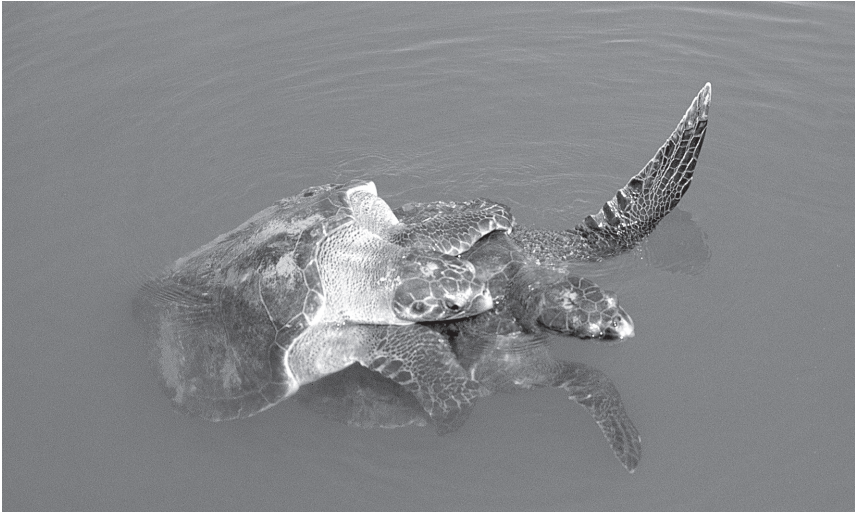




Part 4

MARINE TURTLES  
OF THE SUBCONTINENT

OLIVE RIDLEY'S MATING (PHOTO: BVASH PANDAV)





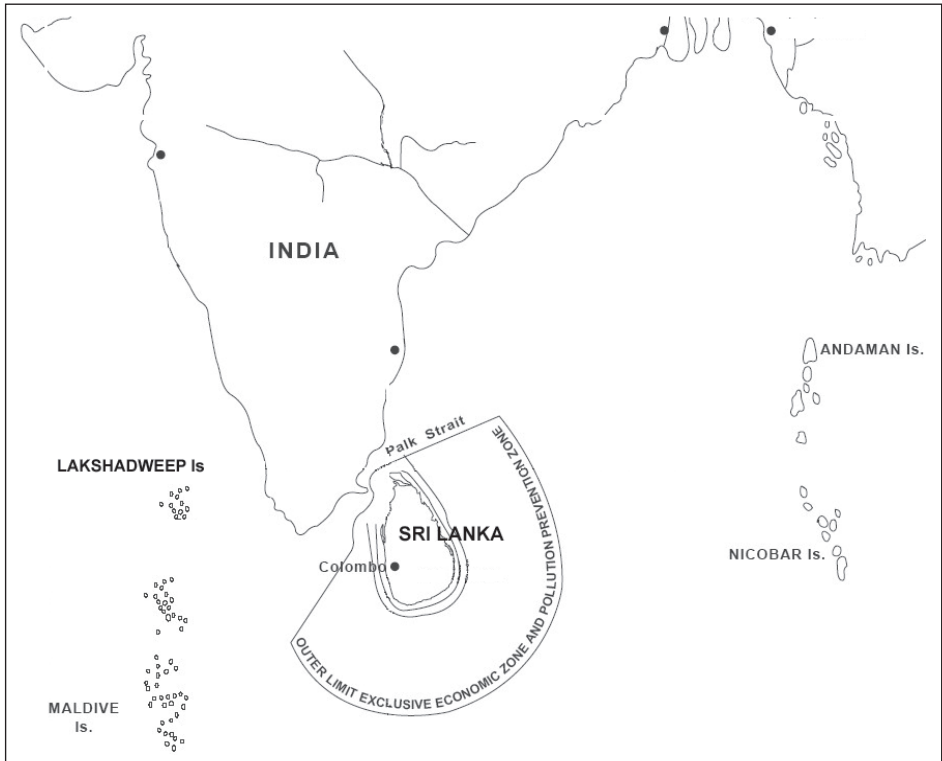
# Status and Conservation of Marine Turtles in Sri Lanka

Thushan Kapurusinghe

Sri Lanka is an island located below the southern tip of India, separated from the South Asian mainland by the shallow seas of the Gulf of Mannar. It is situated between 5°55'–9°51'N and 79°41'–81°53'E. Sri Lanka measures 353 km north–south, is 183 km at its widest point, and covers a total land area of 65,610 sq km. The island has a 1,585-km-long coastline (Olsen et al 1992). Sri Lanka's territorial waters cover an area of approximately 488,675 sq km.

Five species of marine turtles occur in these waters, including the green turtle, olive ridley turtle, loggerhead turtle, leatherback turtle and the hawksbill turtle (Deraniyagala 1953). Despite protection by government legislation since 1972, and a further amendment in 1993 (Fauna and Flora Protection Ordinance (Amendment) 1993), the future of these species in Sri Lankan waters is in jeopardy, with many turtle populations declining significantly. This is mainly due to indiscriminate exploitation for turtle eggs and meat (Frazier 1980, Hewavisenthi 1990). In addition, turtle-nesting beaches are being disturbed by tourism, and feeding habitats—such as coral reefs and coastal vegetation, including mangroves—are being destroyed by pollution. Many turtles are also accidentally caught and drowned in fishing gear each year (Kapurusinghe and Cooray 2002).

Marine turtles have been utilised by the coastal communities of Sri Lanka as food or as an income-generating source of materials (tortoiseshell products) since ancient times. Bennett (1843) has described the abundance of marine turtles in Sri Lanka in the nineteenth century. He reported that hawksbill turtles nested in such abundance that the government leased out the right to harvest them for tortoiseshell products.



