INDIAN OCEAN TURTLE NEWSLETTER

ISSUE - 10

JULY 2009

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 and kshanker@gmail.com

Manuscripts should be submitted in standard word processor formats or saved as rich text format (RTF). 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 www.iotn.org

Sea turtle conservation in Sri Lanka: assessment of knowledge, attitude and prevalence of consumptive use of turtle products among coastal communities

Rupika S. Rajakaruna[1]*, D.M. Naveen J. Dissanayake[1,2], E.M. Lalith Ekanayake[1,2,3] & Kithsiri B. Ranawana[1]

[1] Department of Zoology, University of Peradeniya, Peradeniya, Sri Lanka
[2] Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka
[3] Turtle Conservation Project, Kosgoda, Sri Lanka
** Author for correspondence: 539 RH Michener Park, Edmonton NW, T6H 4M5 Canada*
Email: rupika.r@gmail.com, rupikar@pdn.ac.lk

Introduction

Five of the world's seven sea turtle species including green turtles, leatherbacks, olive ridleys, hawksbills and loggerheads come to nest on Sri Lankan beaches (Deraniyagala, 1953). The south and southeast coastlines with vast areas of sea grass beds and coral reefs provide important nesting and foraging grounds to sea turtles (Deraniyagala, 1939; Amarasooriya, 2000). In this area human population density is high and tourism is also largely concentrated along the coasts. While fishing is the primary source of income in most Sri Lankan coastal communities, people also depend heavily on other available natural resources including sea turtles. Poverty of coastal communities is often associated with exploitation of meat, eggs and other products of turtles (Salm, 1975; Frazier, 1980). In addition to the food that turtle meat and eggs provide for an individual's household, there are economic benefits associated with the sale of turtle meat, eggs and scutes in the market.

Declines in sea turtle populations are a major concern for conservation biologists and today all sea turtle species are globally protected. In Sri Lanka, under the Fauna and Flora Protection Ordinance (FFPO, 1938 amended in 1972) it is an offence to capture, kill, injure or possess sea turtles or their eggs. Sri Lanka has banned the international trade of sea turtle products. Although this has resulted in a considerable decline in slaughtering, sea turtles and their eggs continue to be exploited in some parts of the country (Hewavisenthi, 1993; Richardson, 1995; Kapurusinghe & Saman, 2001). Until the mid 1990's, the most widespread forms of sea turtle exploitation have been the collection of eggs and killing of adults for their meat and scutes (de Silva, 1996). The FFPO was amended in 1993, subsequently increasing the punishment for offenders. Although killing of sea turtles for their scutes to produce ornaments gradually decreased after this strict law enforcement (de Silva, 2005), turtle eggs are still eaten or sold by the local community in some areas (*personal communication*, Turtle Conservation Project). Moreover, incidental capture of sea turtles in various fisheries along the northwestern, western and southwestern coast of Sri Lanka has been reported (Kapurusinghe & Saman, 2001) which is widely recognized as an important issue in the conservation and the recovery of these threatened and endangered species.

Since 1979, Sri Lanka has been a member of CITES (Convention on International Trade in Endangered Species) which prohibits the import or export of sea turtles and their products. A survey carried out by the Turtle Conservation Project (TCP) in 1994 recorded 112 shops openly selling tortoiseshell products made out of hawksbill shell in 6 towns in popular tourist areas (also see Kapurusinghe, 2006). Even though in 1995 responsible government agencies took action to stop this illegal trade in tortoiseshell, a second survey carried out in 1996 recorded 83 shops selling tortoiseshell in 14 towns (Richardson, 1997). However, a recent survey showed that most of these shops do not buy tortoiseshell products from suppliers any more even though a few shops still carry some of the previously stocked unsold items (Rajakaruna *et al*., unpublished observations).

The Marine Turtle Conservation Strategy and

Action Plan for Sri Lanka was prepared in 2005 as part of a comprehensive, concerted and integrated effort at a national level and it highlights the socio-economic benefits of sea turtle conservation (de Silva, 2005). According to the Action Plan, involvement of the local community in sea turtle conservation, providing alternatives to the coastal communities through developing their talents and increasing awareness in the sustainable use of natural resources has been increased in Sri Lanka (de Silva, 2005). This study was conducted to assess the knowledge of villagers about sea turtles, their attitude towards conservation of sea turtles and the prevalence of consumptive use among the villagers in six villages along the northwestern, western, southwestern and southern coast of Sri Lanka.

Methods

Study area:

Six coastal villages, Kandakuliya, Mattakkuliya, Wedikanda, Kahandamodara, Kosgoda and Rekawa, belonging to four districts of Sri Lanka were selected based on nesting frequency and turtle bycatch data (Amerasooriya, 2000; Figure 1; Table 1). Kandakuliya is a remote village in the Gulf of Mannar on the northwestern coast of the island where there is high incidence of turtle bycatch (Kapurusinghe & Cooray, 2002; Shanker & Choudhury, 2006) but no nesting. Mattakkuliya is a small town close to Colombo, the former administrative capital and the largest city of Sri Lanka, where there is no recorded turtle nesting or bycatch. Wedikanda, on the west coast of the island, is a low nesting village occasionally visited by green turtles and olive ridleys. Kahandamodara is a very small village located on the southern coast of Sri Lanka with moderate nesting. Rekawa is also located on the south coast of Sri Lanka close to Kahandamodara but has very high nesting frequency. Rekawa is visited by all five species of turtles nesting year round. Kosgoda is located in the southwestern coast and has a high nesting frequency. All five turtle species visit Kosgoda beach as well. In addition to *in-situ* conservation programmes in Rekawa and Kosgoda, long term turtle awareness programmes are being conducted in and around these high nesting villages by non-governmental organizations such as TCP in collaboration with the Department of Wildlife (DWL), Sri Lanka. In Kandakuliya turtle awareness programmes are conducted by TCP.

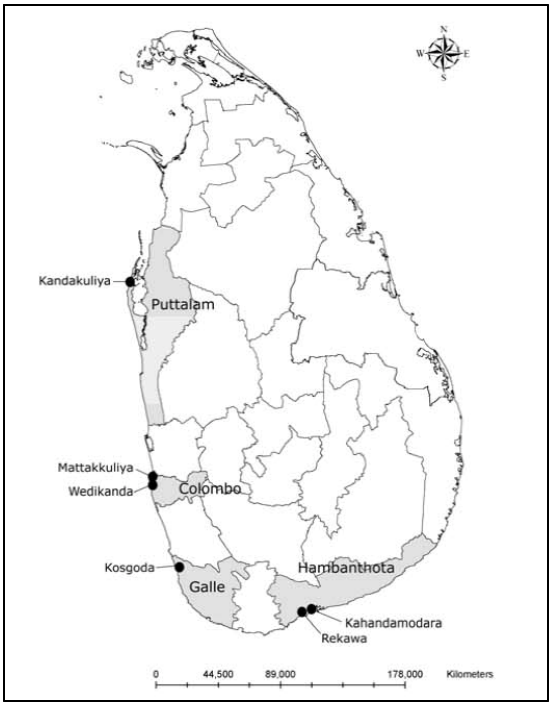

Figure 1: Map of Sri Lanka showing the six study villages and the districts along the northwestern, western, southwestern and southern coast.

Table 1. Site description, population, turtle species occurring and annual nest density of the six villages surveyed.

Village	Site description	Human Population	Species occurring	Annual nest density/km
Kandakuliya	No nesting/ bycatch only	4,115	Olive ridley	0
Mattakkuliya	No nesting/ no bycatch	34,082	None	0
Wedikanda	Low nesting	7,847	Green & olive ridley	< 25 nests
Kahandamodara	Moderate nesting	833	Green, olive ridley, leatherback & loggerhead	150 nests
Kosgoda	High nesting	7,329	Green, olive ridley, leatherback, loggerhead & hawksbill	325 nests
Rekawa	Very high nesting	1,833	Green, olive ridley, leatherback, loggerhead & hawksbill	>375 nests

Data collection

One hundred randomly selected villagers were interviewed from each village and the data were collected over a period of four months from May to August 2007. A verbal consent was sought from the participants after explaining the objectives of the study. Structured interviews were conducted with each villager in the vernacular (Sinhala or Tamil with a translator) using a questionnaire. Information about the respondent (age, sex, educational background and occupation) and his/her family (household income, number of members in the family) were collected during the interview. Specific questions were asked to the respondents to assess his/her knowledge about sea turtles, attitude towards sea turtle conservation and the consumptive use of turtle eggs, meat and other products. An interview lasted 20-40 minutes. By combining several questions the following three aggregate variables were generated.

a) Knowledge about sea turtles:

The villagers were asked the nine following questions to assess their knowledge about sea turtles. 1) How many sea turtle species visit Sri Lanka? 2) Who comes to the beach - male, female or both? 3) Why do they come to the beach? 4) What time of the day do they come to the beach? 5) Is there a difference in visiting frequency depending on lunar cycle of the month? 6) Is there a difference in visiting frequency depending on the month of the year? 7) Have you seen females laying eggs? 8) How many eggs does a female lay at a time? 9) Are all the eggs laid at once during one reproductive cycle? During the interview answers were presented to the participants as multiple choices for them to pick the answer they thought was most correct to each question. One point was assigned to each correct answer and a zero for incorrect or 'don't know' answer. If a respondent scored more than 50% (i.e. five or more correct answers), he/she was considered as having sufficient knowledge about sea turtles.

b) Attitude towards sea turtle conservation:

This was assessed by the awareness of the respondent regarding the protected status of sea turtles and their attitude towards sea turtle conservation. The following four questions were asked. 1) Do you think it is necessary to conserve sea turtles? 2) Do you think that selling eggs or meat or other turtle products provide a good income source for the villagers? 3) Do you think that because of the turtle conservation legislation some people lost their sources of income? 4) Do you consider that hatcheries play an important role in conserving sea turtles? Responses were taken as binary outcome (yes/no). For questions 1 and 4 answering "yes" and for questions 2 and 3

answering "no" was considered as having a positive attitude towards sea turtle conservation. If a villager scored more than 50% (i.e. more than two expected answers) he/she was considered as having a positive attitude towards sea turtle conservation.

c) Prevalence of consumptive use of sea turtle eggs, meat and other products:

Four questions were asked to assess the prevalence of consumptive use of sea turtle eggs, meat and other products among the villagers. 1) Have you ever consumed turtle eggs? 2) Have you ever bought turtle eggs and/or meat in the market? 3) Have you ever sold meat, eggs or any other product of turtles? 4) Have you ever bought any ornaments made out of turtle shell or other body parts? All the answers were recorded as either "yes" or "no" and follow-up questions were asked if the answer was "yes" to find out where they have purchased/sold meat, eggs or other turtle products and when. If a villager answered "yes" for two or more questions, his/her individual consumptive use was considered high. In each village the percentage of respondents with high consumptive use was calculated.

Data analysis

A comparison on respondents from different villages was carried out to see whether the presence of nesting has an effect on the three aggregated variables; knowledge about sea turtles, attitude towards sea turtle conservation and prevalence of consumptive use of sea turtle products. A chi-square test was used comparing Mattakkuliya (no nesting, no bycatch village) with nesting villages (Wedikanda, Kahandamodara, Kosgoda and Rekawa) separately. It also compared Kandakuliya (no nesting bycatch only village) between all other villages separately. The six explanatory variables (age, sex, education, occupation of the respondent, household income and number of members in the family) were included in the analysis to explain the differences found in the three aggregated variables. A logistic regression model was applied to analyse the effect of each explanatory variable on the three aggregated variables taking all responses as binary outcome. The results of the logistic regression analysis were reported as odds ratios (OR) together with their 95% confidence intervals (CI). Statistical analysis was carried out using Stata 8.2.

Results

Profile of the villagers

Of the 600 respondents interviewed in six villages, the majority (76%) were males (Table 2). When consent was sought some females were reluctant to participate in the study and hence they were not interviewed. Most of the respondents were between ages 18-30 years (72%). The main source of income of the villagers was fishing and fishing related occupations (46%). Others were employed as vendors or running their own grocery stores or boutiques selling ornaments and souvenirs to local and foreign tourists, tour guides, taxi drivers, construction workers or working in hotels along the coastline. More than 50% of the women interviewed were homemakers. The level of education of the respondents was low, with more than half (60%) of them having completed only elementary education (up to grade 6) or less. This was particularly low in Kandakuliya village where 84% of the respondents had only elementary or no education. Overall, the coastal community was poor with a monthly household income of less than Rs.10,000 (less than 100 US$) in most of the villages (68%), with more than half earning only Rs. 5,000 or less a month. On average, the coastal community had five members in a family.

Knowledge about sea turtles

Majority of the villagers (more than 85%), even from non-nesting areas, were well aware that only the female visits the beach to lay eggs during the night (Questions 2, 3 & 4; Figure 2). More than half of the respondents said that they had seen females laying eggs and had an idea about the number of eggs a female lays at a time (Questions 7 & 8), while only a few respondents (27%) knew that there are five species visiting Sri Lankan beaches (Question 1). Most of the respondents (93%) were unaware that there is a nesting season and that a female may come ashore more than once (87%; Questions 5, 6 and 9; Figure 2).

Table 2. Profile of the respondents in six villages. (KL = Kandakuliya, MK = Mattakkuliya, WK= Wedikanda, KM = Kahandamodara, KG = Kosgoda, RK = Rekawa. n = 100 per village).

Explanatory Variable		Village						Total
		KL	MK	WK	KG	RK	KM	
Age (years)	<18	1	6	8	1	13	4	6
	>30	24	20	29	25	19	17	22
	18-30	75	74	63	74	68	79	72
Occupation	Fishing & related	78	47	62	15	25	48	46
	Business	5	6	8	18	3	5	8
	Homemakers	9	22	14	21	16	18	16
	Other	8	25	16	46	56	29	30
Sex	Male	84	74	84	75	65	74	76
	Female	16	26	16	25	35	26	24
Education level	No education	9	9	8	1	0	4	5
	Elementary only	75	63	64	38	43	48	55
	Secondary only	14	27	28	51	51	38	35
	Higher	2	1	0	10	6	10	5
Income level (LKR)	< 5 K	16	55	19	21	64	55	38
	5-10 K	33	21	33	31	27	34	30
	10-20 K	37	21	41	33	7	9	25
	20 K <	14	3	7	15	2	2	7
No. of family members	≤3	32	46	36	25	34	42	36
	4-6	64	42	59	57	46	42	52
	≥6	34	12	5	18	20	16	12

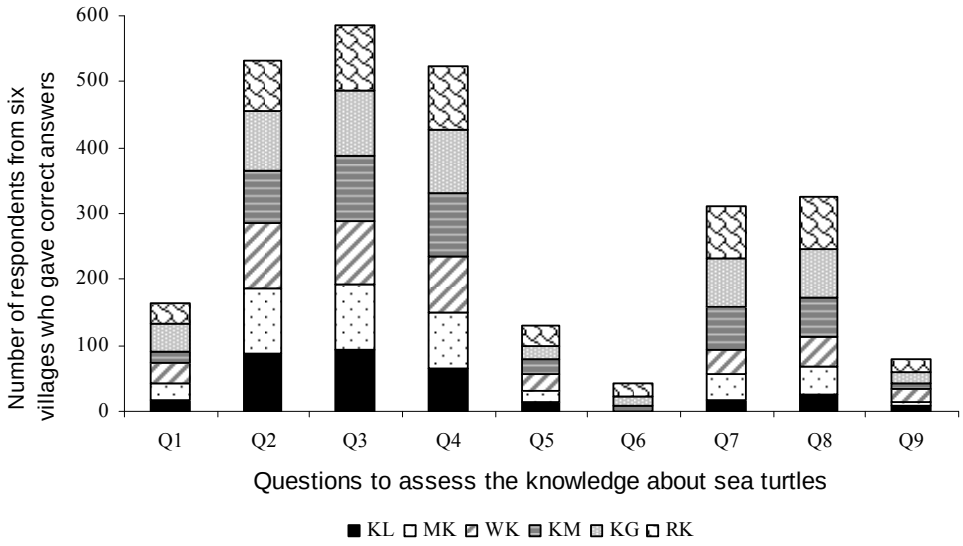

Figure 2: Number of respondents in the six villagers who gave correct answers to nine questions assessing the knowledge about sea turtles. (KL = Kandakuliya, MK = Mattakkuliya, WK= Wedikanda, KM = Kahandamodara, KG = Kosgoda, RK = Rekawa. n = 100 per village).

