A Collection of TCP Research Papers

Volume One

Compiled by E. M. Lalith Ekanayake

A Publication of

The Turtle Conservation Project (TCP)-Sri Lanka.

June 2002
A collection of TCP Research papers

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E.M.Lalith Ekanayake

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Of
The Turtle Conservation Project (TCP), Sri Lanka
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Compiler
E.M.Lalith Ekanayake

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Compilers' Note:

These papers were not edited except to confirm to size and constraints. The papers and abstracts were arranged according to the year of publication. I am gratefully acknowledged to all the TCP staff for their assistants to prepare this book of reprints. This reprint was specially prepared for the First National Symposium on Sea Turtle Biology, Conservation and Management organized by the TCP.

E.M Lalith Ekanayake.
Preface:

Sri Lanka is an important island for Sea Turtles when considering the rich nesting beaches and foraging habitats available around the island. Out of the seven species available in the world, five species nest in Sri Lanka, this evidence alone supports the richness of the coastal biodiversity. Loggerhead sea turtles are found nesting only in Sri Lanka from the countries of Indian sub-continent, while the Leatherback sea turtles visit only Sri Lankan, Andaman & Nicobar Islands of India for nesting from the sub continent. This is another factor why Sri Lanka should be considered as an important location for sea turtles.

Since ancient times coastal communities of Sri Lanka have been known to utilize the sea turtles for their meat, eggs & shells as a source of protein and shells used for decorations. Although this was not critically effecting in the rapid decline of sea turtle populations in the country, in the recent times with the rapid development of the fishing techniques and the increase of human population in the island, the turtle habitat destruction such as coral mining, sand mining, destruction of coastal vegetations such as mangroves etc has caused the rapid decline of sea turtle populations in Sri Lanka.

It is a fact that a group of local coastal community members from Southern Sri Lanka, from Welawwa near Tangalle, have transported live sea turtles, mainly Greens, to a Northern part of the island, Jaffna, on a weekly basis using a lorry. Turtles are slaughtered for varying reasons, while almost 100% of their eggs are being collected from many nesting beaches except a few protected beaches. This information suggests the need for greater attention and focus on sea turtle conservation in Sri Lanka. One way in which we can support the conservation of sea turtles is to conduct researches on sea turtle biology and human effect on them.

The objective of the first volume of "A Collection of TCP Research Papers" is to share the available research information with the interested public in order to encourage them to participate in sea turtle research and conservation. Hence, I am grateful to our research coordinator Mr. Lalith Ekamawake of TCP for his untrrning efforts in compilation of this research paper collection. I also take this opportunity to thank the Mr. Gamini Gamage and Mr. Ajith De Silva of Biodiversity Secretariat of the Ministry of Forestry and Environment for their generous support in printing this volume. I hope that you will find this collection an interesting and useful tool for the conservation and management of sea turtles in Sri Lanka.

Mr. Thushan Kapuruwinghe  
Project Leader & Committee Chairman – TCPSL  
Marine Turtle Specialist – IUCN/SSC-MTSG  
2002-06-12
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TORTOISE SHELL INDUSTRY IN Sri Lanka: A SURVEY REPORT 1996

Peter Richardson,

Abstract
In 1994 the Turtle Conservation Project (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 certain government agencies took action to stop this illegal trade in tortoiseshell, but there has been no subsequent assessment of the efficacy of their actions or the state of the tortoiseshell trade. In light of this efficacy TCP carried out a second tortoiseshell survey in 1996 and recorded 83 shops selling tortoiseshell in 14 towns. 33 of these shops had continued selling tortoiseshell since the 1994 survey. The remainder was either new retailers or was located in towns not surveyed by the TCP in 1994. The survey revealed that at least 42.1% of the shops selling tortoiseshell in 1994 were no longer selling tortoiseshell. 65.40% of the hotels and hotel-associated retailers selling tortoiseshell in 1994 were no longer selling tortoiseshell and 34.6% of the independent gem, jewellery and gift shops, which were selling tortoiseshell in 1994, are no longer selling. The report concludes 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. Therefore the report calls for more action to be taken and includes a list of recommended actions to be taken by the government, NGO’s and the media in order to put an end to the sale of tortoiseshell in Sri Lanka.

Introduction
Of the world’s 8 species of marine turtles, the olive or Pacific Ridley turtle (Lepidochelys olivacea), the green turtle (Chelonia mydas), the leatherback turtle (Dermochelys coriacea), the loggerhead turtle (Caretta caretta) and the hawksbill turtle (Eretmochelys imbricata) have been recorded nesting in Sri Lanka (Deraniyagala, 1953). All five species found in Sri Lanka are listed as either Endangered or Vulnerable in The World Conservation Union (IUCN) Red List. All species of marine turtles are included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES). Sri Lanka is one of the 130 countries party to the convention at the time of writing (IUCN, 1995, Marine Turtle Newsletter (MTN), 1995).

All five species of marine turtles (and their eggs) have been protected by Sri Lankan Law since an amendment to the Fauna and Flora Protection Ordinance in 1972. A further amendment to the Fauna and Flora Protection Ordinance made in 1993, states that it is illegal for any person to kill, wound, capture or hold in captivity any species of marine turtle in Sri Lanka. The 1993 amendment also states that it is illegal to destroy the eggs and nests of marine turtles, possess any part of a marine turtle, expose any turtle products for sale, import or export any parts of marine turtles into or out of Sri Lanka. According to the amendment, any persons found guilty of these are liable to a fine of not less than Rs 10,000 (approx US$200) and or prison term of not less than two years (Parliament of the Democratic Socialist Republic of Sri Lanka 1993).

Tortoiseshell derives exclusively from the carapace scutes of the hawksbill turtle and historically, Sri Lanka has entertained a trade in raw tortoiseshell and finished tortoiseshell items. Hewawisenthri cites Bennet as stating that in 1843, hawksbill tortoises were so frequently encountered nesting along the southern coasts that the British government of the time sold the right to capture the animals to private businessmen (Hewawisenthri, 1980). Hewawisenthri also described the local method used to remove the scutes from the hawksbill carapace. The turtle is held inverted over a fire, which has the effect of destroying the connective tissue that keeps the scutes in place. The scutes are then removed and the turtle is released as the local belief is that the hawksbill scutes will regenerate. Despite local beliefs, scientific opinion is that this method inevitably proves fatal for the turtle (Hewawisenthri, 1990a).

One hundred and thirty nine years after Bennet’s time, Dattari & Samarajeveva (1982) described a flourishing tortoiseshell trade despite the fact that it had been outlawed 10 years before. In the same report, Dattari and Samarajeveva (1982) catalogued the continued exploitation of marine turtles in Sri
Lanka maintained that it is highly doubtful if any (marine turtle) population can survive such sustained and severe exploitation for very long.

There has been very little literature published in the last 20 years regarding the status of Sri Lanka's marine turtle populations. However, Dattani and Samarajeewa (1982) described the status of the Hawksbills turtle population in Sri Lanka as "uncertain and probably declining" (Dattani & Samarajeewa, 1982). In 1988, the number of Hawksbill egg clutches incubated by the Victoria assembled turtle hatchery at Kosgoda represented only 0.7% of the total number of egg clutches incubated there (Hewavitharana, 1990). In accordance with this apparent trend, the author has observed only one wild hawksbill swimming in the coral reefs at Hikkaduwa and has observed hawksbill hatchlings from only one nest at the same Kosgoda hatchery. It would appear that the hawksbill turtle populations of Sri Lanka have declined massively over the last 100 years. It would not be unreasonable to assume that Sri Lanka's tortoiseshell trade has been a major cause for this decline.

**Exposing Sri Lanka's tortoiseshell trade**

In the 1984, the turtle conservation project (TCP) carried out the first survey of the tortoiseshell trade in Sri Lanka. The survey revealed that at least 112 shops were illegally selling tortoiseshell items and included a list of recommended steps that the government could take to stop the illegal trade (Richardson (TCP) 1995). The report was distributed by the TCP to the relevant government ministers and departments, Non Governmental organizations (NGO), newspapers and other interested parties in Sri Lanka and abroad. After reading this report, the UK based "Environmental Investigation Agency (EIA)" came to Sri Lanka to investigate the trade and secretly filmed all aspects of the trade for a television documentary (Curry & Matthew, 1995).

The EIA's investigative television documentary and accompanying report were released in Europe in March 1995. Their investigations exposed many facts about the modern tortoiseshell industry in Sri Lanka including the fact that the majority of hawksbill scutes utilized by the tortoiseshell industry in Sri Lanka are smuggled in from the Maldives in consignments of dried fish. This seems to indicate that the local populations of the hawksbill turtle have declined to such an extent that the majority of raw tortoiseshell had to be imported to meet the demands of the Sri Lankan trade. Indeed, Curry and Matthew stated that "Sri Lanka's hawksbill population has suffered so seriously from [the tortoiseshell trade] that now the Maldivian hawksbills are being systematically wiped out to make up the supply."

The EIA report also called for the governments of the Maldives and Sri Lanka to take necessary steps to stop the tortoiseshell trade.

**Sri Lanka's reaction to the tortoiseshell controversy**

The first reaction of the Sri Lankan media to the TCP's and the EIA's reports was published at the end of April by the Sunday Leader. The article described at length the TCP's and EIA's finding sand printed list of 22 shops in Colombo allegedly selling tortoiseshell. The list was taken from the appendices of the TCP's report but included one other shop called "Lakmedura" which was not included in this report. No address was given for this shop. In actual fact and as stated by the TCP report, only 17 of the shops listed in the Colombo section of the report's appendices had been found to be selling tortoiseshell. The article also quoted the then Director of the Department of Wildlife Conservation (DWLC), Mr. C. P. Attanayake, assaying "We will tackle this problem in the near future." (Sunday Leader, 30.4.1995).

On the 1st of June 1995 "The Island", one of Sri Lanka's most popular English language dailies carried a front-page, headline article entitled "UK environmentalists campaign against Lanka": The article described a planned follow up campaign by the E.I.A., which included demonstrations by their members against Sri Lanka's tortoiseshell trade outside prominent Sri Lankan company offices in London. The article alleged that the EIA were urging British tourists to boycott Sri Lanka* and were planning to demonstrate outside the World Travel Market in London where the Ceylon Tourist Board would be promoting Sri Lanka's flagging tourism industry.
On the 4th of June 1995, "World Environment Day", the Sri Lankan Environmental Journalists Forum (SLEJF) screened the EIA's television documentary on a selected audience of government representatives and NGO's. The chief guest at the screening was the Ministry of Fisheries, Mr. Indika Gunawardena. The screening of the documentary had a strong impact on those present and became the subject of much discussion among officials of the various environment-oriented government departments.

The government's first official response, in the form of "Tessell release from the Ceylon Tourist Board (CTB) appeared 9 days later. The press release announced the appointment of a specialized CTB "Task Force" to deal with illegal, tourist traded activities, including the trade in protected species (CTB press release, 13.6.1995). The Task Force committee comprised of, among others, representatives from the Ceylon Tourist Board, the Police, the Tourist Hotelers Association of Sri Lanka and the Department of Wildlife Conservation.

According to the press the Task Force had written to 305 retailers registered with the CTB informing them of the law with regard to selling turtle products. The Task Force correspondence also warned the retailers that if they were found guilty of stocking, displaying or selling tortoiseshell, they would lose their registration and Licence in addition to stringent legal action against them. Shortly after the CTB corresponded with the retailers, the DWLC made a number of raids on shops in Colombo, which were selling tortoiseshell items. During the raids, DWLC officers confiscated tortoiseshell items and some of the offending vendors were prosecuted during cases, which received some publicity in the popular Sri Lankan daily press (personal communication C. Jayawardena, Asst Director, DWLC 1995). The press release was carried as a front page headline article two days later in the "Daily News", another of Sri Lanka's popular English daily newspapers (Daily News, 15.6.1995).

Other government initiatives included the production of a leaflet by the Department of Customs set up stalls and Fauna Task Force. The leaflet was published in January 1996 and advises tourists arriving at Sinhala and Tamil Naatya plan to buy products made from endangered species, including tortoiseshell products. The ministry of Transport, Environment and Women's Affairs appointed the "coordinating Committee on the Protection of Dolphins/ Turtles". One of the committee's most significant decisions was to persuade the Department of Wildlife Conservation to establish legislation whereby any one giving information about retailers who continued to sell tortoiseshell would be rewarded if the retailer was found guilty and fined. The DWLC officers making the arrests would also benefit from this reward scheme (pers comm., H MBC Heath. Min. of Environment 1996).

The response of Sri Lanka's environmental NGO's to the EIA's documentary was tepid with the outstanding exception of the SLEJF. As well as organizing the first public screening of the documentary at Sinhala, the 28th issue of the SLEJF Sinhala Newspaper "Diyadama" carried a front-page article entitled "Is the government involved in the turtle trade? (Translation)". The title of the article referred to the government run "Laksala" shop, which was identified as selling tortoiseshell by the TCP and EIA report. The article also included a call for immediate action by the government stop the trade the 29th issue of "Diyadama" contained a centre spread Sinhala translation of the EIA report entitled "The law does not protect Sri Lanka's turtles (translation)", thus rendering the finding of the EIA accessible to the Sinhala speaking majority of Sri Lanka (Diyadama, 1995,Diyaadama 1996a).

Recognizing the public interest the EIA documentary generated by the public in the national media, the SLEJF arranged a second public screening of the EIA documentary the British Council on the 5th July. After the screening the audience was invited to enter into a discussion with a panel of government and NGO representatives including the author, TCP, Dr. Ranjen Fernando, Wildlife and Nature protection society, Mr. Jagath Gunawardena, E. F. L and Mr. Samantha Gunasekara, Department of Customs. The conclusions from the discussion were that the relevant government agencies must do more to enforce the Sri Lankan marine turtle protection laws and that the NGO's must play a more cooperative role in the campaign.

As well as educating retailers, about Sri Lanka's marine turtle protection laws the CTB Task Force was instrumental in the distribution of the TCP's tourist awareness "anti-tortoiseshell" posters. The posters
entitled "Turtles and Corals Belong to the sea", were produced in 1995 in cooperation with the coastal conservation department (CCD) with funding from German Agency for Technical Cooperation (GTZ). The posters are designed to educate tourists about the vulnerability of Sri Lanka's coral reefs and the endangered status of the hawksbill turtle. The posters also emphasize the illegal nature of the tortoiseshell trade in Sri Lanka and Europe. The CTB Task Force publicized the posters and assisted in their permanent display at Colombo's Bandaranaike International Airport and the visa section of the hotels, guesthouses and restaurants in all Western and southwestern coastal towns between Negombo and Tissamaharama.

In parallel with the CTB’s actions, the Tourist Hotels Association of Sri Lanka (THASL) also assisted the TCP in the distribution of the posters. In December 1995, the Chairman of THASL, Mr. Gilbert Jayasuriya, personally corresponded to all the members of the THASL asking them to display the posters in order to educate their customers. The TCP also produced a school educational book entitled "Marine turtles of Sri Lanka" which was printed in Sinhala and English. This book, also produced in cooperation with the CCD with funding from the GTZ, is being distributed to all coastal schools via the "TCP School lecture programme Southwest coastal survey" funded by the Norwegian Agency for Development Cooperation (NORAD). In a section entitled "How you can help", the book suggests school children can "Encourage friends, family and any tourists [they] meet not to buy tortoiseshell" (Ranger. Richardson and Jayaweera 1995).

In mid-August 1995 Sinhala language television programme featuring a discussion between the Directors of the Department of Wildlife Conservation C. P. Attanayake and members of the department’s advisory committee was broadcast by Sri Lanka Rupavahini Corporation. During the programme, Mr. Attanayake described the Sri Lankan law and penalties regarding the sale of tortoiseshell products and assured the audience that the department had taken the necessary actions to stop the trade and would continue to do so. This action would include further raids on shops selling tortoiseshell and prosecution of those found guilty of selling tortoiseshell (pers. comm. Mrs. Somiseka Lasman SLRC, 1996).

Sri Lanka was not the only country to respond to the calls to stop the local tortoiseshell trade. In what appears to be a direct response to the EIA’s television documentary and following publicity, the Maldives government announced a moratorium on the catching of turtles and the sale, importation and exportation of turtle products on June 24th, 1995. This moratorium effectively made the tortoiseshell trade in the Maldives illegal for the first time in its islands’ history. The Maldives government also announced that it had formulated new legislation to protect endangered species, was establishing turtle sanctuaries and had launched an awareness programme about the plight of marine turtles in the Maldives (Fisher, 1995, Bombay Eye, 27.5.1995). After August 1995, the publicity surrounding Sri Lanka’s tortoiseshell trade died down. In March 1996 there was some publicity over a controversial dispute between Air Lanka and the Department of Customs Flora and Fauna Task Force over a consignment of tortoiseshell glasses. However, despite Air Lanka’s marketing claims and customs declarations to the country glasses turn out to be made of plastic replicas not tortoiseshell (Sunday Observer 3.3.1996, S. Gunasekera, pers. comm. 1996).

Since the Sri Lankan government’s actions over the latter half of 1995, there has been no official or independent evaluation of the effectiveness of stop the tortoise trade. The aim of this report is to assess the current status of the tortoiseshell trade in Sri Lanka. By comparing the results of this survey with the findings of the 1994 TCP survey it is hoped that the effect of the 1995 government action will be made apparent.