**Figure 1.** Territory and Exclusive Economic Zone of Sri Lanka (Survey Department, Sri Lanka, 1988).

## Status and Distribution

### GREEN TURTLES

The status of green turtles in Sri Lanka seems to have changed during the past few decades. Green turtles were earlier reported as uncommon on Sri Lankan beaches (Deraniyagala 1939, Wickramasinghe 1981, Groombridge 1985) and olive ridleys were considered the most common (Kar and Bhaskar 1982). However, surveys conducted between September 1996–July 2000, by the Turtle Conservation Project (TCP), in Rekawa, on the southwest coast of Sri Lanka, revealed that 96.7 per cent of the total nests ( $n=3,218$ ) belonged to green turtles (Ekanayake et al 2002a). This suggests that the nesting populations of green turtles may have been underestimated in the past. While olive ridleys are common in the Gulf of Mannar region, green turtles are more common in the western and southwestern parts of the island. There are nesting beaches at Bentota, Induruwa, Kosgoda, Ambalangoda, Galle, Matara, Tangalle, Hambantota and Bundala (Figure 2). More green turtles can be seen in these coastal waters.

### OLIVE RIDLEY TURTLES

The olive ridley turtle was reported to be the most common marine turtle in Sri Lanka, with regard to both occurrence and nesting (Kar and Bhaskar 1982). This is also reflected in the data from hatcheries in the early 1980s (Wickremasinghe 1982). In the Gulf of

Mannar, ridleys were commonly caught in nets set for green turtles (Kar and Bhaskar 1982). Oliver (1946) and Deraniyagala (1953) reported migrating aggregations of olive ridleys in the months of September and November.

Olive ridleys nest mainly in Kosgoda and Induruwa. They also nest in small numbers in Rekawa and Bundala beaches on the southern coast. The olive ridleys that nest in the arribadas in Orissa, India use the coastal waters of Sri Lanka in the Gulf of Mannar (Pandav 2000). Sri Lankan fisher folk intentionally kill some of these turtles. Ridleys also get entangled in gill nets in large numbers, especially during the flying fish season in Kalpitiya and Kandakkuliya. Olive ridleys eat the fish in the nets and get entangled and drown. Additionally, angry fishermen kill the turtles if they find them eating the fish and damaging the nets. TCP staff observed olive ridley turtles feeding on entangled flying fish during the turtle bycatch survey that was carried out between 1999–2000 (Kapurusinghe and Cooray 2002).

#### LEATHERBACK TURTLES

IUCN's regional conservation strategy recognises Sri Lanka and the Andaman and Nicobar Islands as the last three areas in South Asia that have nesting populations of leatherback turtles (IUCN 2001). Leatherback turtles mostly nest on beaches located in the dry zone of the southern coast. They nest at Godavaya in relatively large numbers and also at Kosgoda, Rekawa, Ussangoda, Kalametiya, Bundala and Yala. The numbers of nesting females have not been recorded accurately for many beaches. Groombridge (1985) estimated the nesting population to be several dozen but probably less than 100. However, Salm (1976) found 173 leatherback nest excavations at Yala National Park between 9–13 June 1975, and 333 nests were estimated by TCP in 2001 at Godavaya (Ekanayake et al 2002b).

#### HAWKSBILL TURTLES

The southern coast of Sri Lanka was once so heavily used by nesting hawksbill turtles that the government licensed stretches of beaches for exploitation. The nesting populations have now been greatly reduced after heavy exploitation for the tortoiseshell industry. It is not uncommon to find hawksbill carapaces used as wall decorations in houses in the southwest and south of the island. Although the number of nesting females has declined, there are still many juvenile hawksbill turtles in offshore waters. It is possible that coral reefs are used as foraging areas by juvenile hawksbills. Six hawksbill nests were recorded by TCP between 1996–2000 from the Rekawa beach. Several authors have documented deaths and poisoning after eating hawksbill turtle eggs in Sri Lanka (Mortimer 1995). As there is no longer any significant nesting population in the region, special conservation efforts need to be taken to protect this species (IUCN 2001).

#### LOGGERHEAD TURTLES

There are no records that suggest that Sri Lanka is a major nesting area for loggerheads. A few turtles nest on the southern coast and in other areas. However, since this is the only nesting population of loggerheads in the subcontinent, the importance of conserving this population in order to protect its genetic diversity must be emphasised. Although nesting loggerheads are rare, juvenile loggerheads are not uncommon in the coastal



waters of Sri Lanka. In the TCP bycatch survey, a large proportion of the turtle bycatch was composed of loggerhead turtles (Kapurusinghe and Cooray 2002). Loggerhead nesting has been reported from Kosgoda, Induruwa, Rekawa, Ussangoda, and Bundala. There is no information from the northern coast due to the ethnic war in that region.

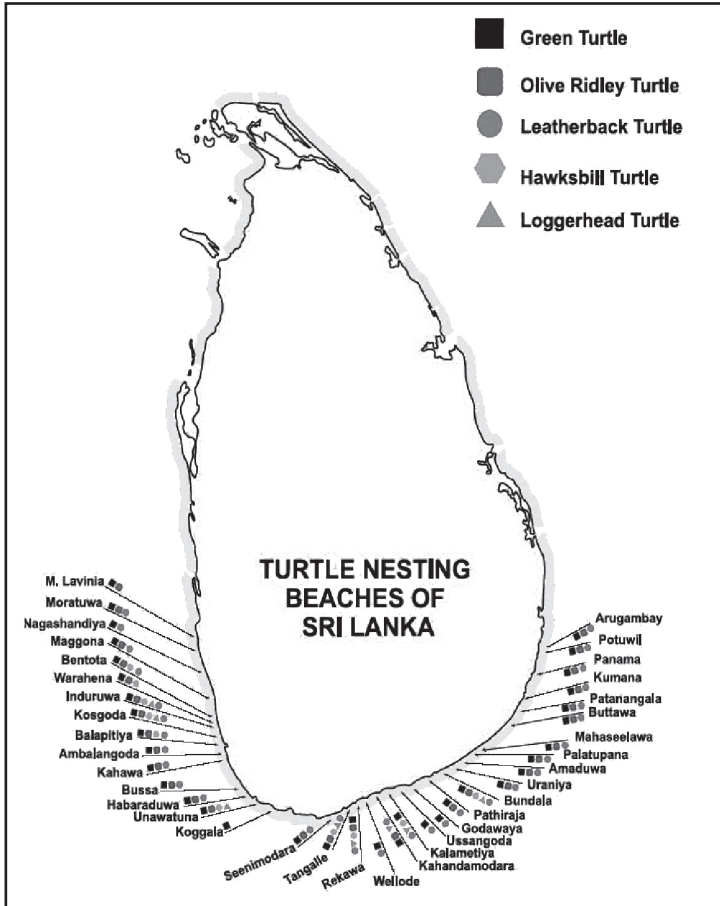


Figure 2. Nesting beaches in southern Sri Lanka.

