

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

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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.

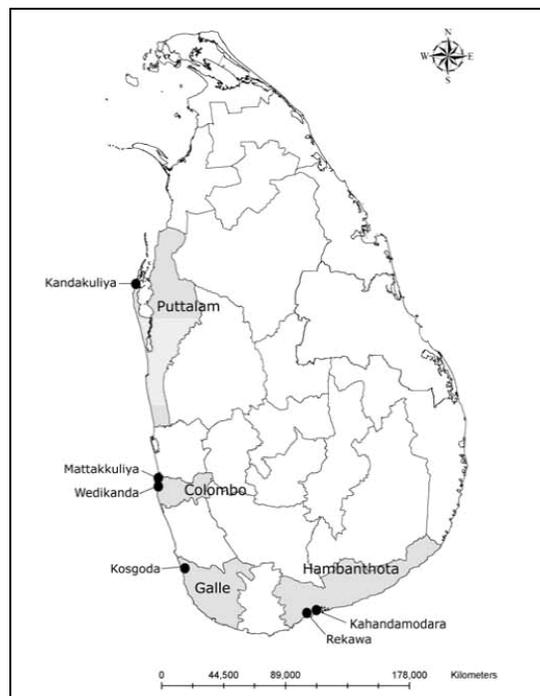


Figure 1: Map of Sri Lanka showing the six study villages and the districts along the northwestern, western, southwestern and southern coast.

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

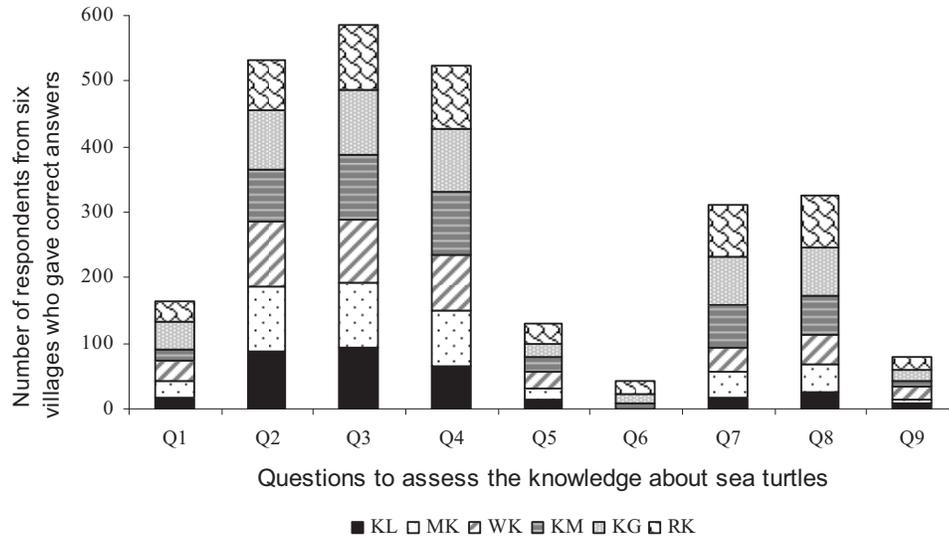


Figure 2: Number of respondents in the six villagers who gave correct answers to nine questions assessing the knowledge about sea turtles. (KL = Kandakuliya, MK = Mattakkuliya, WK= Wedikanda, KM = Kahandamodara, KG = Kosgoda, RK = Rekawa. n = 100 per village).

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.

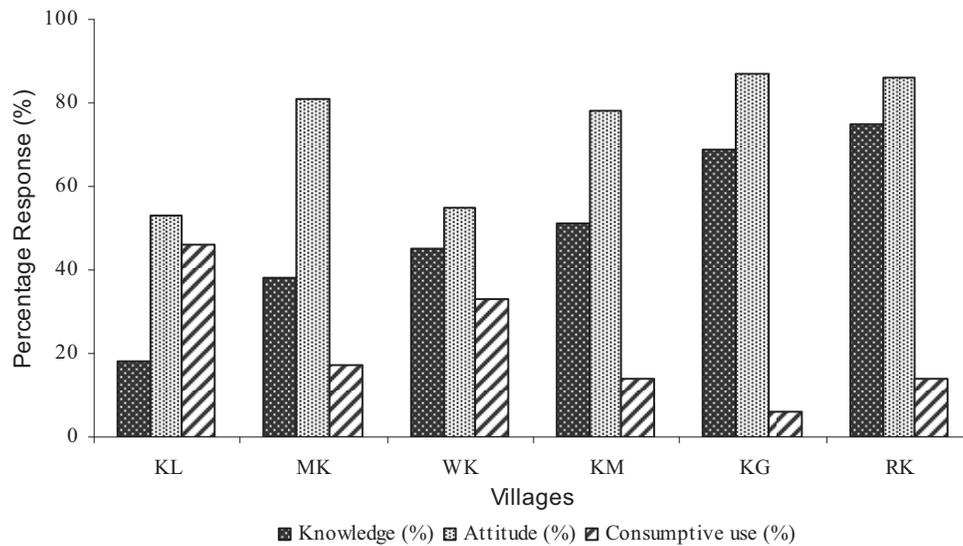


Figure 3: Percentage of respondents who have sufficient knowledge about sea turtles, positive attitude towards sea turtle conservation and high consumptive use in six villages. KL = Kandakuliya, MK = Mattakkuliya, WK= Wedikanda, KM = Kahandamodara, KG = Kosgoda, RK = Rekawa. n = 100 per village.

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 ($\chi^2 = 3.54$, $p = 0.060$; Table 3). When the nesting villages were compared with Mattakkuliya, a significantly less consumption was observed only in Kosgoda ($\chi^2 = 5.94$, $p = 0.015$; 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) 90% (388/432)	0.853 (0.241 – 3.348) 0.800	97% (130/134) 94% (407/432)	1.017 (0.230 – 4.490) 0.982
	30 and above					
Occupation	Fishers & related	50% (144/288) 0.962 (0.698 – 1.325) 0.814	87% (251/288) 93% (289/312)	1.852 (1.071 – 3.201) 0.027*	91% (263/288) 98% (306/312)	4.847 (1.958 – 1.997) 0.001*
	Other					
Sex	Male	58% (266/455) 5.34 (3.433 – 8.331) 0.000**	87% (398/455) 98% (141/145)	0.148 (0.045 – 0.481) 0.001*	90% (41/455) 86% (124/145)	1.46 (1.055 – 2.040) 0.008*
	Female					
Education level	Elementary or >	46% (167/365) 1.46 (1.055 – 2.040) 0.022*	88% (322/365) 93% (218/235)	1.712 (0.951 – 3.080) 0.073	92% (337/365) 99% (232/235)	6.425 (1.930 – 1.382) 0.002*
	Secondary or <					
Income level	Poor (< 10,000 Rs)	48% (212/443) 1.286 (0.892 – 1.853) 0.176	89% (395/443) 92% (145/157)	1.468 (0.758 – 2.842) 0.253	96% (424/443) 92% (145/157)	0.541 (0.256 – 1.142) 0.107
	Moderate (10-20,000 Rs.)					
No. of family members	Small (5 or less)	51% (234/457) 0.738 (0.505 – 1.078) 0.116	90% (413/457) 89% (126/143)	0.838 (0.457 – 1.537) 0.570	95% (434/457) 94% (134/143)	0.887 (0.388 – 2.030) 0.778
	Large (6 or more)					

* 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.

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