**Tortoiseshell Survey.**

The survey was initiated January 1996 and was completed July 1996. TCP staff and volunteers systematically visited all coastal tourist resorts between Negombo and Tissamaharama as well as Kandy and inspected all hotels, tourist gift shops and jewelry shops that they encountered. The Sri Lankan members of the survey team posed as "tourist guides" looking for suitable gifts for their clients, whereas the foreign members of the team posed as tourists. If the shop was not
displaying tortoiseshell shop staff were asked whether or not it was possible purchase tortoiseshell from the retailer. A mental note was taken of any comments that the shop staff made and all relevant information was recorded by the survey team immediately after the learning the shop.

Survey Results.
The results of this survey summarized in Table 1.2, 3. 4 and 5. Shops selling tortoiseshell products were found in all locations surveyed in 1994 report i.e. Negombo, Colombo, Beruwela, Hikkaduwa, Galle and Kandy. In addition, shops selling tortoiseshell were also found in Wadduwa, Kadawatha, Bentota, Kosgoda, Ahungalla, Koggala, Dickwella and Tangalle (these locations will be referred to as "new locations"). Therefore, 14 locations are included in the 1996 survey results, in contrast to the 6 locations surveyed in 1994.

From the 14 locations, 157 shops are included in this survey. Those shops that were inspected in the new locations and were not selling tortoiseshell are not including the data of this survey. A total of 68 shops were named found to be selling tortoiseshell, 2 shops were unnamed and selling tortoiseshell (in Negombo). Of the shops included the 1996 survey, 33 shops were continuing the sale of tortoiseshell, 45 were no longer selling tortoiseshell, 14 shops had closed down and 12 shops were closed during the survey.

Number of shops selling tortoiseshell products
A list of all 83 shops * found to be during that 1996 survey can be found in Table 1. This result contrasts with the 1994 data which recorded 112 (107 named and 5 unnamed) shops selling tortoiseshell. In the 6 locations surveyed in 1994, 33 shops were still selling tortoiseshell in 1996 and 26 new shops were found to be selling tortoiseshell. In Kandy, 3 shops were surveyed that were not included in the 1994 survey. In the new locations 21 shops were found to be selling tortoiseshell. Table shows the recorded number of shops selling tortoiseshell in each town survey during 1996. The table also ranks the towns according to the number of shops found to be selling tortoiseshell there.

Table 1
Shows a list of all the locations, names and address of all the 83 shops found to be selling tortoiseshell during the Turtle Conservation Project (TCP) 1996 Tortoiseshell Survey. The survey dates for each location are also shown.

The table which list the names and addresses of the shops is not published on legally advice:

Editor

Trends in the Sri Lanka tortoiseshell trade
Tables 3, 4 and 5 were compiled in order to assess trends in the change of the extent of the tortoiseshell trade in Sri Lanka since the 1994 survey. The new locations are not included in Table 3 as one can only compare the 1996 data with the 1994 data in order to assess any changes that have occurred. The shops that were found to be selling tortoiseshell in 1994 but were not named are not included in this assessment as it was impossible to positively re-identify most of these shops during the 1996 survey and therefore, their new status could not be ascertained.

Discussion
Possible factors causing a reduction in Sri Lanka's tortoiseshell trade in order to assess the effectiveness of the Sri Lankan government's efforts to stop the tortoiseshell trade, one must first consider the possibility that other factors may have contributed to any apparent changes. Since 1994, the tourism industry in Sri Lanka has suffered due to the prevailing political situation in the North of the country. This may explain the results shown in Table 4. That of the 107 named shops selling tortoiseshell in 1994, 14 (13%) were shut down. However, 25 shops new to the survey were found to be selling tortoiseshell in these locations and therefore the number of shops seems to have increased by at least 12. In fact Hikkaduwa is the only town of those surveyed in 1994 that has seen more gem, jewellery and gift shops close down down (5) than new shops have opened (4). The 14 shops that have shut down since 1994 are obviously no longer selling tortoiseshell items. But it would be incorrect to speculate that the CTB's and the DWLC's actions have resulted in these shops "no longer
sitting tortoishell, i.e. have shut down. The proprietors may have even moved and opened shops in 
locations not covered by this survey. Therefore we cannot include these shops in an analysis to 
the 28 new shops. We cannot say that the business environment is so poor in Sri Lanka that it has 
contributed to any decline in the tortoishell trade.

A decline in the tortoishell trade may also result if retailers believe that there is no longer a market 
for tortoishell in Sri Lanka. However, Table 1 shows that 83 shops in 14 towns were selling 
tortoishell during the survey. Table 4 shows that of these 83 shops, 26 were new shops located in 
tortoishell, otherwise so many retailers, 27.7% of whom have opened since 1994, would not be 
selling tortoishell products.

In the absence of other factors, if one only considers the shops that were open and operational during 
the 1994 and 1996 surveys, one can assume that any reduction in the number of shops selling 
tortoishell since 1994 is a result of the government and NGO action taken 1996.

From Table 1, we can see that the 1996 survey recorded 83 shops selling tortoishell products during 
the survey period. This represents an apparent 25.9% reduction in the number of shops selling 
tortoishell in Sri Lanka. However, 21 shops in 8 new locations are included in this survey and 26 
new shops were discovered selling tortoishell in the 1994 locations. Also, Table 4 shows that of the 
named shops selling tortoishell in 1994, 14.0% were closed during the survey and 13.1% had shut 
down since 1994. Therefore, one must look beyond this apparent 25.9% decline in order to get an 
idea of the actual response of the retailers of the government's efforts.

From Table 4 we can see that of the 197 named shops selling tortoishell in 1994, Only 33 are still 
violating the law by selling tortoishell. 45 of these named shops are no longer selling tortoishell, 
which represents a 42.1% real minimum reduction in the number of shops that are still open and were 
selling tortoishell in 1994. The term "minimum reduction" of the named shops selling tortoishell in 1994 
were closed during the survey. If all these shops are still selling tortoishell then the real 
reduction would be 41.1%. But the reduction would be higher than 42.1% if any of these closed shops 
are no longer selling tortoishell. Thus, 42.1% is a known minimum reduction value from the survey. 
Data. Similarly, one can only state that a minimum of 30.6%(53) of the shops named and selling 
tortoishell in 1994 continue to violate the law in 1996.

Changes in Colombo's tortoishell trade

From Table 3 one can see that the highest minimum reduction in any single location Surveyed in 1994 
was 64.7% record in Colombo. This result could be attributed to several factors. One possible cause 
for such a significant decline in Colombo's tortoishell trade is that the prosecutions bought against 
retailers selling tortoishell by The DWLC, and which received some publicity in the national press. 
Considering that the DWLC's head office is in Colombo, the retailers 
must have realized that there was a likelihood of their shops being inspected by DWLC officers.

Another reason for the strong response from Colombo's retailers in that the name and addresses of 
retails selling tortoishell in Colombo were printed in first relevant newspaper article to appear the whose names and addresses were printed in the "Sunday leader" article, only 2 continued to shell 
tortoishell in 1996.

Further explanation can be derived from the data shown in Table 5. A minimum reduction of 65.4% 
in the number of the hotels and hotel-associated shops, which were selling tortoishell in 1994, was 
recorded in the 1996 survey. This is much higher than the minimum reduction in the number of all 
shops, which were selling tortoishell in 1994 (42.1%). 10 of the 17 shops selling tortoishell in 
Colombo in 1994 were located in hotel premises. In line with the trend among hotel shown in table 
4.7. of these hotels have stopped selling tortoishell. The change among the hotels and hotel 
associated shops was probably a direct consequence of the combine action of the Tourist hoteliers
association of Sri Lanka (THASL) and effect of the Colombo hotel to stop the illegal sale of turtle product on their premises contributed to the significant decline in the number of shops selling tortoiseshell in Colombo since 1994.

It would seem, therefore, that the efforts of the various Sri Lanka Government agencies, THASL and the concerned NGO's have been successful to some extend in their effort to stop the tortoiseshell trade in Sri Lanka as the trade has exhibited a significant reduction. But the fact that there are at least 33 shops selling tortoiseshell in Sri Lanka 33 of which were selling in 1994 seem to indicate that illegal trade is still thriving to ascertain the reason why the government's action were not 100% effective, one must examine the location where the smallest change occurred.

**Changing in Negombo's tortoiseshell trade**

In 1994, there were a higher number of shops selling tortoiseshell in Negombo than in any other 5 locations surveyed by the TCP at that time. Table 2 shows that of all the location surveyed in 1996, Negombo had the most shops selling tortoiseshell and Table 4 shows that Negombo had a higher number of new shop selling tortoiseshell than any other town. Table 4 also shows that the minimum reduction of the shops that were selling tortoiseshell in 1994 also occurred in Negombo (12.9%).

Since 1994, Negombo has had, and continues to have, a thriving tortoiseshell trade.

Table 5 shows that the minimum reduction in 1996 of the number of independent gem jewelry and gift shop named and selling tortoiseshell in 1994 was 34.5%. This reduction is much less than that of the hotel and hotel associated shops (65.4%) and considerably less than the total real minimum reduction for all location surveyed in 1994 (42.1%). From Table 6 we can see that Negombo had the highest percentage of independent shops selling tortoiseshell in 1994 (96.9%) only 1 of the 32 shops selling tortoiseshell in Negombo in 1994 was associated with the hotel and during the 1996 survey this shop was closed. Therefore, even if this shop, like many other hotel associated shops, was no longer selling tortoiseshell, the trends exhibited by Sri Lanka's hotels would not have had an implement on the number of shops selling tortoiseshell in Negombo. Perhaps the high percentage of independent retailer in Negombo, who showed a relatively low national response to the government's actions, explains Negombo's low minimum reduction. Having said this, Galle has the second highest percentage of independent shops (89.6%) and yet the number of shop selling tortoiseshell in 1994 is 57.9%, the third highest reduction of all 6 locations.

Assuming that the 325 retailers with whom the CTB task force corresponded in 1995 were equally distributed throughout the 6-location surveyed by the TCP in 1994, there is perhaps one other reason why Negombo's response has been so poor. This may be revealed by looking at the data in Table 3. Of the 29 new shops recorded to be selling tortoiseshell in the 1994 locations, 12 (48.1%) were recorded in Negombo. Although 6 of 31 named shops selling tortoiseshell in 1994 has closed, the still number of shop selling tortoiseshell was 24. The 9 shops closed during the survey may still be selling tortoiseshell as the data from Negombo does not indicate otherwise. This means that potentially there could be 33 shops selling tortoiseshell in Negombo, and therefore, it is possible that the tortoiseshell trade may have expanded in Negombo since 1994 with the tourism industry suffering throughout the country and increase local competition between gem, jewellery and gift shop retailer in Negombo, individual shop proprietor may be reluctant to withdraw valuable stock even if it is illegal. They are further discouraged from doing so when they see that so many of their competitor are still selling tortoiseshell. Therefore, poor business coupled with a "safety in numbers" attitude may actually be contributing to the continued and extensive tortoiseshell trade in Negombo.

If would seem that in Negombo many new shops selling tortoiseshell indicates that the awareness raising effort of the CTB Task Force were neither effective or consistent allowing newly established retailers to sell tortoiseshell in what may be complete ignorance of the law.

**Other reasons for the continuation of the tortoiseshell trade**

Despite the high real minimum reductions in the number of hotels and hotel associated shops. There are still some of these retailers that frustrate their fellow traders efforts by continuing to violate state law. In some of the new locations too, the hotels and hotel associated shops are still selling
tortoishells despite the efforts of hoteliers elsewhere. In Bentota, 5 of the 12 shops recorded to be selling tortoishells are located in leading hotels. The location of these shops is somewhat of a sad irony because one of Sri Lanka’s first marine turtles hatcheries which was established specifically for the conservation of marine turtles [wickramasinghe, 1981] at the Kosgoda beach is perhaps tortoishell. And Kosgoda Beach Hotel, also a THASL member and which was also operating a turtle hatchery in 1994, a shop selling items was discovered during the 1996 survey [Richardson, 1995]. The continued existence of tortoishell in this hotel is an inconsistency in the policy of the hotel and THASL if they are to achieve their stated objectives.

It is interesting to note from the comments listed in Table 1, that there are 7 shops that do not display tortoishell yet they are willing to sell from hidden stocks. The author experienced this situation in the Colombo 7 shop. The initial response of the shop staff when asked whether or not they sold tortoishells was that they did not because it was “banned by the government”. However, the author was asked to wait for a few minutes while the attendant went into the back of the shop. After 5 minutes, the shop attendant returned with a tray of tortoishell items and proceeded to name a price for each item. When asked whether there would be any trouble taking the items out of the country and into Europe, the shop attendant informed the author that it was not their responsibility and they would not issue a receipt for the items. Indeed, the author was told not to mention where the items were bought if anyone asked!

This cynical attitude to the laws protecting Sri Lanka’s marine turtle does not come as a surprise. However, they do indicate the need for a more effective effort to educate the retailer as to why the laws exist and why is Sri Lanka’s marine turtle particularly the Hawksbill turtle need protection.

The continued existence of the tortoishell trade in Sri Lanka show that the effort of the CTB, DWL and THASL, volunteer noted that many of other retailers selling tortoishell claimed to be approved by the Sri Lanka Handicraft Board and the state gem cooperation and that the Sri Lankan handicraft board seem to have had any involvement in the government’s campaign against the tortoishell trade. It would be in the interest of these organizations to ensure that the retailers who they have approved are not breaking the law. The involvement of such organization in the 1995 campaign would perhaps have meant that more retailers would have been aware of Sri Lanka’s marine turtles protection in 1995.

Conclusion.
From the result of this survey it is quite clear that the effort of the Sri Lankan government and other interested parties to stops the island illegal tortoishell trade have enjoyed some success. However, despite these effort there is still a thriving tortoishell trade in Sri Lanka and the survey revealed that at least 33 shop continue to the violet the law and concerned organization in 1995.

Table 7 below summarizes the strength and weakness of the 1995 campaign by various agencies and organization to stop the tortoishell trade. The survey result seem to indicate that although the action that have carried out can be effective. More must be done to bring and end to the tortoishell trade in Sri Lanka. Effort must be Educate retailers about the law and reason the law. More law enforcement is necessary, especially in those cases where retailers continue to sell tortoishell despite the corresponding and warning of the Ceylon Tourist Board. The CTB and THASL must be more consistent thought their respective organization their determination to stop this trade.

There must be more coordination between the numerous government agencies and committees working against the trade of necessary more relevant agencies must be persuaded towards the same end. For example, many retailers selling tortoishell claim to be approved by the national gem and jewellery authority and or the Sri Lankan Handicraft board. These organization must be persuaded by the Sri Lankan Government to ensure that any they approved or approve in the future is not breaking
state law. Any individual who wishes to be approved by the government agencies effect that the signing of an affidavit before they are accepted. To the effect that he or she are aware of the product
they cannot sell according the state law. These people many even be given the opportunity to display
the TCP’s "anti tortoise shell" posters and the Department of Customs Fauna and flora task force
leaflets as an sing of their ignitions. The decline in the tortoise shell trade in Colombo indicates that the
printing of the list of shops in table 1 in the major national dailies. With calls for further action many
significant impact on the tortoise shell trade as similar article did in Colombo in 1995.

The tortoise shell items seem in every shop found to be selling tortoise shell during the 1996 survey
papered to represent only a small fraction of the retailer’s stocks on display. Most of the shop
seemed to be more dependent on the lager stocks of gems jewellery and other gift items. It is safe to
assume that even if tourism associated retailers are currently suffering a poor business environment
they do not depend heavily on their tortoise shell stocks. Therefore, the complete cessation of the
tortoise shell trade in Sri Lanka probably would not cause the financial collapses of any of the shops
listed in table 1.

however, according to the EIA report, there are some families who are dependent on the crafting of
tortoise shell items. These families must be identified and their craftsmen must be given a government-
sponsored opportunity to re-train in either another craft medium or a different vocation. If this action is
not taken, then any other actions taken would leave the government open to criticisms that they are
"causing more for the turtles than the Sri Lankan people", Obviously, if such a criticism was justified it
would make the government reluctant to take any further action to stop this trade.

Finally, the results of this survey indicate that the efforts of the government agencies have not been
sufficient to stop the trade in tortoise shell. To ensure the success of these actions they must be
complemented by cooperative efforts from other concerned NGO’s and interested parties. One can
see that the SLEJF played a major role in the initiation and publicity of the 1995 campaign. Another
good example of complementary action is provided by the efforts of the TCP since 1995. The
government’s education initiative focused on informing retailer’s via a via the Sri Lankan marine turtle
protection laws. By distributing their tortoise shell-awareness posters to the international airport and all
restaurants, guesthouses and hotels on the West and south-west coasts, the TCP has initiated the
education of the tourists who provide the market for tortoise shell products. These complementary
actions are therefore working towards reducing the number of tortoise shell traders and at the same
time eliminating the market.

Cooperation with this nature is vital if the people of Sri Lanka seriously intend to protect of the most
beautiful and ancient components of their generous nature heritage.

