Marine Turtles of Sri Lanka; Status, Issues, Threats and Conservation Strategies

R.A.M. Jayathilaka* , H.A.C.C.Perera and S.S.K.Haputhanthri

Marine Biological Resources Division, National Aquatic Resources Research and Development Agency (NARA), Crow Island, Colombo-15, Sri Lanka

Abstract

This paper is an attempt to review the results of marine turtle surveys carried out in Sri Lanka by National Aquatic Resources Research and Development Agency (Research arm of Ministry of Fisheries and Aquatic Resources Development Sri Lanka) during the past. Of the seven living sea turtle species recorded in the world, five species were reported in the coastal belt of Sri Lanka coming for nesting: Green Turtle (*Chelonia mydas),*Olive Ridley (*Lepidochelys olivacea),* Hawksbill (*Eretmochelys imbricata),* Loggerhead (*Caretta caretta)* and Leatherback (*Dermochelys coriacea).* The south and southwest coastline of Sri Lanka comprises the largest marine turtle rookeries. All five species are still recorded at Kosgoda,Induruwa, Rekawa and Bundala. In 2014, the highest nesting density was recorded (298 nests $km^{-1}year^{-1}$) at Kosgoda beach. The next highest densities were reported at Ahungalla (105 nests $km^{-1}year^{-1}$)and Induruwa (94 nest $km^{-1}year^{-1}$respectively. Approximately 68% and 30% of the total nesting turtles were Green turtles and the Olive ridley turtles respectively. The rest is shared by other three species. The highest nesting frequency of the green turtle was recorded during the period from February to April whereas the highest nesting frequency of olive ridley turtle was recorded during the period from November to March. There were fifteen operational sea turtle hatcheries situated along the western and southwest coastal belts from Mount Lavania to Koggala. Some of these hatcheries could effectively salvage the number of turtle nests that would otherwise be lost to egg poachers and natural causes such as predations and erosion.

Incidental by-catch, illegal poaching of eggs, natural predation on eggs and hatchlings and habitat change and destruction are some of obvious threats faced by marine turtles in Sri Lanka. Number of strategies and measures are being applied to minimize the interactions with sea turtles through modifications of fishing gear and fishing practices. In Sri Lanka, marine turtles are protected under the Fauna and Flora Protection Ordinance administered by the Department of Wildlife Conservation since 1st March 1937 (Amended 20th July 1972) and the Fisheries and

Aquatic Resources Act of 1996. In 1979.Sri Lanka entered into the CITES agreement. Currently, a number of in-situ nest monitoring and protection programmes are conducted by Department of Wildlife Conservation southern coast of Sri Lanka.. Development and implementation of standardized, scientifically ratified, and legally enforceable set of guidelines is of foremost priority.

INTRODUCTION

Of the seven living sea turtle species recorded in the world, five species were reported in the coastal belt of Sri Lanka coming for nesting: Green Turtle (*Chelonia mydas)*,Olive Ridley (*Lepidochelys olivacea)*, Hawksbill (*Eretmochelys imbricata)*, Loggerhead (*Caretta caretta)* and Leatherback (*Dermochelys coriacea)*. The south and southwest coastline of Sri Lanka comprises the largest marine turtle rookeries (Amarasooriya, 2000). All five species are still recorded at Kosgoda,Induruwa, Rekawa and Bundala. The south and southeast coastlines with vast areas of sea grass beds and coral reefs provide important nesting and foraging grounds to sea turtles (Deraniyagala 1939; Amarasooriya, 2000). Collection of sea turtle eggs from the rookeries for human consumption and marketing eggs to the sea turtle hatcheries have been identified as major threats to the marine turtles in Sri Lanka. Normally, hatcheries receive the turtle eggs from the surrounding beaches, for *ex-situ* conservation activities and these eggs are reburied within the turtle hatcheries for incubation. Law enforcement and the implementation of community-based turtle conservation projects at important nesting beaches are not at satisfactory levels in Sri Lanka. This paper is an attempt to review the results of marine turtle surveys carried out in Sri Lanka by National Aquatic Resources Research and Development Agency (Research arm of Ministry of Fisheries and Aquatic Resources Development Sri Lanka) during the past.

