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INCIDENTAL CATCH OF SEA TURTLES IN INDIA

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The sea turtle fauna of India

Sea turtles are found all along the coast of India including the Lakshadweep and Andaman & Nicobar Islands. Five species inhabit the Indian waters (Table 1). All the species are capable of taking long distance migration.

TABLE 1. Sea turtle fauna of India

Species	Common name	Feeding ground in India	Nesting ground in India
<i>Lepidochelys olivacea</i>	Olive ridley	Present	Present
<i>Chelonia mydas</i>	Green turtle	Present	Present
<i>Eretmochelys imbricata</i>	Hawksbill turtle	Present	Present
<i>Caretta caretta</i>	Loggerhead turtle	Present	Not known
<i>Dermochelys coriacea</i>	Leatherback turtle	Not known	Present

Lepidochelys olivacea (Olive ridley turtle)

This is the most common sea turtle in Indian waters. Very heavy concentration of this species occurs in Orissa coast. Mass nesting occurs in a stretch of 15 km Gahirmatha beach during January-March every year. This species nests both in the east and west coasts of India, as well as in the Bay Islands.

Chelonia mydas (Green turtle)

This is the largest species found in the Indian waters. It occurs in the west and east coasts of India, Lakshadweep and Andaman & Nicobar Islands. The name Green turtle indicates the green colour of the fat. It is predominantly herbivorous and feeds on sea grass. This species was highly priced and there was a directed fishery for the green turtle in the 1970s in the Gulf of Mannar area.

Eretmochelys imbricata (Hawksbill turtle)

It is comparatively a small sized turtle and numerically less abundant in the Indian waters than the other species. It is reported from Lakshadweep, southwest coast, Tamil Nadu and Andaman & Nicobar Islands. It feeds mainly on sponges, crabs and molluscs. As it frequently feeds on poisonous marine animals, the flesh of this species is often reported to be poisonous.

Caretta caretta (Loggerhead turtle)

This species is reddish brown in colour and is characterised by a large head in relation to the body size. In India, it is recorded only from the Gulf of Mannar. It is a carnivore, feeding on crabs, fish and other benthic animals.

Dermochelys coriacea (Leatherback turtle)

Individuals of this species attain a weight of 500 kg. A thick leathery tissue covers the bones of the shells and hence the common name. Indiscriminate poaching of eggs in the 1970s caused the disappearance of this species in the mainland coastal waters. However, they occur in pristine beaches and adjacent waters of Little Andamans and Nicobar Islands.

The area, season and intensity of nesting of the sea turtles are given in Table 2. The mass nesting of the Olive ridley in India is among the most dense sea turtle nestings in

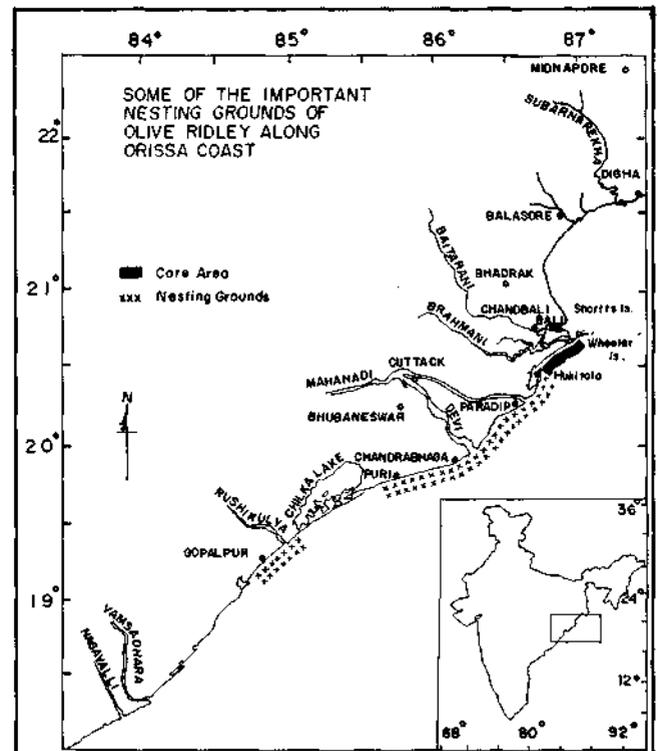


Fig. 1. Some of the important nesting grounds of Olive ridley along Orissa coast.

