The Right to Survive – Turtle Conservation and Fisheries Livelihoods

Reviewed by Ashish Fernandes, Oceans Campaigner, Greenpeace India

This 50-minute documentary on turtle conservation in Orissa presents an accurate, factual, yet moving analysis of a complex issue. Orissa's *arribadas* are by now famous, as is the fact that over 10,000 turtles are killed here every year by illegal fishing. Turtle conservation measures are accused, not without some justification, of jeopardising livelihoods. This film captures all viewpoints and goes on to talk of possible solutions that would protect both turtles and traditional fishing livelihoods. In a debate charged with rhetoric, *The Right to Survive* (TRTS) comes as a breath of fresh air. Starting with a focus on the impact that the fishing ban in the core area of the Gahirmatha Marine Sanctuary (GMS) is having on fishing villages such as Kharnasi, the film moves on to the broader issue of the threat that near-shore trawling poses to both turtles and traditional fishing communities. While factual accuracy and a clear script are the film's strongest points, TRTS also captures the flavour of coastal life in the fishing villages of Orissa, with some stunning sequences.

The film starts in the village of Kharnasi, at the edge of the GMS. The declaration of the GMS put a large chunk of the community's historic fishing grounds off limits, forcing them to sail four hours or more to cross the sanctuary to permitted fishing areas. With many families in the vicious grip of money lenders, Kharnasi has recorded several suicides in the last few years. The village in general blames this on the double whammy of indebtedness and the impact of the fishing restrictions on incomes. TRTS accurately zeroes in on one of the more positive developments in recent years, the orders passed by the Supreme Court's Central Empowered Committee in 2004. If implemented, they will serve to significantly reduce both turtle mortality and livelihood impacts among traditional communities.

There are obvious problems with trying to govern a marine area using the terrestrial model laid down by the *Wildlife (Protection) Act, 1972*. For example, under the law, even non-motorised traditional fishers using simple cast nets are prohibited from the GMS, even though this kind of

fishing has absolutely no impact on turtles and very little, if any, on the ecosystem. It is also undeniable that huge turtle mortalities are being experienced along the Devi coastline. Interestingly, the Forest Department has stated on record that it believes there are no turtles in the Devi region and hence it sees no sense in enforcing the fishing restrictions. This despite the fact that beaches around the Devi region have consistently been recording high turtle mortalities! Similarly, while the forest department admits it doesn't have an effective patrolling capacity, it continues to deny that large speed boats with a trained crew are needed to keep illegal trawlers away from the turtle congregations. TRTS accurately zooms in on one simple truth: a fisheries approach will not only safeguard turtles, but also ensure the viability of traditional fishing, by keeping trawlers, the main culprits in terms of turtle mortality and the destruction of near-shore fishing grounds, further out to sea. If fisheries laws were enforced to keep trawlers beyond 20 km. from the coast, turtle congregations would be safe and the fishing grounds of the traditional fishing community would also be protected.

Though the conservation and livelihoods debate is the central theme, TRTS also flags the issue of the many port and oil exploration projects coming up along the coast. Fishermen, researchers and even the Forest Department officials all agree that these projects will cumulatively spell the end for the turtles and for traditional livelihoods. Yet, the conservation vs. livelihood debate seems to be coming in the way of a united opposition to the looming industrial destruction. The film concludes on an unmistakable note of hope and optimism, something which should bring cheer to those who have been following this complicated issue since its beginning over 15 years ago. The filmmakers are of the view that with so many dedicated individuals and groups working to resolve different aspects of the crisis, it should not be long before we begin to see results. For the sake of the ridleys and the fisherfolk of Orissa, let's hope so.

(Originally published in Sanctuary Magazine, December 2006)

Editor

Kartik Shanker

*Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India, and
Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore, India
Email: kshanker@ces.iisc.ernet.in*

Editorial Board

Sali J. Bache

University of Tasmania, Australia

Jeanne A. Mortimer

*Marine Conservation Society Seychelles,
Seychelles*

John G. Frazier

*Conservation & Research Center, Smithsonian
Institution, USA*

Nicolas J. Pilcher

Marine Research Foundation, Sabah, Malaysia

Matthew H. Godfrey

*North Carolina Wildlife Resources
Commission, USA*

Pankaj Sekhsaria

Kalpavriksh, Pune, India

Mark Hamann

James Cook University, Australia

Country Representatives

B.C. Choudhury

Wildlife Institute of India, Dehradun, India

Thushan Kapurusinghe

Turtle Conservation Project, Sri Lanka

S.M.A. Rashid

CARINAM, Dhaka, Bangladesh

Webmasters

Michael Coyne

Duke University, USA

Shiv Subramaniam

*Ashoka Trust for Research in Ecology and the
Environment (ATREE), India*

Editorial Assistants

Aarathi Sridhar

Anusha Koushik

Sudarshan Rodriguez

*Ashoka Trust for Research in Ecology and the
Environment (ATREE), India*

Cover Design: ECOTONE, Chennai

Printed by: Lotus Printers, Bangalore, India.

Cover photograph: T. Raja (Juvenile green turtle released at Nainarkuppam)

CONTENTS

Articles

- S. Bhupathy *Mourning of marine birds along the Kerala and Tamil Nadu coasts* 7
- Paul McClain *Marine turtle immigration events in Echipu District, Karnataka* 10
- Harry V. Andrews *A bibliography of the marine turtles of the Andaman and Nicobar archipelago* 14
- Notes**
- R.L. Meenan, J.V. Yyee and R.S. Jadhav *Sea turtle hatcheries in Kutchiidi, Gujarat* 19
- S. Krishnapalan and S. Devad Kingston *Some observations on exploitation of sea turtles on the Kanyakumari coast* 20
- Saptarshi Bhattacharya *Interactions between Turtle Protection Force and local owners and workers at Kasembar fishing harbour, Chennai* 22
- Saptarshi Bhattacharya *Hyacinth green and hawkbill turtles in the waters of Namakkapuram, Chennai* 23
- Saptarshi Bhattacharya *Creating awareness about sea turtles of Palazhi-Pazaverkachi (North Chennai)* 24
- Reports**
- N.D. Blinn *Report on the workshop on conservation of sea turtles and mangroves at Honnavar, Karnataka* 25
- News and updates** 26