### Nesting Beaches in Sri Lanka

The TCP and National Aquatic Resources Development and Research Agency (NARA) have collected data from various nesting beaches in Sri Lanka (Tables 1–5) (TCP 1999, Amarasooriya 2000), but a comprehensive survey of the entire coastline of Sri Lanka for marine turtle rookeries has yet to be done. During July 1995–August 1996, NARA surveyed the beaches between Karathivu and Yala and stated that no nesting beaches remain in Puttalam and Gampaha districts. Some beaches in Colombo, Kalutara and Matara districts are still occasionally visited by turtles. Most of the important nesting beaches are located in the districts of Galle and Hambantota (Amarasooriya and Gunawardana 1997). According to TCP beach surveys, some important nesting beaches are located in Bentota (2.5 km), Induruwa (2 km), Kosgoda (1.25 km), Rekawa (2 km), Ussangoda (1 km), Godavaya (2 km), Pattiyawaraya (2 km), Bundala (2 km),

Uraniya (1 km), Pathiraja (1 km) and Yala (2 km) (TCP 1999). According to available data, Rekawa beach is the largest nesting rookery for green turtles, with an average of 800 nests/year (Kapurusinghe and Ekanayake 2000), while Kosgoda is the largest rookery for olive ridleys (over 400 nests/year) in Sri Lanka. For example, between 10 December 1981–4 April 1982 (a period of four and a half months), the Kosgoda hatchery collected 33,741 eggs from approximately 330 nests (Wickramasinghe 1982). According to the TCP data, Godavaya beach has the largest leatherback nesting population (Ekanayake et al 2002b). Further investigations must be conducted to determine species compositions and population sizes for other nesting beaches in Sri Lanka.

**Table 1.** Average monthly nesting frequencies at beaches surveyed by NARA and TCP between 1997–98. Species-wise data is not available, but the Rekawa data (Table 3) suggests that >90 per cent are green turtle nests.

<b>Beach Length (km)</b>	<b>Jan.</b>	<b>Feb.</b>	<b>Mar.</b>	<b>Apr.</b>	<b>May</b>	<b>Jun.</b>	<b>Jul.</b>	<b>Aug.</b>	<b>Sep.</b>	<b>Oct.</b>	<b>Nov.</b>	<b>Dec.</b>	
<b><i>Galle district</i></b>													
Bentota	2.75	14	37	8	2	3	0	1	0	3	2	7	22
Warahena	2.5	8	6	3	2	2	2	3	4	5	7	5	
Induruwa	2	4	4	5	3	3	2	1	1	2	3	4	5
Kaikawala	1.5	10	18	10	10	5	5	4	3	3	8	10	12
Habbakkala	1.5	12	15	17	11	4	3	2	4	6	11	13	14
Mapalana	1	18	15	10	4	2	2	1	2	1	4	14	17
Duwemodara	0.5	10	65	66	32	36	1	8	7	6	12	38	50
Kosgoda	1.25	28	64	86	34	54	9	12	10	9	20	45	48
Bandarawatta	1	24	50	70	33	43	15	19	12	17	28	44	53
Thibbattawa	1	20	41	23	16	16	13	11	10	8	16	17	18
Wathuregama	1.5	9	17	10	11	5	4	4	3	5	9	11	10
Ahungalla	1.5	13	16	16	10	4	5	2	4	5	9	14	14
Balapitiya	1.75	16	25	14	14	13	5	14	12	8	12	14	15
<b>Total</b>	<b>19.75</b>	<b>186</b>	<b>373</b>	<b>338</b>	<b>182</b>	<b>190</b>	<b>66</b>	<b>81</b>	<b>71</b>	<b>77</b>	<b>139</b>	<b>238</b>	<b>283</b>
<b><i>Hambantota district</i></b>													
Rekawa	2	78	121	207	233	261	222	181	134	97	64	33	71
Wellodaya	1.5	5	3	5	10	8	5	7	6	6	6	6	6
Kahan-damodara 1	1.5	16	10	45	6	4	15	17	16	16	16	16	16
Kahan-damodara 2	1	12	4	29	0	8	19	15	13	12	13	12	13
Kahan-damodara 3	1	19	12	38	8	17	17	22	19	19	19	19	19
Welipatanwila	1.75	1	7	7	14	14	17	24	21	14	8	6	6
Walawemodara	1.75	0	0	0	0	19	64	61	55	19	0	0	0
Bundala	2	22	9	14	8	7	2	17	5	6	5	11	20
<b>Total</b>	<b>12.5</b>	<b>153</b>	<b>166</b>	<b>345</b>	<b>279</b>	<b>338</b>	<b>361</b>	<b>344</b>	<b>269</b>	<b>189</b>	<b>131</b>	<b>100</b>	<b>151</b>

Updated from Amarasooriya 2000, using TCP Rekawa data 1996–2000.



**Table 2.** Major nesting beaches and seasons where, X=nesting reported; X (Unknown)=nesting reported, season unknown; Unknown=nesting and season unknown (yet to be surveyed).