METHODOLOGY

Data for this study was mainly obtained through the results of marine turtle surveys carried out in Sri Lanka by National Aquatic Resources Research and Development Agency and from several national instruments such as policy guidelines, laws and regulations.

1. Marine Turtle Nesting on the Beaches of the North-Western, Western and Southern Provinces of Sri Lanka (Amarasooriya,2000).

This study consisted of two main parts, a frame survey (from July 1996 to December 1997) and a comprehensive nesting beach survey (from January 1997 to December 1999)

2. A study on temporal and spatial distribution of sea turtle nesting on the south west coast of Sri Lanka (Jayathilaka *et.al.*, 2016)

   The study area extends 25.8km over two administrative districts, Colombo and Galle. The initial objectives of this survey were to quantify the number of species, distribution and abundance of sea turtles, the seasonality and geographic range of nesting along the study area.

3. The role of the hatcheries in conservation of sea turtle fauna of Sri Lanka. (Amarasooriya, 2001)

   Eight sea turtle hatcheries in the Galle district and one in the Hambanthota district were visited fortnightly from January 1996 to December 2000. The data were collected on the aspects of number of eggs buried, number of hatchlings emerged, number of eggs rotten, number of hatchlings died, number of hatchlings in tank and their age, and number of hatchlings released.

4. Present status of sea turtle hatcheries situated along the coastal belt of the West and Southwest of Sri Lanka (Jayathilaka *et.al*. 2017).

   The study area was extended from the coastal stretch in two administrative districts, Colombo (Mount Lavinia to Rathmalana) and Galle (Benthota to Koggala). The information such as nesting beaches, sea turtle species, name of the egg collector, number of eggs buried, and date of eggs buried were collected from the each hatchery through data sheets. At the same time, direct observations were made by NARA research staff from January 2014 to December 2015.

5. Impacts of large pelagic fisheries on the survival of sea turtles in Sri Lanka (Maldeniya, 2014).

   The interaction of sea turtles with fishing gear (separately for gillnet and longline) targeting tuna have been studied at two major landing centers in the west coast; Negombo and Beruwala over one year period via direct communication with fishermen, monitoring of catches, onboard observer programme and stranding data.

6. The Fisheries and Aquatic Resources Act, No.2 of 1996 (FARA).

FARA is the main legal instrument that provides for the management, regulation, conservation and development of fisheries and aquatic resources in Sri Lanka, and gives effect to Sri Lanka's obligations under certain international and regional fisheries agreements.

7. The Fauna and Flora Protection Ordinance (FFPO)

   FFPO, which establishes the legal frame work for the protection of species of wild animals that include mammals, birds, reptiles, amphibians, fishes or invertebrates and plants in Sri Lanka is another legal instrument that has relevance to the conservation of sea turtles. It is administrated by the Department of Wild Life conservation (DWLC).

RESULTS AND DISCUSSION

Sea turtle nesting beaches have been recorded mainly on the western, south-western and southern beaches (Fig. 1)