Recommendations

Below is a list of recommendations that the Sri Lankan government and NGO’s can implement in order
to stop the tortoise shell trade and rehabilitate those families that depend entirely on the trade for their
income. The list is an updated version of the list that first appeared in 1994, in the TCP’s first “TCP

1. The Ceylon tourist board Task Force should establish itself as the central government agency
to which other government agencies and NGO’s must refer in a concerted national effort to
stop the trade. The CTB Task Force should establish cooperation between government
agencies and cooperation with NGO’s should be encouraged and promoted in order to avoid
damaging public criticisms between parties involved.

2. Retailer who has received the initial correspondence form the CTB Task Force should be
visited immediately by DWLCO officers. If they are found to be selling tortoise shell they should
be prosecuted according to state law.

3. The list of retailers found to be selling during the TCP 1996 survey should be printed in
the national dailies with call for further action from the government.
The Ceylon Tourist Board Task-Force, the department of Wildlife Conservation, the national Gem and Jewellery, the Sri Lanka Handicraft board and the Tourist Hotels Association of Sri Lanka should send out a joint correspondence to all their associated retailers and members. This correspondence should again inform all traders of the laws regarding marine turtle protection and the penalties for violation of the laws and emphasise the reason why Sri Lanka's marine turtle need the protection laws. The correspondences could also include copies of the TCP poster and the Department of customs Fauna and Task Force leaflet to be displayed on the retailer's premises.

5. The CBT, the National gem and jewellery Authority and Sri Lanka Handicraft Board should inform future retailers about the laws regarding the sale of protected species. They should insist that any one applying for either approval registration or a license should sign an affidavit to the effect that they understand the laws regarding the sale of turtle product and that they will not sell turtle product on their premises. Individual signing this affidavit should also be given the TCP posters and department of customs fauna Task force leaflets to display on their premises in order to educate their tourist customers.

6. The correspondence should announce an immediate two month amnesty on tortoise shell where by retailers could submit all their tortoise shell stocks without incurring any penalty, to either the local police station or an officially recognized office related to the DWLC and/or the CBTC. The correspondence should also inform retailers that if they are found to be selling tortoiseshell after the amnesty then their tortoiseshell stocks will be confiscated, their registration and license will be removed and they will be penalized according to state law.

7. After the deadline of the amnesty, DWLC officers should make random and frequent inspection of all shops that were initially mailed. NGO's and other interested parties should be contacted by the CBT Task force and NGO administrations should be encouraged to persuade their members throughout Sri Lanka to report any retailers selling tortoiseshell in their locality to the CBT Task Force. NGO's with extensive membership, such as the Wildlife and Nature Protection Society of Sri Lanka, could prove to be most useful in this respect and gain positive publicity from their efforts.

8. Any retailer found to be selling tortoiseshell products after the amnesty should be penalized according to recommendation 2and state law. All confiscated “tortoiseshell” products should be registered and then destroyed by the DWLC.

9. The department of Sri Lanka Custom Task Force on Fauna and Flora leaflet should be publicized and promoted by the CBT and the DWLC and should made available for distribution at all parts of entry into Colombo as soon as possible.

10. The TCP poster should also be publicized in the national media and made available to any individual who owns tourism related business and wishes to display the poster on his premises.

11. Marine turtle conservation education programme in coastal communities must be promoted encouraged and assisted by the CBT task force so that future generations of retailers will understand and respect Sri Lanka’s protection laws.

Acknowledgements

On behalf of the TCP the author wishes to thank the following people who gave their valuable time and energy to assist with this survey, the1994 TCP tortoiseshell survey and the production and distribution of the TCP's tourist education materials.

Damitha Hewawitharana, ShaunVincent, Susan Ranger,Sanja Ranasinghe,Karen Davies,Steve Hilling,Alan Godfellow, Geoff Sawyers, Alex Wilson, Roland and Ingrid Witzell, Nandani Panditharthana, Gilbert Jayasuriya, David Smith of the GTZ and the coast conservation Department. We could not have done this without you.

The author also wishes to applaud and thank all retailers who have stopped selling tortoiseshell since 1994. This must be considered a valuable contribution to the conservation of the hawksbill turtle in Sri Lanka.
Reference


Customs task force on flora and fauna (1998) stop! Things twice, for what you buy may take you on a long ride!! Dept of Sri Lanka customs.


Newspaper articles and press releases


Diyadama 1995 a the law does not protect Sri Lanka’s turtle (translation) Sinhala print, issue no28.


11
**Table 2**
Showing number of shops selling tortoiseshell in each town in 1996. Each town is ranked according to the number of shops selling tortoiseshell found there.

<table>
<thead>
<tr>
<th>Rank &amp; Location</th>
<th>No of shops Selling Tortoiseshell</th>
<th>Rank &amp; Location</th>
<th>No of shops Selling Tortoiseshell</th>
<th>Rank &amp; Location</th>
<th>No of shops Selling Tortoiseshell</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Kandy</td>
<td>8</td>
<td>9. Kosgoda</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3**
Showing the percentage minimum reduction in the number of named shops selling tortoiseshell in each town since 1994. Each town is ranking according to the extent of this reduction.

<table>
<thead>
<tr>
<th>Rank of location</th>
<th>Percentage reduction in the number of named shops selling tortoiseshell since 1994.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Colombo</td>
<td>64.7%</td>
</tr>
<tr>
<td>2. Beruwela</td>
<td>61.5%</td>
</tr>
<tr>
<td>3. Galle</td>
<td>57.9%</td>
</tr>
<tr>
<td>4. Kandy</td>
<td>44.4%</td>
</tr>
<tr>
<td>5. Hikkaduwa</td>
<td>38.9%</td>
</tr>
<tr>
<td>6. Negambo</td>
<td>12.9%</td>
</tr>
</tbody>
</table>
Table 4
Showing the percentage of shops named and selling tortoiseshell in 1994 that the either selling tortoiseshell, not selling tortoiseshell, closed or shutdown during the 1996 survey.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Negombo</td>
<td>31</td>
<td>1</td>
<td>12</td>
<td>4</td>
<td>9</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>-</td>
<td>12.9</td>
<td>29.0</td>
<td>19.4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Colombo &amp; mt Lavinia</td>
<td>17</td>
<td>0</td>
<td>2</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>-</td>
<td>11.7</td>
<td>64.7</td>
<td>11.8</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>Beruwela</td>
<td>13</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>-</td>
<td>15.4</td>
<td>61.5</td>
<td>23.1</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Hikkaduwa</td>
<td>18</td>
<td>0</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>-</td>
<td>27.8</td>
<td>38.9</td>
<td>5.5</td>
<td>27.8</td>
<td></td>
</tr>
<tr>
<td>Galle</td>
<td>19</td>
<td>0</td>
<td>7</td>
<td>11</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>-</td>
<td>36.8</td>
<td>57.9</td>
<td>0</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>Kandy</td>
<td>9</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>(3)</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>-</td>
<td>55.6</td>
<td>44.4</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>107</td>
<td>5</td>
<td>33</td>
<td>45</td>
<td>15</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>-</td>
<td>30.8</td>
<td>42.1</td>
<td>14.0</td>
<td>13.1</td>
<td></td>
</tr>
</tbody>
</table>

(These 3 shops are not new. But were not surveyed in 1994)
### Table 5
Comparing the trends in the tortoiseshell trade at hotel / hotel associated shops with independent gem, jewelry and gift shops.

<table>
<thead>
<tr>
<th>Total number of shops in 1990 survey</th>
<th>Total number of shops in 1990 survey</th>
<th>Of the shops named and selling in TS in 1994</th>
<th>New shops in 1994 survey</th>
<th>Location selling TS in 1995</th>
<th>Total number of shops in 1990 survey</th>
<th>Location selling TS in 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotels and associated shops</td>
<td>35</td>
<td>26</td>
<td>4</td>
<td>17</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>15.4</td>
<td>65.4</td>
<td>15.4</td>
<td>3.8</td>
<td>.8</td>
</tr>
<tr>
<td>Independent gem jewelry and gift shops</td>
<td>122</td>
<td>81</td>
<td>29</td>
<td>28</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Percentage of total number of shops named and selling TS in 1994</td>
<td>100.0</td>
<td>35.8</td>
<td>34.6</td>
<td>12.6</td>
<td>16.0</td>
<td>30.9</td>
</tr>
</tbody>
</table>

### Table 6
Showing the number of hotels / hotel associated shops and independent jam, jewelry and gift shops as a percentage of the total number of shops selling tortoiseshell in 1994 for each location surveyed.

<table>
<thead>
<tr>
<th>Location</th>
<th>Hotel / hotel-associated shops as a percentage of shops selling TS in 1994</th>
<th>Independent gem jewelry &amp; gift shops as a percentage of shops selling TS in 1994</th>
<th>Location</th>
<th>Hotel / hotel-associated shops as a percentage of shops selling TS in 1994</th>
<th>Independent gem, Jewellery &amp; gift shops as a percentage of shops selling TS in 1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negombo</td>
<td>3.1</td>
<td>95.0</td>
<td>Hikkaduwa</td>
<td>10.7</td>
<td>83.3</td>
</tr>
<tr>
<td>Colombo</td>
<td>58.8</td>
<td>41.2</td>
<td>Galle</td>
<td>10.5</td>
<td>89.5</td>
</tr>
<tr>
<td>Beruwela</td>
<td>23.5</td>
<td>78.5</td>
<td>Kandy</td>
<td>55.5</td>
<td>44.5</td>
</tr>
</tbody>
</table>
Table 7

Showing the apparent strengths and weaknesses of the 1995 campaign against the tortoiseshell trade in Sri Lanka

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Shortcomings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Education</td>
<td>Initial CTB task force correspondence to 325 retailers informing them of the law was extensive and an immediate response to above publicity</td>
</tr>
<tr>
<td></td>
<td>** The correspondence did not emphasise need for Sri Lanka's turtle protection laws</td>
</tr>
<tr>
<td></td>
<td>** The continuance of the TS trade by some CTB associated shops indicated inconsistency in education effort</td>
</tr>
<tr>
<td></td>
<td>** The CTB does not seem to have educated new retailers aboutturtle protection</td>
</tr>
<tr>
<td>2. Law enforcement</td>
<td>Prosecutions by the DWLC were in immediate response to the publicity and screening of the EIA's TV documentary</td>
</tr>
<tr>
<td></td>
<td>** Inspections by DWLC officers were inconsistent allowing 83 retailers to continue selling TS</td>
</tr>
<tr>
<td>3. Publicity</td>
<td>Initial publicity in newspapers over the controversy was extensive immediately after the release of the EIA's TV document</td>
</tr>
<tr>
<td></td>
<td>** Media interest in issue waned shortly after CTB press release</td>
</tr>
<tr>
<td></td>
<td>** Little or no investigative journalism in no effects of government action</td>
</tr>
<tr>
<td>4. Cooperation</td>
<td>Good participation in campaign by CTB, DWLC, THASL, TCP, SLEJF, and the media</td>
</tr>
<tr>
<td></td>
<td>** No central committee/agency taking full responsibility for campaign</td>
</tr>
<tr>
<td></td>
<td>** Internal coordination of participants in campaign inefficient allowing retailers leasing shops from the CTB and THASL hotel shops to sell TS</td>
</tr>
<tr>
<td></td>
<td>** No government monitoring of efficacy of actions</td>
</tr>
<tr>
<td></td>
<td>** Important government agencies and NGO's not involved in campaign</td>
</tr>
<tr>
<td></td>
<td>** Insufficient promotion of tourist education materials e.g. Dept of customs leaflet</td>
</tr>
<tr>
<td></td>
<td>** Positive results of action not recognized or published by the media</td>
</tr>
</tbody>
</table>

AN UPDATE OF THE PROGRESS OF THE TURTLE CONSERVATION PROJECT (TCP), SRI LANKA.

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E-mail: peter@archelon.demon.co.uk

In 1994, UK charity Care for the Wild received a donation from the BCG towards a new project in Sri Lanka. The donation enabled the members of the Turtle Conservation Project (TCP) to buy 400 plastic turtle flipper tags for a proposed rookery monitoring programme at Rekawa, the island’s largest rookery on the south coast. At the time the TCP was coordinated by myself but was only partially realised (Richardson, 1994). Today the TCP is an independent Sri Lankan NGO and continues to grow, having celebrated its fifth anniversary this September. The fact that the TCP has survived as testament to the Sri Lankan staff and committee who now manage the project. Since the project began back in 1993 they have maintained their vision and commitment in sometimes seemingly hopeless working conditions.

The TCP has conducted several noteworthy, ongoing programmes, including a nation-wide campaign to end the illegal trade in tortoise shell products and an extensive school education programme. But in my opinion, the TCP’s most remarkable achievements have occurred in cooperation with the local community at Rekawa. The English classes initiated at Rekawa by my wife, Susan Ranger, in 1994, soon evolved into a comprehensive environmental education programme, employing several young villagers as Community Environmental Education Trainers (‘CEET’s’). The CEET’s, with the help of the TCP, local NGO’s and some government departments went on to initiate various workshop for the Rekawa villagers courses during 1995 and 1996. The courses covered several subjects, including topics as diverse as organic horticulture, mangrove forest replanting and marine turtle conservation.

The TCP CEET’s opened and managed the village’s first library / community centre in 1996 and in 1998 they established Rekawa’s first clinic. This work was primarily funded by donations from the Sri Lanka aid programmes of the governments of Norway and the Netherlands.

The turtle Conservation Project Office and Community Centre
A widespread campaign was set up in the late 1980s to try and generate local enthusiasm and awareness for the protection of the island's turtle population. The campaign was successful, and a new project in Sri Lanka was launched to buy 400 plastic nesting platforms, which would be placed on the beaches to protect the turtles from predators. The project was led by the Sri Lanka Conservation Society (SLCS), in collaboration with the Government of Sri Lanka and the World Wildlife Fund (WWF). The project was initially managed by the Dutch government, and continued to receive funding from various sources. Despite the challenges faced by the project, it has survived and continues to be a success story.

The environmental awareness programme encouraged local enthusiasm and acceptance for the project's goals. In May 1996, the Sri Lankan Department of Wildlife Conservation (DWLC) finally granted permission to the TCP to establish the island's first community-based marine turtle nest protection and research programme. Despite scepticism and ridicule, the TCP took the unprecedented step of training and employing the egg poachers of REKAWA as research assistants / nest protectors. Then as now, the programme was supervised by TCP research officers as well as officers from the DWLC and Ministry of Fisheries.

On the 2nd of September 1996, after years of uncontrolled egg harvest at the rookery, the monitoring programme began. A system of 24-hour patrols employed 26 former egg collectors (renamed 'Nest Protectors' or 'NP's) on a shift basis to assist TCP research officers with the activities at the rookery. The TCP research team soon began to learn the difficulties of teaching biometric data collection procedure, turtle tagging and nest protection to the NP's. Fortunately, the NP's were used.
Turtle Conservation Project officer training Nest Protectors how to measure the curved carapace length of a green turtle.

A turtle Conservation Project officer training Nest Protectors how to measure the curved carapace width of a green turtle.
In the unaccustomed hours of the work and appreciated their salaries. They were therefore keen to learn, in the first year of the rookery monitoring programme the TCP tagged and identified all the female turtles that nested on the 2 kilometres of rookery. The numbers of the different species are as follows: 116 green turtles (Chelonia mydas), 9 olive ridley turtles (Lepidochelys olivacea), 5 leatherback turtles (Dermochelys coriacea), 3hawksbill turtles (Eretmochelys imbricata) and 2 loggerhead turtles (Caretta caretta).

Of the 962 nests laid on the rookery in that period, 776 were successfully protected resulting in 62,222 hatchlings making it to the sea immediately after emerging from the nest. The success of a marine turtle conservation project cannot be judged by one year's work. The effects of this programme on the turtle populations will not become evident at the rookery for several decades. However, the TCP has good reason to be proud of its achievements. For approximately 20 years prior to September 1996, the villagers collected almost 100% of the eggs laid at the rookery. One of the most enduring images that I remember is that of the faces of the NP's when the first green turtle nest emerged. For many of them, the green turtle hatchlings that poured from the first successfully protected nest were the first they had ever seen. For those that haven't seen green turtle hatchlings, they can easily be described as 'baffles' and their appearance had a fundamental effect on the many of the NP's attitudes towards their turtles.

However, the first year of progress of this programme was not always smooth and in terms of practical solutions to nest protection, the TCP staffs were experiencing a steep learning curve. The first nesting season brought with it very high seas and 27 nests were washed away. Any turtle nests which the TCP now judges to have been laid too close to the high tide line are excavated immediately after laying and relocated to carefully hand dug nests further up the beach. Despite the daytime patrols and physical protection measures, such as metal meshes covering the nests, 14 were lost to theft, crows, mongoose and ants. The metal meshes have since been adapted to be a more effective deterrent to the larger animals.

But most disheartening to the TCP was the gradual re-occurrence of egg theft. During June and August 1997, a small group of the NP's started smuggling eggs from the rookery for sale at local markets. 143 nests were lost in this way before the culprits were caught with eggs. The NP's
committee took matters into their own hands and unanimously voted to dismiss the offenders from the project and hand them over to the police. Now the TCP employs a core of 20 committed NPs and according to the TCP leader, Mr. Thushan Kapurusinghe, egg theft is no longer a problem (pers. comm. 1998). Unfortunately, the TCP's only computer crashed shortly before the time of writing and therefore I couldn't present the 1997-1998 nesting data in this report. I hope to have an opportunity to present this data at a later date.