Attitude towards sea turtle conservation

On average, majority of the respondents (73%) had a positive attitude towards sea turtle conservation, specifically they did not consider that people had lost their sources of income due to implementation of turtle conservation legislations. Based on the percentage distribution of responses, villages were categorised as having poor (<35%), average (35% - <65%) or positive (> 65%) attitude. The attitude of the villagers in Kandakuliya (53%) and Wedikanda (55%) was average while in all other villages it was positive (more than 66%; Figure 3).

When the attitude of the villagers in Kandakuliya was compared with that of the nesting villages (Rekawa, Kosgoda, Kahandamodara and Wedikanda) it was found that villagers of nesting areas had a significantly positive attitude (Kahandamodara $\chi^2 = 12.66$, $p < 0.001$; Kosgoda $\chi^2 = 27.51$, $p < 0.001$; Rekawa $\chi^2 = 25.69$, $p < 0.001$) about sea turtles except in Wedikanda ($\chi^2 = 0.08$, $p = 0.77$; Table 3). Villagers from nesting areas had a better attitude about sea turtles than villagers in Mattakkuliya but the difference was not statistically significant (Chi-square; $p > 0.05$; Table 3). However, the attitude in villagers in Mattakkuliya was significantly more positive than that of the villagers in Kandakuliya (no nesting, bycatch only; $\chi^2 = 17.73$, $p < 0.001$; Table 3) and Wedikanda ($\chi^2 = 15.53$, $p < 0.001$; Table 3).

Prevalence of consumptive use of sea turtle eggs, meat and other products

Overall, 22% of the respondents in the six villages had a high consumptive use, answering "yes" to two or more questions based on their involvement in eating, buying and selling of turtle eggs, meat or other products, with Kandakuliya recording the highest (46%) followed by Wedikanda (33%) and Kosgoda recording the lowest (6%; Figure 3). Based on the distribution of the percentage prevalence of high consumptive users in the six villages, each village was categorized as low (<25%), moderate (25% - <50%), and high (50% and above). Among the villages, Kandakuliya and Wedikanda had moderate levels while Kosgoda, Rekawa (14%), Kahandamodara (14%) and Mattakkuliya (17%) had a low level of consumptive use.

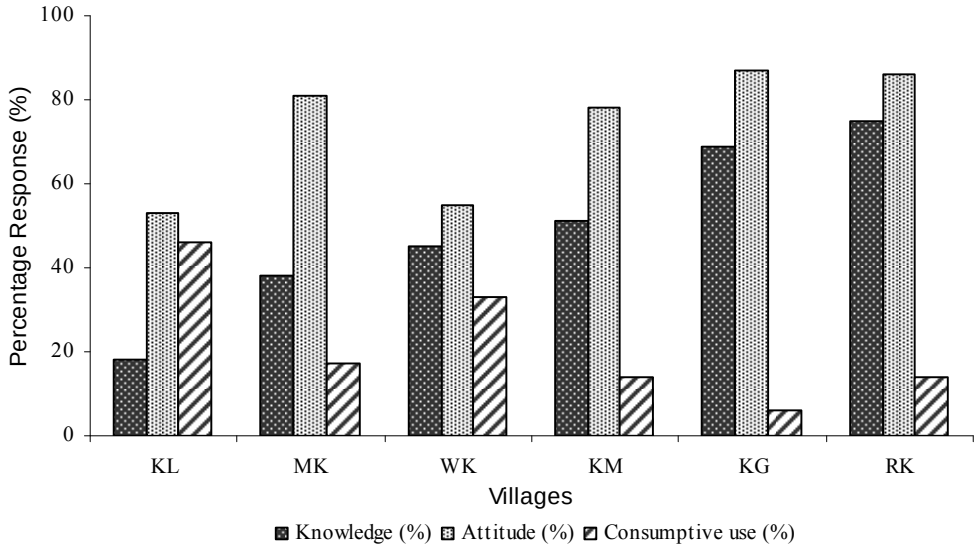

Figure 3: Percentage of respondents who have sufficient knowledge about sea turtles, positive attitude towards sea turtle conservation and high consumptive use in six villages.
KL = Kandakuliya, MK = Mattakkuliya, WK= Wedikanda, KM = Kahandamodara, KG = Kosgoda, RK = Rekawa. n = 100 per village.

Table 3. Comparison of respondents' knowledge about sea turtles, attitude towards conservation of sea turtles and consumptive use of turtle products in nesting and no-nesting villages.
Four villages with different nesting frequencies were compared with villages that have no nesting. n = 100 per village**.** * denotes significant differences at p <0.05; **denotes significant differences at p <0.01.

	Village (nesting frequency)	**Exposure Variable**					
		Knowledge		**Attitude**		**Consumptive use**	
		χ^2	***p***	χ^2	***p***	χ^2	***p***
Kandakuliya	Mattakkuliya (no nesting)	9.92	0.002*	17.73	0.000**	19.49	0.000**
	Wedikanda (low)	16.89	0.000**	0.08	0.777	3.54	0.060
	Kahandamodara (moderate)	24.09	0.000**	12.66	0.000**	22.69	0.000**
	Kosgoda (high)	54.87	0.000**	27.52	0.000**	41.58	0.000**
	Rekawa (very high)	65.30	0.000**	25.69	0.000**	24.38	0.000**
Mattakkuliya	Wedikanda (low)	1.01	0.315	15.53	0.000**	6.83	0.009**
	Kahandamodara (moderate)	3.42	0.064	0.48	0.487	0.15	0.700
	Kosgoda (high)	20.61	0.000*	1.34	0.247	5.94	0.015*
	Rekawa (very high)	27.85	0.000*	0.91	0.341	0.34	0.558

In all the nesting villages consumptive use of turtle products was significantly less compared to Kandakuliya (Chi square; p <0.05) except in Wedikanda, which was close to significant (χ^2 = 3.54, p = 0.060; Table 3). When the nesting villages were compared with Mattakkuliya, a significantly less consumption was observed only in Kosgoda (χ^2 = 5.94, p = 0.015; Table 3). In

Mattakkuliya consumptive use was significantly less compared to that of Wedikanda ($\chi^2 = 6.83$, $p = 0.009$) and Kandakuliya ($\chi^2 = 19.49$, $p < 0.001$; Table 3).

Of the 600 participants, 375 (62.5%) had eaten either turtle eggs or meat (or both), with people from Kandakuliya displaying the highest proportion (81/100) and Rekawa being the second highest (67/100; Table 4). Even though a high percentage of people in Rekawa had eaten turtle eggs and/or meat, 88% of them (59/67) had consumed more than five years ago and only one person said he had eaten turtle eggs during the last six months of the study period. In contrast, more than 30% (25/81) of villages in Kandakuliya had consumed turtle meat during the last six months of the study period and more than 55% (45/81) had consumed meat during the last five years. Villagers in Wedikanda also had a high recent (less than six months) consumption of 22.7% (15/66) followed by Mattakkuliya 13.7% (7/51). However, out of all those that had eaten turtle eggs and/or meat in the six villages, 60% of the respondents (226/375) had eaten it more than five years ago (Table 4).

A large percentage of respondents in Kandakuliya (62/100) had bought eggs and/or meat in the market or from other vendors, more than one fourth of which (16/62) had occurred during the last six months of the study period. Recent purchases of turtle meat and/or eggs had also taken place in Mattakkuliya (5/22) and in Wedikanda (8/41). However, in Kosgoda and Rekawa none of the villagers said that they had bought turtle meat and/or eggs during the last year of the study period. Only a small percentage of villagers from Kosgoda (3/100) and Rekawa (13/100) and Kahandamodara (3/100) were involved in selling turtle products. In Rekawa and Kosgoda all the villagers interviewed claimed that they were involved in selling these more than 5 years ago. However, even recently, villagers from Wedikanda and Kandakuliya had been involved in selling turtle eggs, or meat or other products (4/17 and 3/16, respectively; Table 4).

Only one respondent from Mattakkuliya had purchased ornaments made out of turtle products (tortoiseshell), which was more than five years before the study period. All the other respondents claimed that they had never purchased any ornament made out of tortoiseshell and/or turtle bone.

Factors affecting knowledge and attitude towards conservation of sea turtles

We analysed how the six explanatory variables; age, occupation, sex, education, monthly income and number of family members affect the three response variables using a logistic model. Age, monthly income and number of family members of the respondents did not have a significant effect on the knowledge and attitude towards sea turtle conservation (Table 5). Even though males seem to have a significantly higher knowledge about sea turtles (OR 5.34, CI = 3.433 – 8.331, $p < 0.001$), females had a more positive attitude towards conservation of sea turtles than males (OR = 0.148, CI = 0.045 – 0.481; $p = 0.001$). There was no difference in the knowledge of fishers and villagers occupied in non-fishing jobs (OR = 0.962, 95% CI = 0.698 – 1.325, $p > 0.05$). However, non-fishers had a better attitude towards conservation of sea turtles than fishers (OR = 1.852, 95% CI = 1.071 – 3.201, $p = 0.027$; Table 5). Level of education had a significant effect on the knowledge of sea turtles. Knowledge about sea turtles of respondents with secondary or higher education was significantly higher (OR = 1.46, 95% CI = 1.055 – 2.040, $p = 0.022$) and there was a trend for better attitude compared to the respondents having only elementary or lower education (OR = 1.712, 95% CI = 0.951 – 3.080, $p = 0.073$; Table 5).

Factors affecting consumptive use of sea turtle eggs, meat and other products

Age, monthly income and number of family members of the respondents did not have a significant effect on the consumptive use of turtle products (Table 5). However, sex, education and occupation had significant effects with females showing less consumptive use than males (OR = 1.46, CI = 1.055 – 2.040, $p < 0.008$). Consumptive use was higher in villagers with better education (secondary and higher) than those with only elementary or lower education (OR = 6.425, 95% CI = 1.930 – 21.382, $p = 0.002$) and in people involved in occupations not related to fishing compared to fishermen (OR = 4.847, 95% CI = 1.958 – 11.997, $p = 0.001$; Table 5).

All the above information was based on the responses received from the villagers who were interviewed. It is important to mention here that what villagers claim during an interview may not exactly equal what they practice.

Table 4. Responses of participants in the assessment of consumptive use of turtle eggs, meat and other products in six villages.

Consumptive use of sea turtles	Village						Total
	KL	MK	WK	KG	RK	KM	
Consumed eggs or meat	**81/100**	**51/100**	**66/100**	**48/100**	**67/100**	**62/100**	**62.5% (375/600)**
Consumed in the village	92.6% (75/81)	94.1% (48/51)	100% (66/66)	100% (48/48)	89.6% (60/67)	98.4% (61/62)	95.5% (358/375)
When Last 6 months	30.9% (25/81)	13.7% (7/51)	22.7% (15/66)	4.2% (2/48)	1.5% (1/67)	3.2% (2/62)	13.9 % (52/375)
Last year	7.4% (6/81)	5.9% (3/51)	4.5% (3/66)	2.1% (1/48)	3.0% (2/67)	4.8% (3/62)	4.8% (18/375)
1 – 5 years	17.3% (14/81)	23.5% (12/51)	30.3% (20/66)	20.8% (10/48)	7.5% (5/67)	29.0% (18/62)	21.1% (79/375)
5 < years or don't remember	44.4% (36/81)	56.9% (29/51)	42.4% (28/66)	72.9% (35/48)	88.1% (59/67)	62.9% (39/62)	60.3% (226/375)
Bought eggs or meat	**62/100**	**22/100**	**41/100**	**3/100**	**8/100**	**19/100**	**25.8% (155/600)**
Bought from the village	90.3% (56/62)	86.4% (19/22)	100% (41/41)	66.7% (2/3)	87.5% (7/8)	94.7% (18/19)	92.3% (143/155)
When Last 6 months	25.8% (16/62)	22.7% (5/22)	19.5% (8/41)	0	0	5.3% (1/19)	19.4% (30/155)
Last year	12.9% (8/62)	13.6% (3/22)	2.4% (1/41)	0	0	15.8% (3/19)	9.7% (15/155)
1 – years ago	16.1% (10/62)	18.2% (4/22)	39.0% (16/41)	66.7% (2/3)	12.5% (1/8)	36.8% (7/19)	25.8% (40/155)
5 < years or don't remember	45.2% (28/62)	45.5% (10/22)	39.0% (16/41)	33.3% (1/3)	87.5% (7/8)	42.1% (8/19)	45.2% (70/155)
Sold eggs, meat or other products	**16/100**	**13/100**	**17/100**	**4/100**	**13/100**	**3/100**	**11% (66/600)**
Sold in the village	93.8% (15/16)	92.3% (12/13)	100% (17/17)	75% (3/4)	92.3% (12/13)	100% (3/3)	93.9% (62/66)
When Last 6 months	18.8% (3/16)	0	23.5% (4/17)	0	0	0	10.6% (7/66)
Last year	6.3% (1/16)	7.7% (1/13)	0	0	0	0	3.0% (2/66)
1 – years ago	6.3% (1/16)	23.1% (3/13)	5.9% (1/17)	0	0	66.7% (2/3)	10.6% (7/66)
5 < years or don't remember	68.8% (11/16)	69.2% (9/13)	70.6% (12/17)	100% (4/4)	100% (13/13)	33.3% (1/3)	75.8% (50/66)
Bought ornaments	**0**	**1/100**	**0**	**0**	**0**	**0**	**0.2% (1/600)**
Bought in the village	0	0	0	0	0	0	0
When Last 6 months	0	0	0	0	0	0	0
Last year	0	0	0	0	0	0	0
1 – years ago	0	0	0	0	0	0	0
5 < years or don't remember	0	100%	0	0	0	0	100%

Table 5. Effect of six explanatory variables on the villagers' knowledge about sea turtles, attitude towards conservation of sea turtles and their consumptive use of eggs, meat and other turtle products.