Beach	Green-turtle	Leather-back	Olive ridley	Hawks-bill	Logger-head
Bentota	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	X (Dec–Feb)	Unknown
Warahena	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	Unknown	Unknown
Induruwa	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	X (Dec–Feb)	X (Unknown)
Kaikawala	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	X (Dec–Feb)	Unknown
Habbakkala	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	X (Dec–Feb)	Unknown
Mapalana	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	X (Dec–Feb)	X (Unknown)
Duwemodara	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	Unknown	Unknown
Kosgoda	X (Apr–May)	X (Jun–Jul)	X (Dec–Feb)	X (Dec–Feb)	X (Unknown)
Bandarawatta	X (Apr–May)	Unknown	X (Dec–Feb)	X (Dec–Feb)	X Unknown
Thibbattawa	X (Apr–May)	Unknown	X (Dec–Feb)	Unknown	Unknown
Wathuregama	X (Apr–May)	Unknown	X (Dec–Feb)	Unknown	Unknown
Ahungalla	X (Apr–May)	Unknown	X (Dec–Feb)	X (Dec–Feb)	Unknown
Balapitiya	X (Apr–May)	Unknown	X (Dec–Feb)	X (Dec–Feb)	X (Unknown)
Rekawa	X (Mar–Jul)	X (Apr–Aug)	X (Unknown)	X (Unknown)	X (Unknown)
Wellodaya	X (Mar–Jul)	X (Apr–Aug)	X (Unknown)	X (Unknown)	X (Unknown)
Kahanda-modara	X (Mar–Jul)	X (Apr–Aug)	X (Unknown)	X (Unknown)	X (Unknown)
Kalametiya	X (Unknown)	X (Apr–Aug)	Unknown	X (Unknown)	X (Unknown)
Welipatanwila	X (Unknown)	X (Apr–Aug)	X (Unknown)	X (Unknown)	X (Unknown)
Ussangoda	X (Unknown)	X (Apr–Aug)	Unknown	X (Unknown)	X (Unknown)
Walawe-modara	X (Unknown)	X (Apr–Aug)	Unknown	X (Unknown)	X (Unknown)
Bundala	X (Unknown)	X (Unknown)	X (Unknown)	X (Unknown)	X (Unknown)
Palatupana	X (Unknown)	X (Unknown)	X (Unknown)	X (Unknown)	X (Unknown)
Yala	X (Unknown)	X (Unknown)	X (Unknown)	X (Unknown)	X (Unknown)

(Source: Amarasooriya 2000, TCP 1999.)

**Table 3.** Summary of marine turtle nesting data on Rekawa beach between 2 September 1996–24 July 2000.

Species	Nesting females	Number of nests	Average clutch size
Green turtles	752 (90.93)	3218 (96.70)	112.1 (n=985)
Olive ridleys	38 (4.59)	42 (1.26)	105.1 (n=30)
Leatherbacks	28 (3.38)	55 (1.65)	100.5 (n=30)
Hawksbills	03 (0.36)	06 (0.18)	115.2 (n=6)
Loggerheads	06 (0.72)	07 (0.21)	105.2 (n=5)
<b>Total</b>	<b>827 (100)</b>	<b>3,328 (100)</b>	

**Table 4.** Year-wise and species-wise nesting data on Rekawa beach from 2 September 1996–24 July 2000 (data for 1996 is from September–December, while data for 2000 is from January–July). The number of turtles is listed with the number of nests in parenthesis.

	1996	1997	1998	1999	2000
Green turtles (nests)	56 (196)	198 (852)	202 (794)	255 (772)	208 (604)
Olive ridley (nests)	5 (8)	6 (7)	15 (15)	9 (9)	3 (3)
Leatherback (nests)	3 (3)	7 (10)	11 (17)	10 (13)	8 (12)
Hawksbill (nests)	3 (6)	0	0	0	0
Loggerhead (nests)	0	3 (4)	3 (3)	0	0
<b>Total females</b>	<b>67</b>	<b>214</b>	<b>231</b>	<b>274</b>	<b>219</b>
<b>Total Nests</b>	<b>213</b>	<b>873</b>	<b>829</b>	<b>794</b>	<b>619</b>

**Table 5.** Monthly nesting at Rekawa beach from 2 September 1996–24 July 2000.

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1996	-	-	-	-	-	-	-	-	61	57	51	44	<b>213</b>
1997	41	60	115	122	129	119	100	65	47	29	11	35	<b>873</b>
1998	37	61	92	111	132	103	81	69	50	35	22	36	<b>829</b>
1999	56	86	151	171	125	57	53	34	11	4	14	32	<b>794</b>
2000	46	73	107	142	126	80	45	-	-	-	-	-	<b>619</b>
<b>Total</b>	<b>78</b>	<b>121</b>	<b>207</b>	<b>233</b>	<b>261</b>	<b>222</b>	<b>181</b>	<b>134</b>	<b>97</b>	<b>64</b>	<b>33</b>	<b>71</b>	<b>3,328</b>

## Threats

### MEAT

The slaughter of marine turtles has been widely reported (Dattari and Samarajeewa 1982). Currey and Mathew (1995) reported the slaughter of marine turtles in Beruwela, Trincomalee, Negambo, Chilaw and Kalpitiya areas, while Parsons (1962) reported the slaughter of between 20–30 green turtles in Jaffna each Sunday. TCP staff members interviewed local fisher folk and found that, in the north and northwest, marine turtles were killed for their meat more often than in the west, southwest, south and southeast coasts of Sri Lanka. Nesting turtles are killed particularly to provide at special occasions, such as wedding parties.

### EGG COLLECTION

The most widespread form of marine turtle exploitation is the illegal poaching of turtle eggs. Almost all marine turtle nests on Sri Lankan beaches are depredated (Kapurusinghe 2000a). The eggs are either sold at markets for consumption or to hatcheries for conservation; this means that few, if any, hatchlings return to the sea under natural conditions. Salm (1976) reported that turtle nests were dug during the day in full view of the public at Bentota in 1976. Feral dogs, water monitors, common monitors, jackals, wild boars, mongooses and some species of ants and crabs can be considered natural predators for marine turtle eggs and hatchlings (Kapurusinghe and Ekanayake 2000).