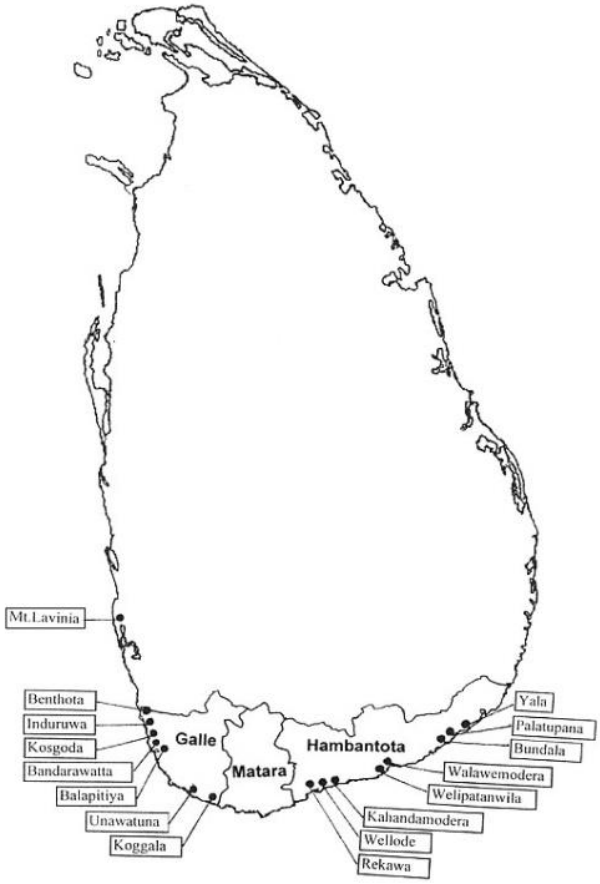


Figure 1 : Map of Sri Lanka showing major sea turtle nesting beaches along the south western coast and south coast

The highest nesting rates were from Rekawa beach (53 nests.month $^{-1}$) in Hambantota, followed by Kosgoda (30), Bandarawatta (25) and Duwemodara (24) beaches in the Galle district. The Highest nesting density reported was on Duwemodara beach in the Galle district (814 nests.year $^{-1}$ km $^{-1}$), followed by Kosgoda (322) , Rekawa (320) and Bandarawatta (283) beaches. Beaches were classified in to four major grades depending on the nesting rates and densities. Each grade was further divided into five sub-grades depending on the number of species nesting in the area. Five species nest in southern Sri Lanaka (*Caretta caretta, Chelonia mydas, Lepidoclys olivacea, Dermochelys coriacea and Eretmochylus imbricata*), but all five species are only found on two beaches in the Galle district (Bandarawaththa and Balapitiya) and three beaches in the Hambantota district (Rekawa, Walipatanwila and Bundala) (Table 1).

Table 1. Mean Values of nesting frequencies, nesting densities and nesting diversity at the survey beaches for 1997, 1998 and 1999

Beach	Length (km)	Nesting rate (nests month^{-1})	Nesting density (nests year^{-1} km^{-1})	No. of species (nesting diversity)
Benthota	2.73	9	40	4 (GT, OR, HB, LB)
Warahena	2.40	4	17	3 (GT, OR, LB)
Induruwa	2.00	3	16	4 (GT, OR, HB, LB)
Kaikawala	1.00	9	96	3 (GT, OR, LB)
Habakkala	1.32	9	73	2 (GT, OR)
Mapalana	0.50	6	103	4 (GT, OR, HB, LB)
Duwemodara	0.25	24	814	4 (GT, OR, HB, LB)
Kosgoda	1.00	30	322	3 (GT, OR, HB, LB)
Bandarawaththa	1.16	25	283	5 (GT, OR, HB, LH, LB)
Thibbattawa	1.00	17	193	2 (GT, OR)
Wathuragama	2.80	10	59	3 (GT, OR, LB)
Ahungalla	0.30	7	111	4 (GT, OR, HB, LB)
Balapitiya	1.75	14	103	5 (GT, OR, HB, LH, LB)
Rekawa	2.00	53	320	5 (GT, OR, HB, LH, LB)
Wellodaya	2.60	6	39	3 (GT, OR, LB)
Kahadamodara	4.00	44	146	3 (GT, OR, LB)
Welipatanwila	3.80	18	76	5 (GT, OR, HB, LH, LB)
Walawemodara	1.70	21	141	4 (GT, OR, HB, LB)
Bundala	3.60	9	43	5 (GT, OR, HB, LH, LB)

GT = Green turtle, OR = Olive ridley, HB = Hawksbill, LH= Loggerhead, LB = Leatherback

Rekawe, Bandarawatta, Duwemodara, and Kosgoda beaches were identified as the best nesting beaches in southern Sri Lanka and recommendations were made to declare them as protected sea turtle nesting habitats.