The TCP is aiming to ensure that the rookery monitoring programme is also self funding. To this end, a programme of 'turtle watches' was initiated in late 1994, whereby local and foreign tourists could pay to be guided in small unobtrusive groups to watch turtles nesting at the rookery at night. In the first year over 200 foreign and 40 local tourists enjoyed the spectacle of nesting turtles. The small amount of profit generated from this scheme has been invested in a small-loan account, which is currently used by the Rekawa villagers. It is hoped that the TCP will be able to attract more tourists to the beach in the future. Unfortunately the civil war in the North of Sri Lanka has meant that tourism has suffered.

In 1998 the TCP has moved up a gear once again. The government advisory committee on marine turtle conservation that was dissolved after the 1994 elections was resurrected after persistent lobbying by the TCP. The committee's first meeting was scheduled to be held in September 1998 when the logistics of a national action plan for marine turtle conservation is to be discussed. A TCP proposal has been approved in concept and the team plan to begin a long-awaited national turtle by-catch survey planned to begin in early 1999.

There are still many problems nation wide facing the conservation of marine turtles in Sri Lanka. The TCP's work has really only just begun. But the success of the project at Rekawa has provided a model of integrated conservation. And so long as there is a working model in Sri Lanka that can inspire further advances in marine turtle conservation, there is hope for the island's threatened turtle populations.

Reference:


The TCP will always consider the offer of a helping hand. If anyone feels that they would like to volunteer their assistance to the TCP, either in Sri Lanka or the UK, or would like to visit the TCP and observe their work, please do not hesitate to write to the TCP Committee Secretary at the following address:

TCP, 73, Hambantota Rd., Tangalle, Sri Lanka.
e-mail: turtle@panlanka.net

This paper should cited as:


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Introduction
Five of the world's eight species of marine turtle come ashore to nest in Sri Lanka. They are the Green turtle (Chelonia mydas), Leatherback turtle ( Dermochelys coriacea), Loggerhead turtle ( Caretta caretta), Hawksbill turtle (Eretmochelys imbricata) and Olive Ridley turtle (Lepidochelys olivacea). All five species are listed in the IUCN Red List as either endangered or vulnerable in the IUCN Red List (IUCN, 1996). Despite legal protection since an amendment to the Fauna and Flora Protection Ordinance in 1972, marine turtles are still exploited in Sri Lanka by coastal communities for their eggs, meat and carapaces (Hewaviththi, 1990). The Turtle Conservation Project (TCP) is an independent Sri Lankan NGO which aims to devise and facilitate the implementation of sustainable marine turtle conservation strategies via a programme of education, research and local participation in communities close to important marine turtle habitat. Rekawa, a small village on the south coast of Sri Lanka, was selected by the TCP as a project site to implement a model turtle conservation programme. Rekawa was identified as a suitable location due to the close proximity to be a significant marine turtle rookery on the local beach.

Rekawa
Rekawa is a small village on the South coast of Sri Lanka, approximately 10 kilometres eastwards along the coast from Tangalle. Rekawa is located on the border of the Intermediate and dry climatic zones of Sri Lanka and borders on a large brackish lagoon surrounded by extensive mangrove forests. There are no electricity or telephones in the village and the majority of households do not have running water. Water is obtained mainly from roadside storage tanks. The village is divided into two divisions, Rekawa East and Rekawa West. The numbers of families in these two divisions are 121 and 144 respectively (Foederer, 1996, in press). Income generation activities for the families in the Rekawa area include agriculture (47%), lagoon fishing (10%), sea fishing (18%), coral mining (9%) and others (17%) such as masonry, carpentry, government services and labour (Ganewatte et al., 1995).

The community of Rekawa village have suffered several setbacks in the last decade. An irrigation system designed by the government to improve the quality of the agricultural land surrounding Tangalle near by drained the ground water of Rekawa.

The groundwater was eventually replenished by saline water from the sea and the Rekawa lagoon. This rendered the land unsuitable for agriculture unless there are heavy rains. These events have resulted in low income for most of the families in Rekawa with approximately 57% of the families dependent to some degree on government welfare (Foederer, 1996, in press).

Rekawa's natural resources
Because Rekawa is located on the border of two climatic zones there is a high biodiversity. The local vegetation consists of scrub jungle, as well as the mangrove forests. It harbours a medicinal plants, fruit trees and a wide variety of wildlife including resident and migratory birds, mammals, reptiles, amphibods and aquatic life.

Rekawa Kalapuwa is a large lagoon of 250 hectares, which is surrounded by mangrove forests. The neighbouring villages of Netolipitya, Medilla, Marakolliya, Kapuwenwela and Wetawatugoda also border the lagoon and the lagoon fishermen from these villages depend on the lagoon fishery. The fishery consists of several species of fish and the more economically viable shrimp. Community members have been involved in the removal of lagoon shells for lime production and sand for use in the construction industry. However, lagoon shells and lagoon sand are difficult to collect today and this has led to local dependence on other resources (Ganewatte et al., 1995).
A causeway has been built across the narrow westerly section of the lagoon that leads to the lagoon's exit to the sea. The causeway has improved accessibility to the village of Kapuhewela but has reduced the natural exchange of sea and lagoon water. This has led to a change in the quality of lagoon water causing a dramatic reduction in the lagoon fishery's productivity recently, in order to maintain catch size many local fishermen have invested in modern nylon nets, a practice which has contributed to the over-exploitation of the lagoon fishery. The degradation of the fishery has meant that lagoon fishermen have had to look to other resources for income generation. Although coral mining is illegal in Sri Lanka, the coral reefs offshore of Rekawa beach have also been mined by the community for the production of lime. The mangrove forests have been extensively cleared to provide firewood for the limekilns.

Coral reefs give natural protection against erosion and provide feeding habitat for many marine creatures including marine turtles. The 3km of Rekawa beach immediately westwards of the Rekawa headland provides nesting habitat for populations of 4 species of marine turtle. The undisturbed coastal vegetation and wide, clean sandy beach create the ideal conditions for female turtles when they come ashore to nest at night. For at least 20 years, local villagers have collected almost 100% of the turtle eggs laid on Rekawa beach and some adult females have also been harvested (Richardson, 1996, in litt.).

The most profitable activity in the Rekawa community was sea fishing, employing at least 131 people (Foerderer, 1996, in press). But the sea fishing in Rekawa is not without problems. There is no artificial harbour and the fishermen land their boats in a natural harbour formed by dead coral heads and rocks. During the rough season (July-October), the fishermen cannot use this harbour and therefore cannot go fishing. This problem is compounded by the fact that the fishermen are in competition with the fishermen from nearby Tangalle which has a harbour constructed by the government. In the calm weather season, the lack of electricity, street lighting, and the poor condition of the roads in Rekawa makes potential fish buyers reluctant to come to the sales point. The few businessmen who do come to Rekawa are able to buy the fishermen's catch at relatively low rates, effectively reducing the income of the fishermen. Because the fishermen cannot fish in the rough season, some are forced to exploit other resources to generate enough income to feed their families.

**Turtle egg gathering in Rekawa.**

The marine turtle rookery at Rekawa provides nesting habitat for the 4 species of marine turtle listed below. The numbers of nests recorded over a 119 consecutive day period (24.8.1995-11.10.1995) in 1995 are:

**Green Turtle (Chelonia mydas):** The most common species, which nests in Rekawa. In the period stated above 223 green turtle nests were recorded.

**Leatherback Turtle (Dermochelys coriacea):** Rare but regularly nests on beach. May and July is the peak season in Rekawa. In the period stated above 5 nests were recorded.

**Olive Ridley Turtle (Lepidochelys olivacea):** Occasionally nests on Rekawa beach. In the period stated above 2 nests were recorded.

**Loggerhead Turtle (Caretta caretta):** This turtle is also rare. Loggerhead nests were not observed during the study period, however between May and July 1994, 3 nests were recorded.

The fifth species of marine turtle found in Sri Lanka, the **Hawksbill Turtle (Eretmochelys imbricata)** is reported to nest occasionally at Rekawa but there are no records of the hawksbill turtle nesting at Rekawa between 1993-1995.

TCP surveys seem to indicate that for the last 20 years almost 100% of the eggs laid by the turtles on Rekawa beach have been harvested for local consumption or for sale to private dealers. Egg collectors from Rekawa who were interviewed during TCP surveys have said that in the 1970's it was
not uncommon to take eggs from as many as 40 nests per night. But today the number of the nest per night rarely exceeds 10. As there has been no recruitment into the Rekawa turtle populations in the last 20 years due to egg collection, then there will only be a further 10 year period when first-time nesters and the nesting peculation will begin to dwindle due to mortality from natural and man-made factors (e.g. fishing by-catch, pollution etc.). If egg collection continues there will be no further prevent egg collection within the next 10 years the nesting population of marine turtles at Rekawa will have been over-exploited to such an extent that it will be unable to recover.

Previous instances have shown that if action is taken to stop the over-exploitation of natural resources in Rekawa without the provision of any alternative income generation activities, then the Rekawa community will either resist the action or begin to exploit other resources. Therefore the TCP decided to take a holistic approach to conservation in Rekawa and implement a number of participatory programmes. These programmes were designed to improve environmental awareness in Rekawa and initiate the investigation into alternative sustainable and non-destructive income generation activities in the area.

The TCP’s activities in Rekawa as solutions to environmental degradation

The TCP has established an education and research centre in Rekawa. The activities of this centre are coordinated by two TCP officers who operate from Rekawa and the centre is the base for all TCP activities in the area. The TCP staff are not specifically qualified or experienced in the field of rural community mobilisation and development. The TCP is therefore engaged in an effort to involve NGO's who focus on development with the Rekawa community. The role of the TCP will be that of facilitator. The TCP staff is currently using their skill and experience in the environmental field in order to create a foundation on which the community can develop alternative and environmentally sustainable income generation schemes in the future. In this way the TCP aims to demonstrate that economic development and environment conservation can be complementary aspects of progress in this community.

Environmental Education Workshop Programme

In October 1995 the TCP launched an environmental education training programme in the Rekawa community. In March 1996, 14 Rekawa community members graduated from an initial 6 months training programme during which they were trained in educational methods and taught about various environmental subjects relevant to their locality. These community trainers are now involved in various environmental projects in the Rekawa area and have begun to conduct workshops for school children and community groups. The workshops focus on participatory resource mapping, identification of conservation issues and seeking sustainable solutions to problems of destructive exploitation. The first workshop about marine turtle conservation was held on the 26.7.1996 and was attended by over 100 fishermen and other community members from Rekawa and surrounding villages. The trainer holding the workshop invited the fishermen to participate in a turtle by-catch survey which the TCP hopes will eventually lead to the design of methods which will avoid turtle by-catch.

"In situ" nest protection and research programme

In August 1996 the TCP will begin a tagging and monitoring programme of nesting turtles at the Rekawa rookery in cooperation with the University of Peradeniya (Sri Lanka) and the Department of Wildlife Conservation (DWLC). The TCP will train research officers in marine turtle data collection and conservation methods at the Rekawa rookery. The TCP and DWLC will ask those individuals who are currently collecting turtle eggs to stop such activity. As an alternative they will be provided with the opportunity to take up employment as assistants to the research officers in the research programme and the "in situ" protection of marine turtle nests. The transformation of the local "egg collectors" to nest protectors is essential as they have an understanding of turtle behaviour in Rekawa which will prove invaluable to the research team.
It is hoped that this programme will become sustainable through the establishment of an unintrusive "eco-tourism" venture based around the marine turtle research and nest protection. A scheme will be established whereby tourists staying at the resorts on the Southwest coast will be invited to make contributions to the project to come and watch the adult female turtles nesting and observe emerging hatchlings. The money earned from this venture will be used to reimburse nest protectors and members of the research team, maintain equipment and purchase new equipment when necessary. The success of this programme would demonstrate the possibilities for sustainable forms of income generation in Rekawa.

References


This paper should cited as:

COMMUNITY PARTICIPATION IN TURTLE CONSERVATION IN SRI LANKA: A SUMMERY OF COMMUNITY-BASED TURTLE CONSERVATION PROJECT'S (TCP) ACTIVITIES IN SRI LANKA

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Five of the world's seven species of marine turtle come ashore to nest in Sri Lanka. Despite the protection of marine turtles under government legislation since 1972, Sri Lankan fishermen are still exploiting marine turtles for their meat, eggs and shell. The TCP predicts that the marine turtle populations of Sri Lanka will decline to extinction within the next few decades because of the above-mentioned threats.

Sri Lanka's marine turtle populations can recover from this inevitable decline, but only if effective conservation measures are carried out immediately and are continuous for at least the next 10 years. In order to facilitate the necessary recruitment of hatching turtles into the local turtle populations, as many nests as possible must be allowed to hatch naturally and the hatchlings allowed to make their way to the sea. Where it is not possible to protect marine turtle nests 'in situ', scientifically managed hatcheries should be established. Marine turtle by-catch in fishing gear must be reduced, critical habitats must be protected and rookery monitoring programmes must be established at the most significant rookeries. These measures will only be effective if the coastal communities of Sri Lanka are involved and informed. To achieve this, coastal communities must be educated about the importance of conserving the coastal ecosystems on which they depend.

Turtle Conservation Project (TCP) in Sri Lanka was established in 1993 to address the issue of marine turtle conservation through research, education and community participation. The TCP has launched three major community-based turtle conservation programmes to address the identified threats to marine turtles of Sri Lanka.

The TCP has selected Rekawa, a small village on the South coast of Sri Lanka, approximately 10 km east along the coast from Tangalle, for community-based turtle conservation activities. Rekawa is located on the border of the Intermediate and dry climatic zones of Sri Lanka, and borders on a large saline lagoon surrounded by extensive mangrove forests. There are no electricity or telephone lines in the village and the majority of households do not have running water. Water is primarily obtained from roadside storage tanks.

The village is divided into two divisions, Rekawa East and Rekawa West, and the numbers of families in these divisions are 121 and 144 respectively (Foorder, 1996, in press). Income generation activities for the families in the Rekawa area include agriculture (47%), lagoon fishing (10%), sea fishing (18%), coral mining (9%) and others (17%) such as masonry, carpentry, government services and labour.

The community of Rekawa village has suffered several setbacks in the last decade. During the late 1980's and early 1990's, Rekawa was the location of political violence, which bereaved many families of their skilled men-folk. An irrigation system designed by the government to improve the quality of the agricultural land surrounding nearby Tangalle drained Rekawa of its groundwater. The groundwater was eventually replenished by saline water from the sea and Rekawa lagoon, which rendered the land unsuitable for agriculture unless there are heavy rains. These events have resulted in low incomes for most of the families in Rekawa with approximately 57% of the families dependent to some degree on government welfare.

Rekawa's Natural Resources Because Rekawa is located on the border of two climatic zones there is a high local biodiversity. As well as the mangrove forests, the local vegetation consists of scrub jungles, medicinal plants, fruit trees and a wide variety of wildlife including 150 resident and migratory birds, 27 species of mammals, 23 species of reptiles, many arthropods and aquatic life.
Community Participation. TCP has initiated three major community based turtle conservation programmes in Sri Lanka, in order to conserve the marine turtles. These programmes are listed and described below:

i). An in situ nest protection and research programme is managed by a full-time coordinator supervised by 5 full-time research officers, 3 of whom were recruited from the University of Peradeniya, the Department of Wildlife Conservation (DWLC) and the National Aquatic Resource Agency (NARA).

The programme employs 17 former turtle egg poachers to assist TCP, DWLC, NARA and University of Peradeniya research officers in the collection of biological data and the in situ protection of marine turtle nests. These nest protectors patrol the beach and guard the nests from predators. The TCP aims to make this programme sustainable by organizing turtle-sensitive, nocturnal "turtle watches" for fee-paying visitors.

ii). The TCP school workshop programme and Southwest coast beach survey. The TCP conducted a series of educational workshops for pupils and teachers in schools along the southwestern coast (phase 1). At the lectures, pupils and teachers were invited to set up school turtle conservation groups and are invited to participate in the TCP Southwest coastal beach survey (phase 2). So far over 1,500 pupils and teachers from 130 coastal schools have participated in the educational programme. During this programme, the TCP distributed the school educational materials that were produced by the TCP in cooperation with the GTZ and the Coast Conservation Dept (CCD).

15 potential school conservation groups have been identified and over 450 pupils and teachers have volunteered to participate in the Southwest coast beach survey. The TCP School lecture programme coordinator is in charge of this programme predicts that there will be a total of approximately 50 school conservation groups when the series of workshops has been completed at all central schools within the extended programme boundaries from Kirinda to Puttalam.

The proposed third phase of this programme, will aim at strengthening the school turtle conservation groups and encouraging them to actively participate in the design, funding and implementation of turtle conservation and awareness raising activities in their local communities. The TCP also aims to undertake an extension of this programme to include the area between Colombo and Chilaw.

iii). Environmental education workshops. In October 1995, the TCP launched a wide-ranging programme of environmental education workshops in the Rakawa community. In March 1996, Rakawa community members graduated from an initial 6-month training programme during which they were trained in educational methods and taught about various environmental subjects relevant to their locality.