Explanatory Variable		Aggregated Response Variable					
		Knowledge		Attitude		Consumptive use of turtle products	
		Bivariate Analysis	OR (95% CI) *P*	Bivariate Analysis	OR (95% CI) *P*	Bivariate Analysis	OR (95% CI) *P*
Age (years)	18 – 30	46% (61/134)	1.167 (0.580 – 2.349) 0.664	90% (121/134)	0.853 (0.241 – 3.348) 0.800	97% (130/134)	1.017 (0.230 – 4.490) 0.982
	30 and above	51% (220/432)		90% (388/432)		94% (407/432)	
Occupation	Fishers & related	50% (144/288)	0.962 (0.698 – 1.325) 0.814	87% (251/288)	1.852 (1.071 – 3.201) 0.027*	91% (263/288)	4.847 (1.958 – 1.997) 0.001*
	Other	49% (153/312)		93% (289/312)		98% (306/312)	
Sex	Male	58% (266/455)	5.34 (3.433 – 8.331) 0.000**	87% (398/455)	0.148 (0.045 – 0.481) 0.001*	90% (41/455)	1.46 (1.055 – 2.040) 0.008*
	Female	21% (30/145)		98% (141/145)		86% (124/145)	
Education level	Elementary or >	46% (167/365)	1.46 (1.055 – 2.040) 0.022*	88% (322/365)	1.712 (0.951 -3.080) 0.073	92% (337/365)	6.425 (1.930 – 1.382) 0.002*
	Secondary or <	55% (130/235)		93% (218/235)		99% (232/235)	
Income level	Poor (< 10,000 Rs)	48% (212/443)	1.286 (0.892 – 1.853) 0.176	89% (395/443)	1.468 (0.758 – 2.842) 0.253	96% (424/443)	0.541 (0.256 – 1.142) 0.107
	Moderate (10-20,000 Rs.)	54% (85/157)		92% (145/157)		92% (145/157)	
No. of family members	Small (5 or less)	51% (234/457)	0.738 (0.505 – 1.078) 0.116	90% (413/457)	0.838 (0.457 – 1.537) 0.570	95% (434/457)	0.887 (0.388 -2.030) 0.778
	Large (6 or more)	44% (62/143)		89% (126/143)		94% (134/143)	

* Significant at $p < 0.05$, ** Significant at $p < 0.001$; OR = Odds ratios, CI = confidence interval

Discussion

Coastal communities from nesting areas had a significantly higher knowledge about sea turtles than villagers from non-nesting areas. They had a more positive attitude towards sea turtle conservation than villagers from Kandakuliya and Wedikanda. Moreover, the consumptive use of turtle eggs, meat and other turtle products was much less in nesting areas except in Wedikanda, a low nesting village. Even though a large number of participants from nesting villages had eaten turtle meat and/or eggs, not many of them had been involved in buying or selling turtle meat, eggs or other products. Moreover, much of the consumption in these high nesting villages took place more than five years before the study period.

Villagers in Kandakuliya had poor knowledge about sea turtles and a high consumptive use, being involved in eating, purchasing and selling turtle meat. Kandakuliya is located on the northwestern coast of the island where there is no nesting but high turtle bycatch. It may not be surprising that the respondents living in areas where there was no nesting lack knowledge about sea turtles since they have not seen turtles coming to the beach and laying eggs. As most of the questions were about turtle nesting, villagers' poor knowledge of turtles predominantly reflects poor knowledge of turtle nesting behaviour. If questions had been based on the behaviour of turtles at sea, as most respondents happened to be fishers, they may have scored more. Nonetheless, villagers in Kandakuliya still continue to eat, buy and/or sell turtle meat or eggs.

In Sri Lanka bycatch is thought to be the leading cause of mortality for the island's turtle population (Jones & Fernando, 1968; Jinadasa, 1984). A survey reported that an annual catch of more than 5000 turtles occurs from the northwestern to the southern coast of Sri Lanka (Kapurusinghe & Cooray, 2002). Some of these may be incidental take of drowned turtles during fishing activities and used for subsistence purposes. However, many reports show that people in the north are accomplished turtle-catchers and are known to use a variety of nets to capture sea turtles (Frazier, 1980; Hewavisenthi, 1990). Moreover, there are reports witnessing the butchery and selling of live turtles openly in Kandakuliya and northwestern parts of the island (also see Kapurusinghe, 2006). This shows that captures are not all incidental but some turtles are caught purposely to meet cash needs through the selling of meat. Although legislative measures are in place to control the killing of turtles for meat and poaching their eggs, their enforcement needs to be strengthened, specifically in the northern part of the island now that the impediment of civil war conflict is gone.

Even though Mattakkuliya has no turtle nesting or bycatch, villagers had a significantly higher knowledge about sea turtles than those in Kandakuliya. In general, people living in villages close to large cities tend to have better education, easy access to media and other sources of information. This is reflected in the fact that people from Mattakkuliya which is a suburb of Colombo, the largest city of Sri Lanka, had better knowledge than those from Kandakuliya, which is a very remote area on the northwestern coast, even though both villages had no nesting. Inevitably, remoteness of a village or closeness to a large city becomes a confounding factor when comparing the knowledge of villagers in Kandakuliya with Mattakkuliya.

The consumptive use among the villagers in Mattakkuliya was 51%, out of which seven villagers (13.7%) had eaten turtle eggs/meat during the last six months before the study period. Moreover, a large percentage of people from Mattakkuliya had been involved in purchasing (22%) and selling (13%) of turtle products. None of them had been involved in selling during the last six months though five people said they had purchased turtle meat recently. Most of them had purchased (86.4%) or/and sold (92.3%) in their own village. Kapurusinghe and Saman (2001) interviewed fishermen operating between Kirinda (southern coast) and Kandakuliya (northwestern coast) and reported that a total of 5241 turtles were caught by the surveyed fishermen over a 12 month period with 142 of these turtles being caught by fishers operating in Colombo. Villagers may be buying the meat directly from the fishers since it is illegal to sell turtle meat in the market. However, this calls for further investigation to find out from where and how these villagers have access to turtle meat and eggs.

Despite having high nesting, the consumptive use of turtle products is low in Rekawa, Kosgoda and also in Kahandamodara. This is because a large number of villagers had only eaten eggs or meat but were not extensively involved in selling and purchasing of turtle products. It is possible that they may have eaten the eggs or meat when offered as a meal by others or have themselves sourced the products by poaching rather than purchasing. In Kosgoda and Rekawa none of the villagers had sold or purchased turtle meat or eggs during the year preceding the study period. Only four villagers in Kahandamodara claimed that they had been involved in buying while none of them sold turtle eggs or meat in the past year. In contrast, Wedikanda, a low nesting village, had high consumptive use. During the last six months of the study period 15 people (22.7%) had eaten turtle eggs or meat, eight involved in purchasing (19.5%) and four in selling (23.5%) during the last six months. Turtle awareness and conservation programmes are conducted by NGOs with the collaboration of DWL along the southern and southwestern coast of Sri Lanka focusing on high nesting areas such as Rekawa and Kosgoda. Kahandamodara is close to Rekawa and villagers may be affected by the same programmes. Wedikanda on the other hand, is on the western coast of Sri Lanka and so the NGO programmes may have lower influence here.

While presence of nesting has strongly contributed to the knowledge of the villages in nesting areas, activities of the NGOs in the southern and southwestern coast have clearly led to reduced consumption of eggs and meat, specifically in Kosgoda and Rekawa. The Turtle Conservation Project (TCP), established in 1993 as an independent NGO in Sri Lanka, is specialized in turtle conservation and management. Since 1996 the TCP together with the DWL started an *in-situ* turtle nest protection programme in Rekawa (Richardson, 1998; Ekanayake *et al*., 2002; Ekanayake, 2003) and in Kosgoda since 2003. The TCP has conducted a number of community based conservation activities such as *in-situ* nest protection and research programmes, and educational programmes aimed at local communities previously dependent on egg poaching. Ecotourism, beach surveys, monitoring activities and community development are among the activities pursued by the TCP with subsequent socio-economic benefits to fishers and turtle poachers (Kapurusinghe & Ekanayake, 2000). Other community based organizations such as Nature Friends of Rekawa (NFR) and Rekawa Development Foundation (RDF) are also known to be involved in turtle related activities in the southern coast. Even though TCP conducts similar programmes in Kandakuliya, villagers still continue to eat, buy and/or sell turtles that are caught incidentally or intentionally during fishing. Political instability and civil war in the northern part of the island may have hampered conservation activities. Considering the overall performance of the villagers at Kandakuliya, where there is high bycatch, and also at Wedikanda, implementation of intensive awareness programmes is a necessity in these areas.

Both implementing and strengthening awareness and conservation programmes, and improving enforcement of laws prohibiting consumptive use along the coastline, specifically in villages in the western and northwestern areas, is a necessity. However, it is important to recognise that the majority of the coastal community is poor and the level of education is low. As Shanker and Choudhury (2006) indicate, the economic concern of the coastal community is an important issue when trying to bridge the gap between intent and success. Considering the poverty of the community involved in sea turtle exploitation, it becomes critical shifting conservation efforts towards these local communities (Tambiah, 2000), particularly to fishers in Kandakuliya who are often in the position to make choices directly impacting the fate of sea turtles. Many proposed protection measures in the Action Plan (de Silva, 2005) are associated with highlighting the socio-economic benefits of conservation and of sustainable use of natural resources, as well as initiatives providing viable, sustainable livelihoods.

Acknowledgements

We would like to express our deep appreciation to the villagers who agreed to participate in the study. We also thank Nayana Wijayatilake for his technical support. The study received financial support from the International Foundation for Science (IFS) Sweden (Grant number A/3863-1).

Literature cited

Amarasooriya, K.D. 2000. Classification of sea turtle nesting beaches of southern Sri Lanka. In: *Sea Turtles of the Indo-Pacific: Research, Management and Conservation*. (Eds. Nicolas Pilcher and Ghazally Ismail) pp. 228-237. *Proceedings of the Second ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation, Malaysia*.

Deraniyagala, P.E.P. 1939. The Tetrapod reptiles of Ceylon. Vol. 1 Testudinates and Crocodilians, pp. 412. The Director, Colombo Museum; London, Dulau and Co., Ltd.

Deraniyagala, P.E.P. 1953. *A coloured Atlas of some vertebrates from Ceylon*. Vol.2 Tetrapod Reptiles, pp. 101. Colombo Museum, Colombo, Sri Lanka.

de Silva, A. 1996. Proposed Action Plan: Conservation, restoration and management of the testudines and their habitats in Sri Lanka, pp. 28. *Department of Wildlife Conservation and Global Environmental Facility Programme.*

de Silva, A. 2005. Marine turtle conservation strategy and Action plan for Sri Lanka. Department of Wildlife Conservation, Sri Lanka.

Ekanayake, E.M.L. 2003. *Nest site fidelity and nesting behaviour of marine turtles in Rakawa Turtle Rookery*. M.Phil thesis. University of Peradeniya, Sri Lanka.

Ekanayake, E.M.L., K.B. Ranawana, T. Kapurusinghe, M.G.C. Premakumara, & M.M. Saman. 2002. Marine turtle conservation in Rekawa turtle rookery in southern Sri Lanka. *Ceylon Journal of Science* 30: 79-88.

Frazier, J. 1980. Exploitation of marine turtles in Indian Ocean. *Human Ecology*. 8: 329-370.

Jones, S. & A.B. Fernando. 1968. The present state of the turtle fishery in the Gulf of Mannar and Palk Bay. *Proceedings of the Symposium of Living Resources of the Seas Around India*. Cochin. Pp: 712-715.

Jinadasa, J. 1984. The effect of fishing on turtle populations. *Loris*. 16: 311-314.

Hewavisenthi, S. 1990. Exploitation of marine turtles in Sri Lanka: Historic background and the present status. *Marine Turtle Newsletter*, 48: 14-19.

Hewavisenthi, S. 1993. Turtle hatcheries in Sri Lanka: Boon or Bane? Marine Turtle Newsletter 60:19-22.

Kapurusinghe, T. & M.M. Saman. 2001. Marine turtle bycatch in Sri Lanka. Three year study from September 1996 to September 1999. *Proceedings of the twenty first annual symposium on marine turtle biology and conservation*, Philadelphia, USA

Kapurusinghe, T. 2006. Status and conservation of Marine turtles in Sri Lanka. In: *Marine turtles in the Indian subcontinent.* (Eds. K. Shanker & B.C. Choudhury). Pp 173-187. Universities Press, India.

Kapurusinghe, T. & R. Cooray. 2002. *Marine turtle bycatch in Sri Lanka: Survey report*. Turtle conservation Project (TCP) Publications, Sri Lanka.

Kapurusinghe, T. & E.M.L. Ekanayake. 2000. Community participation in sea turtle conservation in Sri Lanka. *Proceedings of the 19th Annual Symposium on Marine Turtle Biology and Conservation.* Pp 57-58

Richardson, P. 1995. The status of marine turtles and their conservation in Sri Lanka. *Lyriocephalus.* 2:81.

Richardson, P. 1997. Tortoiseshell industry in Sri Lanka: a survey report 1996. *Lyriocephalus* 3(1): 6-24.

Richardson, P. 1998. An update of the progress of the turtle conservation project (TCP), Sri Lanka. *Testudo.* 4: 64-70.

Salm, R.V. 1975. Preliminary report of existing and potential marine park and reserve sites in Sri Lanka, India and Pakistan. Mimeographed, IUCN, Morges.

Shanker, K. & B.C. Choudhury. 2006. A brief history of marine turtles of Indian subcontinent. In: *Marine turtles in the Indian subcontinent.* (Eds. K. Shanker & B.C. Choudhury). Pp 173-187. Universities Press, India.

Tambiah, C.R. 2000. "Community participation" in sea turtle conservation: Moving beyond buzzwords to implementation. In: H. Kalb and T. Wibbles (Compilers). *Proceedings of the 19th Annual Symposium on Sea Turtle Conservation and Biology.* NOAA Technical Memorandum NMFS-SEFSC-443.

Green turtle (*Chelonia mydas*) nesting and conservation activity in Thameehla Island, Myanmar

Maung Maung Lwin

Assistant Director, Crocodile Farm and Marine Turtle Conservation Unit, Department of Fisheries, Yangon, Union of Myanmar
E-mail: akthar10160@gmail.com

Introduction

The waters of Myanmar coastal areas harbour five species of sea turtles including green turtles (*Chelonia mydas)*. Green turtles breed regularly on Myanmar's beaches. Since 1963, the Department of Fisheries (DoF) has taken up a project to breed and protect sea turtles on Thameehla Island (also known as Diamond Island) in Ngaputaw Township, Ayeyarwady Division, Myanmar. Thameehla Island at the mouth of Pathein River hosts green turtles. This article describes some of the results of a study from data collected between 1986 and 2007 on Thameehla Island. In the study, factors that could lead to sea turtle extinction locally were studied and current sea turtle conservation activities were examined. From September 1986 to December 2007, clutch sizes, number of eggs and the number of hatchlings released were recorded.

Sea turtles nest all year round at Thameehla Island, which is a major nesting site of green turtles in the Ayeyarwady delta. The hatching area is one mile in length and half a mile in breadth. It is situated at 15° 51.30' North and 94° 17.30' East (Figure 1).

Figure 1: Map of Thameehla Island

The island is protected by the Department of Fisheries all year round. The Department of Fisheries has also established hatcheries on these beaches (DoF, 2003). The green turtle (*Chelonia mydas*) is one of the five species of sea turtles recorded nesting in Myanmar coastal areas, including - Ayeyarwady delta area, Rakhine coastal area, Mon coastal area and Tanintharyi

coastal area. The sea turtle species recorded in Myanmar are loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), olive ridley (*Lepidochelys olivacea*) and leatherback (*Dermochelys coriacea*) turtles. In the Rakhine coastal area of Myanmar, the hawksbill turtle (*Eretmochelys imbricata*) is the predominant nesting species (Sann Aung & Hahn, 2001), while the predominant nesting turtle species in some parts of the Tanintharyi coastal area and Ayeyarwady delta area is olive ridley turtle (*Lepidochelys olivacea*). Here, the first batch of nesting turtles comes up in October at night and large numbers of turtles have been recorded in December, January and February (Win Maung, 1999).