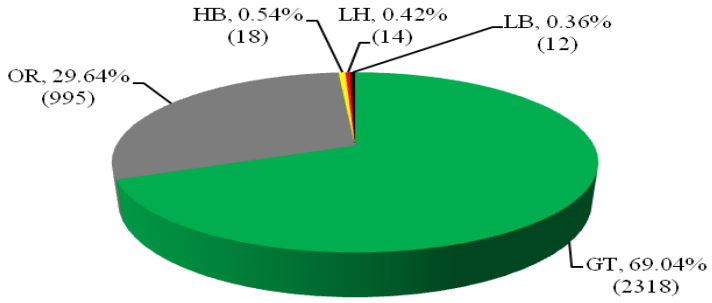
In 2014, the highest nesting density was recorded (298 nests $km^{-1}year^{-1}$) at Kosgoda beach. The next highest densities were reported at Ahungalla (105 nests $km^{-1}year^{-1}$) and Induruwa (94 nest $km^{-1}year^{-1}$respectively.

Table 2. Values of nesting densities and nesting diversity at the surveyed beaches in 2014

Major nesting Beaches	Length of the stretch (km)	No. of nesting	Green turtle	Olive ridley	Hawksbill	Loggerhead	Leatherback	Nesting density (nest km^{-1},$year^{-1}$)
Mount Lavania	1.44	31	9	20	2	0	0	21.5
Benthota	2.30	49	2	40	0	0	0	21.3
Warahena	0.90	26	6	20	0	0	0	28.9
Induruwa	4.10	384	280	102	0	0	2	93.7
Mahapalana	1.30	72	60	10	0	1	1	55.4
Duwemodara	1.20	99	85	14	0	0	0	82.5
Kosgoda	2.30	685	570	107	3	4	1	297.8
Ahungalla	1.50	157	90	65	2	0	0	104.7
Balapitiya	2.00	46	30	16	0	0	0	23
Ambalangoda	1.200	32	2	30	0	0	0	26.7
Kahawa	5.20	94	48	45	1	0	0	18.1
Habaraduwa	0.80	44	14	30	0	0	0	55
Koggala	1.60	33	2	30	0	0	1	20.6

Approximately 69% and 30% of the total nesting turtles were Green turtles and the Olive ridley turtles respectively. The rest is shared by the other three species.(Fig. 2)

Figure 2. Percentage of nests by species in south west coast in 2014 and 2015



The highest nesting frequency of the green turtle was recorded during the period from February to April whereas the highest nesting frequency of olive ridley turtle was recorded during the period from November to March.