## INCIDENTAL AND INTENTIONAL CATCH

Previous data and reports on the extent of turtle catch in Sri Lanka are confusing due to their contradictory nature (see Hewavisenthi 1990 for a review). Jinadasa (1984) estimated—assuming that marine turtle bycatch for the entire island was approximately 12–15 turtles per week—that a bycatch of approximately 400 turtles was a realistic, perhaps even conservative, estimate of the annual marine turtle bycatch for the whole of Sri Lanka. However, it seems likely that these were gross underestimates when one considers reports by other authors. Gunawardena (1986) estimated that in Kandakuliya, a small fishing village on the northwest coast of Sri Lanka, approximately 10 turtles were landed and butchered per day. Perera (1986) witnessed the butchering of 16 turtles in Negombo, a fishing town approximately 110 km south of Kandakuliya, over a three-day period in May of the same year. Both these authors noted that the majority of turtles caught in that area were olive ridleys. In early 1994, TCP staff witnessed the butchering of 13 olive ridley turtles at Kandakuliya in one morning and found the recently butchered remains of 6 olive ridleys during another visit. When interviewed, local fisher folk said that at least 20 turtles were butchered each week. If we take into account the observations of these authors, it is quite feasible that the number of turtles landed and killed in Kandakuliya alone has been over 1,000 annually for the last 10 years.

The fisher folk of Jaffna have for long had a tradition of fishing for turtles. Hoffman (c.f. Frazier 1980) estimated the annual bycatch of turtles in Jaffna in the mid-1970s to be around 1,500, with a total of 3,000–5,000 turtles island-wide. Somanader (1963) describes over 100 turtles being caught in the nets of one boat over a 4–5 day period in 1963. Due to the current political circumstance, up-to-date information regarding turtle bycatch in Jaffna is scarce. However, a recent interview conducted by the TCP, with a refugee who fled Jaffna in 1990, suggested that the practice of turtle fishing was extensively carried out by Jaffna fisher folk at least until 1990.

Dattari and Samarajeewa (1982) found olive ridley carapaces in almost every fishing community along the southern, southwestern, western and northeastern coasts. The fisher folk who were interviewed throughout the island during their study confirmed that turtles were often caught and drowned in their nets. Indeed, the fishermen were of the unanimous opinion that the mortality caused by their nets was the major cause for the decline in turtle populations around the island. Dattari and Samarajeewa concluded that turtles are caught and killed ‘in most coastal villages’ of Sri Lanka. This suggests that even the higher estimates of turtle bycatch in the past may have been conservative and that marine turtle take and bycatch poses a significant threat to Sri Lanka’s marine turtle populations.

TCP surveys in 1993, 1994, 1995 and 1999 revealed that the most common species of marine turtle in Sri Lanka is probably the green turtle (TCP 1999). In the early 1980s, several authors reported that the most common species was the olive ridley, even stating that the ridley was ‘the only marine turtle species in Sri Lanka not in immediately in danger of extinction’ (Wickremasinghe 1979, Wickremasinghe 1981, Dattari and Samarajeewa 1982). It is unlikely that Sri Lanka’s green turtle population has increased in number due to the high degree of exploitation that all marine turtle species have

been subject to in Sri Lanka in the last 20 years. One possibility is that green turtles have been underestimated in the past. On the other hand, these results might indicate that there may have been a significant decline in Sri Lanka's olive ridley populations mainly due to bycatch in fishing gear.

However, before solutions can be found to minimise marine turtle bycatch, the extent and nature of this threat must be investigated. During the TCP surveys, many fisher folk stated that they would often kill entangled turtles and sell their flesh or carapace in order to obtain enough 'compensation' money to repair the damage that entangled turtles caused to their nets. Therefore, it is essential to the success of conservation programmes to ensure the cooperation of fishing communities. The fisher folks' needs must be identified and addressed by reconciliatory actions.

The latest TCP bycatch survey shows 5,241 turtle entanglements between Kalpitiya and Kirinda during the period November–June 2000 (Table 6) (Kapurusinghe and Saman 2001). Of these, 1,626 were olive ridleys, 1,310 were loggerheads, 908 were green turtles and 431 were leatherbacks; the remaining 148 were unidentified. Of the 5,241 turtles entangled, 1,063 were either found dead, killed or sold. The remaining 4,178 were released by fisher folk.

**Table 6.** Results of TCP turtle bycatch survey (N=Number of fisher folk interviewed; GT=green turtle, LH=loggerhead, OR=olive ridley, LB=leatherback, HB=hawksbill, UK=Unknown).

Survey site	N	GT	LH	OR	LB	HB	UK	Total
Beruwala	699	13	28	36	36	7		120
Chilaw	591	1	25		1	2		29
Colombo	881	43	25	29	9	29	7	142
Dondra	481	4	8	9	6	24		51
Galle	1,421	473	678	597	40	263	4	2,055
Hambantota	1,395	2	1		2		3	8
Kandakkuliya	608			107				107
Kirinda	655	117	160	236	32	82	2	629
Kottogoda	1,176	15	51	2	115	23	7	213
Mirissa	922	75	146	55	106	51	68	501
Morogalla	885	1		6		2		9
Negombo	1,429	43	115	483	1	4	8	654
Panadura	350	5	4	1	14	3		27
Tangalle	1,030	10	6	11	24	137	4	192
Wadduwa	229	2	2	4	1	7		16
Weligama	1,008	104	61	50	44	184	45	488
<b>Total</b>	<b>13,760</b>	<b>908</b>	<b>1,310</b>	<b>1,626</b>	<b>431</b>	<b>818</b>	<b>148</b>	<b>5,241</b>

It was clearly observed that if more flying fish are entangled in gill nets, more turtles arrived to eat the fish. If high waves occur, then the number of turtles to stay at the nets and eat fish decreased dramatically. If the sea is very calm without any waves (fisher folk call this *pullukkama*), many basking turtles can be observed. Not all turtles that eat flying fish at the nets get entangled. While some turtles feed at the nets, some turtles were



observed eating dead flying fish. Some turtles had injuries on their necks and carapaces; it was observed that fishermen may attempt to kill the feeding turtles or chase them away by beating them on the head or carapace.