Materials and methods

Nesting sea turtles were observed and identified according to the description of Smith (1973), Carr (1967) and Win Maung and Win Ko Ko (2002) at Thameehla Island during 1986 to 2007. Some nests were excavated and transferred for incubation to hatcheries at selected sites. Data collection on hatching success of turtles at original nest sites was also carried out. Total egg numbers, unhatched and damaged egg numbers and number of hatchlings that emerged were recorded during the study period. The data recorded were then analyzed.

Results

The number of sea turtle nests and total eggs laid on the beaches of Thameehla Island were recorded during the period from 1986 to 2007 (Table 1). Almost all turtles recorded in Thameehla Island were green turtles (*Chelonia mydas*). Eggs of some turtle nests located in unfavourable environments were collected and incubated in hatcheries for later release as a conservation measure.

A total of 7,461 nests and 693,929 eggs were recorded during the study period. The highest number of turtle nests was recorded in 1989 and was followed by those of the years 1993, 1990 and 1987. The highest number of total eggs laid was noted in 1989 and the least in 1986 (Figure 2; Table 1). The number of nests recorded during the study period was different across the years indicating the fact that the population of the nesting turtles was fluctuating.

The positive relationship between the number of eggs laid and the number of emerged hatchlings was higher than that between the numbers of eggs laid and the number of unhatched or/and damaged eggs and dead hatchlings (Figures 3 and 4).

Figure 2: Nesting turtle populations recorded during the study period

Table 1. Number of nests, eggs laid, dead hatchlings, unhatched and/or damaged eggs and number of emerged hatchlings during September 1986 and 2007.

Year	Nesting Populations (No.)	Eggs laid (No.)	Hatchlings emerged (No.)	Dead Hatchlings, Damaged and Unhatched Eggs (No.)
1986	106	5200	970	4230
1987	528	16073	8069	8004
1988	297	27900	10089	17811
1989	549	66908	35031	31877
1990	537	52300	44979	7321
1991	359	34334	26939	7395
1992	369	36900	21929	14971
1993	540	47902	34723	13179
1994	387	34461	30474	3987
1995	419	39613	31564	8049
1996	463	45928	36844	9084
1997	456	47312	40485	6827
1998	306	30679	24950	5729
1999	136	13651	11763	1888
2000	431	45673	43472	2201
2001	402	46680	43590	3090
2002	122	11549	9133	2416
2003	251	21016	11084	9932
2004	239	20737	11410	9327
2005	285	24703	14073	10630
2006	134	11291	6825	4466
2007	145	13119	5688	7431
Total	**7461**	**693929**	**504084**	**189845**

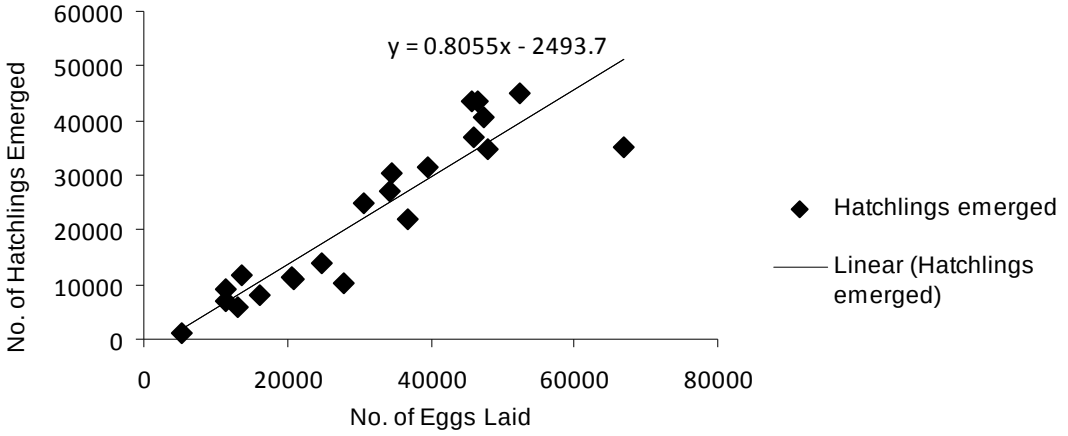

Figure 3: Number of eggs laid and number of emerged hatchlings in Thameehla Island during the study period

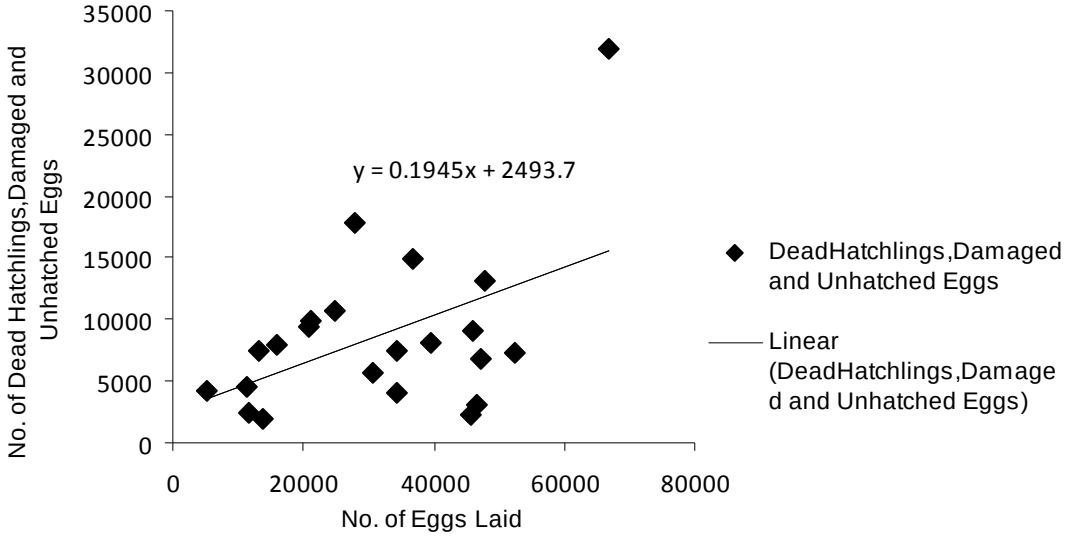

Figure 4: Damaged, unhatched eggs and dead hatchlings amongst eggs laid

Discussion

The green turtle (*Chelonia mydas)* is one of the five sea turtle species which occurs in the coastal waters of Myanmar. It is a predominant species in Thameehla Island. Conservation activities such as protection from human disturbance, illegal harvesting and hunting are conducted by the Ministry of Livestock and Fisheries. In addition to these activities, artificial incubation for later release of the hatchlings is done to increase the survival rate of hatchlings. After release, the hatchlings are believed to spend their life in the oceanic area, drifting passively in ocean currents before appearing in coastal feeding areas (Kitagawa *et al*. 2002; Hays & Marsh, 1997) and it is difficult to observe them during this period (Witham, 1980).

As successful conservation of sea turtles in Myanmar waters depends on the interest and participation of local people, particularly from the coastal areas, education and awareness is key to ensuring their participation. Education programmes have been initiated in fishing communities and among local people along Myanmar coastal areas, including on Thameehla Island. To increase turtle conservation awareness, the Ministry of Livestock and Fisheries has distributed pamphlets with the objective of raising public awareness. Education programmes have also been implemented through newspapers, magazines, radio and television. Sea turtles are protected under the Myanmar Marine Fisheries Law (1990). To strengthen effective conservation measures, the Ministry of Livestock and Fisheries prohibits capture, killing and any other form of harmful behaviour towards sea turtles. Large scale mortality is a result of incidental capture of turtles in fishing nets. Myanmar Marine Fisheries Law (1990) therefore prohibits any kind of mechanized fishing within five miles of the shore along the coast (DoF, 2003).

Acknowledgements

The author wishes to convey his special thanks to the Director General and Deputy Director General of the Department of Fisheries for due permission and constant encouragement to carry out this study. The author also wishes to express his gratitude to Dr. Win Maung, Associate Professor, Department of Zoology, Yangon University for suggesting the topic and for his untiring guidance throughout the writing of this report. Finally, the author is indebted to the staff at the Sea Turtle Conservation and Management Center under the Department of Fisheries in Ayeyarwady Division.

References

Carr, A. 1967. Handbook of turtles. The turtles of the United States, Canada and Baja California. Comstock Publishing, New York.

Hays, G.C. & R. Marsh.1997 Estimating the Age of Juvenile Loggerhead Sea Turtle in the North Atlantic. *Can. J. Zool*. (75): 40-46.

Kitagawa, T, H. Kudo & S. Kimura. 2002 Hatchling transport of Loggerhead turtles in the North Pacific. In: SEASTER 2000 (Southeast Asia Sea Turtle Associative Research); Proceedings of the 3rd Workshop on SEASTAR 2000, Bangkok, Thailand: 39-44.

Maung Maung Lwin & Khin Myo Myo. 2003. Report on Sea Turtle Threats, Conservation and Management in Myanmar. ASEAN/SEAFDEC Regional Technical Consultation on Management and Conservation of Sea Turtle in Southeast Asian, Kuala Lumpur, Malaysia. (16-18 September 2003).

Sann Aung & C. Hahn. 2001. Final Report of Marine Turtle Conservation Pilot Project in Northern Rakhine State.

Smith, M.A. 1973. The Fauna of British India Including Ceylon and Burma. Reprinted by Ralph Curtis Books, Hollywood, Florida.

Win Maung. 1999. Preliminary Study on the Species Composition and Population Dynamic of Marine Turtles in Some Parts of Tanintharyi and Ayeyarwady Division with Respect to Wildlife Conservation.

Win Maung & Win Ko Ko. 2002. Turtles and Tortoises of Myanmar. Published by the Wildlife Conservation Society (Myanmar Programme). Pp. 82-91.

Witham, R. 1980 The "Lost Year" Question in Young Sea Turtles. *Am. Zoologist* (20): 525-530.

Rescue of a leatherback turtle (*Dermochelys coriacea*) at Manakudi beach, Kanniyakumari District, Tamil Nadu, and the need for an awareness campaign

S. Balachandran, P. Sathiyaselvam & P. Dhakshinamoorthy

BNHS Bird Migration Study Centre, Point Calimere, Kodiakadu.P.O, 614807, Nagapattinam District, Tamil Nadu
Email: bnhsbala@rediffmail.com, sathiyaselvam11@rediffmail.com

The leatherback turtle (*Dermochelys coriacea*) is the largest marine turtle and one of the largest living reptiles in the world. Leatherbacks are also one of the most migratory of all marine turtles. They are easily distinguished by their carapace, which is leathery, not hard like in other turtles, and by their long front flippers. It has been included in the IUCN red data list as Critically Endangered and under Schedule I of the Indian Wildlife (Protection) Act, 1972.

The Bombay Natural History Society has been monitoring the migration of terns and other coastal bird species in various coastal habitats, including the saltpans of Kanniyakumari District, through its Point Calimere Bird Migration Study Centre for the last three years. On 23rd June 2009, one of us (P. Dhakshinamoorthy), during a field trip to the Puthalam saltpans, saw and photographed a large sea turtle that was tied to one of the pillars of Manakudi bridge and was further harnessed with the weight of a sandbag and a large stone.

From the photographs we identified the turtle as a leatherback based on its distinguishing features including the seven distinct ridges on the leathery carapace. We immediately informed the local District Forest Officer and the Chief Conservator of Forests (Wildlife) of the stranded turtle. The Department staff, media, press personnel and the general public thronged the site to get a glimpse of the giant reptile and the rescue operation. The sandbag and stone were removed and the turtle was dragged into the sea by eight people with the help of ropes. When it reached a floating depth of 2 feet in the surfing (tidal) zone of the sea, the turtle started to inadvertently pull the people holding the ropes into the sea. More people then joined in to hold the ropes until the turtle had crossed the surfing zone (Figure 1). Then the ropes were removed and the animal was set free. We watched in awe till it disappeared into the depths of the sea. The next day, news about the successful rescue operation of the leatherback turtle and information about its rareness and endangered status was published in many of the local daily newspapers and was also broadcast on local television channels.

During the rescue operation, enquiries with the local fishermen revealed to us that sea turtles (including leatherbacks) are regularly caught in fishing nets as bycatch and are often slaughtered. According to local fishermen, and also as reported by Krishnapillai and Kingston (2007), most of the turtles that are caught are olive ridley turtles (*Lepidochelys olivacea*). The leatherback turtles, locally known as 'Panni Aamai' (Pig Turtle) are relatively rare. The prevalence of a local name for the leatherback turtle among the fishermen however indicates its occasional occurrence/catch along this beach.

Leatherbacks are of profound conservation concern around the world after their populations crashed by more than 90 percent in the 1980s and 1990s. In India, although leatherbacks come to the beaches of Kerala and the Andaman and Nicobar Islands for nesting (Pai, 2009), their populations in the Indian seas remain generally un-assessed and unevaluated. There is also considerable concern about the impact that the December 2004 tsunami had on the two key nesting areas in Kerala and the Andaman and Nicobar Islands for the leatherback turtles that visit these shores (Hamann *et al*., 2006). Further, observations by local fishermen indicate that *Casuarina* plantations raised along the coast between Kovalam and Manakudi up to the high-tide mark after the 2004 tsunami has also resulted in sea turtles abandoning the beaches where they previously nested (Balachandran *et. al*., unpublished observations).

Figure 1: Releasing the leatherback turtle back into the sea
Photo: P. Sathiyaselvam, 2009.

As the rescue operation of the leatherback was held in the presence of a large gathering and as it also received media coverage, we thought it a good opportunity to initiate awareness among the local community. Although all five species of sea turtles that occur in the Indian seas are included in the IUCN Red Data List and in Schedule I of the Wildlife (Protection) Act (1972), there is a lack of awareness about them among the fishing community. Hence, it is necessary to undertake awareness campaigns along the entire stretch of the coastal areas of Kanniyakumari district, especially among the local fisherfolk. The awareness campaigns should be planned in such a manner so as to get more information on the Indian Ocean sub-population through local fisherfolk as little research has been done on the status of this critically endangered marine fauna from the subcontinent.

Acknowledgements

We would like to express our sincere thanks to Dr. V. N. Singh, Chief Conservator of Forests (WL), Southern Circle, and Mr. Sundararaju, District Forest Officer, Kanniyakumari District, Tamil Nadu for providing us the services of the forest staff team led by Range Officer Mr. Chellan for the rescue of this turtle. We are also grateful to Dr. Ranjit Manakadan, Assistant Director, BNHS for going through this manuscript and providing useful inputs.

References

Hamann, M., C. Limpus, G. Hughes, J. Mortimer & N. Pilcher. 2006. Assessment of the conservation status of the leatherback turtle in the Indian Ocean and South East Asia. Bangkok: IOSEA Marine Turtle MoU Secretariat.

Krishnapillai, S & S.D. Kingston. 2007. Some observation on exploitation of sea turtles on the Kanyakumari coast. *Indian Ocean Turtle Newsletter* No. 5: Pp. 20-22.

Pai, 2009. Vanishing species – Leatherback turtle. Visited: May, 2009. URL: http://mohanpais articles.blogspot.com/2009/03/vanishing-species-leatherback-turtle.htm.

