



Conservation activities carried out on olive ridley turtles, *Lepidochelys olivacea* (Eschscholtz, 1829) and observations on its hatching from Chavakkad beach, Kerala, India

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ABSTRACT

Knowledge on the nesting of olive ridley turtle, *Lepidochelys olivacea* along the west coast of India is scanty. Along Kerala coast not many studies have been carried out on the nesting and hatching behavior. Hence an attempt was made to study and observe its nesting habits from Chavakkad, Kerala, India. Olive ridley turtles are categorized as Vulnerable on the IUCN Red List, hence the study gains more importance. In pursuance of this study, every year during the nesting season in this area, i.e. from November to March, periodically walking trips in the night hours were made along the coast from 1988-99 onwards. Olive ridleys usually nest in this belt such as Panchavadi, Edakkazhiyur and Akalad beaches in Chavakkad. To prevent predation from animals and humans, the eggs of the turtles were transplanted by the volunteers of Green Habitat, an NGO committed to the conservation of turtles, to a permanent hatchery. The total number of nests at Chavakkad beach ranged from one (1998-09) to ten (2017-18) during the breeding season over the years. The clutch size varied from 47 to 135 eggs during the observation period. After about 45-50 days the eggs hatched. Local people, fishermen, students etc. were invited on the release date and the hatchlings were released in to the sea. The number of eggs hatched during the study period was between 41 in 1998-09 to 490 in 2017-18. The Green Habitat has successfully protected 44 nests and ensured the safe release of 2,306 hatchlings into the sea till date.

Key words: Olive ridley, Conservation, Hatchery, Chavakkad, Kerala

INTRODUCTION

Sea turtles are found all along the coast of India including the Lakshadweep, Andaman and Nicobar Islands. Five species inhabit the Indian seas such as *Dermochelys coriacea* (Leatherback turtle), *Eretmochelys imbricata* (Hawksbill turtle), *Chelonia mydas* (Green turtle),

Lepidochelys olivacea (olive ridley turtle) and *Caretta caretta* (Loggerhead turtle) (Rajagopalan et al., 1986). Among the five species of sea turtles distributed in the Indian region, except *C. caretta* all the other four nest on Indian coasts (Kar and Bhaskar, 1982). In India studies on the nesting and hatching have been carried out by various authors. Whitaker and Kar (1984) reported a number of major and minor nesting beaches of olive ridley turtles in India. Silas (1984) and Silas et al. (1985a) gave a detailed description of the nesting habits and habitats of turtles along the Indian coast and Bhaskar (1984), on its distribution. Silas et al. (1984), James et al. (1991) and Shanker et al. (2004) gave an account on the mass nesting and recently by authors such as Shenoy et al. (2011) and Kurian (2013).

The Odisha coast in India, sustains the largest congregation of olive ridley turtles, and is among the only three mass nesting grounds of the world; this phenomenon of mass nesting is called the Arribada-a Spanish term for mass arrival. The olive ridley turtle is the most common marine turtle nesting along the Indian coast. The mass nesting beaches of the species in India are at Gahirmatha (Shankar, 2004). Many authors have described the nest of *L. olivacea* from the east coast of India and in the Andaman Islands by Namboothri et al. (2015). However, our knowledge on the nesting of this species along the west coast of India is scanty. According to Rajagopalan et al. (1986), olive ridley nests both in the east and west coast of India. Though the nesting grounds along the west coast of India are diffused and the breeding populations of these areas are not as extensive as those of the east coast, the study of this population, as well as the breeding biology of these turtles, is important for developing conservation strategies.

Along Kerala coast in India not many studies have been carried out on the nesting and hatching behavior, although olive ridley turtles were reported to nest frequently along the Kerala coast (Kar and Bhaskar 1982). Kerala has a 590 km long coastal belt rich in biodiversity with a relatively narrow beach, broken at many places by rocks, sea walls, inlets and backwaters (Jaykumar and Dileepkumar, 2004). Some of the studies on turtles from Kerala are by Lal Mohan (1986), Muhamed and Radhakrishnan (2004), Dileepkumar and Jaykumar (2006), Bhupathy (2007), Murukan and Mathew (2013) and recently by Thirumalaiselvan et al. (2018).