These Community Environmental Education Trainers (CEETs) conducted environmental education workshops for school children and community groups in the Rakawa area. The workshops focused on the environment as a whole using techniques such as participatory resource mapping to identify conservation issues and seek sustainable solutions to problems of destructive exploitation.

The TCP currently employs 4 CEETs to run the core environmental and educational programmes, such as model medicinal garden project, mangrove nursery, free herbal drink project and library project in Rakawa.

English classes for Rakawa Community members. The TCP has been conducting English classes in Rakawa since January 1994. These classes employ volunteer teachers from the UK and are attended by approximately 350 community children, adults and English teachers from Rakawa and the surrounding area. With these classes, the TCP aims to improve the employment prospects of participating community members in non-resource dependent jobs and therefore reduce community dependency on environmental exploitation. The classes also helped improve the
communication abilities of community members who are employed in TCP research and conservation activities in Rekawa and also they will act as tour guides for the nature trail programme.

Marine Turtle Conservation Workshops/Exhibitions. The TCP has conducted several workshops and exhibitions to increase awareness about marine turtle exploitation in Sri Lanka and the work of the TCP in trying to implement sustainable community participation strategies to combat these threats. Many of these workshops were organized by the CEETs of TCP for important government and nongovernmental institutions such as the Teacher Training College at Unawatuna, the Ceylon Tourist Board, Fisheries Societies, Police station-Tangalle etc.

This paper should be cited as:
COMMUNITY PARTICIPATION IN SEA TURTLE CONSERVATION IN SRI LANKA

Thushan Kapurusinghe and Lalith Ekanayake

Five of the world's seven species of marine turtles come ashore to nest in Sri Lanka, namely the Green turtle (Chelonia mydas), Leatherback turtle ( Dermochelys coriacea ), Loggerhead turtle ( Caretta caretta ), Hawksbill turtle ( Eretmochelys imbricata ), and Olive Ridley turtle ( Lepidochelys olivacea ). The Turtle Conservation Project (TCP) initiated the first conservation and sustainable management programme, with community participation, to conserve marine turtles in Sri Lanka. Among the main programmes initiated by TCP are the research and tagging programme. Other ongoing programmes include the mangrove conservation, highly commended global award from the Judges Board of the "British Airways Tourism for Tomorrow" in recognition of its success in community based conservation projects in Sri Lanka.


THE NESTING FREQUENCY OF MARINE TURTLES ON THE REKAWA TURTLE ROOKERY IN SOUTHERN SRI LANKA

Lalith Ekanayake and Thushan Kapurusinghe

The first in situ marine turtle nest protection and research programme with community participation was established in Rekawa by the TCP in 1996. The project deals with the protection of nests in situ enabling the immediate release of hatchlings to the sea on emergence, and the collection of biological data on the nesting marine turtle female population (of all five species present at the Rekawa turtle rookery). Data are collected on the number of nests per season, the size of the nesting female population, growth rates of individuals, longevity of individuals after tagging, mean breeding frequency, incubation period, nest temperature and hatching success rates (in situ and hatchery comparative studies), migratory paths and geographical range. To date, about 800 turtles (of all five species) have been tagged. Of the 2,860 nests laid in the Rekawa beach during the past three years, the Ridley – 1.35%, Loggerhead – 0.26% and Hawksbill – 0.22%. Significantly, 82 percent of the 290,000 eggs laid were hatched successfully.

COMMUNITY PARTICIPATION IN TURTLE CONSERVATION IN SRI LANKA

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Abstract
Five of the world's seven species of marine turtle come ashore to nest in Sri Lanka. They are the Green turtle (Chelonia mydas), Olive ridley turtle (Lepidochelys olivacea), Loggerhead turtle (Caretta caretta), Hawksbill (Eretmochelys imbricata) and Leatherback turtle (Dermochelys coriacea). Despite the protection of marine turtles under government legislation since 1972, marine turtles are still being exploited by Sri Lankan fishermen for their meat, eggs and carapaces.

The Turtle Conservation Project (TCP) has initiated conservation programmes in Sri Lanka, in order to conserve the marine turtles. TCP selected Rekawa, a small village on the South coast of Sri Lanka, approximately 10 kilometres eastwards along the coast from Tangalle, for the community based turtle conservation activities as TCP's major project site. People of this village were collecting all the eggs and occasionally killed turtles. Major programmes initiated by TCP are the Rekawa environmental education programme, school lecture programme and research and tagging programme. All these programmes were community based and successfully achieved the goal. Many programmes are ongoing presently and details of the programmes are described below. It is very important to note that the TCP has won a 'Highly commended' global award from the judge board of the British Airways Tourism for Tomorrow award scheme because of its success in community based conservation projects.

Introduction
Five of the world's seven species of marine turtle come ashore to nest in Sri Lanka. Despite the protection of marine turtles under government legislation since 1972, they are still being exploited in Sri Lanka for their eggs and their meat. Turtle rookeries are being disturbed by tourist industry development, and unsustainable harvesting is destroying feeding habitats such as coral reefs. Many turtles are accidentally caught and drowned in fishing gear each year. The critically endangered Hawksbill turtle has been hunted to the brink of extinction for its carapace in order to provide raw materials for the illegal 'tortoiseshell' trade.

The most widespread form of marine turtle exploitation in Sri Lanka is illegal poaching of turtle eggs. TCP surveys have revealed that for the past 20 years almost 100% of the marine turtle nests on the South and South-West coast of Sri Lanka have been robbed for their eggs by poachers. This stretch of coastline is Sri Lanka's largest marine turtle rookery. TCP surveys have also revealed that marine turtle populations are in decline at all of Sri Lanka's rookeries. As a result of egg collection alone, the TCP predicts that the marine turtle populations of Sri Lanka will decline to near extinction within the next few decades.

However, Sri Lanka's marine turtle populations can recover from this inevitable decline, but only if effective conservation measures are carried out immediately and are continuous for at least the next 10 years. In order to facilitate recruitment of turtles into the local turtle populations, as many nests as possible must be allowed to hatch naturally and the hatchlings allowed to make their way to the sea. Where it is not possible to protect marine turtle nests in situ, scientifically managed hatcheries should be established. Marine turtle by-catch in fishing gear must be reduced, critical habitats must be protected and rookery-monitoring programmes must be established at the most significant rookeries. These measures will only be effective if the coastal communities of Sri Lanka are involved and informed. To achieve this, coastal communities must be educated about the importance of conserving the coastal ecosystems on which they depend.

The Turtle Conservation Project (TCP) in Sri Lanka was established in 1993 to address the issue of marine turtle conservation. The TCP aims to devise and facilitate the implementation of sustainable marine turtle conservation strategies through education, research and community participation.
Rekawa - The project site

Rekawa is a small village on the South coast of Sri Lanka, approximately 10 kilometers eastwards along the coast from Tangalle. Rekawa is located between the intermediate and dry climatic zones of Sri Lanka, and borders on a large saline lagoon surrounded by extensive mangrove forests. There are no electricity or telephone lines in the village and the majority of households do not have running water. Water is mainly obtained from roadside storage tanks.

The village is divided into Rekawa East and Rekawa West, and the numbers of families in these divisions are 121 and 144 respectively (Foerderer 1996, in press). Income generation activities for the families in the Rekawa area include agriculture (47%), lagoon fishing (10%), sea fishing (18%), coral mining (9%) and others (17%) such as masonry, carpentry, government services and labour (Ganewatte et al. 1995).

The community of Rekawa has suffered several setbacks in the last decade. During the late 1980’s and early 1990’s, Rekawa was the location of political violence, which bereaved many families of their skilled men-folk. An irrigation system designed by the government to improve the quality of the agricultural land surrounding nearby Tangalle, drained Rekawa of it’s groundwater. The groundwater was eventually replenished by saline water from the sea and Rekawa lagoon, which rendered the land unsuitable for agriculture except after heavy rains. These events have resulted in low incomes for most of the families in Rekawa with approximately 57% of the families dependent to some degree on government welfare (Foerderer 1996).

Rekawa’s natural resources

Because Rekawa is located on the border of two climatic zones there is a high local level of biodiversity. As well as the mangrove forests, the local vegetation consists of scrub jungles, medicinal plants, fruit trees and a wide variety of wildlife including 150 resident and migratory birds, 27 species of mammals, 23 species of reptiles, many arthropods and aquatic life (Kapurusinghe T 1994 unpublished report).

Although coral mining is illegal in Sri Lanka, the coral reefs immediately offshore of Rekawa beach have been mined by the community for the production of lime. The mangrove forests have been extensively cleared to provide firewood for the lime kilns.

Rekawa Kalapuwa is a large lagoon of 250 hectares, which is surrounded by mangrove forests. The neighbouring villages of Netolipitya, Meltilla, Marakoliya, Kapuhenwela and Welivawagoda also border the lagoon and the fishermen from these villages depend on the lagoon fishery. The fishery consists of several species of fish and the more economically viable shrimp. Community members have been involved in the removal of shells for lime production and sand for use in the construction industry. However, today, shells and lagoon sand are difficult to collect and this has led to local dependence on other resources (Ganewatte et al. 1995).

A causeway has been built across the narrow westerly section of the lagoon. “The causeway has increased accessibility to the village of Kapuhenwela but has reduced the natural exchange of sea and lagoon water. This has lead to a change in the quality of lagoon water causing a recent dramatic reduction in the lagoon fishery’s productivity. In order to maintain catch size many local fishermen now use nylon nets, a practice that has contributed to the over-exploitation of the lagoon fishery. The degradation of the fishery has meant that lagoon fishermen have had to look to other resources for income generation.”

The 2 km of Rekawa beach immediately westwards of the Rekawa headland provides nesting habitat for populations of 5 species of marine turtle. For at least 20 years, local villagers have collected almost 100% of the turtle eggs laid on Rekawa beach and some adult females have also been harvested (TCP Survey reports 1993-1996 unpublished).
Results of TCP community based conservation activities

Previous efforts have shown that if action is taken to stop the over-exploitation of natural resources in Rekawa, without the provision of any alternative income generation activities, the Rekawa community will either resist the action or begin to exploit other resources. Therefore, the TCP decided to take a holistic approach to conservation in Rekawa and implement a marine turtle nest protection programme that involved the Rekawa community in the conservation of marine turtles and provided them with tangible benefit. This was an innovative programme addressing both environmental and socio-economic problems in the area that would hopefully serve as a model for further marine turtle conservation efforts, and indeed conservation efforts in Sri Lanka generally.

i) An in-situ marine turtle nest protection and research programme:

This programme is managed by a fulltime in situ nest protection programme coordinator and supervised by 5 full-time research officers, 3 of whom were recruited from the University of Peradeniya, the Department of Wildlife Conservation (DWLC) and the National Aquatic Resources Agency (NARA).

The programme employs 17 former turtle egg poachers to assist TCP, DWLC, NARA and University of Peradeniya research officers in the collection of biological data and the in situ protection of marine turtle nests.

Summary of Key Marine Turtle Nest Protection and Research Results, September 21st, 1996 - February 26th, 1999 - Total number of turtles tagged: 462

Table 1: Turtle eggs

<table>
<thead>
<tr>
<th>Turtle species</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green turtles</td>
<td>194,113</td>
<td>98.00</td>
</tr>
<tr>
<td>Olive Ridley turtles</td>
<td>1,919</td>
<td>0.98</td>
</tr>
<tr>
<td>Leatherback turtles</td>
<td>1,250</td>
<td>0.64</td>
</tr>
<tr>
<td>Loggerhead turtles</td>
<td>482</td>
<td>0.25</td>
</tr>
<tr>
<td>Hawksbill turtles</td>
<td>241</td>
<td>0.13</td>
</tr>
<tr>
<td>Total turtle eggs</td>
<td>198,005</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 2: Nests laid

<table>
<thead>
<tr>
<th>Turtle species</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green turtles</td>
<td>1,977</td>
<td>96.30</td>
</tr>
<tr>
<td>Olive Ridley turtles</td>
<td>32</td>
<td>1.57</td>
</tr>
<tr>
<td>Leatherback turtles</td>
<td>31</td>
<td>1.53</td>
</tr>
<tr>
<td>Loggerhead turtles</td>
<td>6</td>
<td>0.30</td>
</tr>
<tr>
<td>Hawksbill turtles</td>
<td>6</td>
<td>0.30</td>
</tr>
<tr>
<td>Total nests</td>
<td>2,052</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Total number of eggs laid = 198,005
Total hatchlings released to the sea = 98,198

NB: The data on hatchlings released refers to nests hatching in the reporting period and does not correspond to the number of nests laid in the reporting period. This is due to an incubation period.
of between 50-60 days.

The primary aim of the project is to collect biological research data on nesting female populations of marine turtles and hatchlings of each species present at the Rekawa turtle rookery, with the aim of building a comprehensive database to assist in the conservation of marine turtles both nationally and internationally. Specific areas of data collection and analysis include the following:

- number of nests per season (individual and population totals);
- monitor the size of nesting female populations;
- growth rates of individuals;
- longevity of individuals beyond tagging;
- mean breeding frequency;
- nesting behaviour;
- nest incubation periods;
- hatching success rates (in situ and hatchery comparative studies);
- examination of factors influencing hatching success rates;
- migratory paths and geographical range of nesting marine turtles.

Biological research data listed above were successfully collected and entered into a computer database. All hatchlings were released immediately to the sea from hatching nests. Threatened nests were moved to safe areas to avoid human consumption and predation from animals. Nests that were laid on adjacent beaches outside the project boundaries were collected and reburied within TCP protected boundaries. Within this project over a thousand personnel from universities, government institutions/departments and various NGOs, visited the Rekawa in situ programme receiving various degrees of education/training/experience in marine turtle biology and in situ research and conservation methodology according to their needs.

ii) Turtle night watch programme — The TCP aims to achieve its sustainability by organising nocturnal 'Turtle Watches' for fee-paying visitors. TCP used the collection to:
- cover project wages when there was a lack of funding;
- initiate a loan scheme among the community members;
- organise field trips for community members;
- initiate new community-based programmes;
- promote eco-tourism in the area.

This programme includes the merchandise of TCP T-shirts, stickers, badges etc., and turtle adoption. After their visit all of the visitors had received new knowledge about marine turtles, the threats they face and the importance of conservation.

iii) The TCP school workshop programme and Southwest coast beach survey

The TCP has conducted a series of educational workshops for pupils and teachers in schools along the Southwest coast (phase 1). Pupils and teachers were invited to set up turtle conservation groups and we invited to participate in the TCP Southwest coastal beach survey (phase 2). So far, over 1,500 pupils and teachers from 130 coastal schools have participated in the educational programme. During this programme, the TCP distributed educational materials, which were produced by the TCP in cooperation with the GTZ and the Coast Conservation Department (CCD).

Fifteen school conservation groups have been identified and over 450 pupils and teachers have volunteered to participate in the Southwest coast beach survey. The TCP School lecture programme coordinator in charge of this programme predicts that there will be a total of approximately 50 school conservation groups when the series of workshops has been completed at all central schools within the extended programme boundaries from Kandy to Puttalam.

The proposed third phase of this programme will aim at strengthening the turtle conservation groups and encouraging them to actively participate in the design, finding and implementation of turtle conservation and awareness raising activities in their local communities. The TCP also aims to undertake an extension of this programme to include the area between Colombo and Chilaw.
iv) Environmental education workshops

In October 1995, the TCP launched a wide-ranging programme of environmental education workshops in the Rekawa community. In March 1996, 14 Rekawa community members graduated from an initial 6-month training programme during which they were trained in educational methods and taught about various environmental subjects relevant to their locality.

These Community Environmental Education Trainers (CEETs) conducted environmental education workshops for school children and community groups in the Rekawa area. The workshops focused on the environment as a whole using techniques such as participatory resource mapping to identify conservation issues and seek sustainable solutions to problems of destructive exploitation.

The TCP currently employs 4 CEETs to run the core environmental and educational programmes such as model medicinal garden project, mangrove nursery, and free herbal drink project and library project in Rekawa.

English Classes for Rekawa Community Members — The TCP has been carrying out English language classes in Rekawa since January 1994. These classes employ volunteer teachers from the UK and are attended by approximately 350 community children, adults and English teachers from Rekawa and the surrounding area. With these classes, the TCP aims to improve the employment prospects of participating community members in non-resource dependent jobs and therefore reduce community dependency on environmental exploitation. The classes also help improve the communication abilities of community members who are employed in TCP research and conservation activities in Rekawa, who will also act as tour guides for the nature trail programme.

v) Marine Turtle Conservation Workshops/Exhibitions/Lectures — The TCP conducted many workshops and exhibitions to increase awareness on marine turtle exploitation in Sri Lanka and the work of the TCP in trying to implement sustainable community participation strategies to combat threats to marine turtles. Many of these workshops were organised by CEETs for important government and non-government institutions such as the Teacher Training College at University, the Ceylon Tourist Board, Fisheries Societies, Police Station-Tangalle, National Zoological Gardens, many local schools etc. TCP receives many invitations to deliver lectures on marine turtles and other coastal ecosystems.

vi) TCP medical centre — In 1998, TCP established a rural medical clinic at Rekawa. TCP voluntary medical doctors are conducting the clinics in weekends and two employed health assistants serve at the clinic during the weekdays. These health assistants were trained by the District Medical Officer of Tangalle (DMO) coordinator of this programme who is working hard to expand the capacity of the clinic.