TABLE 2. Details on occurrence and nesting of five species of sea turtles in India

Species	Occurrence	Nesting area	Nesting season	Nesting intensity
<i>C. mydas</i>	Sporadic in coastal mainland & A & N Islands	Gujarat (Kutch & Saurashtra)	July-January	Moderate
		Maharashtra (Thane Dt)		Sparse
		Tamil Nadu (Gulf of Mannar & Palk strait)	November-January June-September	Sparse
		A & N Islands Lakshadweep		Moderate Moderate
<i>E. imbricata</i>	-do-	Tamil Nadu	April-January	Extremely low
		Andhra Pradesh		-do-
		Orissa		-do-
		Gujarat		Rare
		A & N Islands Lakshadweep		Moderate Rare
<i>D. coriacea</i>	-do-	Tamil Nadu	December-April	Very rare
		A & N Islands		Moderate
		Lakshadweep		Stray
<i>C. caretta</i>	Tamil Nadu (sparse)	Not known	Not known	
<i>L. olivacea</i>	Almost throughout the mainland and bay islands	Gujarat	July-September	Moderate
		Maharashtra	-do-	Stray
		Goa	-do-	Stray
		Karnataka	-do-	Stray
		Kerala	-do-	Stray
		Tamil Nadu	December-February	Moderate
		Andhra Pradesh	-do-	Moderate
		Orissa	-do-	Mass nesting
		West Bengal	-do-	Moderate
		A & N Islands Lakshadweep	-do- June-September	Moderate Stray

the world. It is estimated that, on an average, about 2,40,000 female Olive ridleys nest every year (Table 3) in the Gahirmatha beach, Orissa (Fig. 1) in a phenomenon called "arribada". Tagging experiments and observations by the coast guards suggest northward mass migration of the Olive ridleys off Sri Lankan waters in November. The turtles cover the entire southern part of the east coast of India to reach the mass nesting beach in Orissa coast during January (Fig. 2). A few ridleys stray and nest in Tamil Nadu and Andhra Pradesh coast during the migration. The mass nesting occurs in two batches, the first major nesting during January-February and the second minor nesting in March. Prior to the peak mating period, large number of copulating pairs swim passively along the surface currents. The copulating pairs of Olive ridleys migrate from south to north, i.e. towards the mass nesting site in the north (Gahirmatha) and move parallel to the coast till they gather in very large

numbers just in front of the mass nesting zone. Mating takes place almost daily in the shallow waters at a distance ranging from 50 metres to 5 km from the shore during October-December. The mating ridleys exhibit little response to external disturbance until the process of copulation is over. Hence, the mating pair is highly vulnerable to fishing gears.

Exploitation and predation

In India, directed turtle fishery existed in the past in Orissa. Trade in the turtle eggs and turtle flesh existed every year along Orissa and West Bengal coasts during the 'arribada'. The Forest Department of Orissa issued license for collection of eggs and it was estimated that 1.5 million eggs were legally removed in the 1973 'arribada' season. The Govt. of Orissa ceased issuing licenses from the year 1975. Exploitation of adult turtles existed till the early 1980s.

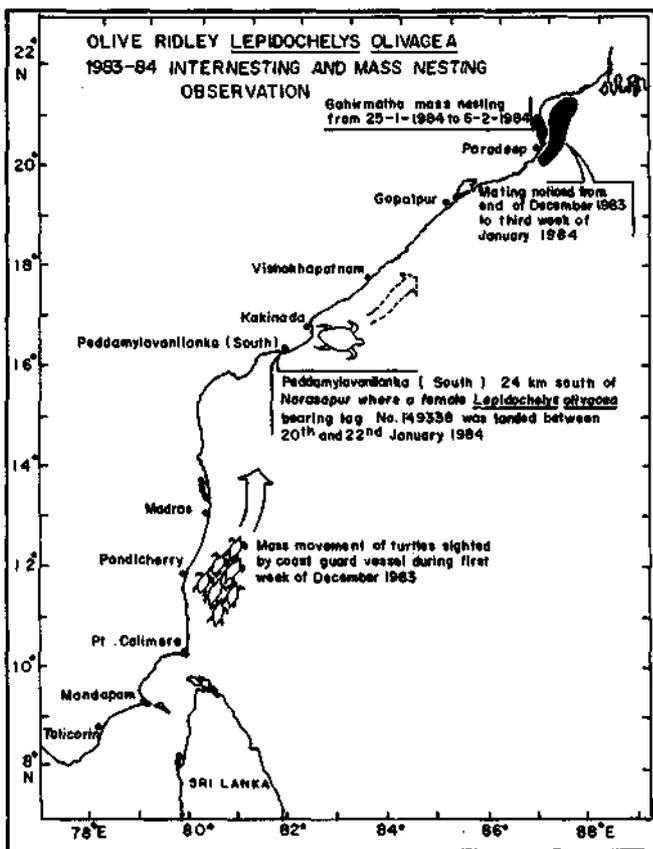


Fig. 2. Map showing the interesting and mass nesting activity phases of the Olive ridley during the 1983-'84 season.