Olive ridley turtles are categorized as Vulnerable on the IUCN Red List (IUCN, 2010) (www.redlist.org) and are included in Schedule-I of the Indian Wildlife (Protection) Act, 1972. They are listed in Annexure II of the SPAW (a Protocol Concerning Specially Protected Areas and Wildlife), Appendix-I of CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) and Appendices I and II of the Convention on Migratory Species (the Bonn Convention). Hence a study was carried out on the nesting and hatching behavior of olive ridley turtles from Chavakkad beach, Kerala, India by the NGO, Green Habitat, who are dedicated and committed to the cause of turtle conservation along Kerala coast. Since it's an endangered species the study gains more importance. The species was identified as *Lepidochelys olivacea*, commonly known as olive ridley turtle as per Shenoy et al. (2011). Locally all turtles are called *Aamaa*. The beaches of Kerala and the turtles that nest and visit are not acknowledged in the way it deserves. James (2011) has mentioned the conservation activities of Green Habitat in Kerala.

MATERIALS AND METHODS

In pursuance of this study, every year during the nesting season in this area, i.e. from November to March, periodically walking trips in the night hours were made along the Chavakkad coast. The initiative was undertaken from the year 1998-99 nesting season onwards. Backed by the knowledge accumulated over the past by the local fishermen, nesting sites were identified. Beaches were extensively examined for indications of turtle nesting such as crawling tracks by the turtles etc. Volunteers of the Green Habitat have been keeping a round-the-clock vigil to sight turtle nesting sites. From the night tramping carried out it became known that olive ridleys usually nest in this belt such as Panchavadi (10°37'12"N, 75°59'08"E), Edakkazhiyur (10°36'32"N, 75°59'24"E) and Akalad (10°38'04"N, 75°58'46"E) beaches in Chavakkad. During the hatching season daily trips were made to these beaches by a team of volunteers at night and sometimes places were visited following information provided by local people. Measurements of turtles were taken in cm by a measuring tape. Egg length and hatchlings carapace length was measured using a digital caliper and total weight of the eggs and hatchlings was determined using an electronic balance. The measurements were taken as described by (Whynekan, www.ivis.org), conservation and

management techniques as per Pritchard and Jeanne (1999) and Shenoy *et al.* (2011).

RESULT AND DISCUSSION

At Chavakkad beach, it was observed that the turtles come to the shore during night time to lay their eggs. Usually the turtles were 55-65 cm in carapace length and weighed approximately 30-40 kg. The animals first propped their heads out of water, rested for a few minutes after coming out of water and proceeded slowly up the beach and ultimately stopped in a place much above the high tide water mark. They then scraped out sand with its hind flippers and created a pit for oviposition. The turtle takes about an hour to lay all its eggs. They frequently stopped with mild hissing sound, raising their heads when an egg is deposited in the pit (Plate 1, 2 and 3). Once oviposition begins, the turtle goes into a 'nesting trance' and the turtle usually did not react even if she is handled gently. After laying the eggs, it closes the pit again with its hind flippers and then the pit is flattened completely by the turtle using its body and crawls back in to the sea. It is very difficult to find the site where it had laid its eggs, the only clue being the crawling tracks on the sand. The depth of the nest approximately varied from 25-35 cm. During night it was found that jackals were digging the nests for eggs and devouring them and during day time stray dogs did the same. To prevent predation a temporary barrier net was created around the pits in the night, by volunteers who were there in night vigil (Plate 4). Later during the day, the eggs were transplanted to a permanent hatchery created about 100 m from the high tide mark (Plate 5 and 6). The hatchery was built for safe keeping the eggs laid. Hatchery and other procedures regarding collection etc. were followed as per Shankar *et al.*, (2003). The hatchery was assembled safely distanced from the sea where all the eggs laid by the female turtles are collected and placed in a hand dug nest to protect them from the changing tides and predators. Care is taken to prevent sea water from entering the nest, if sea water is to enter the nest it would cause temperature changes which would lead to insufficient incubation thus preventing hatching. To counter this, manmade nests *i.e.* hatcheries are dug in which the eggs are incubated till they hatch. Humans also predated on these eggs and it is believed that consumption of turtle eggs provide cure for diseases such as asthma and piles. This practice is not followed

now after awareness was made about the status of these turtles regarding them being protected by law. It was also explained to the locals about the consequences of repeated destruction to nests during the period of incubation of eggs, which can have a serious cumulative effect in the long run. Direct poaching of turtles and eggs from nesting sites has reduced considerably due to the night patrolling carried out by Green Habitat. When it rains, which usually happens in Kerala, the hatchery was covered with tarpaulin to protect the eggs. Apart from collecting information and protecting nests, these hatcheries sites were also used for education and public awareness programmes.