Final assessment of project activities & results

At Rekawa, as the TCP continues to involve the community in sustainable conservation activities, any poachers who attempt to steal eggs will be prevented from doing so by joint TCP-community efforts.

- TCP managed to protect sufficient nests to allow 98,186 hatchlings to the sea. This is a mean success rate of around 72%. This is an excellent figure, showing how successful nests are, when they are left where they are laid. Success rates for hatchery reared nests are significantly lower in Sri Lanka, often only between 40-60%.

- However the TCP remains pleased by the fact that so many hatchlings have been released to the sea, and sees this as a positive continuation of this programme’s achievements in its first years. More than 98,000 hatchlings have been released during this time when previously there were none.

- The number of nests recovered from outer areas similarly demonstrates this proactive approach to nest protection. Especially pleasing is the fact that National Park staff has often, while not on duty, protected nests they have discovered in out-boundary areas when going about their daily business, and also reported any marine turtle activity they were aware of.

- The TCP was very satisfied with the number of visitors from various government, NGO and higher education institutions to the in situ programme. The TCP provided them with various degrees of training in in situ marine turtle research and nest protection methodology, according to their needs.
Some personnel from these institutions wanted to simply learn more about marine turtles, threats and conservation efforts. The TCP also received visits from some hatchery managers interested to learn about in situ nest protection. In addition, hotel owners from all over the south have come to learn how best to protect turtle nests laid on beaches near their property. All such educational and training progress will serve to further marine turtle conservation in Sri Lanka.

- In addition to the institutional visitors there were many Sri Lankans and foreign visitors to the project. Many of them were school children, and many local people from the Tangalle area. Visits from local people and school children have high educational values that will assist future marine turtle conservation efforts. The in situ programme is proving an important field site for practical education and training that should prove to have a more lasting impression on visitors than 'classroom' education / training. The TCP has undertaken various marketing efforts within the Tangalle area, by distributing 'Turtle Watch' promotional leaflets to all hotels and guesthouses. In addition, the TCP has advertised nationally on the radio and within local Colombo 'events' magazines. The TCP has also contacted the main tour agencies in Colombo, Galle and Hikkaduwa to promote the programme.

Acknowledgements

The Turtle Conservation Project (TCP) offers its appreciation to the Royal Netherlands Embassy, Norwegian Embassies (NORAD) and Columbus Zoo for providing the funding for various community based TCP conservation programs. We also thank the National Aquatic Resources Agency (NARA) and the University of Peradeniya for assisting us during the project. We appreciate the contribution of the Wildlife Department of Sri Lanka and to the staff of the Tangalle Police for providing legal support. The British Airways Assisting Conservation (BAAC) Program supported TCP since its establishment by providing free flights for TCP English teachers and TCP staff. We would like to offer our thanks to the Rekawa community members who worked with us throughout the project period. Finally, we are grateful to all the TCP members and supporters who contributed their valuable time to conserve Sri Lanka's endangered marine turtles.

References

Ganewatta et al., 1995. The Coastal Environmental Profile of Rekawa Lagoon, Sri Lanka.
TCP Beach survey reports 93-96 (unpublished).

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1. Abstract

Five of the world’s seven species of marine turtles come ashore to nest in Sri Lanka (Daraniyagala, 1953). Those are the green turtle (Chelonia mydas), leatherback turtle (Dermochelys coriacea), loggerhead turtle (Caretta caretta), hawksbill turtle (Eretmochelys imbricata) and the olive ridley turtle (Lepidochelys olivacea). Despite government legislative protection, marine turtles are still being exploited in Sri Lanka for their eggs and their meat. As a result of this and threats to habitats, all marine turtles are considered under threat and the Hawksbill turtle is critically endangered in Sri Lanka (Hewawithaththi, 1993).

The Turtle Conservation project (TCP) is a Sri Lankan NGO, established in 1993, with the aim of devising and facilitating the implementation of sustainable marine turtle conservation strategies through education, protection, research and community participation. Rekawa beach, on the southern coast, is Sri Lanka’s most important marine turtle nesting rookery, but was under serious threat from 100% turtle egg collection since the 1970’s by local people. In 1996 the TCP established a pioneering community based ‘in situ’ marine turtle nest protection and research programme in Rekawa. This programme was designed to employ former turtle egg poachers as turtle ‘Nest Protectors’. The main aims of the programme were:

- To protect all nests using the in-situ method and allow for the immediate natural release of all hatchlings to the sea on emergence
- To provide new data on the biology of the nesting marine turtle populations of Sri Lanka
- To provide an alternative sustainable income for the turtle egg collectors in Rekawa

So far TCP researches have tagged 600 turtles including all five species. Of the 600 nesting females, 541 were green turtles, 28 were olive ridleys, 23 were leatherbacks, 3 were hawksbills and 5 were loggerheads. 2660 nests were laid on Rekawa beach during the period September 1996 to September 1999. There were 2572 green turtle nests (96.7%), 39 leatherback nests (1.47%), 36 olive ridley nests (1.35%), 7 loggerhead nests (0.28%) and 6 hawksbill nests (0.22%).

2. Introduction

TCP surveys revealed that Rekawa is the location of one of the most important green turtle (Chelonia mydas) rookeries in Sri Lanka (TCP internal reports - unpublished). Leatherback turtles (Dermochelys coriacea), loggerhead turtles (Caretta caretta), hawksbill turtles (Eretmochelys imbricata) and olive ridley turtles (Lepidochelys olivacea) also nest at Rekawa. All of these species are listed as either endangered or vulnerable by the World Conservation Union (IUCN).

For more than 20 years up until 1999, local people from the impoverished Rekawa village had collected all the turtle eggs laid on Rekawa beach for sale or local consumption. This resulted in zero recruitment into the local marine turtle population. Egg collectors from Rekawa interviewed during TCP surveys have said that in the 1970’s it was not uncommon to take eggs from as many as 40 nests per night. But today the number of the nests per night rarely exceeds 10. These egg collectors are either dependent or semi-dependent on the sale of marine turtle eggs for income generation. Some nesting female turtles are also occasionally killed for their flesh, which is also sold at local markets (TCP internal reports 1994/95 - unpublished).

Marine turtles are believed to reach sexual maturity at about 30 years of age (Mrosovsky, 1983); research has also found that female turtle’s return to nest at their natal beach. Therefore, as there’s been no recruitment into the Rekawa populations for more than 20 years - due to egg collection,
there would only be a further 10 year period when first-time nesting turtles would arrive at Rekawa, i.e. up to the year 2006. After this time there would be no first time nesters and the nesting population would begin to dwindle due to mortality from natural and human factors (e.g. fishing by-catch, pollution etc.). If egg collection had continued there would have been no further recruitment of the nesting population. The TCP therefore believed that if no action was taken to prevent egg collection, the nesting population of marine turtles at Rekawa would have been so over-exploited as to have been unable to recover, leading to the extinction of this population within 20 years (Richardson, 1996, in li.).

2.1. Rekawa: the project site
The TCP selected Rekawa, a small village near Tangalle, in the district of Hambantota in southern Sri Lanka, for the implementation of the TCP’s in situ marine turtle nest protection and research programme. Rekawa is located on the border of the intermediate and dry climatic zones of Sri Lanka, and borders a large saline lagoon surrounded by extensive mangrove forests. There are no electricity or telephone lines in the village and the majority of households do not have running water.

The village is divided into two divisions, Rekawa East and Rekawa West, and the numbers of families in these divisions are 121 and 144 respectively (Foerderer, 1996, in press). Income generating activities for the families in the Rekawa area include agriculture (47%), lagoon fishing (10%), sea fishing (18%), coral mining (9%) and others (17%) such as masonry, carpentry, government services and labour (Ranaweera Banda et al., 1994).

The community of Rekawa village has suffered several setbacks in the last decade. During the late 1980’s and early 1990’s, Rekawa was the location of political violence, which bereaved many families of their skilled men-folk. An irrigation system designed by the government to improve the quality of the agricultural land surrounding nearby Tangalle, drained Rekawa of its groundwater. The rendered the land unsuitable for agriculture unless there are heavy rains. These events have resulted in low incomes for most of the families in Rekawa with approximately 57% of the families dependent to some degree on government welfare (Foerderer, 1996, in press).

2.2. Rekawa’s natural resources
Because Rekawa is located on the border of two climatic zones there is a high local biodiversity. As well as the mangrove forests, the local vegetation consists of scrub jungles, medicinal plants, fruit trees and a wide variety of wildlife including 150 resident and migratory birds, 29 species of mammals, 23 species of reptiles, many arthropods and diverse aquatic life (Kapurusinghe T., 1995-unpublished report).

3. Project Objectives
The objectives of the TCP Rekawa community in situ marine turtle conservation and research project can be listed as follows:

- To protect in situ, all marine turtle nests located within the project boundaries and ensure that all resulting hatchling turtles reach the sea immediately after emerging from the nest;
- To incubate the eggs collected from as many nests as possible laid on adjacent beaches outside the project boundaries in a small, scientifically managed hatchery and immediately release the resulting hatchlings;
- To collect biological data from the nesting female populations of marine turtles of each species present at the Rekawa turtle rookery. Research topics will include determining: number of nests per season (individual and population totals); size of nesting female populations; growth rates of individuals; longevity of individuals beyond tagging; mean breeding frequency; migratory paths and

4.1. Data collection methods
A series of data collection programs employed as in situ conservation.

4.2. Data analysis
Discuss appropriate methods of data analysis. There are several ways to analyze the results obtained from the Rekawa study. The 2 km stretch of beach was divided into 5 0.2 km sections and the stretch closest to the village was to be monitored. Once a turtle track and laying site was located, a signal was given to the research team and he was informed to keep his way to
geographical range, nest incubation periods, nest temperatures, and hatching success rates (in situ and hatchery comparative studies).

- To involve local stakeholders in the planning and implementation of the in-situ nest protection and research programme.

- To provide an alternative and sustainable income to those Rekawa community members currently financially dependent on marine turtle egg gathering by employing them in a system of non-consumptive and sustainable utilisation of local nesting marine turtle populations.

- To set up a 'Turtle Watch' programme for paying tourists to help contribute to the future sustainability of the project.

- To provide a field study and training site for interested parties, such as university students, government department research officers, and NGO members, to learn about marine turtle conservation and research methodology.

4. Methodology

4.1. Involvement of former egg collectors

A series of meetings were held with the egg collectors. During these meetings the regular egg collectors were identified by TCP. Those individuals were requested to stop collecting eggs once the programme began. As an alternative they would be provided with the opportunity to take up employment as assistants to the Research Officers (ROs) (see 4.2) of the research programme and as in situ protectors of marine turtle nests. The transformation of the local egg collectors to 'Nest Protectors' provided the research team with an invaluable local understanding of turtle behaviour in Rekawa.

24 egg collectors were organised into a formally recognised group of 'Nest Protectors' (NPs). Discussions were held on the methodology of the in-situ nest protection and research programme and appropriate alterations made. The TCP also carried out basic training in in-situ nest protection methods and data collection skills. The project began on the 2nd September 1996.

4.2. Research Methodology

Data sheets were designed to collect biometric data from each turtle and from each nest laid. Key data collection involved an initial mapping of the beach; the weighing, measuring and tagging of nesting female turtles; monitoring nesting behaviour; and collecting data on incubation periods, hatching biometrics, and hatching success rates. Each hind flipper of each turtle was tagged with a Dalton plastic tag, using first a leather punch to make a hole in the flipper and then an applicator for affixing the tags. Flexible measuring tapes were used to turtle curved carapace length and width.

The 2 km stretch of beach within the project boundaries were patrolled 24 hours a day by the NPs in order to prevent poaching of marine turtle eggs. At least 2 ROs and 8 NPs were present on the beach from 19:00 hrs to 03:00 hrs every night. The ROs organised rotation patrols for themselves and the NPs, originating from a central position on the beach. Therefore, each half of the 2 km stretch of beach was patrolled every half hour at night by 2 personnel. The purpose of the patrols was to locate landed turtles and protect nests already laid.

Once a track has been located by a patrol unit of NPs, one of the personnel carefully ascends the track and ascertains the stage of the nesting procedure of the turtle. They then issue a recognised torch signal to the central position to indicate to the rest of the patrolling team that a turtle has been located. A RO based at the central position then returns a recognition torch signal and then makes his way to the nesting site with the necessary research equipment. Meanwhile the NPs observe the
turtle's behaviour, recording the time at the beginning of each stage of the nesting process. On arrival at the site, the RO manages the patrol unit in the collection of biometric data.

The RO and NPs on daytime duty measure the exact location of the previous night's nests and place a 'nest screen' over the nest. The nest screen is a 1 metre square piece of steel cable mesh, the mesh size is small enough to prevent animal predators from excavating the nest, yet large enough to enable emerging hatchlings to escape.

ROs and NPs occasionally patrol the beach outside of the project boundaries. Any recently laid nests found in these areas are relocated and incubated within TCP boundaries, to prevent poaching. Similarly any nests that the TCP staff decides may be threatened within TCP boundaries for various reasons (eg. some nests are laid in areas subject to high tides), are relocated to a safe place. All the data collected by ROs was fed into a database (Microsoft Excel) on a regular basis.

5 full-time ROs were trained in data collection, research methods and nest protection, and were responsible for the coordination and supervision of the beach research and conservation. The posts were occupied as follows:

One TCP Senior Research Officer and programme coordinator
One TCP Research Officer
One Post-graduate student, registered with the Department of Zoology at the University of Peradeniya
One Officer from the Department of Wildlife Conservation
One National Aquatics Resources Agency (NARA) officer, also a Post-graduate student registered with the Department of Zoology at the University of Ruhuna.

5. Results

Summary of marine turtle nesting and hatching data on Rekawa beach:
2 September 1999 - 30 September 1999

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Nesting females</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Turtle</td>
<td>541</td>
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<tr>
<td>Olive ridley Turtle</td>
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<td>Loggerhead Turtle</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Nests laid</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Olive ridley Turtle</td>
<td>38</td>
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<td>Leatherback Turtle</td>
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<tr>
<td>Loggerhead Turtle</td>
<td>6</td>
<td>0.26</td>
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</tr>
<tr>
<td>Total Turtle nests laid</td>
<td>2660</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

38
5. Discussion

Setting up and operating the participatory in situ nest protection and research programme at Rekawa was an enormous challenge for the TCP. It was Sri Lanka’s first genuine marine turtle conservation and research programme and one of only a few marine turtle conservation projects in the world operating as either in situ, or community participatory.

The programme has not been without its problems and the TCP has had to continually review the programme and address problems as they arise, working in co-operation with the NPs. It has been a learning process in both in-situ turtle conservation, and community participation in conservation and development. The TCP staff is now confident in being able to deal with any future difficulties.

During the research period TCP staff observed dogs, crabs, water and land monitors, ants and ghost crabs attacking and consuming hatchlings. Ghost crabs are the main night-time predator, while the remainder are daytime predators. One of the most destructive predators on Rekawa beach was a species of red ant attacking a small number of nests, killing and consuming hatchlings still in the sand after hatching.

The hatching success rate has improved through the project’s duration as the TCP has adopted better methods in nest protection and nest relocation. Nests and their emergent hatchlings have been successfully protected from predators and environmental threats and it is believed that the nest success rate is significantly higher than it would be in the wild. The TCP expected considerable thefts on nests considering the radical change over from egg collection to egg protection as villagers were depending on eggs for over twenty years. The TCP managed to catch 7 nest thieves who were reported to the police and given severe reprimands. Disappointingly, 5 of these people were ‘Nest Protectors’ working for the TCP and were subsequently sacked in the early stages of the project, a decision taken by the NPs and TCP management.

The predominance of the green turtle species was expected. We were however pleasantly surprised by the 3 hawksbill turtles that nested, as these have not been seen nesting in Rekawa for 5 years! The research has also been extremely successful with ROs and NPs working well as a team to produce a comprehensive and detailed database on nesting turtles and nests hatched. This
information will be extremely important in ensuring an improved understanding of the biology and behaviour of Sri Lanka’s marine turtles and hence provide for more effective future marine turtle conservation strategies. The research information collected by the TCP will also be an important contribution to the world data base on marine turtles to help produce more effective regional strategies to protect this long distance migratory species.

The Rekawa project has also been very successful as a site for in-situ training for marine turtle research and conservation methodology:
- NARA and the DWLC now have a trained officer in in-situ marine turtle conservation.
- ROs are currently undertaking their MSc dissertations based on the in-situ conservation programme, with positive implications for future marine turtle research in the Zoology departments of their respective universities.
- Two hatchery managers have been trained in in-situ methodology and good hatchery management procedure. It is hoped that hatchery management practice will become more scientific and conservation orientated as a result, and that hatchery managers and interested conservationists may be inspired to set up similar in-situ programmes.
- Marine turtle conservationists from around the world have also visited the project.

The project has provided a valuable source of education and promotion of marine turtle conservation and the principle of conservation as a whole, with visits from local people, Sri Lankans, foreign tourists and schools. A group of students from an International school in Colombo stayed in Rekawa for a week and undertook scientific research on beach geography and chemistry to evaluate impacts on nest success rates.

The project has provided a valuable alternative source of income for community members previously dependent on the destructive exploitation of marine turtles and their eggs at Rekawa. NPs now receive higher and more stable earnings from as egg collectors, thus aiding local development. Local people can now see there is an alternative to destructive exploitation of natural resources. Some NPs have seen hatchlings for the first time and now say they would not collect or eat turtle eggs again.