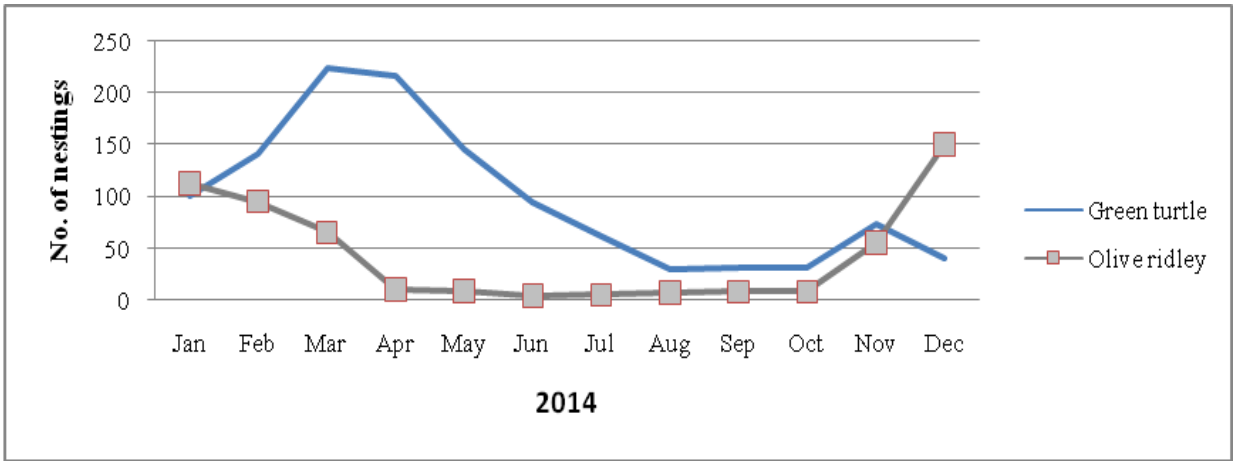


Figure 3. Pattern of monthly nesting frequency of Green turtle and Olive ridley during the study period in the study area

The number of Sri Lankan sea turtle hatcheries has fluctuated a great deal. Amarasooriya (1997) recorded 9 hatcheries. This number had been increased to 15 in 2015 (Jayathilaka *et.al*, 2017). Some of these hatcheries could effectively salvage the number of turtle nests that would otherwise be lost to egg poachers and natural causes such as predations and erosion.

The maximum numbers of eggs reburied were reported during the period of December to May in each year. In addition, relatively low numbers of eggs were reburied from June to October and the period of less number of eggs reburied was coincided with south-west monsoon. (Fig. 4)

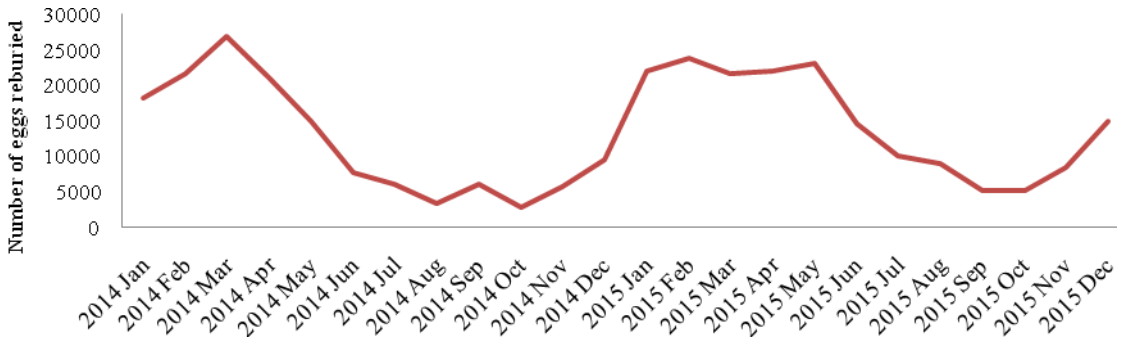


Fig 4: Pattern of total number of eggs reburied by all the sea turtle hatcheries

During the study period number of 208,053 (68.7%) green turtle eggs , 90,695 (30%) olive ridley turtle eggs, 1,442 (0.5%) hawksbill turtle eggs, 1,516 (0.5%) loggerhead turtle eggs and 1,010 (0.3%) leatherback turtle eggs were reburied inside the hatcheries (Table 3). Furthermore, a total number of 3,354 nesting and 368,835 number of eggs production were estimated in the study area.