Olive ridley turtle conservation activities along the Nagapattinam coast, Tamil Nadu, India

Thirunavukarasu Velusamy[1] & R. Sundararaju[2]

[1] *Wildlife Warden, Nagapattinam District, Tamil Nadu*
Email: dfo.tnngp@nic.in, revthiru@gmail.com
[2] *Principal Chief Conservator of Forests and Chief Wildlife Warden, Tamil Nadu*
6th Floor, Pangal Building, Saidapet, Chennai, Tamil Nadu, India
Email: cwlw@tn.nic.in

Introduction

Nagapattinam district in Tamil Nadu has a coastline of 161 km. Coastal characteristics vary along this stretch. For example, the 40 km coastal stretch from Point Calimere to Voimedu is primarily swampy and there are no sandy beaches. Northwards from Point Calimere up to Kollidam, a distance of 120 km, the stretch is predominantly sandy with a few swampy patches in Thirumullaivasal and Palaiyar. Results of surveys carried out reveal that sporadic nesting of olive ridley turtles occurs in the sandy stretches along this coastline from Point Calimere in the south up to Chennai in the north during the nesting season between December and March. The Government of India through its Ministry of Environment and Forests and the Wetland and Wildlife Management Division funds various olive ridley conservation projects every year along this coast. A description of various activities carried out along the Nagapattinam coast is given below.

Establishment of Olive Ridley Protection Camps:

Every year Olive Ridley Protection Camps are established in important nesting sites during the nesting season from December to March. Two 'protection watchers' are stationed at each of these camps and the camps are equipped with tents, cots, torches and other accessories (Figure 1). The camps are set up for the following purposes:

- To protect nesting sites and nests from disturbance by humans and animals,
- To protect the eggs from illegal take for consumption by humans,
- To protect the eggs and hatchlings from predation by domestic and wild animals, and
- For collection of eggs and translocation to hatcheries.

Figure 1: An olive ridley protection camp with 'Protection Watchers' at Nagapattinam, Tamil Nadu. Photo: V. Thirunavukarasu, 2008.

Watchers in these camps are on duty round the clock and ensure protection to turtles that visit these sites. During the 2009 nesting season, nine such protection camps were established. The locations of the camps were selected based on established records and local knowledge of fishermen. The camps were set up in the following locations (Figure 2):

1. Point Calimere
2. Keechan Odai
3. Manian Theevu
4. Arukatuthurai
5. Pushpavanam
6. Tharangambadi
7. Vanagiri
8. Koolaiyar
9. Madavamedu

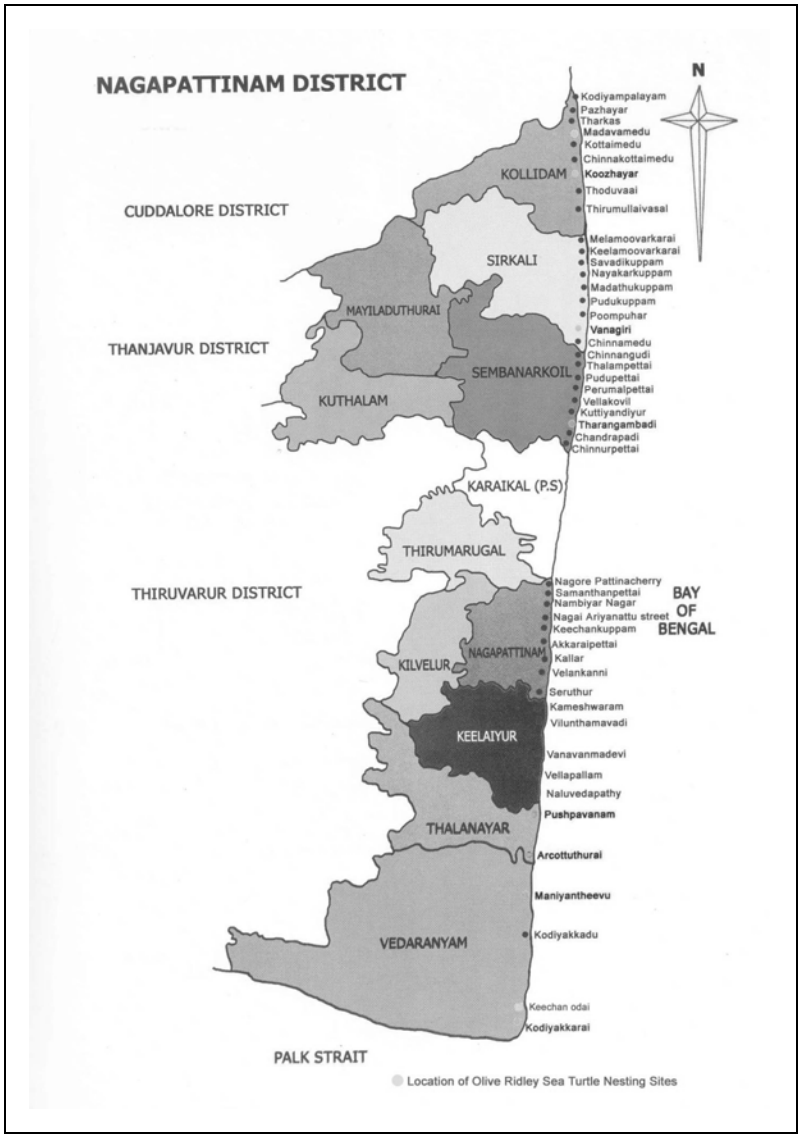

Figure 2: Location of olive ridley turtle nesting sites in Nagapattinam
Courtesy: Asst. Director, Survey and Settlements, Nagapattinam

Turtle egg collection and hatchery management:

The turtle watchers perambulate the coast for a distance of 5-8 km on both sides of the protection camp and are trained to collect turtle eggs. The collected eggs are immediately translocated to a hatchery for incubation. During the 2009 nesting season, hatcheries were established in five important sites:

1. Point Calimere
2. Tharangambadi
3. Vanagiri
4. Koolaiyar
5. Madavamedu

The collected eggs are incubated for 45-52 days and after the hatchlings emerge, they are released safely back into the sea. This activity has been carried out for the last four years. The details of eggs collected and hatching success is given in the table below (Table 1).

Table 1. Collection of eggs and hatching success during 2005 – 2009

Sl. No.	Year	No. of eggs collected	No. of eggs hatched	No. of young ones
1.	2005-06	680	452	452
2.	2006-07	487	292	292
3.	2007-08	1755	1149	1149
4.	2008-09	5224	5100	5100

Figure 3: An olive ridley turtle hatchery in Nagapattinam
Photos: V. Thirunavukarasu, 2008.

Olive ridley turtle nesting site management:

The tsunami that struck the coast in December 2004 left more than 6500 people dead along the Nagapattinam coast alone and caused enormous damage to property. Many post-tsunami assessment studies claimed that the existing coastal shelterbelt plantations and bio-shields had protected life and property in certain areas. Hence, large scale coastal afforestation activities were carried out from 2005 onwards by raising coastal shelterbelt plantations with *Casuarina equisetifolia*. Later however, it was found that some of the trees, having been planted near the high tide line, were hindering the movement of the olive ridley turtles that had come ashore to nest. In October 2008, three important nesting locations were identified and the grown up *Casuarina equisetifolia* trees were removed to facilitate turtle nesting. A minimum distance of 25 m from the high tide line was ensured for turtle nesting. The details of this activity are given below (Table 2):

Table 2. Details of removal of *Casuarina equisetifolia* from the three important nesting sites

Sl. No.	Name of the location	No. of trees removed
1.	Arukatuthurai	48
2.	Pushpavanam	61
3.	Naluvedapathi	204

Awareness activities:

The Tamil Nadu Forest Department has produced a VCD on olive ridley turtles which has been put up for sale at the Point Calimere Wildlife Sanctuary. This VCD has also been screened on many occasions to school and college students, fisherfolk and tourists, as part of the State Forest Department's conservation awareness and education activities.

On the rescue operations and rehabilitation carried out on three olive ridley turtles from Mumbai, Maharashtra, India

Sujit Sundaram & C.J. Josekutty

Mumbai Research Centre of Central Marine Fisheries Research Institute,
2nd Floor, C.I.F.E old campus, Fisheries University road,
Seven Bunglows,Versova, Mumbai – 400 061.
Email: sujitsundaram@hotmail.com

Sea turtles are found all along the coast of India, including the Lakshadweep and Andaman & Nicobar Islands. Five species inhabit the Indian seas; *Dermochelys coriacea* (leatherback turtle), *Eretmochelys imbricata* (hawksbill turtle), *Chelonia mydas* (green turtle), *Lepidochelys olivacea* (olive ridley turtle) and *Caretta caretta* (loggerhead turtle) (Rajagopalan *et al*., 1996). These five species of sea turtles, distributed widely all over the world, are highly endangered (Chhapgar, 2005). There are four listed species of sea turtles that occur in Maharashtra, India; hawksbill turtle, green turtle, loggerhead turtle and olive ridley turtle (Daniel, 1983; Bhaskar, 1984; Das, 1985). Giri (2001) has made a detailed survey of the various species of sea turtles found in Maharashtra. Katkar (1991) has reported nesting site of olive ridley observed on the beach of Palshet, Ratnagiri, Maharashtra. Green and olive ridley turtles are known to nest along parts of the coast of Maharashtra such as Alibag, Dahanu, etc., and in Ratnagiri (Gole, 1997; Kar & Bhaskar, 1981; Shaikh, 1984; Giri & Chaturvedi, 2006). In Mumbai they usually nest at Backbay, Juhu Chowpati, Girgoan Chowpati, Governor's Gate, Shivaji Park to Mahim, Juhu to Versova Mud Island, Gorai, Marve, Manori, Worli and Vashi Creek (Chhapghar, 2005; Kar & Bhaskar, 1981; Giri & Chaturvedi, 2006).

Olive ridley turtles are categorized as *Vulnerable* on the IUCN Red List (IUCN, 2002) and are included in Schedule I of the Indian Wild Life (Protection) Act, 1972.

During the months of June – July 2008, three olive ridley turtles (*Lepidochelys olivacea*) were found stranded on the Mumbai coast in Maharashtra. These turtles are locally called '*Kasav*' (Karbari *et al*., 1986). Details of these turtles such as morphometric measurements, type of capture, etc. are given in Table 1. There are reports of accidental stranding and inadvertent landings of marine turtles along the Maharashtra coast (e.g. Katdare & Mone, 2005), but a majority of such instances have not been properly documented. Some of the documented instances of turtles landed in Maharashtra are provided in Table 2.

The first turtle, measuring 50.5 cm in carapace length and weighing 20 kg, was found stranded at Juhu Chowpati beach on 29th June 2008 at around 9 pm (Figure 1). A passerby informed the Bombay Society for the Prevention of Cruelty to Animals (BSPCA) of the stranded turtle. The BSPCA immediately arrived at the spot and administered first aid to the turtle. They then took it to the Sakarbai Dinshaw Petit Hospital for Animals (SDPHA) situated at Parel, which is a 127 year old veterinary hospital in the heart of Mumbai city dedicated to the cause of selfless service towards the welfare of abandoned and injured animals. The right fore flipper was cut off completely and it was observed that the turtle was very weak and could barely move its body. The turtle was treated with antibiotics and food supplements at the hospital.

Figure 1: Turtle I - that was found stranded at Juhu.

Figure 2: Turtle II - that was found caught at Colaba.

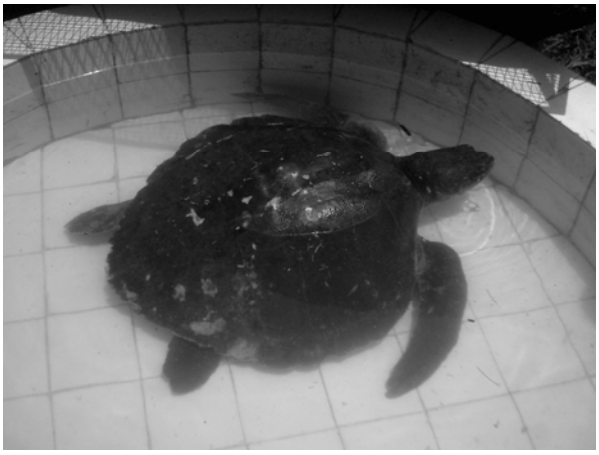

Figure 3: Turtle III – that was found stranded at Marine Lines.

Photos: S. Sundaram, 2008.

Another turtle, measuring 54 cm in carapace length and weighing 27 kg was found entangled in a fishing net by local fishermen on 2nd July 2008 at Cuffe Parade, Colaba (Figure 2). The animal was caught with a hook and line and the hook was still intact in its neck when it was found. The fishermen had carried the turtle and handed it over to the BSPCA. It was then taken to SDPHA where it was operated upon successfully and the hook was removed. After the wound healed the turtle started eating small pieces of fish. This turtle was also heavily starved for many days, as it could not eat food due to the hook in its mouth.

The third turtle was found stranded at Marine Lines on 11th July 2008 at 5 pm (Figure 3). The turtle was comparatively large, measuring 75 cm in carapace length and weighing about 49 kg. It was found by Mumbai police personnel patrolling the area. The Police Department took the animal to the BSPCA and eventually to the SDPHA. The turtle was injured very badly with both its fore flippers heavily damaged. The left fore flipper was fractured with its arteries ruptured and the flipper was dangling from the turtle's body. The turtle was immobile. It was assumed that propellers from trawlers had caused the injury. At the hospital, both flippers were bandaged with gauze. After taking X rays, surgery was attempted on the left flipper to suture it, but was not successful. Subsequently, the flipper had to be amputated to prevent further infection.

All three turtles were administered similar treatment after they were found; they were placed in a tank filled with seawater with Poviodine solution. They were treated with Tetanmtoxide (TT), antibiotics and multivitamins. Initially, pieces of fish (of *Scienid sp*. and *Nemiptres sp*.) were given to them on a plate, but they did not eat. Later however, when they were fed manually with a pair of tongs, they began to eat. According to veterinary doctors, it would take at least one and a half months for the turtles to recover completely. They were of the opinion that the treated turtles would find it extremely difficult to fend for themselves in the wild, and suggested handing them over to the State Wildlife Department or the Taraporewala Marine Aquarium in Mumbai for rehabilitation, before being released into the sea. They were eventually given to the care of the NGO 'Green Cross' and were air lifted to Goa, where they will be monitored until they recover.

Table 1. Morphometric measurements (in cm) and other information of the turtles landed at Mumbai

Description	Turtle - I	Turtle - II	Turtle - III
Date of capture/stranded	29-06-08	02-07-08	11-07-08
Type of capture	Stranded	Hook and line	Stranded
Place	Juhu	Colaba	Marine lines
Found and saved by	Public	Fishermen	Police department
Type of injury	Right forelimb cut completely	Hook fixed in throat	Both the forelimbs cut and heavily injured
Length of carapace	50.5	54.0	75.0
Width of carapace	42.0	45.5	66.0
Length of plastron	30.0	33.0	52.0
Width of plastron	25.0	26.0	37.5
No. of lateral scutes on carapace	7.0	6.0	7.0
Total weight	20.0	27.0	49.0

Table 2. Instances of turtle stranding along the coast of Maharashtra (between 1981 – 1996)

Year	Month	Place	Species	Sex	Carapace length (cm)	Weight (kg)	Mode of capture	Reference
1981	Sep	Mumbai	Hawksbill	F	78.3	80.0	Gill net	Karbhari, 1981
1984	Apr	Mumbai	Olive ridley	M	63.0	48.0	Trawl net	Karbhari *et al.*,1984
		Vasai	Green	F	66.5	42.8	Bag net	
	Sep	Vasai	Olive ridley	F	75.0	54.5	Bag net	
1985	Apr	Dev Bag	Leatherback	?	149.8	100.0	Gill net	Karbhari,1985
	Dec	Pawas	Green	M	51.2	38.0	Trawl net	Karbhari *et al.*1985
1988	Apr	Ratnagiri	Olive ridley	?	60.0	25.5	Gill net	Katkar, 1988
1991	May	Bassien Koliwada	Olive ridley	M	68.5	34.8	Bag net	Hotagi, 1991
1995	Nov	Ratnagiri	Olive ridley	?	64.0	30.0	Hook and lines	Katkar, 1995
1996	May	Janjira Murud	Olive ridley	?	71.0	56.0	Stranded	Jadhav, 1996

Literature cited

Bhaskar, S. 1984. The distribution and status of sea turtles in India. In: *Proceedings of the Workshop on Sea Turtle Conservation*. E.G. Silas (Ed.). Central Marine Fisheries Research Institute, Kochi, Special Publication- 18:21-35.