5. Conclusions

According to the results the authors would like to conclude that:
- All five species nesting in Sri Lanka nest at the Rekawa marine turtle rookery.
- The most common nesting marine turtle species in Rekawa is the green turtle (Chelonia mydas).
- The 2 km stretch of beach at Rekawa can be considered the most important green turtle nesting rookery in Sri Lanka, according to the available data.
- The least common nesting species at Rekawa is the hawksbill turtle (Eretmochelys imbricata).
- The nesting female population in Rekawa is so far estimated to be 600 and it includes all five species found in Sri Lanka.
- On average more than 800 nests per year are laid by the nesting turtles in Rekawa.
- Almost a 100,000 eggs are laid annually by the nesting turtles in Rekawa.
- Dogs, crows, water and land monitors, ants, and ghost crabs are the main land predators for eggs and hatchlings on Rekawa beach.
- A viable alternative has been provided to the previous marine turtle egg collectors of Rekawa who were unsustainable exploiting the local marine turtle population.
7. Recommendations

Marine turtles have over 180 million years of evolutionary history. Despite increasing intensity in international marine turtle research, researchers still know very little about marine turtle biology. Therefore, the best method to conserve marine turtles would be by adopting the in situ conservation method, which allows turtles to continue to interact with their natural environment and reproduce naturally as they would in the wild. Where in situ conservation is not possible or economically unfeasible then ex situ conservation can play an important role in marine turtle conservation, as long as it is carefully managed according to the best scientific protocol available.

Considering the TCP's experience during the Rekawa marine turtle nest protection and research programme, the authors would like to make the following recommendations:

- The Rekawa in situ marine turtle conservation and research programme should be continued for at least another ten years to ensure a reasonable recovery of the exploited marine turtle population in Rekawa.
- The strength of the research and management including the administration should be increased by receiving more support from both government and non-government agencies including foreign donor and research agencies.
- Aspects of marine turtle research in the programme should be expanded and improved by increasing the areas of research, incorporating more modern research techniques and increasing research staff training.
- The community should be continuously involved with the programme development and participate fully in programme activities and benefits, as they do now.
- Further activities for self-sustainability need to be developed and implemented.

8. Acknowledgements

Firstly, the authors wish to thank Mr. Richard Zanine for editing this paper. We also thank the TCP Research Officers who continuously collected marine turtle data at the Rekawa nesting rookery since 1996. We would also like to acknowledge the TCP Committee members for joining us in the day to day project administration. We would like to thank the Department of Wildlife Conservation in Sri Lanka for providing the research permission and a Research Officer for TCP. We also thank Mr. Arasasooriya of National Aquatic Resources Agency (NARA) for providing Research Officers. We thank the Rekawa villagers for accepting us into the community and without whose support the TCP would have been unable to implement this programme in Rekawa. We also gratefully thank NORAD, Netherlands Embassy and the British Embassy in Sri Lanka, as well as the Ministry of Forestry and Environment for providing funding for the programme since 1996. We thank British Airways for supporting TCP by providing free flights for TCP volunteers and staff since 1994. Finally, we would like to thank the members of the Young Zoologists' Association and other local and foreign volunteers for their invaluable help in conducting the research and conservation activities.

References


This paper should cited as:

ESTIMATION OF THE AVERAGE NUMBER OF NESTS FOR GREEN TURTLE ON THE REKAWA BEACH IN SOUTHERN SRI LANKA. THREE YEAR STUDY FROM SEPTEMBER 1996 TO SEPTEMBER 1999

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2 Department of Zoology, University of Peradeniya, Sri Lanka.
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Introduction

Many marine turtle research programmes around the world involve the tagging of the nesting females for obtaining information on the life history of the species (Broderick and Godley, 1999). The information could be the reproductive biology, movements (migration), stranding, and residency, re-nesting and growth rates (Balazs, 1999). The Turtle Conservation Project (TCP) is conducted an in-situ nest conservation program on Rekawa beach in southern Sri Lanka. A two-kilometer stretch of beach was patrolled for 24 hours per day and 365 days per year. Five species of the world’s seven species of marine turtles come ashore to nest on this beach (Kapurusingha and Ekanayake, 2000). The species are Green turtle (Chelonia mydas), Olive ridley (Lepidochelys olivacea), Leatherback (Dermochelys coriacea), Hawksbill (Eretmochelys imbricata) and Loggerhead (Caretta caretta). Of these five species more than 90% was green turtle and therefore this species was selected for this study. Most of the turtle populations have individuals that display both regular and irregular re-nesting behaviour (Hughes, 1982) and Green turtles show a high degree of nest site selection. It has been observed that in Rekawa, Sri Lanka eight green turtles nested within this 2km stretch of beach was reappeared during the next nesting season, which occurred after a gap of 2.5 to 3.5 years.

Method

About 2050m stretch of beach on the project site was marked by wooden posts with 50-meter intervals starting from 0 to 41. The numbering of the posts started from right side to the left side. Each post was marked with a number and the distance in meters that the post represents. While the survey was in progress, it was noticed that some turtles are laying to the right of the beach from the post 0. Therefore, another post was erected as beach post –1, thus extending the survey area by another 50 m. When a turtle comes to nest, the nesting site is marked on the data sheet indicating the location of the nest between a pair of beach posts. With the commencement of the project, turtles coming to nest at Rekawa beach were tagged. The best time we found for the tagging turtles was when they were covering their egg chamber. Therefore, most of the tagging was done during this time and the turtle was tagged on both hind flippers. For this we used the plastic tags (The Dalton Supplies Ltd, England). A number and address printed on both male and female part of the tag. About ninety five percent of the nesting green turtles and the re-nesting were recorded from September 1996 to September 1999.

Results

The total number of nests laid on the beach is 2442 and 598 green turtles were tagged during the reporting period. The lowest number of nest per season is one and, the highest number of nest per season for the green turtles is twelve. Out of 598 green turtles 21.14 % laid only one time per one nesting season and 0.34% green turtles laid twelve nest per nesting season. The mean number of nesting per season was four times.
Table 1. The number of nests per green turtle for a single nesting season.

<table>
<thead>
<tr>
<th>Number of nests</th>
<th>Number of turtles</th>
<th>Total nests</th>
</tr>
</thead>
<tbody>
<tr>
<td>One time</td>
<td>126</td>
<td>126</td>
</tr>
<tr>
<td>Two time</td>
<td>90</td>
<td>180</td>
</tr>
<tr>
<td>Three time</td>
<td>73</td>
<td>219</td>
</tr>
<tr>
<td>Four time</td>
<td>53</td>
<td>212</td>
</tr>
<tr>
<td>Five time</td>
<td>66</td>
<td>330</td>
</tr>
<tr>
<td>Six time</td>
<td>56</td>
<td>336</td>
</tr>
<tr>
<td>Seven time</td>
<td>69</td>
<td>453</td>
</tr>
<tr>
<td>Eight time</td>
<td>41</td>
<td>328</td>
</tr>
<tr>
<td>Nine time</td>
<td>17</td>
<td>153</td>
</tr>
<tr>
<td>Ten time</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>Eleven time</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Twelve time</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>998</td>
<td>2442</td>
</tr>
</tbody>
</table>

Figure 1. Number of green turtles and their re-nesting times for a single nesting season, Rekawa beach in Sri Lanka.

Discussion

All the species of turtles lay several clutches of eggs during a nesting season (Hirth, 1986; Miller, 1997) and the nesting behaviour could be regular or irregular (Hughes, 1982). The inter-nesting duration vary from nine to thirty days for the sea turtles and for green turtle it is vary ten to 14 days (Miller, 1997). However the number of clutch laying in a season vary with the species, population and different individuals. Carr (1952) cited that green turtle lay two to five times in a single nesting season. Chan (1999) recorded that one green turtle laid 12 nests per season in Redang Island, east cost peninsula in Malaysia. In the past there was lack of study in Sri Lanka about re-nesting times of turtles. In this study I observed twelve nesting for two green turtles which came to nest on Rekawa beach.
Acknowledgement

We thank for the Turtle Conservation Project (TCP) and the staff for their continued support for this study. Also we thank for the NORAD, Netherlands embassy for their financial support for this study. We thank to the Columbus Zoo and the British Airways for their support to attend this symposium.

References


MARINE TURTLE BY-CATCH IN SRI LANKA

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Acknowledgements:
TCP greatly appreciate the contribution received from the following institutions and persons for the successful completion of marine turtle by-catch survey. Firstly, we offer many thanks to the Scientific Council of the Convention on Migratory Species (CMS) / United Nations Environmental Programme (UNEP) for providing the funding for this survey. Mr. Peter Richardson and Susan Ranger for developing the by-catch concept and research proposal for the TCP; the National Aquatic Resource Agency (NARA) for providing technical assistance; Ceylon Fisheries corporation for giving permission to TCP staff and survey monitors to enter their harbours; the Sri Lankan NAVY for allowing TCP staff and monitors access to high security harbour areas; Managers of the fisheries harbours for granting access to their respective harbours.

Summary:
This by-catch survey was carried out between September 1999 and November 2000 in order to assess the extent and nature of incidental marine turtle by-catch at fish landing sites within programme boundaries by collecting data on marine turtle entanglements. Information derived from this survey was then used to formulate an action plan to minimise turtle by-catch in Sri Lanka. Sixteen major fish landing sites were selected for this survey. The programme included an introductory seminar programme for fishermen at each fish landing site and the collection of by-catch data from each site. Between November 1999 and November 2000 a total of 5241 turtle by-catch was reported, this figure included all five species of turtle which rest on the beaches of Sri Lanka. A total of 13760 interviews with fishermen were carried out, which represented a sample of 39% of the total fishermen operating from the landing sites selected.

Introduction:
Sri Lanka is an island nation situated at the Southern point of the Indian Ocean. It is located between the latitudes of 5°55N and 9°51N, and the longitudes of 79°41E and 81°53E; and is shaped like a teardrop falling from the southern tip of India, separated only by the shallow seas of the Gulf of Mannar. Five species of marine turtle come ashore to nest and inhabit the waters of Sri Lanka. All five species are listed by the International Union for the Conservation of Nature (IUCN) as either vulnerable or endangered (IUCN, 1995). Despite the protection by government legislation since 1972 their future is one in jeopardy, with many turtle populations declining to the point where they are no longer significant resources either materially or culturally. This is due mainly to the indiscriminate exploitation largely at the breeding stages (Frazier, 1980; Hewavithana, 1990) for their eggs and meat.

Marine turtle by-catch in Sri Lanka:
Data and reports to date on the extent of turtle by-catch in Sri Lanka are confusing and provide little insight due to their contradictory nature. In 1984 Jindasena estimated (via a series of calculations based on generalised assumptions) that marine turtle by-catch for the entire island was approximately twelve to fifteen turtles per week. Therefore, he estimated the annual marine turtle by-catch for the whole of Sri Lanka to be four hundred turtles (Jindasena, 1984) as a realistic albeit conservative total. Hoffman also made a similar estimate in 1975.

However, it seems that these were probably gross underestimate when reports from other authors are considered. Gunawerdane (1986) estimated that ten turtles were landed and butchered per day in Kandakuliyaa, a small fishing village on the North West coast of Sri Lanka. Perera (1985) witnessed the butchery of 16 turtles over a three day period in May 1986, in Negombo, a fishing town approximately 110km due south of Kandakuliyaa. Both authors noted that the majority of the turtles caught in the region were Olive Ridleys (Lepidochelys olivacea). In early 1994, TCP staff witnessed the butchery of thirteen Olive Ridleys at Kandakuliyaa in one morning. When interviewed local fishermen confirmed that on average at least twenty turtles were slaughtered each week. Taking into account the observations
of Gunawardana and Perera and those of the TCP staff, it is entirely feasible that the number of turtles landed and killed in Kandakuliya alone has been over 1000 per year for the last decade.

General objectives of the marine turtle by-catch survey:
Before solutions can be found to minimise marine turtle by-catch in Sri Lanka, the extent and nature of this threat must be investigated fully. The objectives of the programme were as follows:

- Assess extent and nature of incidental marine turtle by-catch at fish landing sites within programme boundaries by collecting data on marine turtle entanglements.
- Identify important marine habitats for marine turtles in Sri Lankan waters, e.g. feeding grounds, migration routes, breeding aggregation sites.

Survey sites:
16 sites were selected for the by-catch survey along the Northwest, Western, Southwest, Southern and Southeast coasts of Sri Lanka between Kalpitiya and Kirinda (448km). These fish landing sites were: Kandakuliya, Chilaw, Negombo, Colombo (Modara), Panadura (Modara), Wadduwa, Beruwela, Moragalla, Galle, Weligama, Mirissa, Dondra, Kotegoda, Tangalle, Hambantota and Kirinda.

Methods and materials:
1. Survey coordinator and 2 Survey Assistants (S A's) were employed and trained to carry out initial introductory seminars at each fish landing site. 16 monitors were employed, 1 from each of the fish landing sites who were expected in collecting marine turtle entanglement data on a daily basis. The SA's and the Survey Coordinator trained the monitors in data collection and interviewing techniques within the first two months of the programme. For the following 12 months the monitors have collected turtle entanglement data from fishermen at each of the fish landing sites. The Survey Coordinator and the SA's made random visits to each site to evaluate the monitors performance and collect completed data sheets. Every 2 months the monitors, SA's and the Survey Coordinator met in Colombo to evaluate the survey progress. A data sheet was designed to collect the by-catch data.

Results:

<table>
<thead>
<tr>
<th>Project site</th>
<th>No.7</th>
<th>Cm</th>
<th>Cc</th>
<th>Lo</th>
<th>Dc</th>
<th>Ei</th>
<th>Uk</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Beruwela</td>
<td>693</td>
<td>13</td>
<td>28</td>
<td>36</td>
<td>36</td>
<td>7</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>2 Chilaw</td>
<td>591</td>
<td>1</td>
<td>25</td>
<td>1</td>
<td>2</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Colombo</td>
<td>881</td>
<td>43</td>
<td>25</td>
<td>9</td>
<td>29</td>
<td>7</td>
<td>142</td>
<td></td>
</tr>
<tr>
<td>4 Dondra</td>
<td>481</td>
<td>4</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>24</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>5 Gale</td>
<td>1421</td>
<td>473</td>
<td>878</td>
<td>597</td>
<td>40</td>
<td>263</td>
<td>4</td>
<td>2056</td>
</tr>
<tr>
<td>6 Hambantota</td>
<td>1395</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Kandakuliya</td>
<td>608</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Kirinda</td>
<td>656</td>
<td>117</td>
<td>160</td>
<td>230</td>
<td>32</td>
<td>82</td>
<td>2</td>
<td>629</td>
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<td>9 Kotegoda</td>
<td>1176</td>
<td>15</td>
<td>51</td>
<td>2</td>
<td>115</td>
<td>23</td>
<td>7</td>
<td>213</td>
</tr>
<tr>
<td>10 Mirissa</td>
<td>922</td>
<td>75</td>
<td>145</td>
<td>55</td>
<td>108</td>
<td>51</td>
<td>68</td>
<td>501</td>
</tr>
<tr>
<td>11 Moragalla</td>
<td>885</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Negombo</td>
<td>1429</td>
<td>43</td>
<td>115</td>
<td>483</td>
<td>4</td>
<td>8</td>
<td>654</td>
<td></td>
</tr>
<tr>
<td>13 Panadura</td>
<td>350</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>14</td>
<td>3</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>14 Tangalle</td>
<td>1030</td>
<td>10</td>
<td>6</td>
<td>11</td>
<td>24</td>
<td>137</td>
<td>4</td>
<td>192</td>
</tr>
<tr>
<td>15 Wadduwa</td>
<td>229</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>16 Weligama</td>
<td>1008</td>
<td>104</td>
<td>61</td>
<td>50</td>
<td>44</td>
<td>154</td>
<td>45</td>
<td>489</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13780</td>
<td>908</td>
<td>1310</td>
<td>1826</td>
<td>431</td>
<td>818</td>
<td>148</td>
<td>5241</td>
</tr>
</tbody>
</table>

Key: No.7 - Number of fishermen interviewed Cm - Green (Chelonia mydas) Cc - Olive ridley (Lepidochelys olivacea) Cc - Loggerhead (Caretta caretta) Dc - Leatherback (Dermochelys coriacea) Ei - Hawksbill (Eretmochelys imbricata) Uk - Unknown
According to the results, of the 5241 turtles recorded as by-catch (entangled), 1626 were Olive ridley turtles, 1310 were Loggerhead turtles, 908 were Green turtles, 431 were Leatherbacks and the remaining 148 were of unknown species (unidentified). The fate of these turtles is as follows. Of the 5241 turtles entangled, 1063 were either found dead, were killed or sold. The remaining 4178 were reported to have been released by the Fishermen.

When the fish landing sites are considered individually, 2055 turtle by-catch was recorded over the survey period for Galle. This was the highest level of by-catch of all the sites considered. For Hambantota and Moragalle, 8 and 9 turtle by-catch was recorded respectively, representing the lowest levels of by-catch. In Negombo 654 turtle by-catch was recorded and in Kirinda it was 629. The various types of Gill nets can be considered to be the key threatening nets for turtles with regard to by-catch. Although the nestings of Loggerheads and Hawksbills are occasional in Sri Lanka, survey results demonstrate that by-catch of these two species was reported in surprisingly considerable numbers.