Table 3. Number of nests laid and estimated total number of eggs laid by the five species of sea turtles in the study area and total number of eggs reburied inside hatcheries from January 2014 to December 2015

Species	No. of nesting	Average egg count	Estimated total number of eggs	Total number of eggs reburied inside hatcheries
Green turtle	2318	112.1	259 848 (70%)	208 053 (68.7%)
Olive ridley turtle	995	105.1	104 575 (28%)	90 695 (30%)
Hawksbill turtle	18	100.5	1 809 (0.5%)	1 442 (0.5%)
Loggerhead turtle	14	115.2	1612 (0.4%)	1 516 (0.5%)
Leatherback turtle	12	105.2	1 263 (0.3%)	1010 (0.3%)
Total	**3357**		**369 107**	**302 716**

Around 82% of the total number of eggs was incubated under the hatchery conditions. The study revealed that the practices in egg collection, transportation, and reburying, rearing and releasing hatchlings comprise considerable negative impacts on the survival of the wild turtle stocks. Also, inappropriate rotations and movements of eggs may cause damages to the development of embryonic membranes and change the natural sex ratio. Capacity building of interested parties through proper trainings in each activity is needed to minimize the mortality rates and other negative impacts on wild marine turtles.

Threats

Incidental by-catch, illegal poaching of eggs, natural predation on eggs and hatchlings and habitat change and destruction are some of obvious threats faced by marine turtles in Sri Lanka.

Conservation Strategies

Sri Lanka coordinates with most of the international and regional management, conservation bodies such as IOTC, CITES. Sri Lanka has developed several national instruments such as policy guidelines, law and regulations, and plan of action to guide the process of implementation of the commitments made under the above treaties. In Sri Lanka, marine turtles are protected

under the Fauna and Flora Protection Ordinance, No 2 of 1937 administered by the Department of Wildlife Conservation since 1st March 1937 (Amended 20th July 1972) and the Fisheries and Aquatic Resources Act, No 2 of 1996 administrated by Department of Fisheries. Sea turtles and their eggs, both on land and sea, are completely protected by amendments to the Fauna and Flora Protection Ordinance in 1970 (for the leatherback turtle) and by regulation in 1972 (for the other four turtle species). The punishments meted out to offenders have been increased by the Fauna and Flora Protection (Amendment) Act No 49 of 1993). Under Section 30 of the Fauna and Flora Ordinance (as amended), it is an offence to kill, wound, harm or take a turtle, or to possession a turtle (dead or alive) or any part of a turtle, to sell or expose for sale a turtle or part of a turtle, or to destroy or take turtle eggs. Sri Lanka entered into the CITES agreement in 1979 which prohibits member nations from export or import of turtles and their parts and products. Number of strategies and measures are being applied to minimize the interactions with sea turtles through modifications of fishing gear and fishing practices. Currently, a number of in-situ nest monitoring and protection programmes are conducted by Department of Wildlife Conservation southern coast of Sri Lanka. Development and implementation of standardized, scientifically ratified, and legally enforceable set of guidelines is of foremost priority. To increase the public awareness in turtle conservation, the NARA conducts various programmes for coastal communities each year.

A past study showed that incidental capture of sea turtles in the two major fisheries; gillnets and longline targeting large pelagic fish in the offshore and high seas are quite low and thus impact to the survival of sea turtles is insignificant. Current practice of fisheries such as deploying of gear confined to sunset hours, use of circular hooks, more use of non-attractive fish bait species (use fish bait instead of squid bait) and also use of multifilament nets may influence in mitigating likely impact of prime fisheries on sea turtle vulnerability. Of the two fisheries; gillnet and longline impact of longline on sea turtles is relatively higher and often carnivores Olive Ridley are likely to get attracted the bait (Maldeniya and Danushka ,2014).

Declaration of Kosgoda-Induruwa beach as protected areas, introduction of hatchery guide lines, strict implementation of laws, enhanced research efforts and improvement in public awareness, eco-tourism based on turtle fauna at these beaches are recommended for their conservation.