Table 1. Provides the turtle nesting sites, number of nests, number of eggs laid and the number of eggs hatched from Chavakkad beach, Kerala, which is obtained from the data sheets maintained by NGO, Green Habitat from 1998-99 till date (20 years). According to Lal Mohan (1986), the nesting season for olive ridley along Calicut coast, Kerala is from August to March with peak period of nesting from November to December. Turtles visit the Malabar beach during September to February, every year, mainly from October to January, with a peak period in November (Muhammed and Radhakrishnan, 2004). Rajagoplan *et al.* (1986), states that in Kerala the nesting season is July-September but the nesting intensity is stray. Thirumalaiselvan *et al.* (2018) carried survey for nesting and hatchling between November to March. However, at Chavakkad beach it was observed that they came for nesting during the period November to March every season. The total number of nests at Chavakkad beach ranged from one (1998-09) to ten (2017-18) during the breeding season over the years (Table 1).

The clutch size varied from 47 to 135 eggs during the observation period. The egg size and the clutch size are found to vary based on size and age of turtle. The diameter of the eggs in the current study at Chavakkad ranged between 38-42 mm and the corresponding weight ranged between 30-35 g. Silas and Rajagopalan (1984), while studying the *L. Olivacea* of Madras coast, found that the egg diameter varied from 35.1-39.6 mm weighing 22.9-36.5 g and the egg diameter. According to Lal Mohan (1986), the egg diameter at Calicut coast ranges from 29-37 mm and weighing 35-39 g. According to James *et al.* (1991), the diameter of the eggs varied from 33.4-39.8 mm at Orissa.

Table 1. Number of nests, eggs laid and eggs hatched at various locations on Chavakkad beach, Kerala (1998-2018)

Period (Dec-Mar)	Edakkazhiyur	Eggs	Hatched	Panchavadi	Eggs	Hatched	Akalad	Eggs	Hatched	Total nests	Total eggs	Total hatched
1998-1999	15-12-88	60	41							1	60	41
1999-2000				21-01-00	80	52				1	80	52
2000-2001	02-01-01	90	56	14-02-01	68	39				2	158	95
2001-2002	Nil									0	0	0
2002-2003	10-12-02	110	80							1	110	80
2003-2004	28-11-03	104	78							1	104	78
2004-2005	Nil									0	0	0
2005-2006	Nil									0	0	0
2006-2007	24-12-06	108	84							1	108	84
2007-2008	Nil									0	0	0
2008-2009	Nil									0	0	0
2009-2010				10-12-09	68	43				1	68	43
2010-2011	20-11-10	108	0	28-12-10	98	48				4	450	197
	10-12-10	116	82									
	04-02-11	128	67									
2011-2012	14-01-12	94	76	10-01-12	122	80	20-02-12	80	28	3	296	184
2012-2013	13-12-12	120	61	26-01-13	130	78				3	340	179
	02-01-13	90	40									
2013-2014	27-02-14	116	62				28-02-14	94	48	2	210	110
2014-2015	Nil									0	0	0
2015-2016	04-12-15	140	78	08-12-15	68	40	20-02-16	96	58	5	562	176
							26-02-16	132	0			
							04-03-16	126	0			
2016-2017	07-01-17	112	103	12-01-17	115	106	27-01-17	87	22	9	900	497
	16-01-17	111	77	23-01-17	140	84	05-02-17	67	0			
	21-01-17	47	27				03-03-17	119	0			
2017-2018	12-02-18	93	74	07-02-18	135	56	14-03-18	103	0	10	1025	490
	16-02-18	129	75	25-02-18	70	51	14-03-18	40	0			
	17-02-18	121	81	26-02-18	123	80						
				03-03-18	103	73						
				10-03-18	108	0						
										Total	44	4471
											2306	