It is estimated that 50,000-80,000 adult Olive ridleys comprising of both the sexes were captured off Gahirmatha during every nesting season upto 1981-'82. During 1982-'83, due to vigilance by the Forest Department, Govt. of Orissa, West Bengal and coast guard, poaching of sea turtles in the high seas was reduced to 10,000. From 1983, marketing the turtles was totally stopped and directed fishery was also stopped. Since then, turtles succumb only as incidental catch and the carcasses are washed ashore in the Gahirmatha beach.

Similar directed fishery existed in Gulf of Mannar and Palk Bay in Tamil Nadu. The turtles were exploited by employing special type of wall nets. In the 1960s, it was estimated that 3,000-4,000 turtles were landed every year between Pamban and Kanyakumari. In the Palk Bay, about 1,000 turtles were landed annually. The Green turtle formed 75% of the catch; Olive ridley and Loggerhead together formed 20% of the catch. The turtles were sent to Tuticorin market. Following action by the Dept. of Forest,

Govt. of Tamil Nadu, the turtle exploitation and trade were stopped in the early 1980s.

Prior to the 1960s, turtles were exported to Sri Lanka and turtle shells to France, U.K. and several other countries. The export of chelonian flesh and products was stopped in 1977.

The type of exploitation in India in the 1960s and the 1970s could be categorised as follows:

- (i) Directed turtle fishery for meat and shell;
- (ii) Exploiting the adult female when it comes to the beach for nesting;
- (iii) Exploitation of eggs for human consumption; predation of eggs by dogs and jackals;
- (iv) Predation of hatchlings by birds and dogs.

TABLE 3. Number of Olive ridley nestings in Gahirmatha (Orissa) from 1976-'96

Year	Months	Number of nests
1976	Not available	1,50,000
1977	Not available	1,50,000
1978	Not available	2,00,000
1979	Not available	1,30,000
1980	Not available	2,00,000
1981	Not available	2,00,000
1982	Not available	200
1983	February	2,00,000
1984	January-March	5,00,000
1985	January, March	2,87,000
1986	April	48,000
1987	January, March	6,02,000
1988	February	100
1989	January	3,25,600
1990	March	2,58,000
1991	March, April	6,10,000
1992	January-March	3,21,700
1993		Not available
1994	March	2,00,000
1995		Not available
1996	January-March	2,00,000
Average		2,40,000

Conservation

In order to prevent poaching and protect the sea turtle population, the Govt. of India developed conservation and management measures. The turning point was the promulgation of the Indian Wildlife (Protection) Act (1972)

TABLE 4. Number of mechanised, non-mechanised and motorised craft in India

State	Mechanised craft			Non-mechanised craft			Motorised craft			Total		
	1980	1990	1994	1980	1990	1994	1980	1990	1994	1980	1990	1994
West Bengal	1,054	1,880	1,880	4,061	4,361	4,091	0	270	270	5,115	6,511	6,241
Orissa	469	1,796	2,453	9,728	13,791	7,796	0	529	529	10,197	16,116	12,702
Andhra Pradesh	580	4,082	8,911	36,013	50,333	54,000	0	1,688	3,269	36,593	56,103	66,180
Tamil Nadu	2,627	4,500	8,230	43,343	39,969	26,737	0	3,298	5,340	45,970	47,767	40,307
Pondicherry	176	561	553	1,750	5,293	5,900	0	332	365	1,926	6,186	6,818
Kerala	3,038	5,026	4,206	26,271	27,104	27,873	0	7,934	12,913	29,309	40,064	44,992
Karnataka	2,004	3,730	3,655	6,942	11,860	11,952	0	190	1,189	8,946	15,780	16,796
Goa	908	736	850	2,513	2,445	1,100	0	675	900	3,421	3,856	2,850
Maharashtra	4,718	6,451	7,930	7,928	17,441	9,888	0	286	4,701	12,646	24,178	22,519
Gujarat	3,413	5,215	8,365	4,120	7,795	8,370	0	1,154	4,283	7,533	14,164	21,018
A & N Islands	10	184	230	N.A.	964	1,180	0	124	160	10	1,272	1,570
Lakshadweep	213	410	443	N.A.	740	780	0	225	298	213	1,375	1,521
Total	19,210	34,571	47,706	1,42,669	1,82,096	1,59,667	0	26,171	36,141	1,61,879	2,33,372	2,43,514