Chhapgar, B.F. 2005. Marine life in India. The Gentle Giants. *Oxford University Press.* 306-310.

Daniel, J.C. 1983. *The book of Indian reptiles*. Bombay Natural History Society, Mumbai.

Das, I. 1985. *Indian turtles: A field guide*. WWF-India.

Giri, V. 2001. Survey of marine turtles along the coast of Maharashtra and Goa. *Kachhapa*. 4: 14-16.

Giri, V. & N. Chaturvedi. 2006. Sea turtles of Maharashtra and Goa. K. Shanker & B.C. Choudhury (Eds.). *Marine Turtles of the Indian subcontinent*. 147-145.

Gole, P. 1997. *Conservation of biodiversity on the west coast between Mumbai and Goa*. Ecological Society, Pune.

Hotagi, J.S. 1991. On a marine turtle *Lepidochelys olivacea* landed at Basseein Kolliwada in Maharashtra. *Mar. Fish. Infor. Serv., T and E ser.,* No.118: 19.

Jadhav, D.G. 1996. On an Olive ridley turtle stranded at Janjira Murud coast, Maharashtra. *Mar. Fish. Infor. Serv., T and E ser.,* No.145: 17.

Kar, C.S. & S. Bhaskar. 1981. Status of sea turtles in the Eastern Indian Ocean. In: Bjorndal, K. (Ed.). *Biology and conservation of sea turtle*. Smithsonian Institution press, Washington, D.C.

Karbhari, J.P. 1981. On the rare occurrence of a giant sized Hawksbill turtle off Elephanta caves (near Bombay). *Mar. Fish. Infor. Serv., T and E ser.,* No.33: 17.

Karbhari, J.P. 1985. Leatherback turtle caught off Devbag near Malwan. *Mar. Fish. Infor. Serv., T and E ser.,* No.64: 23.

Karbhari, J.P., A. Prosper, C.J. Josekutty & J.R. Dias. 1986. Some observations on marine turtles landed along Maharashtra coast. *Mar. Fish. Infor. Serv., T and E ser.,* No.70: 20-21.

Katdare, V. & R. Mone. 2005. Second successive year of the Marine Turtle Conservation Project in Konkan, Maharashtra. *Indian Ocean Turtle Newsletter* No. 2. 3-4.

Katkar, B.N. 1988. On Olive ridley turtles landed along Ratnagiri coast. *Mar. Fish. Infor. Serv., T and E ser.,* No.95: 9.

Katkar, B.N. 1991. Nesting site and hatching of olive ridley reported from Palshet, Ratnagiri, north Kanara coast. *Mar. Fish. Infor. Serv., T and E ser.,* No.108: 16.

Katkar, B.N. 1995. Turtles and whale shark landed along Ratnagiri coast, Maharashtra. *Mar. Fish. Infor. Serv., T and E ser.,* No.141: 20.

Rajagopalan, M., E. Vivekanandan, S.K. Pillai, M. Srinath & A.B. Fernando. 1996. Incidental catches of sea turtles in India. *Mar. Fish. Infor. Serv., T and E ser.,* No.143: 8-16.

Shaikh, K.A. 1984. Distribution of nesting sites of sea turtles in Maharashtra. In: *Proceedings of the Workshop on the Sea Turtle Conservation*. E.G. Silas (Ed.). Central Marine Fisheries Research Institute, Kochi, Special Publication- 18:109-115.

Report: Workshop on Social Dimensions of Marine Protected Area Implementation in India: Do Fishing Communities Benefit?

Ramya Rajagopalan

International Collective in Support of Fishworkers
27, College Road, Chennai – 600 006
Email: icsf@icsf.net
Website: www.icsf.net

Marine and coastal protected areas are increasingly being promoted as an important tool for the conservation of marine and fisheries resources. Recently, the International Collective in Support of Fishworkers (ICSF) undertook a series of studies on marine and coastal protected areas in India to highlight the various legal, institutional, policy and livelihoods issues that confront fishing and coastal communities. The five case studies focused on (i) the Gulf of Mannar National Park and Biosphere Reserve, (ii) the Malvan (Marine) Wildlife Sanctuary, (iii) the Gahirmatha (Marine) Wildlife Sanctuary, (iv) the Sundarban Tiger Reserve, and (v) the Gulf of Kutch (Marine) National Park and Wildlife Sanctuary.

In order to discuss the findings of the case studies and to suggest proposals for livelihood-sensitive conservation and management of coastal and fisheries resources, ICSF organized a two-day workshop on 'Social Dimensions of Marine Protected Area (MPA) Implementation in India: Do Fishing Communities Benefit?' at Chennai during 21-22 January 2009. Apart from highlighting fishing communities' perspectives on MPAs, the workshop was also meant to be a forum to put forward proposals for achieving livelihood-sensitive conservation and management of coastal and fisheries resources.

Over 70 people participated in the workshop. They included representatives from the Ministry of Agriculture, Government of India; the Forest Departments of the States of Orissa, West Bengal and Tamil Nadu; the Fisheries Departments of West Bengal and Tamil Nadu; National Fishworkers' Forum and other fishworker organizations, South Indian Federation of Fishermen Societies, the Wildlife Institute of India (WII); and the Indian Institute of Science (IISc), non-governmental organizations; environmental groups; and independent researchers.

The introduction to the workshop highlighted that in the Indian context, marine and coastal protected areas refer to National Parks and Wildlife Sanctuaries declared in coastal and marine areas, under the Wild Life (Protection) Act (WLPA), 1972. Large numbers of men and women in fishing communities—an estimated 10 per cent of the marine fisher population of India—face a potential loss of livelihoods due to restrictions on fisheries in coastal and marine protected areas. The manner in which regulations are implemented often results in a feeling that fishing communities are disproportionately bearing the costs of conservation. Compounding the problem is the limited effort to create long-term alternative livelihood opportunities and improved access to basic social services and infrastructure.

In his opening address to the workshop, Mr. M.K.R. Nair, Fisheries Development Commissioner, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India, said that fishers residing along the coastline of India are the traditional owners of the resources in those areas. While there is consensus on the need for environmental restrictions and regulations, the impact of marine and coastal protected areas on fishers who are already below the poverty line, is severe. There needs to be a system of co-management for protected areas that is located within a balanced 'seascape' approach, he suggested.

The case study presentations highlighted the socioeconomic problems facing fishing

communities, including women, as a result of protection measures. These ranged from regulations that restrict fishing access within/around the protected areas, to arbitrary imposition of rules and fines, and arrest of fishers. In the case of the Gahirmatha (Marine) Wildlife Sanctuary, it was highlighted that 43 percent of affected fishers live below the poverty line. The fishing communities in all the five protected areas complain of lack of consultation and transparency in setting up protected areas, and in the implementation of protection measures.

Fishworker organizations in all the marine and coastal protected areas studied are demanding that fishing activities of traditional fishers using non-motorized vessels must be protected. Further, existing, self-regulatory community initiatives, such as controlling seaweed extraction and imposing restrictions on fishing gear, must to be recognized and supported. They are also demanding alternative livelihood options—long-term options for future generations, and short-term options for the present generation. Another demand is for the effective implementation of provisions in the Marine Fishing Regulation Act (MFRA), especially the five-km 'trawl-free' zones, and for implementation of provisions of the WLPA, 1972 (as amended in 2002 and 2006), especially those relating to protecting the innocent passage of fishers and their occupational interests, through clear guidelines and rules.

From presentations and discussions at the workshop it was clear that the approach adopted of regulating mainly fisheries activities, while ignoring serious issues of degradation and pollution by non-fisheries factors, is highly problematic, compromising the very objectives for which the protected areas were set up. The case study of the Gulf of Kutch (Marine) National Park and Sanctuary, for example, highlighted the severe threats to the marine environment from industrial activities and special economic zones. The study pointed out that the current legal regime for protected areas is not adequate to address the special needs of marine protection, especially to combat the threats from non-fishery related activities taking place adjacent to protected areas. Fishworkers organizations, therefore, are demanding a comprehensive approach to the management of the marine environment, which addresses the root causes of habitat destruction and depletion of resources.

During discussions at the workshop several participants queried the very rationale for setting up marine and coastal protected areas, as there is no clear evidence of their benefits—biological and social. It was questioned whether it was a classic 'lose-lose' situation in which thousands lose their livelihoods, with no clear indicator of conservation objectives having been achieved. On the issue of alternative and alternate livelihood options, it was stressed that these should benefit the local fishers who are worst affected, and should be a way to reduce pressure on fishery resources, and not to take away the rights of fishers to the resource. Several participants highlighted the need for gender-segregated socioeconomic data.

The workshop was also informed of the initiatives taken by local communities to conserve marine resources in the Lakshadweep islands, where there is a proposal for declaring a Conservation Reserve under the WLPA.

The workshop's legal session drew attention to the need for putting in place a holistic and comprehensive management framework for protecting coastal and marine resources, which addresses both fishery and non-fishery management concerns, and draws on international and national legal and policy frameworks. Within the fisheries context, there is a need to move from a production focus to a management focus, requiring an environmental plan for fisheries. There is also need to recognize existing artisanal zones, under the MFRA, as a form of protected area, given that they enjoy a higher level of protection than their surroundings, consistent with the Convention on Biological Diversity (CBD) definition of marine and coastal protected areas.

The legal session also drew attention to options, under other legislation, for designating specified areas that could meet both livelihood and conservation objectives. The need to elaborate, in operational terms, what is meant by the reference in the WLPA to "protect the occupational interests of fishermen", was also stressed. The need to operationalize the provisions for "innocent

passage" in the WLPA, to prevent the arrest of those passing through, but not fishing in, sanctuary waters, was also highlighted. The session recommended the need to demystify information on various aspects of designating and implementing protected areas, so that it can be understood by lay persons.

The role of fishing community institutions in conservation of marine living resources was also illustrated, drawing attention to the several traditional systems and institutions such as the *kadakodi* system of northern Kerala and the federated structure of governance of the *pattanavar*s of Tamil Nadu and Andhra Pradesh, which have evolved rules to regulate fishing and reduce conflicts. Besides these traditional institutions, the role of new institutions such as boatowner associations, trade unions, co-operatives, women's self-help groups and federations, and trade associations was also stressed. It was suggested that a co-management approach could include traditional structures that are already embedded with social capital.

The workshop agreed that the larger fight is really against environmentally destructive development, particularly in a post-liberalization context. In the absence of the right to say "no" to destructive development in protected areas, any talk of "people's participation" becomes merely ritualistic.

The group discussions at the workshop focused on the benefits from marine and coastal protected areas, and how they could be enhanced. All groups pointed out that while some form of protection is needed for coastal and marine resources, on the whole, marine and coastal protected areas have had few beneficial impacts, particularly for local communities. The need for community participation, good governance, transparency, accountability, and reliable data, was stressed. It was suggested that traditional knowledge systems should be integrated with conventional science for protected area management.

The panel discussion on the way forward pointed out that management of existing marine protected areas is weak, and that fishers and managers need to get together to review management approaches to define practical "win-win" strategies. Fishworker organizations drew attention to the various struggles of the National Fishworkers' Forum (NFF) for better management and conservation of resources, stressing the importance of a comprehensive and integrated approach. Conservation efforts should start with regulating the high-impact activities of the larger players in the fisheries and non-fisheries sectors, not the relatively lower-impact activities of the weakest. It was also stressed that costs of conservation should be borne by all, and not just by fishers. The need is to recognize the concept of 'sustainable use', particularly in a marine context, and to adopt frameworks that do not exclude people. The process of setting up marine and coastal protected areas should also recognize power differences between stakeholders. The need is to focus on managing ecosystems as a whole, as waters are interlinked, which calls for better co-ordination and collaboration between different departments and ministries. Institutional co-ordination is important, where Fisheries Departments are seen as partners in the marine and coastal protected area management process. Co-management frameworks need to be devised, with a substantial representation for women as members of co-management committees.

The importance of quantifying benefits from protected areas, and using a comprehensive socioeconomic database, monitoring changes in fish catches and the incomes of fishing communities in the area, was stressed. Where it is clear that livelihoods are being negatively affected, adequate compensation should be given to communities. Periodic evaluations of marine and coastal protected areas also need to be undertaken, to determine whether they are meeting the objectives for which they were set up. Further, consultative processes should be started at the beginning of any effort to declare a protected area, and new categories like Conservation Reserves and Community Reserves, which protect both the rights of local communities and meet conservation objectives, should be explored.

The concluding address by Mr. Suresh Prabhu (Former Union Minister for Power, Environment and Forests, Government of India), to the workshop reiterated the need for a holistic

approach to the conservation of coastal and marine resources. The importance of co-management approaches that integrate the traditional knowledge of fishers into a model of sustainable conservation was also stressed.

The Statement finalized by the participants of the workshop highlights the need to integrate the fundamental principles of participation, environmental and social justice, and human rights in the implementation of marine and coastal protected areas.

The India MPA Workshop Proceedings, which has been published by ICSF, contains the prospectus of the workshop, a report of the proceedings, executive summaries of the case studies, and the consensus Statement that was reached by organizations and individuals who participated in the workshop. The presentations, proceedings of the workshop and case studies are available online at:
http://mpa.icsf.net/icsf2006/jspFiles/mpa/indiaWorkshop.jsp.

Project Profile

Local Ocean Trust: Watamu Turtle Watch, Kenya: An update on sea turtle conservation programmes

Introduction and background

Watamu Turtle Watch (WTW) is based in Watamu, a small coastal village located about 100 km north of Mombasa. It was established in 1997 by concerned local community members, in an effort to consolidate and strengthen sea turtle conservation efforts, practiced in the area since the 1970's. In its early years, WTW focused its conservation efforts on sea turtles in the Watamu Marine National Park and northern shores of the adjacent Mida Creek Reserve, combined with an education programme directed at fishermen and schools. The management of WTW soon realised that the survival of sea turtles in Watamu was intrinsically linked to the wellbeing of the surrounding marine environment, including the protection of sea turtles across their migratory range.

Concerned by the increasing widespread degradation of the Kenyan inshore marine environment, in 2003 the WTW broadened its efforts to encompass marine conservation issues by forming the Local Ocean Trust (LOT). WTW sits as the sea turtle flagship programme within LOT. LOT works in close co-operation with the Kenya Sea Turtle Conservation Committee (KESCOM), of which it is a lead member, the Kenya Wildlife Service (KWS) and Fisheries Department, as well as numerous other stakeholders within the community. Overall, WTW covers three main sea turtle conservation programmes that in combination, conduct nest protection and monitoring, bycatch release and a rescue centre, with community outreach and education incorporating income generating activities, education directed at schools and capacity building coming under general LOT programmes.

Watamu and Malindi Marine National Park sea turtle nest protection programme

Since 1997, with the co-operation of the local community, WTW has managed and operated a nest protection and monitoring programme in Watamu Marine National Park and Reserve. In the Malindi Marine National Park, WTW has established a similar programme, managed by KWS, and guided and overseen by WTW. Staff patrol the nesting beaches every night of the year, to locate and tag nesting sea turtles and protect the nests. Green turtles are the predominant nesters along with occasional olive ridleys.