Discussion:

The total number of 5241 turtles caught by surveyed fishermen during this period is alarming given this was only a sample of the total number of fishing boats operating at any one time. TCP estimates that the sample size of fishermen questioned is around 39% of the total present. The figure of 5241 turtles caught can be considered the minimum of actual turtle by-catch due to likely survey bias in reporting the true number for fear of negative consequences. The numbers of catch species caught also produced surprises, as the predominant nesting species in Sri Lanka is undoubtedly the green turtle, while large numbers of olive ridleys are known to inhabit offshore waters. Preliminary surveys have shown that loggerhead and hawksbill turtles provide rare nesting in Sri Lanka and yet according to the by-catch survey large numbers of these turtles are caught by fishermen. Loggerhead by-catch being actually higher than that of the green and almost equal to the numbers of olive ridleys caught. While hawksbill by-catch was almost the same as green turtle by-catch. This was extremely surprising and implies that the waters surrounding Sri Lanka might provide important feeding habitats for loggerheads and hawksbills. Furthermore given that hawksbills are classified on the IUCN red list as critically endangered the numbers of these turtles caught and possibly killed is a subject of grave concern. It is also possible that the Sri Lankan fishermen are confusing the loggerhead with the green turtle due to similarities in size and characteristics.

Conclusions:

The figure of 5241 turtle by-catch was recorded as a result of interviews with 39% of the total fishermen operating between Kirinda and Kandalakuliyaa, can be considered the minimum by-catch number for Sri Lanka (between Kirinda and Kanakuliyaa only). For example, if 100% of fishermen were interviewed we can assume that the true by-catch figure would be discovered to be in excess of approximately 13,000 (5241/39 x 100) turtles per year. Of these turtles caught as by-catch, not all die. Out of the 5241 recorded as by-catch, approximately 20% (1063) are killed, found dead or sold. Olive ridley turtles are the most frequently entangled (total 1626). The largest proportion of this species being recorded as caught in Galle (597). Galle survey site has the highest overall number of by-catch (2055). Other significant survey sites for by-catch include Negombo (654), Kirinda (629), Minissa (501) and Weligama (488). Those survey sites which proved to be the least significant in terms of turtle by-catch were: Hambantota with only 8 recorded by-catch, Moragalle with 8, and Panadura with 27 turtles recorded as by-catch.
References:


This paper should cited as:

ESTIMATION OF SEX RATIO OF GREEN TURTLE HATCHLINGS AT REKAWA TURTLE ROOKERY IN SRI LANKA.

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Genetic sex determination (GSD) predominates among most vertebrate species. Nevertheless, in many reptiles and in some other taxa, sex is determined by environmental factors, such as temperature (Temperature-dependent sex determination- TSD), which act after conception (Moynihan and Yntema, 1980). In many species of reptiles, incubation of eggs at some temperature yields 100% phenotypic males and 100% females at other temperatures (Godfrey et al, 1996). Both sexes may be obtained only in a narrow range of temperature between which males and females produce temperatures. This narrow range is called the transitional range of temperature usually not more than 2°-3°C wide (Godfrey et al, 1997). The "pivotal temperature" is centered within this range, which gives 50% individuals of each sexual phenotype (Moynihan and Yntema, 1980). For the sea turtles lower temperature produces more males and the temperature higher than pivotal temperature produce more females (Godfrey et al, 1997). The mean temperature during the middle third of the incubation period is a good indicator of the sex ratio of the clutch (Standora and Spotilla, 1985). The phenotypic sex of sea turtles depends on the temperature during the incubation. Hence, incubation duration can be used as an index of sex (Moynihan, 2000). Moynihan and Yntema (1980) stated that 1°C drop in temperature results of five days increase of incubation duration. If the temperature of the nest during the critical period correlated with the total incubation period (IP) it is possible to estimate the approximate sex ratio of the population of the turtles.

The sex ratios of turtles were range from 1:1 to more than 8:1 in favour of females (Godfrey et al, 1996). Many studies carried out at the green turtle nesting sites around the world estimated primary sex ratios—basically skewed towards females (Standora and Spotilla, 1985; Godfrey et al, 1996). Therefore, it is important to know the information on natural sex ratio for the turtles to design better conservation programs as well as for hatchery practices.

We have measured nest temperature of three nests using Hobo temperature data loggers and the IP were recorded for 477 green turtles nests during the period from September 1996 to September 1999 at Rekawa beach.

The IP ranged from 43 days to 68 days. The nest temperature during the critical period was averaged 29.85°C, 30.45°C and 30.95°C respectively for three nests.

Table 1. Pivotal temperature for green turtle in other turtle nesting beaches of the world.

<table>
<thead>
<tr>
<th>Pivotal temperature</th>
<th>Country</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.0-30.3°C</td>
<td>Costa Rica</td>
<td>(Moynihan, 1984: Standora and Spotilla, 85)</td>
</tr>
<tr>
<td>28.9°C</td>
<td>Guyana</td>
<td>(Moynihan, 1984)</td>
</tr>
<tr>
<td>29.14°C</td>
<td>Suriname</td>
<td>(Girondot, 1996)</td>
</tr>
<tr>
<td>28.5°C</td>
<td>Costa Rica</td>
<td>(Moynihan, 1988)</td>
</tr>
<tr>
<td>28.2°C</td>
<td>Eastern Mediterranean</td>
<td>(Broderick et al, 2000)</td>
</tr>
</tbody>
</table>

Using the above data (table 1) we made an assumption that the pivotal temperature for green turtles in Rekawa beach is 29.5°C. The transitional range within the critical period is usually not more than 2°-3°C wide (Godfrey et al, 1997). Girondot and Piau, (1995) stated that the thermal sensitivity of sex determination of the embryos affect the thermal condition during a critical period of approximately 15 days. According to the above findings 0.2°C will change the incubation duration by one day. The observed nest temperature of 29.5°C for 54 days incubation period and the temperature of 30.95°C for 49 days of incubation period were fitted on the figure 1. Using the above results the pivotal
incubation duration for the green turtle was assumed as 56 days. Broderick et al. (2000) made an assumption that the incubation duration of eastern Mediterranean green turtle is 56 days. This pivotal incubation duration and the range of incubation duration for the critical period applied to calculate the sex ratio for each incubation period. The incubation period of 40 days and below produced almost 100% of females and, the IP of 63 days and above produced almost 100% of males. This method was applied to calculate the approximate sex ratio for 472 nests in the Rekawa beach and the estimated sex ratio of the green turtle population was 7 (female): 3 (male).

In this study we have present the first substantial investigation of natural temperature regimes in nests of the green turtles nesting in Sri Lanka. Such studies have not been carried out for the other four species of sea turtles nesting in Sri Lanka.

![Graph](image)

**Figure:** The relation of the temperature measured from the green turtle nests and the assumption of the incubation duration.

**References:**


This paper should be cited as:

THE AVERAGE EGG COUNT FOR NESTING SEA TURTLES ON REKAWA BEACH IN SRI LANKA

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Sea turtles spend their entire lives in marine or estuarine habitats and only for nesting (rarely for basking) they come to land. Physiological, anatomical and behavioural adaptations of sea turtles have evolved largely in response to selection in the aquatic environment. Sea turtles are unevenly distributed throughout the tropical and subtropical seas depending on their food and habitat requirements (Marquez, 1994; Miller, 1997, 1983; Hirth, 1997). Generally female sea turtles do not reproduce every year. The duration between two reproductive seasons is defined as the remigration interval, and it varies between sea turtle species. The range of the remigration interval is from one to nine years, or more (Hirth, 1980; Miller, 1997).

The eggs are laid individually or in groups of two, three or occasionally four. Marine turtles lay two types of eggs: normal and odd shape eggs. Normal eggs are white, spherical dodecoid eggs with (1) flexible calcareous shell (3% of total weight), (2) a capsule of albumen (48.5%) & (3) yolk (48.5%). Miller, 1997 & 1999). Odd shape eggs may be very large multi yolked or very small yolkless. The diameter, shape and the weight of the eggs laid in one clutch slightly varies within the clutches laid by the same female, which vary considerably within and between species (Hirth, 1980; Miller, 1997). A clutch is defined as the number of eggs laid into the nest, excluding the yolkless eggs. The mean number of eggs in a clutch varies among the species. The number of eggs in a clutch can be determined when the turtle is laying the eggs, or it can be counted if the eggs are to be moved and reburied (Miller, 1987 & 1999). Sea turtles lay several clutches of eggs during a nesting season, with a gap of approximately two weeks between each clutch. The number of eggs was counted at the time of laying.

Table 1. The average egg count for the five species of turtles nested at Rekawa beach from September 1996 to September 1999.

<table>
<thead>
<tr>
<th>Species</th>
<th>Average egg count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green turtle</td>
<td>112.1 (x = 1985)</td>
</tr>
<tr>
<td>Olive Ridley</td>
<td>105.1 (x = 30)</td>
</tr>
<tr>
<td>Leatherback turtle</td>
<td>100.5 (x =30)</td>
</tr>
<tr>
<td>Hawksbill turtle</td>
<td>115.2 (x =6)</td>
</tr>
<tr>
<td>Loggerhead turtle</td>
<td>105.2 (x = 5)</td>
</tr>
</tbody>
</table>

(x = number of nests observed)

The average egg count for green turtles nesting on Rekawa beach is 112.1 (range 10-195) and according to Miller (1997) it is 112.8 for 24 green turtle populations around the world. Therefore, the green turtles in Sri Lanka also laid similar size clutch, which agrees with Millers (1997) observations. In contrast green turtle laid average of 147 eggs in Europa Island and in the Galapagos Islands green turtles laid the average of only 81 eggs (Hirth, 1980). Therefore, we can say that green turtles in Sri Lanka lay a middle size clutch. The average egg count for Olive ridley turtles is 105.1 eggs (range 57-181) on Rekawa beach and it is 115 in Gahirmatha, in India (Dash and Kar, 1990). The average clutch size for 11 olive ridley populations around the world was 106.9 (Miller, 1997). Therefore, olive ridleys in Sri Lanka lay smaller clutch comparing to the other places and the olive ridleys in Playa Naranjo, Costa Rica also laid same size of (105) clutch (Hirth, 1980). Average egg
count for leatherbacks is 100.5 (range 29-140) while it is 115.2 (range 61-154) for hawksbills and 105.2 (range 90-115) for loggerheads on Rekawa beach. The average egg count for 12 population of leatherbacks is 81.5, 17 populations of hawksbills is 130 and 19 population of loggerhead is 112.4 (Miller, 1997). The leatherbacks in Malina, Costa Rica laid about 60 eggs per clutch and in Tongatapu, South Africa it was 103.7 (Hirth, 1980). According to this data the leatherbacks in Sri Lanka laid larger number of eggs and it is closer to the South African population. The hawksbills in Cousin Island, Seychelles laid average of 182 eggs and Seil Ada Kebir Island, Sudan laid average of 73.2 eggs (Hirth, 1980). Therefore, the hawksbills in Sri Lanka laid middle size of clutch comparing to other populations in the world. The loggerheads in Cape Romanian, South Carolina laid average of 125 eggs and Masirah Island, Oman laid 101 eggs. Hence, in Sri Lanka also loggerheads lay smaller size of clutch.

References:


This paper should cited as:

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.

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**Introduction**

Sea turtles represent an ancient and distinctive part of the world's biological diversity. Sea turtles are reptiles and basically spend their entire lives in marine or estuarine habitats. They, like most other aquatic reptilians, are only tied to terrestrial habitats for nesting and restricted cases of basking. Physiological, anatomical and behavioural adaptations of sea turtles have evolved largely in response to selection in the aquatic environment. Sea turtles are unevenly distributed throughout the tropical and subtropical seas depending on their food and habitat requirements (Witzell, 1983; Dodd, 1988; Marquez, 1994; Hirth, 1997; Miller 1997). There are seven species of sea turtles living in the world and five of them come to ashore in Sri Lanka. On some these beaches, turtle nesting is seasonal while on others nesting can be observed throughout the year with a peak season. The species composition is changing in the various beaches. The Turtle Conservation Project (TCP) surveys revealed that Godavaya in southern Sri Lanka is an important nesting beach for the leatherback turtle compared to the available data about turtle nesting in Sri Lanka (TCP, 1999). Therefore, the objective of this study was to estimate the number of nests of the leatherback turtle during the nesting season in 2001 at Godavaya.

**Methodology**

This is an unprotected beach and therefore, egg collection occurs every night throughout the nesting season. In the early morning we patrolled the 4 km long beach for the counting tracks. Using our past experience, we have identified the leatherback nesting crawls and also the false crawls. We have counted only the fresh crawls, which was made previous night. All the false crawls and nests were counted on an average of five days per month and, in the peak months about eight days per month. The survey was carried out from the 21st of March 2001 until 30th November 2001. But, the first leatherback nesting was occurred in 16th April and the last nesting was observed in the 30th of August.

**Result and calculation**

Number of leatherback nests counted = 70
Number of leatherback False crawls counted = 34
Number of surveyed days = 32
Total number of days between the leatherback nesting dates = 153

Average number of leatherback nests per day = 70/32 = 2.18

Therefore, estimated total number of nests during the survey period = 2.18 * 153 = 333

Average number of leatherback false crawls per day = 34/32 = 1.06

Therefore, estimated total number of false crawls during the survey period = 1.06 * 153 = 162
Discussion

Surveys on the turtle nesting beaches are the most widely implemented monitoring tool used by the turtle conservationist around the world. This is an important component of a comprehensive program to assess and monitor the status of sea turtle populations. These assessments are necessary to evaluate the effects of recovery and conservation activities, which are being implemented at all life history stages (Schroeder and Murphy, 1999). Daily monitoring throughout the nesting season is required for a complete nest count. On the other hand daily monitoring is not always necessary or logistically possible and data from intermittent surveys can be used as an index to total nesting. Provided there is baseline data available and provided the survey is appropriately designed to periodically sample throughout the nesting season (Schroeder and Murphy, 1999).

In our survey we have periodically sampled the leatherback nesting throughout the nesting season. According to the result there were 333 leatherback nests recorded during the nesting season in year 2001 on the Godavaya beach. The estimation of population size is important for several reasons. An estimation of population size is critical for science, conservation and management. Many threats to turtle population cannot be evaluated unless we have an estimate of population size (Gerrard and Taylor, 1999). Leatherback turtles nests on average of 4.9 nests per season ranging from one to seven times depending on the annual reproductive status (Andrews, 2000 cited from Bhaskar, 1993). Therefore, we can estimate that the annual nesting population of leatherback turtles on the Godavaya beach is 88 individuals. Earlier there was no literature about the nesting population of leatherback turtles on this beach. The TCP survey in 1999 was identified this beach as an important nesting place for the leatherback turtles. Hence this is the first proper survey done about leatherback nesting on this beach. Therefore, we recommend that surveys should continue at least few years to get a good estimate of the leatherback population on this beach.

References


*Editors note: The remigration of leatherback turtles is estimated to be 2.5 years and hence, the total population may be estimated as 170 leatherback turtles.

This paper should be cited as:

Turtle Conservation Project (TCP) - Sri Lanka

The TCP was established in 1993 and 1995 it was registered as an independent Sri Lankan non-governmental organization (NGO) with the Central Environmental Authority (CEA). The TCP operates according to an approved constitution and is currently coordinated by a committee of 7 residents of Sri Lanka. The TCP employs a core of 4 full-time staff and has its head office in Tangalle. It maintains field offices in Rekawa, Panadura and Randakuliyar in order to facilitate the operations of the initiated activities.

The Vision of the TCP is “Sustainable level of sea turtle populations in Sri Lanka” while its mission is to “conducted research, surveys, education & awareness programmes, community based conservation & management programmes, to achieve the sustainable level of sea turtle populations in Sri Lanka”.

In doing so it works closely with the following decision making bodies: a) National Aquatic Research Agency; b) Department of Wildlife Conservation, d) Other International/National Conservation bodies like CMS, IUCN & Law enforcement authorities etc.; e) Tourist Board and f) Ministry of Fisheries, providing valuable information helping in prudent decision making, policy development & strategic planning.


It also publishes many publications like reports, leaflets, booklets, posters and a quarterly news bulletin called “Turtle News”. It has in its possession a rare collection of slides and video footage collected over the years. It also maintains its web site www.search.lk/turtle as a source of information for the local and international community.

The TCP organized turtle-sensitive, nocturnal “Turtle Watches”, for fee-paying tourists, to provide employment as tourist guides with egg protection patrols for 17 one-time turtle egg collectors in the Rekawa community in-situ marine turtle nest protection and research programme for which, the TCP in 1998 won the highly commended British Airways Tourism for Tomorrow award for the southern region.

TCP is has received funding or is presently funded by the following agencies NORAD, Netherlands Embassy, The British Embassy, CEIF (Ministry of Forestry and Environment), Columbus Zoo, British Airways, CMS / United Nations Environment Programme, WSPA, and has also been allocated funding under Global Environmental Facility - Medium grants scheme to carry out an in-situ conservation project covering Kalattiyawa, Uswangoda and Rekawa in the South to Southeast of Sri Lanka.

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