Issues

- Inadequate habitat protection and management
- Inadequate expertise, skills and training for in-situ conservation
- Lack of co-ordination and collaboration in in-situ conservation initiatives
- Reduced effectiveness of in-situ conservation measures due to insufficient information on marine turtle populations, biology, ecology and human impacts
- Inadequate funding to conduct effective and comprehensive in-situ programmes
- Lack of concern about in-situ protection measures
- Practice of certain hatchery techniques is detrimental to the survival of marine turtle populations
- Inadequate monitoring and regulation of hatchery activities
- Inadequate skills and hands-on training for systematic hatchery management
- Current hatchery practices are reflected more as commercial ventures and less as conservation initiatives
- Insufficient awareness on hatchery activities among tourist and local communities
- Insufficient funding to operate and maintain hatcheries on scientific management basis
- Insufficient knowledge and application of existing scientific knowledge
- Inadequate funding for research and monitoring programmes
- Inadequate number of trained personnel
- Inadequate infrastructure and equipment for research and monitoring
- Insufficient coordination and cooperation among various turtle research and monitoring organizations
- Insufficient information dissemination on research and monitoring activities
- Available data is not analysed completely for use in conservation and management
- Many research programmes are ad hoc and not sustained
- Lack of community involvement in turtle monitoring and management
- Inadequate knowledge and skilled personnel for effective enforcement of the law
- Inadequate manpower for effective enforcement of the law
- Insufficient public awareness on the conservation of marine turtles

- Limited access, and lack of information relevant to the preparation of turtle conservation awareness progrmmes
- Lack of sufficient information material
- Insufficient co-ordination and co-operation between government and other agencies
- Lack of appropriate communication between conservation agencies and the community.
- Inadequate legal, institutional and field level infrastructure
- Inadequate technical capacities in the field of eco-tourism

Research gaps and Data gaps

Due to the civil war limited data collection, statistics and research papers in the northern and eastern parts (1983-2009) and due to lack of nesting in some parts of the country data collections were negatively affected. During the past four decades, several short-term research studies and conservation projects have been conducted when internal and external funds were available and data have also been collected. But research on sea turtles has been discontinuous making results obtained from these surveys difficult to compare. Such data are not conducive to deciphering sea turtle long term population trends or impact of human activities. Land-based surveys, such as those on fisheries by-catch and direct take, have been more extensive and thorough than boat-based surveys on live animals. This is mainly due to lack of resources for at sea research surveys, which are expensive and unaffordable for developing country like Sri Lanka.

References

1. Amarasooriya ,K.D. and Jayathilaka, R.A.M.Gunawardana, (1997) Marine Turtle Nesting on the Beaches of the North-Western, Western and Southern Provinces of Sri Lanka. *Paper presented at the 20th Annual Sea Turtle Symposium, 2000, Orlando, Florida,USA.*
2. Amarasooriya, K. (1999), A Classification of the Sea Turtle Nesting Beaches of Southern Sri Lanka, *Paper Presented at the 22nd ASEAN Symposium and Workshop on Biology and Conservation of Sea Turtles, Kota Kinabalu, Sabha, Malaysia*.

3. Amarasooriya, K. (2000) The role of the hatcheries in conservation of sea turtle fauna of Sri lanka. *21st Annual symposium on sea turtle biology and conservation, Philadelphia, Pennsylvania, USA. 92-93.*
4. Deraniyagala, P.E.P. 1953. A coloured Atlas of Some Vertebrates from Ceylon. Vol.1 *Testudinates and Crocodilians.London:Colombo Museum. Pp.101*
5. Jayathilaka, R.A.M. Maldeniya, R., Kumara, M.D.I.C. A study on temporal and spatial distribution of sea turtle nesting on the south west coast of Sri Lanka. *National Aquatic Resources Research and Development Agency (NARA), Scientific Sessions 2016*
6. Jayathilaka,R.A.M., Perera, H.A.C.C. and Kumara, M.D.I.C. Present status of sea turtle hatcheries situated along the coastal belt of the West and Southwest of Sri Lanka. *National Aquatic Resources Research and Development Agency (NARA), Scientific Sessions 2017*
7. Maldeniya, R. Danushka, P (2014) Impacts of large pelagic fisheries on the survival of sea turtles in Sri Lanka. *Indian Ocean tuna Commission-2014 Working party on ecosystem and by-catch 10- paper 27*