#### TORTOISESHELL TRADE

The endangered hawksbill turtle has been killed for its shell or carapace for the illegal tortoiseshell trade (Fisher 1995, Richardson 1997). Three of the six geographical types of tortoiseshell recognised in the European tortoiseshell trade originated in the Indian Ocean: Zanzibar–Bombay, Mauritius–Seychelles and Sri Lanka (Parsons 1972). This suggests the importance of the Sri Lankan tortoiseshell industry. In 1994, TCP carried out a survey of Sri Lanka's illegal tortoiseshell trade and recorded 112 retailers openly selling tortoiseshell products in 6 towns. In 1995, government agencies took action to stop this illegal trade. TCP carried out a second tortoiseshell survey in 1996 and recorded 83 shops selling tortoiseshell products in 14 towns. Of these, 33 shops had continued selling tortoiseshell since the 1994 survey. The others were either new retailers or were located in towns not surveyed in 1994. The survey also revealed that at least 42.1 per cent of shops, 65.4 per cent of hotels and hotel-associated retailers and 34.6 per cent of independent gem, jewelry and gift shops which were selling tortoiseshell in 1994 were no longer doing so. Hence it appears that the actions of the government to stop the tortoiseshell trade were effective to a certain extent. Despite this the tortoiseshell trade continues to thrive in Sri Lanka and more action needs to be taken. Richardson (1997) includes a list of recommended actions to be taken by the government, NGOs and the media in order to put an end to the illegal sale of tortoiseshell in Sri Lanka.

#### HABITAT DEGRADATION

Coral reefs provide an important feeding habitat for marine turtle as well as a vital protective barrier to turtle nesting beaches from erosion. Sri Lanka's coral reefs are being destroyed by unsustainable harvesting (Kapurusinghe 1998). Coral mining is a lucrative activity, and in some areas has been practiced for generations. Collection of corals from the beaches and reef-breaking have been reported in Ambalangoda to Hikkaduwa, Koggala, Midigama, Polhena, Rekawa, Pasikuda, Kuchchaveli and Nilaveli (Olsen et al 1992). In many coastal areas, erosion is a major problem. The removal of corals and sand mining increases the rate of beach erosion, resulting in the destruction of nesting habitats. The Coast Conservation Department has managed to control the large-scale removal of sand from beaches in most areas, but this is still a problem in areas such as Panadura, Lunawa, Angulana and Palliyaatta (Olsen et al 1992). Most of the beaches between Beruwala and Hikkaduwa have either been developed for tourism, resulting in the beaches being floodlit at night, or have been subject to beach armouring which has rendered the beaches totally unsuitable for nesting. Large hotels and restaurants adjacent to the beach create a lot of noise and light. This disturbs nesting turtles and disorients hatchlings when they emerge.

Marine pollution claims the lives of many marine turtles. Leatherback turtles are known to mistake plastic bags for jellyfish, which is their main food. Marine pollution is caused by various pollutants such as dyes, nutritional chemical compounds, heavy metals, acids and carbonates from garment factories, chemical industries, agricultural industries and

tourist hotels. Polluted inland water flowing into the sea can be seen in Bera Lake, Colombo. Dumping of garbage on beaches is a common practice in some coastal areas of Sri Lanka. During high tide, the garbage, including polythene and plastics, is washed out into the sea where it can be lethal to marine turtles.

#### NON-SCIENTIFIC TURTLE HATCHERY PRACTICES

In 1994, the Turtle Conservation Project (TCP) surveyed 16 marine turtle hatcheries in Sri Lanka (Richardson 1996). In agreement with Hewavisenthi (1993), the report concluded that hatchery management practices were not effectively contributing to the conservation of marine turtles. The TCP report also included a draft proposal for the establishment of a hatchery licensing scheme to be implemented by the Department of Wildlife Conservation (DWLC) and the Ceylon Tourist Board (Richardson 1996). The status of the existing turtle hatcheries along the west, southwest and southern region was investigated by NARA between July 1995 and June 1996. They observed the retention of a total of 14 juvenile green turtles, 16 hawksbills, 9 olive ridleys and 1 loggerheads. All these animals were either young or juveniles. The report says that the main reason or aim of all these hatcheries, except two, was income generation as a tourist attraction (Amarasooriya 1996).

### **Conservation Plans**

A national action plan for the conservation of marine turtles in Sri Lanka was drafted in late 1999 but is yet to be published. During the preparation, six priority issues were listed. These were research and monitoring, public awareness, hatchery guidelines, *in situ* conservation, policy issues and law enforcement (National Action Plan 1999). The global conservation strategy and regional conservation strategy for the northern Indian Ocean can be used as a guide for conservation activities in Sri Lanka. Marine turtle species that nest in Sri Lanka and their conservation needs have been recognised by the regional action plan (IUCN 2001).

*Ex situ* conservation is represented in Sri Lanka by turtle hatcheries initiated by various organisations, hotels and individuals along the southwest and southern coast of Sri Lanka. However, most of these hatcheries operate for tourism rather than turtle conservation. The retention of hatchling turtles in tanks seriously reduces the probability of their survival after release and serves limited conservation purpose (Richardson 1996). *In situ* conservation of species allows the animals to survive under natural selection. Other *ex situ* conservation practices can be implemented when the *in situ* conservation actions are difficult or economically unfeasible. The Turtle Conservation Project (TCP) established Sri Lanka's first *in situ* nest protection and research programme in Rekawa in 1996, but temporarily closed down the beach patrol in July 2000 due to lack of funding. Currently, the Department of Wildlife Conservation collects all the eggs from Rekawa beach and relocates them in front of the base camp. The TCP has initiated its second *in situ* nest protection programme at Kosgoda with funding from the UNDP/GEF small grants programme. This programme employs 15 former egg poachers as nest protectors, and beach patrols are conducted every day on a one km stretch of Kosgoda beach.