Plate 1. Turtle olive ridley on Chavakkad beach, Kerala for laying eggs **Plate 2.** Olive ridley laying eggs in pit created on the beach **Plate 3.** Cluster of eggs laid by olive ridley in the pits **Plate 4.** Temporary barrier net created around the egg pits **Plate 5.** Eggs being carried to permanent hatchery **Plate 6.** Permanent hatchery erected on Chavakkad beach **Plate 7.** The hatchlings removed from the pit in to a container **Plate 8.** The hatched babies being transferred in container with sea water for release



Plate 9. Releasing turtle babies in to the sea in presence of local people

Plate 10. Turtle hatchlings crawling towards the sea

Plate 11. The entire clutch which did not hatch on Akalad beach

Plate 12. Awareness programmes on turtle conservation for school children

After about 45-50 days the eggs hatched in the hatchery at Chavakkad. Silas and Rajagopalan (1984) observed the variation in the incubation period to be 45 to 58 days along the Madras coast and according to Lal Mohan (1986) the incubation period at Calicut coast was found to be between 48 days in February to 51 days in December. At a mass nesting site in Orissa the hatchlings emerged after 60 days (James *et al.*, 1991). The carapace length of the hatchlings at Chavakkad varied from 42-45 mm with the carapace width ranging from 17-19 mm and the corresponding weight of the hatchling ranged from 18-21 g. According to Lal Mohan (1986), the carapace length of the hatchlings of Calicut coast varied between 40-41 mm and weighed 18-20 g. According to James *et al.* (1991), the carapace length ranged from 36.48-42.85 mm and the body weight ranged from 13.6-18.6 g at Orissa. These variations cannot be attributed to any particular factor in the absence of information on the size and age of the turtle and the clutch size.

Since the turtles generally hatch during the night time, in the absence of volunteers in the vicinity during that time, the chances of hatchlings getting dehydrated is high. To prevent this, a bowl containing sea water is kept inside the hatchery by digging a pit in the sand and placing the bowl in it. As the turtles hatch they instinctively go towards the bowl filled with sea water and get inside. The hatchlings were then carefully removed from the pit and transferred to a container the next day (Plate 7). The hatchlings were then transferred to a larger container with sea water (Plate 8), to carry them to the seashore for release in to the sea. Generally hatchlings should be released at night or early in the morning, and should be allowed to crawl on the beach prior to entering the surf, and the same was followed here also. At Chavakkad the hatchlings were released in late evening. Local people, fishermen, students etc. were invited on the release date and the hatchlings were released in to the sea in their presence making it an event to remember (Plate 9 and 10). State forest department personal and local panchayat

members were also present and witnessed the events. Observations were also made on the entry of hatchlings into the sea. Some of the hatchlings entering into the sea during high tide were washed back again on the beach and re-entered with subsequent retreating waves. The hatchling face danger from the time they emerge from the pits, until they reach the sea. Once hatched they make their first journey towards the sea and during this time efforts include keeping them safe from a crow or eagle waiting for a snack on 'turtlings' (a new word coined for turtle hatchlings) taking its first walk. Artificial light poses a threat to the turtles which rely solely on their visual stimuli for finding a route to the sea; they orient using the brightness of open seaward horizon and the illumination appearing from the reflection of stars and the moonlight on water. Artificial lighting on the beach and adjacent habitat create results in poor orientation. Thus, it is imperative to bar any sort of artificial lighting on the beach in order to facilitate an efficient conservation programme. Similar activities are also carried out in Velas, Maharashtra (Pawar, 2016).