N.A. = Not available.

wherein all species of sea turtles are placed as endangered species in Schedule I and are thereby protected. India is a member of the Convention of International Trade in Endangered Species of Fauna and Flora (CITES), which prohibits trade in turtle products by party countries. In June 1981, India became a party to the Bonn Convention on the Conservation of Migratory Species of Wild Animals. To protect the sea turtles, Bhitarkanika and Gahirmatha (65,000 ha) in Orissa were declared as wildlife sanctuaries in 1975. These sanctuaries are situated in Kanika Island and includes 12 other offshore islands and several beaches. In addition, the coastal mainland has 4 national parks and 17 protected areas. There are 94 sanctuaries in the Andaman & Nicobar Islands.

Nevertheless, there was a subsistence fishery for the Green turtle and the Olive ridley, the former in the Gulf of Mannar and the latter along Orissa and West Bengal coast primarily for the Calcutta market. In the early 1980s, sea patrol was effectively activated and surveillance strengthened for strict enforcement of the Acts and Legislations. The poachers were arrested with the help of coast guard vessels. These measures effectively prevented poaching and directed activities on sea turtle exploitation were phased out during 1980-83.

In addition to prevention of poaching, different agencies, viz. maritime state

governments and union territories particularly Tamil Nadu, Andhra Pradesh, Orissa, Gujarat, Andaman & Nicobar Islands and numerous non-governmental agencies are engaged in sea turtle conservation activities. The Universities in Orissa have conducted pioneering studies on the hatching mechanism of Olive ridley eggs. The Central Marine Fisheries Research Institute (ICAR) conducted exhaustive studies on the

TABLE 5. Incidental catch of sea turtles in fishing gears; the data pertain to the observed number of sea turtles in fish landing centres during 1985-'95

State	Species	Incidental catch		Gear
		Month	Number	
West Bengal	Olive ridley	December-February	23	Gill net
Orissa	Olive ridley	December-February	21	Gill net
Andhra Pradesh	Olive ridley & Green turtle	December-March	79	Gill net
Tamil Nadu	Olive ridley, Green turtle, Hawksbill & Loggerhead	All months	21	Gill net Shoreseine Trawl net
Kerala	Olive ridley, Green turtle & Loggerhead	All months	33	Trawl net Hooks & line
Karnataka	Olive ridley	November	2	Gill net
Maharashtra	Olive ridley	November-April	6	Trawl net
			150*	
Total			335	

* Stranded young ones; gear not specified.

nesting in Tamil Nadu and Gahirmatha coasts. The CMFRI installed a hatchery for the Olive ridley in Kovalam (near Madras) and conducted a recovery programme, in which 53,000 hatchlings of the Olive ridley were released to the sea during 1978-'86. The CMFRI also reared the Olive ridley hatchlings for 4 years and studied the growth under captivity; conducted experiments on food preference of the hatchlings, yolk utilization during egg development and behavioural pattern during nesting.

TABLE 6. Fishing gears responsible for incidental catch of sea turtles

Gear	% in total incidental catch
Gill net	76.5
Trawl net	17.8
Shore seine	3.2
Hooks & line	2.5

The conservation and management strategies evolved by these organisations for effective protection of the sea turtle population are: (i) Habitat preservation of the present critical areas, already identified vulnerable areas, new areas and the national sea shore system; (ii) Species preservation through recovery programmes, translocation of nests and setting up of hatcheries; (iii) Legislation and enforcement of prevalent laws and regulations and future requirements; (iv) Research pertaining to biology, ecology, reproductive physiology, endocrinology, behaviour and (v) Education, training and extension among the public especially children on the importance of turtles and need for their conservation, and of the supervisory personnel.

In addition to these, the CMFRI developed a national programme for: (i) Surveying and demarcating nesting grounds of sea turtles along the Indian coasts and the bay islands; (ii) Monitoring incidental catch of turtles in fishing operations and finding ways and means of minimising the same; (iii) Developing hatchery and hatchling release programme; (iv) Carrying out tagging of turtles to understand their population structure, migratory habits, growth, longevity and mortality rates; (v) Investigating biological aspects and behaviour of turtles; and (vi) Strengthening the National Marine Living Resources Data Centre (NMLRDC) for the acquisition and dissemination of data

on sea turtles from the Exclusive Economic Zone.

The CMFRI conducted a national workshop on sea turtle conservation in 1984 in Madras. The Marine Biological Association of India conducted an international symposium on the endangered marine animals and marine parks in 1985 in Cochin. The CMFRI has published the research findings in the form of proceedings, bulletins, special publications, research papers etc.