### Research and Monitoring

Research on marine turtles in Sri Lanka is mainly based on terrestrial aspects and data on aquatic life of marine turtles has to be investigated. Currently, the TCP is conducting a beach monitoring programme in Hambantota district to assess the number of turtles nesting in the area; the captured turtles are tagged. So far 827 marine turtles have been tagged by TCP in Rekawa between 1996–2000 (Kapurusinghe and Ekanayake 2000), of which 752 were green turtles. During the flying fish season of 2000–01, TCP conducted an olive ridley tagging programme 15–40 miles off the Kandakkuliya beach. During the programme, TCP managed to tag 278 olive ridley turtles, including 105 adult females (average CCL=63.7 cm), 57 adult males (average CCL=63.2 cm) and 116 juveniles (average CCL=33.5 cm). This suggests that the Gulf of Mannar area provides important migratory routes or foraging habitats (or both) for olive ridley turtles. Out of 278 tags, only one tag was recovered. This tag was collected by a military personnel from Kankasanthurai in Jaffna district, who found the dead turtle on the beach. This provides evidence of movements of olive ridley turtles in the Gulf of Mannar, Palk Bay and the Bay of Bengal. During the turtle bycatch survey conducted by TCP, 18 tags were found with the fisher folk in Kandakkuliya, Chilaw and Negambo fishing areas. These tags were from olive ridley turtles tagged in Orissa (see Pandav 2000). This suggests that olive ridleys that nest in Orissa forage in the waters off Sri Lanka, especially in the Gulf of Mannar. There was no international return of turtles tagged in either Rekawa or the Gulf of Mannar (Kapurusinghe and Cooray 2002).

More extensive research, surveys and monitoring programmes need to be conducted in order to fully understand the current status of marine turtle populations in Sri Lanka; and also to understand their biology, ecology and behaviour in order to aid conservation.

### Education and Awareness

Public education and awareness is one of the key issues for turtle conservation in Sri Lanka. Target groups for education and awareness include policy makers and people with commercial interests. These target groups need to be made aware of the importance of conserving marine turtles. The general public also needs to be made aware of the historical, ecological and biological value of marine turtles through education and awareness programmes that address specific problems such as beach lighting, encroachment, tortoiseshell trade, etc. Public awareness on marine turtles is mainly conducted by the TCP in Sri Lanka. TCP produces turtle booklets, ID cards, stickers, educational posters, turtle T-shirts, and a website to increase awareness of marine turtles among the general public and school children. TCP also conducts TV programmes, radio programmes and art and essay competitions (Kapurusinghe 2000b).

### Community-based turtle conservation in Sri Lanka

Marine turtles have been used since time immemorial for food and other commodities. Their importance in trade dates back millennia, whether it was calipee, leather, meat, oil or tortoiseshell. Recently, marine turtles have become important in non-consumptive uses—tourism, education and scientific research, activities that provide opportunities for employment and information services, as well as other economic gains (Frazier

1999). The coastal communities of Sri Lanka have been dependent on marine turtles as a source of income for centuries. In 1972, the local government banned the exploitation of turtles. However, the government couldn't provide alternative incomes and therefore law enforcement has had little success. Any conservation activities must collaborate with local communities to achieve maximum results and the activity should provide benefits for the local communities. Turtles must be identified as an economically valuable resource to provide income for the coastal communities in non-destructive ways (Kapurusinghe 1998). The TCP has initiated a wide range of community-based turtle conservation activities in Sri Lanka such as *in situ* nest protection programmes, model medicinal garden programmes, mangrove rehabilitation programmes, nature trail programmes, nature guide training programmes, community library programmes, community primary school programmes, free English-teaching programmes, rural clinic programmes, etc to involve the local communities in marine turtle conservation in Sri Lanka (Richardson 1998).

### Literature Cited

- Amarasooriya, D. 1996. Turtle hatcheries: Is it an additional disaster for the turtle fauna of Sri Lanka? In *Proceedings of the International Conference on the Biology and Conservation of the Amphibians and Reptiles of South Asia*, Kandy, Sri Lanka, 1996.
- Amarasooriya, D. 2000. Classification of marine turtle nesting beaches of southern Sri Lanka. In *Sea turtles of the Indo-Pacific: Research, management and conservation*, eds. N Pilcher and G Ismail. UK: ASEAN Academic Press Ltd. 228–237.
- Amarasooriya, D, and M G K Gunawardana. 1997. Present status of the turtle nesting beaches of the north-western, western and southern provinces of Sri Lanka. *Paper presented at the 3<sup>rd</sup> annual session of SLAFAR*. National Aquatic Resources and Development Agency, Colombo.
- Bennett, J W. 1843. *Ceylon and its capabilities*. Kalapaluwawa: Trumpet Publishers Ltd. 427 pp.
- Currey, D, and E Matthew. 1995. *Report on an investigation into threats to marine turtles in Sri Lanka and Maldives*. Environmental Investigation Agency report.
- Deraniyagala, P E P. 1939. *The tetrapod reptiles of Ceylon. Vol. 1*. Colombo: Colombo Museum. 412 pp.
- Deraniyagala, P E P. 1953. *A coloured atlas of some vertebrates from Ceylon. Vol. 2. Tetrapod Reptiles*. Colombo: Colombo Museum. 101 pp.
- Dattari, S, and D Samarajeeva. 1982. *The status and conservation of sea turtles in Sri Lanka. March for Conservation (MFC)*. Unpublished Report. Colombo, 1982.
- Ekanayake, E M L, K B Ranawana, T Kapurusinghe, M G C Premakumara, and M M Saman. 2002a. Marine turtle conservation in Rekawa turtle rookery in southern Sri Lanka. *Ceylon Journal of Science (Biological Science)* 30: 79–88.
- Ekanayake E M L, T Kapurusinghe, M M Saman, and M G C Premakumara. 2002b. Estimation of the number of leatherback (*Dermochelys coriacea*) nesting at the Godavaya turtle rookery in Southern Sri Lanka during the nesting season in the year 2001. *Kachhapa* 6: 11–12.
- Fauna and Flora Protection Ordinance (Amendment). 1993. Published as a supplement to Part II of the Gazette of the Democratic Socialist Republic of Sri Lanka of Oct 22, 1993.