The number of eggs hatched during the study period was between 41 hatchlings in 1998-09 to 490 hatchlings in 2017-18. According to Silas and Rajagopalan (1984), the eggs kept for incubation during December hatched after 51 days, whereas the eggs kept for incubation in February took 48 days. This may probably be due to the increase in beach temperature during February-March. It's common knowledge that the sex of the babies depend on the temperature. According to Shenoy *et al.* (2011), the sex of a hatchling is determined by incubation (nest) temperature. Lower temperatures produce males, higher temperatures produce females. Silas *et al.* (1985b) has observed in Orrisa that the hatchlings developing at the lower temperature from the eggs laid during the first arribada may mostly be males and those at relatively higher temperature during the second arribada predominantly females. The percentage of hatchings in Chavakkad was satisfactory, however in some seasons; the entire clutch did not hatch (Plate 11), the reasons for which are still unknown. However, generally the reasons are sea water getting in to the nest, predation by jackals or dogs, rains etc. It was observed that hatching percentage collected from Akalad beach was less. In Kerala, turtle hatchings were also observed from *Puthen Kadappuram* beach and Palapetty beach both in Thrissur district by Baby (2011) and Miriam *et al.*

(2016) respectively. Jaykumar and Dileepkumar (2004), Dileepkumar and Jaykumar (2002, 2006) has made extensive studies and reported turtle nests along all the costal districts of Kerala. The Green Habitat has successfully protected 44 nests and ensured the safe release of 2,306 hatchlings into the sea till date.

CONSERVATION MEASURES

To protect these turtles, use of trawlers and fishing nets during mating and nesting season should be regulated and create awareness among fishermen to release back the turtles which may be accidentally caught. The migration of the turtles to the feeding grounds and then for reproduction to the nesting beaches needs study. Use of turtle excluder device (TED) by fishing trawlers may be considered. According to Rajagopalan *et al.* (2002), the month-wise incidental catch of sea turtles along Kerala coast indicated that the maximum catch was in the month of January, hence maximum care should be taken during this period. In the wild, olive ridley turtle feed on fish, prawns, crabs, lobsters, snails, oysters, sea urchins and importantly jelly fishes (Chhapgar, 2005), hence during jellyfish bloom also they come nearshore for feeding and thus face threats. Keeping the beaches clean also helps a great deal in bringing the turtle to hatch on the beach. This is precisely what happened in Versova beach, Mumbai, where the turtles laid eggs, even hatched and found its way in to the sea. This has happened after 20 years of absolutely no hatching on the beach because of intense pollution of all kinds. Developmental activities along the coast line also pose a threat. A detailed study on the conservation of sea turtles in India was initiated by Silas *et al.* (1983). According to Silas *et al.* (1983), any reduction or changes of beach configuration and profile would also adversely affect the rookery. Casuarina plantations along all the beaches of Kerala are rampant as it could act as a buffer for coastal storms, but such plantations should be very carefully planned. In the nesting sites, plantation should be well above the possible nesting areas. Planned plantation can also be effective in screening and reducing the impact of artificial lights from traffic or habitation close to the nesting grounds because presence of artificial lights near the nesting beach disorients the hatchlings and instead of moving toward the sea they tend to move towards the source of artificial illumination. In India, live sea turtles if accidentally caught in the sea are usually released back into the sea by the local fishermen as they venerate the

turtle as an incarnation of lord Vishnu. This practice based on religious grounds, goes a long way in the conservational measures of turtles.

CONCLUSION

The Central Marine Fisheries Research Institute (CMFRI) has developed a national programme for conservation of turtles such as surveying and demarcating nesting grounds, carrying out tagging of turtles to understand their population structure, migratory habits, growth, longevity and mortality rates, investigating biological aspects and behavior of turtles etc. Silas *et al.* (1983). The Green Habitat arranged awareness programmes in nearby villages in Chavakkad in the form of meetings, lectures, and exhibitions especially for school kids (Plate 12). Direct threats include loss of nesting beaches due to erosion, sand mining, pollution etc. More information is required on the diffused nesting population of the west coast of India where both the turtle eggs and the nesting population are subject to heavy predation. An education programme was formulated with an objective of sensitizing the coastal community of Kerala on turtle conservation by Jaykumar and Dileepkumar (2004). Table. 1, clearly indicates that the number of nests and the eggs hatched have increased over the years on Chavakkad beach, and in all probability it may be due to the conservation measures with tireless efforts carried out by Green Habitat. Hopefully greater awareness through proper extension programmes at the village level would be initiated in the state by the government and the artisanal fisheries sector could be fully taken into confidence to also help in the conservation programme. For conservation and studies on turtles, Green Habitat intends to open a Turtle Research Centre on Chavakkad beach, Kerala, India.

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