The Watamu programme provides valuable information on the population status of turtles in the area. For the past four years in a row, previously tagged nesting sea turtles have returned to Watamu after an absence of 3-5 years. These were the first recorded return-nesting sea turtles in Kenya, highlighting the value of this programme.

For the period 1997 to 2007, 325 green sea turtle nests have been protected, making Watamu a very secure nesting area. Up to the end of July 2008, 29 green sea turtle nests have been protected. With sea turtle populations under threat in Kenya, the natural 'release' of over 43,000 hatchlings since 1997 highlights the conservation value of nest protection and monitoring.

Sea turtle bycatch release programme

This programme works in co-operation with local fishing communities, in an effort to encourage fishermen to release, rather than slaughter sea turtles accidentally caught in their fishing gears. The localities where sea turtles are caught in this manner include Mida Creek Reserve and the Watamu Marine Reserve. The sea turtles are released by WTW into the Watamu Marine National Park, which is a no-take sanctuary for all sea life. WTW pays a compensation fee of approximately $US 5 per sea turtle to the participating fishermen, to cover their public transport, telephone costs, fishing gear damage, and time and inconvenience in notifying WTW about the captured sea turtle. Biometric data are recorded and each sea turtle is tagged before release.

In the Watamu area, from August 1998 to June 2009, over 4000 sea turtles had been saved from slaughter and released by WTW under this scheme.

Fishermen in Mida Creek with a bycatch juvenile green sea turtle

The direct conservation value of LOT activities and programmes is clear and they receive support from donor organisations like African Fund for Endangered Wildlife and the local tourism sector. Funds are also raised through sea turtle adoption schemes, and many activities are carried out by volunteers, making this a long term sustainable programme. The bycatch programme is believed to be the longest running programme of its kind worldwide. The programme has also revealed that the Mida Creek Reserve and surrounding Watamu waters are a nationally important feeding ground for juvenile green and hawksbill turtles. Each year the number of fishermen participating in the scheme around Watamu increases, as do the number of releases. By June 2009 over 200 hundred fisherman had participated. This reflects the success of LOT's education and awareness work among the fisher communities. It can also be seen as an indication of positive change in fishers' attitudes towards conserving sea turtles and the marine environment.

LOT has assisted with the formation of Beach Management Units (BMUs) in the Watamu area. BMUs are formed by co-operative groups of fishermen and marine stakeholders, licensed with the Kenya Fisheries Department and encouraged

to use approved fishing gears and methods to manage their fishery and activities in a sustainable manner. LOT provides educational input and advice to BMUs to emphasise the value to conserve the marine environment and sea turtles.

Watamu Marine National Park and Reserve patrols

LOT employs a field officer and a member of the local fishing community to conduct daily patrols within the marine protected areas around Watamu, collecting information on illegal and deleterious marine resource exploitation. This information is recorded in monthly reports and sent to the authorities and marine stakeholders, in an effort to promote awareness and effective law enforcement.

Sea turtle rescue centre

Prior to 2003 there were only two African countries with sea turtle rescue centers. Donor funding has also enabled LOT to put Kenya's sea turtle conservation efforts on the map, with Africa's third and Kenya's first sea turtle rescue centre.

This is now the fifth year of rescuing/rehabilitating sick and injured sea turtles with considerable success during this period, releasing approximately 40 of 60 sea turtles that have come into our care through the WTW net release programme.

Community education programme

Sea turtle and marine conservation education and awareness activities have been undertaken in 21 local schools in the region and also among fisher communities. Besides providing otherwise unavailable education of this kind, LOT's Community Education Programme also encourages and supports community based eco-tourism and alternative income generating initiatives in an effort to alleviate local poverty and pressure on the marine resources.

For more information about LOT-WTW, write to Belinda Norris at *wtwkenya@swiftmalindi.com*.
For more information about KESCOM, write to *kescoms@yahoo.com*.

Contributors: Steve Trott and Rob Markham

NGO Profile

Action for Protection of Wild Animals (APOWA):

Sea turtle conservation and habitat protection in the buffer zone of the Gahirmatha sea turtle rookery, Kendrapara, Orissa

Background

Over the years, olive ridley turtles have suffered along the Orissa coast due to several reasons. Apart from fishing related mortality, turtles face multifarious problems while they are in the coastal waters of Orissa. The threat of predation by feral and wild animals is a hindrance to the recruitment of offspring, and anthropogenic activities are harmful to the habitat and impact breeding of turtles. Sporadic nesting contributes equally to that of *arribadas* (mass nesting) and hence it is imperative that sporadic nests are offered equal protection. In the recent past, increased disposal of garbage has rendered these beaches unsuitable for nesting and there is now a need for consistent clean-up programmes to provide the olive ridley turtles a safe and clean nesting habitat. There is also a need to increase awareness among the communities living in these areas as they can contribute substantially to conservation of turtles that visit the Orissa coast.

APOWA (Action for Protection of Wild Animals) works towards saving, protecting and helping conserve endangered sea turtles and their habitats along the Orissa coast. Our programmes aim for the active participation of every seaside village along the coast. We endeavor to continue and strengthen these efforts.

The current activities of APOWA are carried out under a project that is being undertaken along the periphery and buffer zone of the Gahirmatha Wildlife Sanctuary, with the funding support of a Rapid Action Project of the Wildlife Trust of India. The project involves the monitoring of the nesting population as well as protection of nests. Sea turtle hatchlings, when they emerge, are offered protection from predators, and disoriented hatchlings are guided safely to the sea. Our activities also include a public awareness component aimed for the residents of coastal villages and tourists. Awareness programmes are conducted by involving and mobilizing local people, especially members of fishing communities. Beach cleaning activities have also been conducted in specific sites. The project has received considerable assistance from local volunteers, members of local communities and school students, who are organized, trained and supervised by our experienced personnel.

Details of project activities:

Clean-up of nesting sites:

The cleaning of debris from sporadic nesting beaches is carried out to ensure sea turtles easier access to nesting sites and hatchlings easier access to the sea. Members of APOWA along with volunteers of other NGOs, local youth clubs, women's SHGs (Self Help Groups) and school students participated in the recent beach clean-up programme at Paradeep and at other places in a phase-wise manner. The field workers along with the local volunteers carried out the beach clean -up every afternoon for an hour at the project sites. Garbage on the beach, such as plastic, polythene bags, clothes and other debris were cleared from the beach for the safe nesting of turtles.

Monitoring and patrolling:

A large part of this project is devoted to direct protection of turtles and their nests. Volunteers from local coastal villages have been appointed as "turtle guides". They work round the clock for the protection of nests and turtles along the coast. They protect turtles and their nests from feral dogs, jackals, wild boars and other wild and domestic animals.

Rescue of disoriented hatchlings:

Hatchlings normally emerge after a period of about 45-55 days, depending upon the ambient sand temperature and climatic conditions. Artificial lighting and other factors disorient hatchlings, which then tend to move further inland from their nests, away from the sea. To prevent such disorientation, turtle guards and volunteers are trained to guide the hatchlings to the sea.

Awareness programmes:

Conservation of sea turtles is not possible without the help of local communities, fisherfolk and members of other communities that reside in these areas. We create awareness about sea turtle conservation among these communities regarding the detrimental impacts of mechanized trawlers and boats that endanger not just sea turtles but also threaten local artisanal fishing communities. Also, excess fishing by mechanized trawlers and boats significantly reduces fish stocks. While APOWA primarily tries to discourage the use of mechanized boats in these areas, we promote the use of Turtle Excluder Devices where mechanized boats are already in use. Members of local communities have also been sensitized to the need for maintaining a balance in the coastal and marine ecosystem. As part of awareness generation activities that extend beyond local communities, a large hoarding with relevant information has been installed for the benefit of visitors and tourists.

Future plans

The Rapid Action Project has achieved new heights and has helped in reaching all of APOWA's goals, none of which would have been possible without the support and assistance of the Wildlife Trust of India, and a fine team of members and volunteers of APOWA. In keeping with our own recommendations for effective conservation of sea turtles, we would like to carry on the following activities in the coming months that will ensure the survival of the sea turtles along the Orissa coast.

Monitoring:

Proper monitoring of nesting sites will be carried out and monitoring units will be formed by involving greater participation of local communities, members of the youth, and others across nesting sites, especially outside of the protected area where turtles are more vulnerable to threats.

Awareness programmes:

Community involvement in conservation activities will be strengthened by increasing awareness amongst members of these communities. Awareness among the coastal community will help maintain habitats and will ensure survival of the species.

Beach cleaning:

Cleaning of beach debris on nesting beaches in highly sporadic nest pockets will be carried out before the next nesting season (December-January).

Hatcheries:

The use of hatcheries will contribute to the recruitment of sea turtles in Orissa. In addition, it will serve well as an educational tool to generate awareness among the local community and general public about the necessity for sea turtle conservation.

For more information on APOWA's activities, write to *mail@apowa.org*, or visit www.apowa.org.
Contact APOWA at Hatapatana, P.O. Kadaliban, Kendrapara District, Orissa – 754222, India.

Contributor: Bijaya Kumar Kabi, Honorary Director, APOWA

Research Summaries

From pattern to process: recent marine turtle publications advance our understanding of oceanographic influences on marine turtle biology and demography

Jeffrey A. Seminoff

Marine Turtle Ecology & Assessment Program, Southwest Fisheries Science Center, NOAA – National Marine Fisheries Service, La Jolla, California USA
Email: Jeffrey.Seminoff@noaa.gov

When I was asked to write this summary of what I considered to be the key research articles in marine turtle ecology to emerge over the past year, I knew there would be some difficult choices ahead. Indeed, we're in a golden time in marine turtle research; today there are more researchers studying more questions in more places than ever before. And thanks to this research, we've got a better handle on a wide palate of topics; from physiology and behavior to social science and economics; from long-term nesting beach monitoring to the ecology of turtles at sea. While we've no doubt strengthened the foundation of knowledge for these and other topics, for this review I'd like to shed attention on a rather new line of research, one that blends a variety of new technologies and novel approaches. Here I describe a 'set' of papers that have a common theme which reflects an important area of research, critical in fact, as together these papers represent the intersection between three important fields: oceanography, marine turtle demography, and fisheries management. These are by no means the only papers on these topics, yet they do show the research community's movement beyond simply describing the patterns we see in marine turtles, and reflect the growing investment 'we' are making toward understanding the reasons why turtles do what they do, and how we can use that information to improve fisheries management.

Caut, S., E. Guirlet, E. Angulo, K. Das & M. Girondot. 2008. Isotope analysis reveals foraging area dichotomy for Atlantic leatherback turtles. *PLoS ONE* 3: 1845-1853.

Stable isotope analysis is a blossoming research tool in the study of marine turtles and the paper by Caut *et al.* is a fine example of how this technology can be used to get at 'big picture' concepts such as the influence of migration and foraging area on nesting remigration intervals. Based on the paradigm of 'you are what you eat', marine turtles – just like humans, or butterflies, or neotropical song birds, or great whales – integrate the isotopic signatures of their surroundings, the foods they eat and the water they drink. This information is stored in their body's soft tissues for a period of weeks to months such that a skin or blood sample collected from a turtle at a nesting beach can provide some insights about the habitat characteristics, and diet, from the area previously occupied prior to nesting. In Caut *et al.* (2008) the authors use stable isotopes as dietary tracers to reveal the isotopic characteristics of feeding grounds of leatherback females (*Dermochelys coriacea*) nesting in French Guiana. Caut *et al.* show that there is a strong difference in the stable carbon and nitrogen isotope signatures between leatherback turtles that are 2-yr vs. 3-yr remigrants to the nesting beaches of Yalimapo beach in French Guiana, South America. With these results, the research team suggests that these two groups have substantial differences in their choice of feeding habitats (offshore vs. more coastal) and foraging latitude (North Atlantic vs. West African coasts). And while this 'match' between isotope signatures in tissue and the specific oceanic region that produces such a signature is more speculative than based on hard data, this study is the first paper to examine how dichotomies in habitat selection among individuals in the same nesting population may drive variability in remigration interval.

Saba, V., J. Spotila, F. Chavez & J. Musick. 2008. Bottom-up and climatic forcing on the worldwide population of leatherback turtles. *Ecology* 89: 1414-1427.

Much like the previous paper, this landmark paper by Saba *et al.* provides a fantastic account of the oceanographic mechanisms that drive variability in the remigration interval of leatherback turtles. This is a follow up paper to a Saba *et al.* paper published in 2006 in the Journal of Applied Ecology (volume 44, pages 395–404). However, I focus on this paper published in Ecology because it provides a more global perspective that encompasses leatherbacks and the influence of oceanography on reproductive output in the Pacific, Atlantic, and Indian Oceans. Saba *et al.* conduct an extensive review of leatherback nesting and migration data in light of net primary production at post-nesting migratory regions and foraging areas. They show how influences of oceanographic processes of decadal oscillation and El Niño Southern Oscillation (ENSO) are two major forces that impact the periodicity of leatherback nesting. For me, the major point of the paper was that lower productivity and inconsistent oceanography of the Pacific Ocean may render some Pacific leatherbacks more susceptible to variable reproductive output, and thus in a more precarious position when it comes to population recovery. The paper does not delve deeply into questions about how much the human factor has helped, or hindered, leatherback population recovery, but it is another shining example of how marine turtle research has graduated from simple pattern recognition and is now addressing the underlying processes that influence a population's reproductive output. Not to mention, the paper does a great job at taking something that could be rather technical and putting it into understandable language for those not familiar with oceanographic concepts.

Chaloupka, M., N. Kamezaki & C. Limpus. Is climate change affecting the population dynamics of the endangered Pacific loggerhead sea turtle? 2008. *Journal of Experimental Marine Biology and Ecology* 356: 136-143.

Moving on from studying how oceanography may impact the remigration intervals of marine turtles, we now arrive at a paper that works to distill the potential effects of oceanography on nesting trends of a population – loggerheads (*Caretta caretta*) in the Pacific Ocean. Chaloupka *et al.* use well established modeling approaches to explore whether sea water temperatures in the Pacific Ocean affect the long-term nesting population dynamics for loggerheads nesting in Japan and Australia. Interestingly, they found that both Pacific 'stocks' have been exposed to slowly increasing trends in mean annual sea surface temperature (SST) in their respective foraging habitats over the past 50 years. Why is this important? Because Chaloupka's team demonstrates that regardless of decade or population, there was an inverse correlation between nesting abundance and mean annual SST in the oceanic foraging regions during the year prior to the nesting season, such that warmer waters resulted in lower nesting abundance. Chaloupka *et al.* go on to explain how temperature may affect primary productivity and food availability, but the take-home message is that warming regional ocean temperatures could potentially lead to long-term decreases in nesting and recruitment unless Pacific loggerheads adapt by shifting their foraging habitat to cooler regions. While this may not be the 'smoking gun' that people are looking for to explain the slow recovery of loggerheads in the Pacific, it certainly shows that there is potential for other factors outside of fisheries bycatch to be impacting a population's capacity to recover. Much like the approach of Saba *et al.* (2008), this is a paper that represents the intersection between oceanographic studies with marine turtle reproductive output. Obviously, a central theme to the marine turtle conservation community is population recovery, thus I consider this paper, and others like it (see Saba *et al.* above) to be among the most important areas that scientific research can help inform marine turtle conservation. I hope it is a research area that will continue to expand in the future!

Howell, E.A., D.R. Kobayashi, D.M. Parker, G.H. Balazs & J.J. Polovina. TurtleWatch: a tool to aid in the bycatch reduction of loggerhead turtles *Caretta caretta* in the Hawaii-based pelagic longline fishery. 2008. *Endangered Species Research* 5: 267-278.