- Fisher, S. 1995. Illegal turtle trade in Sri Lanka and the Maldives: An encouraging note of progress. *Marine Turtle Newsl.* 71: 10–11.
- Frazier, J G. 1980. Exploitation of marine turtles in the Indian Ocean. *Human Ecology* 8: 329–370.
- Frazier, J G. 1999. Community-based conservation. In *Research and management techniques for the conservation of sea turtles*, eds K L Eckert, K A Bjorndal, F A Abreu-Grobois and M Donnelly. IUCN/SSC Marine Turtle Specialist Group Publication No. 4, Washington D C.
- Groombridge, B. 1985. India's sea turtles in the world's perspective. In *Proceedings of the Symposium on Endangered Marine Animals and Marine Parks* 1: 205–213.
- Gunawardana, P S. 1986. *National sea turtle survey progress report*. Unpubl. Report for the National Aquatic Resources and Development Agency, Colombo, 1986.
- Hewavisenthi, S. 1990. Exploitation of marine turtles in Sri Lanka: Historic background and the present status. *Marine Turtle Newsl.* 48: 14–19.
- Hewavisenthi, S. 1993. Sri Lanka's hatcheries: Boon or Bane? *Marine Turtle Newsl.* 60:19–22
- IUCN/SSC Marine Turtle Specialist Group. 2001. *A Marine Turtle Conservation Strategy and Action Plan for the Northern Indian Ocean (NIO)*. IUCN SSC Marine Turtle Specialist Group Publication No. 03.
- Jinadasa, J. 1984. The effect of fishing on turtle populations. *Loris* 16 (6): 311–314.
- Kar, C S, and S Bhaskar. 1982. Status of sea turtles in the eastern Indian Ocean. In *The biology and conservation of sea turtles*, ed. K Bjorndal. Washington D C: Smithsonian Institution Press. 365–372.
- Kapurusinghe, T. 1998. Destructive exploitation of natural resources and the decline of the nesting marine turtle population in Rekawa, Sri Lanka, 1993–1996. *Proceedings of the International Conference on the Biology and Conservation of the Amphibians and Reptiles of South Asia, Sri Lanka, 1-5 August 1996*. 189–193.
- Kapurusinghe, T, and E M L Ekanayaka. 2000. Nesting frequencies of marine turtles in Rekawa, Sri Lanka, September 1996 to September 1999. In *Proceedings of the 20th Annual Symposium on Sea Turtle Biology and Conservation*, compiled by A Mosier, A Foley and B Brest. NOAA. Tech. Memo. NMFS-SEFSC-477. 57–58
- Kapurusinghe, T. 2000a. Community participation in turtle conservation in Sri Lanka: A summary of community-based Turtle Conservation Project's (TCP) Activities in Sri Lanka. In *Proceedings of the 19th Annual Symposium on Sea Turtle Biology and Conservation*, compiled by H J Kalb and T Wibbels. NOAA. Tech. Memo. NMFS-SEFSC-443. 57–58.
- Kapurusinghe, T. 2000b. Community participation in turtle conservation in Sri Lanka. In *Sea turtles of the Indo-Pacific: Research, management and conservation*, eds. N Pilcher and G Ismail. UK: ASEAN Academic Press Ltd. 35–44.
- Kapurusinghe, T, and M M Saman. 2001. Marine turtle by-catch in Sri Lanka. In *Proceedings of the 21st Annual Symposium on Sea Turtle Biology and Conservation*, Philadelphia, USA.
- Kapurusinghe, T, and R, Cooray. 2002. *Marine turtle by-catch in Sri Lanka: Survey report*. TCP publication: ISBN 955-8758-01-9.
- Mortimer, J A. 1995. Status of the hawksbill turtle (*Eretmochelys imbricata*): Status in the Atlantic and Indian oceans and a historical perspective on global patterns of human utilization.

Paper presented at the international workshop on the management of sea turtles. 8–10 March 1995, Tokyo, Japan.

National Action Plan. 1999. *National action plan for sea turtle conservation in Sri Lanka, 1999*. Unpublished report prepared and submitted to the Department of Wildlife Conservation, Sri Lanka.

Oliver, J A. 1946. An aggregation of Pacific sea turtles. *Copeia* 1946:103.

Olsen, S, D Sadacharan, J I Samarakoon, A T White, H J H Wickremaratne, and M S Wijeratne. 1992. *Coastal 2000: Recommendations for a resource management strategy for Sri Lanka's coastal region (Vols. I and II)*. CRC Tech. Rep. No. 2033. Coast Conservation Department, Coastal Resources Management Project, Sri Lanka and Coastal Resources Center, University of Rhode Island, USA.

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

Parsons, J J. 1962. *The green turtle and man*. Gainesville: University of Florida Press. 54.

Parsons, J J. 1972. The hawksbill turtle and the tortoiseshell trade. In *Etudes de geographie tropicale offertes a Pierre Gourou*. 45–60.

Perera, L. 1986. *National sea turtle summary report*. Unpubl. report submitted to National Aquatic Resources Agency (NARA), Colombo.

Richardson, P. 1996. *The marine turtle hatcheries of Sri Lanka: A TCP review and assessment of current hatchery practices and recommendations for their improvements*. Unpubl. TCP report submitted for DWLC and NARA.

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.

Somanader, K. 1963. Jaffna's turtle trails. *Loris* 9(5): 312–314.

Salm, R V. 1976. *Critical marine turtle habitats of the northern Indian Ocean*. Contract report to the IUCN Morges, Switzerland, 1976.

Survey Department of Sri Lanka. 1988. *The national atlas of Sri Lanka*. Report published by the Survey Department of Sri Lanka.

TCP. 1999. *TCP beach survey report: Ecological assessment of marine turtles on Sri Lanka's south coast between Rekawa and Godavaya*. Unpubl. report submitted to IUCN, Sri Lanka.

Wickramasinghe, S. 1979. Turtle tales. *Loris* 15(2)

Wickramasinghe, S. 1981. Turtles and their conservation. *Loris* 15: 313–315.

Wickramasinghe, S. 1982. The WNPS turtle hatcheries. *Loris* 16: 2–5.