In this contribution to the Theme Section 'Fisheries bycatch: problems and solutions' of Endangered Species Research, Howell *et al.* show how understanding the oceanographic drivers to sea turtle movements and habitat use can be used to better manage fisheries in relation to their impacts on turtles. This study focuses on loggerhead turtles in the central North Pacific, and uses satellite telemetry and remotely sensed oceanographic data to show that loggerhead turtles closely track sea surface frontal zones. More importantly, the authors have taken this understanding 'online' with fisheries management of U.S. longline fleets in the North Pacific. Howell's team has developed a first-of-its-kind management tool that has resulted in substantial acclaim. Fishers now have a better understanding of the oceanographic forces that dictate loggerhead movements. And of course they don't want to interact with sea turtles during their fishing efforts, so for many fishers on the high seas, this is a welcome product. The great aspect of this is that many vessels have satellite internet, and thus are able to get this information real-time while they are at sea. And there is strong evidence that TurtleWatch works! As reported in Howell *et al.* (2008) the observed fleet movement during the initial fishing efforts of 2007 was to the north of the area recommended for avoidance by the TurtleWatch product (north of the 18.5°C isotherm), and despite increased fisheries effort compared to previous years, the loggerhead turtle bycatch rates were lower. Granted, fisheries bycatch avoidance may not be so straight forward all around the world, but this paper shows the potential for products to be developed that blend our understanding of marine turtle habitat use with remotely sensed satellite data and that can be quickly disseminated to fishers to help them avoid turtle interactions. As far as publication goes, I can't think of a better venue than Endangered Species Research, due to its numerous special focus issues and the fact that it is freely available online; I only wish that more journals moved to 'free access' format. In closing, I must admit that I work for the same agency (NOAA) that Howell and his colleagues work for. But in this present case I have watched from the sidelines and have not been involved with the development or implementation of the TurtleWatch product in any way.

2nd Announcement: 30th Annual Symposium on Sea Turtle Biology & Conservation 27 – 29 April, 2010 Goa, India

Kartik Shanker

President, International Sea Turtle Society
Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560012, India.
Email: kshanker@ces.iisc.ernet.in
Symposium website: http://india.seaturtle.org/symposium2010

The annual sea turtle symposium, organized by the International Sea Turtle Society (ISTS), will be coming to South Asia for the first time. It will be held in Goa, India between the 27th and 29th of April, 2010. Regional and pre-symposium meetings will be held between the 24th and 26th of April, 2010. Details of these meetings and post-symposium activities will be provided on our website.

The event will be jointly hosted and organized by sea turtle conservation groups and research organizations as well as institutions that work on marine environment issues across India and South Asia. Based on previous Annual Symposia of the ISTS, we are expecting up to 700 participants, from as many as half the nations on the planet. The ISTS Annual Symposium is truly unique, drawing an enormous number and diversity of people interested in these intriguing animals.

Dates: Symposium: 27-29 April 2010
Regional and Pre-symposium meetings: 24–26 April 2010
Post-symposium workshops and tours: From April 30, 2010

Venue: Symposium: Kala Academy, Panaji, Goa (www.kalaacademy.org)
Regional and Pre-symposium meetings: *To be decided*

Theme: *The world of turtles*

Sea turtles inhabit the land and the sea. They connect the shallow nearshore waters to the open sea, cold temperate to warm tropical waters. They migrate across ocean basins. And through several thousands of years, they have connected us ecologically and culturally to the sea. The thirtieth annual symposium on sea turtle biology and conservation will seek to explore these connections and focus on the world they live in. The world of coral reefs, seagrass meadows, open seas and sandy beaches. The world of people, living and working on the coast or at sea; of fishing cultures and livelihoods. All connected by sea turtles and by us.

The 30th symposium will also draw attention to the concerns of fishing communities, especially those across the South Asian region, within the conservation paradigm and will address how marine conservation issues can be approached without jeopardizing - but rather by enhancing - the livelihoods of communities that depend on these resources and the same environments that are needed by the turtles. In this context, discussions will also focus on traditional fishing communities, whose practices have often been questioned by the conservation community, but whose contributions to maintaining and ensuring the "health" of the marine ecosystems must be acknowledged and addressed.

Registration

Early registration deadline: 31st October 2009

To attend or participate in the symposium, you must register, preferably in advance. The registration process will commence by 1st September 2009. The early registration deadline is 31st October 2009. You can register at iconferences.seaturtle.org. Early registration fees are as follows:

High income: USD 195
Regular income: USD 125
Student / Low income: USD 25/INR 1000

Registration remains open until the symposium, but you will incur a higher registration fee past the early registration deadline (31st October 2009). Hence, we encourage you to register well in advance, which will then allow you to submit your abstracts and applications for travel grants. This will also give us adequate time to make preparations for the many programmatic, lodging, social event related, travel, and other activities that need to be dealt with in an event as large and complex as this.

If you are unable to make an online payment for registration, contact your regional travel chair (see below), or one of the local organizers if you are from South Asia (see below); the registration fee for travel grant applicants may be deferred until you arrive in Goa.

If you are attending the symposium for the first time, it is important to point out that by registering for the 2010 symposium you automatically become a member of the International Sea Turtle Society. You can then receive updates about the symposium, and other events from the ISTS, through seaturtle.org.

Travel grant applications

Travel grant application deadline: 31st October 2009

You may apply for a travel grant to help finance your travel to the symposium. In the least, a travel grant ensures you accommodation for the duration of the symposium. Travel grant applications are submitted to regional travel chairs for consideration. Please note that you can submit a travel grant application only after registration; however, you can submit a travel grant application prior to payment of the registration fee.

Abstract submission

Abstract submission deadline: 31st October 2009

Abstracts should be submitted online at iconferences.seaturtle.org. To submit an abstract, you must first register and make a payment. However, under special circumstances, travel grant applicants can have the payment deferred by contacting their travel chair; this will enable you to submit your abstract without paying beforehand, but you must still submit the abstract before the deadline. Your abstracts will be reviewed by the Programme Committee and a notification of whether or not your abstract has been accepted will be sent to you by January, 2010. You may choose your preference of oral, speed and/or poster presentation. Instructions and more details are available on the symposium website.

Programme

The symposium will be held at the Kala Academy, Goa. In keeping with the theme of the symposium, the sessions proposed to be held during the main days of the symposium (27 – 29 April 2010) include standard symposium as well as special sessions, including Ecosystem function, Resource dependent livelihoods, Environmental impacts and others. Further details will be announced on our website soon. Several workshops have been planned and will also be announced shortly.

Pre- and post – symposium meetings (24 – 26 and 30th April 2010) include the IUCN/MTSG meeting, Freshwater Turtles meeting, and several regional meetings.

Sponsors

An event of this magnitude and complexity requires the support and participation of many key/active partners and sponsors. Support for the 2010 symposium is solicited from all quarters. If you would like to contribute by way of sponsorship, or help us locate potential sponsors, towards organizing and conducting the symposium, we'd be grateful for any help.

Volunteer!

A dedicated team of local and international volunteers is helping organize the many facets of the symposium. We will however, need plenty more help leading up to, and during the days of the symposium. If you would like to volunteer your

time and effort towards organizing this event, do write to us (Supraja Dharini – International Volunteers Coordinator at treefoundation2002@gmail.com or Seema Shenoy – Symposium Coordinator (India) at seemashenoy83@gmail.com).

Location: Goa

Goa was chosen as the ideal location to host the symposium for a variety of reasons. It has long been a favoured destination for tourists from around the world and has the necessary facilities and infrastructure to cater to a very large and diverse group of visitors. Being on the coast, Goa offers symposium participants the opportunity to explore its unique shores, its rich tropical forests and mountains, and diverse cultural and historical heritage sites. Information about Goa will be provided on our symposium page.

Travel to India / Goa

Many international flights ply to major Indian cities on a regular basis. Mumbai (Bombay), situated 600 km to the north of Goa, is one of the primary ports of entry. Trains, buses and taxis frequently ply between Mumbai and Panaji, the capital of Goa and the location of the symposium. From all other major cities in India, low cost airlines, trains and buses provide easy and reasonably priced transportation to Goa. Goa also has an international airport located 30km from Panaji. You can contact the event manager (Host India Events) or official travel agency (Integrated Conference or Event Management – ICE India) for help with your bookings. Contact details and other information are available on the symposium website.

We strongly recommend applying for visas to India well in advance. Specific information related to visa applications and travel options will be available on our website. Useful visa and travel related information is also available at www.visatoindia.com and www.tourism.gov.in. You can write to ICE India (see below) for any further information or assistance you may need.

We encourage you to arrive early, or stay on after the symposium. Traveling within India is easy on the pocket, and there is a lot to explore. Low budget airlines and an extensive road and rail network connect all corners of the country. Tour packages are also on offer from ICE India. Visit our website to know more.

Accommodation

A wide range of accommodation options is available in Goa. You can book rooms through the symposium website or can make bookings on your own. Booking rooms through our website will give you the added benefits of reduced rates, special offers and the option of choosing a hotel that is best suited to your budget and other preferences.

More information

For more details, visit http://india.seaturtle.org/symposium2010 or iconferences.seaturtle.org. Be sure to visit these sites regularly for the latest updates. By registering for the symposium, you could also choose to have the latest updates reach you by email. For any additional information, queries, inputs and suggestions, do contact us:

Symposium Coordinator
Seema Shenoy
(seemashenoy83@gmail.com)

Symposium Event Manager
Vijitha D'Silva, Host India Events
(jacintha@hostindiaevents.com)

Travel, Accommodation and Visa
G.N. Raju, Integrated Conference and Event Management (raju@iceindia.in)

Programme Advisors
Jack Frazier and BC Choudhury
kurma@shentel.net and bcc@wii.gov.in

Programme Committee
goaprogram@lists.seaturtle.org

Programme Coordinator
Dubose Griffin (griffind@dnr.sc.gov)

Programme Coordinator (India) and Regional Partners Coordinator

Naveen Namboothri: naveen.namboo@gmail.com

International Volunteers Coordinator
Supraja Dharini: treefoundation2000@gmail.com

Travel Committee Chair
Hoyt Peckham hoyt@biology.ucsc.edu

Regional Travel Chairs

Africa: Angela Formia - aformia@seaturtle.org
Asia/Pacific and Middle East: Nicolas J. Pilcher - pilcher@tm.net.my
South Asia: Kartik Shanker - kshanker@ces.iisc.ernet.in
Caribbean (English-speaking): Karen Eckert - keckert@widecast.org
Europe: Aliki Panagopoulou - aliki@archelon.gr
Latin America and Spanish-speaking Caribbean: Alejandro Fallabrino - afalla7@gmail.com
USA and Canada: Bryan Wallace - b.wallace@conservation.org

Regional partners

We cordially invite other regional organizations to collaborate. Our current partners include:

Centre for Advanced Research in Natural Resources & Management (CARINAM), Bangladesh
Contact: S.M.A Rashid: carinam95@yahoo.com

Marine Life Alliance, Bangladesh
Contact: Zahirul Islam: marinelife_al@yahoo.com

Marine Research Centre, Maldives
Contact: Shiham Adam (Executive Director): msadam@mrc.gov.mv
Marie Saleem (Reef Ecologist): msaleem@mrc.gov.mv

WWF – Pakistan
Contact: Ahmad Khan: akhan@wwf.org.pk

Turtle Conservation Project, Sri Lanka
Contact: Thushan Kapurusinghe: turtle@sltnet.lk
Lalith Ekanayake: lalitheml@yahoo.com

South Asia Cooperative Environment Programme (SACEP), South Asia
Contact: Jacintha Tissera (Director General): sacep@eol.lk
Dr. Venkatesan (Regional Coordinator): dr.r.venkatesan@gmail.com

India partners

Several more partners are expected to come on board in the next few weeks, including from the government. Two major networks, the Turtle Action Group, a newly formed national network of small non-government organizations working on sea turtles on the coast of India, and the Orissa Marine Resources Conservation Consortium, an alliance of fisher groups and conservationists in Orissa, are also partnering in the symposium.

- Ministry of Environment and Forests, Govt. of India (MoEF)
- Bombay Natural History Society (BNHS), Mumbai
- Centre for Ecological Sciences (CES), Indian Institute of Science, Bangalore
- Dakshin Foundation (DF), Bangalore
- Greenpeace India
- Gujarat Institute for Desert Ecology (GUIDE), Bhuj
- Madras Crocodile Bank Trust, Mamallapuram
- National Centre for Biological Sciences, Bangalore
- Nature Conservation Foundation, Mysore
- Orissa Marine Resources Conservation Consortium (OMRCC), Orissa
- Turtle Action Group (TAG), India
  (A national network of community based and local conservation groups)
- Wildlife Protection Society of India (WPSI), New Delhi
- Wildlife Information Liaison Development (WILD), Coimbatore
- WWF – India, New Delhi
- Zoo Outreach Organization (ZOO), Coimbatore

Resources of Interest

Resources from the necroscopy workshop at the 29th Annual Symposium on Sea Turtle Biology and Conservation, Brisbane Australia (February 2009)
(http://www.uq.edu.au/vetschool/index.html?page=102248)

An extremely popular sea turtle necropsy training workshop was held at the 29th Symposium on Sea Turtle Biology and Conservation in Brisbane in February this year. The workshop aimed to provide a "taster" of necropsy techniques and information and give participants direct access to relevant international experts. The workshop was delivered by Mark Flint, Jeanette Wyneken, Nancy Mettee, David Blair, Janet Patterson-Kane, Paul Mills and Chris Harvey-Clark. A green turtle post mortem guide and the lectures from the presenters of the workshop are available from the University of Queensland's Vet-MARTI website under "Resources" including:

1. Post Mortem Guide: A veterinarian's guide for the post mortem examination and histological investigation of the green turtle (*Chelonia mydas*).

2. Workshop documents:
   - Anatomy of Sea Turtles
   - Forensic Evaluation of Sea Turtle Injury
   - Abnormal Necropsy Findings in Marine Turtles
   - Sample Collection Techniques for Histology and PCR
   - Parasites of Sea Turtles

Participants at the workshop in Brisbane

Dive below the seas or travel back in time
(http://earth.google.com/tour.html)

The latest Google Earth 5 developments are nifty. The ocean layer allows you to dive beneath the waves and explore the sea floor, while a new button in the toolbar gives you the potential to travel back through time by viewing historical images of an area e.g., to look at changes in coastal development. The touring feature lets you create personal tours of the globe that can be shared with others, e.g. you could make a short Google Earth video tour of the turtle nesting beaches in an area, complete with narration.

Coastal passive net fisheries bycatch – how to mitigate it
(http://www.ioseaturtles.org/feature_detail.php?id=284)

The proceedings of the Technical Workshop on Mitigating Sea Turtle Bycatch in Coastal Passive Net Fisheries held in Honolulu, Hawaii, from 20-22 January 2009 are now available.

For an overview of the workshop and link to the proceedings document go to the website.

Also of note, the IOSEA website now has a page that lists (and links to) selected resolutions, recommendations and decisions concerning marine turtles (particularly mitigation of bycatch), e.g. from regional fisheries management organizations. http://www.ioseaturtles.org/content.php?page=Resolutions,%20Recommendations,%20Decisions.

Cover Design: ECOTONE, Chennai
Printed by: Medknow Publications Pvt. Ltd., Mumbai, India.
Cover photograph: Release of a stranded leatherback turtle in Kanniyakumari district, Tamil Nadu, India (Photo: P. Sathiyaselvam, 2009)

CONTENTS