The concerted effort of all the concerned organisations during the 1970s and the 1980s helped, to a large extent, in arresting the massacre of sea turtle population.

Incidental catch

A major threat which persists is the incidental catch of turtles in fishing gears like trawl net and gill net. The total number of mechanised craft has increased from 19,210 in 1980 to 47,706 in 1994 (Table 4). Almost the entire fishing fleet exploit the inshore area <50 m depth, exerting enormous pressure on the living resources.

Table 7. Number of dead olive ridley stranded in the Gahirmatha beach due to incidental catch in fishing gears

Year	Number of dead turtles	Year	Number of dead turtles
1983	7,500	1988	422
1984	392	1989	408
1985	694	1990	NA
1986	531	1991	1,000
1987	360	1992	1,500

NA = Not available

The CMFRI besides its headquarters has 12 research centres and 30 field centres along the coast from where data on exploited marine fishery resources from artisanal and industrial sectors are being collected and evaluated. The Institute is at an advantage that a fund of field data is being collected by the staff which help in the proper monitoring of marine living resources. The National Marine Living Resource Data Centre (NMLRDC) of the Institute is a repository of the data. The NMLRDC also collects data on the incidental catch of sea turtles in all the fish landing centres by designating code number for the five species of sea turtles for facilitating computer analysis.

With the aid of simple line drawings and photographs, field identification characters of these species, specieswise information on sightings, incidental catch in fishing operations, observations from the nesting grounds and so on could be collected in the designed proformae (Proforma I, II and III).

Table 8. Monthly variation in the stranding/incidental catch of adult olive ridley in Gahirmatha

Month	% of stranded turtles	Month	% of stranded turtles
September	0.1	March	1.2
October	2.5	April	0.4
November	8.3	May	0.0
December	25.8	June	0.0
January	38.1	July	0.0
February	23.6	August	0.0

From the data thus collected on the incidental catch in all the maritime states during 1985-95, it could be observed that 335 sea turtles were incidentally caught all over the Indian coasts (barring Gahirmatha coast) (Table 5). It is estimated that 17.8% of the incidental catch was by the trawlers and 76.5% by the gill netters (Table 6). The prime objective of CMFRI survey is the collection of data on the marine landings by following stratified random sampling method. The incidental catch of sea turtles given in Table 5 is the number of turtles which were incidentally caught in the fishing gears only on the observation days in the sampling centres. There is no estimates on the total incidental catch. Also, there is no record on the number of sea turtles which are caught and discarded in the sea. Hence, the actual number of sea turtles incidentally caught in India (barring Gahirmatha) by fishing gears must be much higher than 335.

Nevertheless, the incidental catch appears to have sharply decreased considering the large scale capture in earlier years. The reasons for the decline despite increase in the number and efficiency of fishing craft are: (i) Awareness of the fishermen to release the turtles; (ii) Lack of demand for turtle meat even if brought to the shore due to vigilance by different agencies; and (iii) implementation of a 3 km inshore fishing ban on mechanised trawlers to prevent massive annual incidental take.

Incidental catch in the mass nesting area

Observations on the stranded sea turtles in a stretch of 10 km at Gahirmatha beach revealed that 7,500 Olive ridley carcasses were washed ashore during 1983 (Table 7). The turtles were washed ashore due to entangling in fishing operations conducted off Paradip and adjacent fishing areas, the carcasses drifting northwards and reaching the Gahirmatha beach. Thanks to the stringent measures taken by the forest officials of Orissa and West Bengal state governments and with the ban on fishing activities during mass nesting, the mortality declined in the subsequent years. The mortality was maximum during December-February (Table 8) and 87.5% of the annual strandings was during this period.

Conclusions

Considering the present status of sea turtle exploitation and incidental catch, especially that of the Olive ridley in the Gahirmatha coast, the following conclusions could be drawn:

(i) due to strict vigilance, exploitation of adults and eggs has been effectively reduced.

(ii) Estimates on the incidental mortality of sea turtles due to fishing activity are not available. However, observations and sample surveys suggest that incidental catch has reduced following ban on fishing off Gahirmatha during the mass nesting period and ban on mechanised fishing in shallow waters (within 3 km from the shore) throughout the year all along the Indian coast.

(iii) Gill netters are responsible for 76.5% of incidental mortality of sea turtles.

(iv) The number of nesting Olive ridley females in the Gahirmatha coast has not reduced in the 1990s compared to earlier years.

Recommendations

(i) A mechanism has to be developed for properly estimating the incidental catch of sea turtles in the fishing gears. The CMFRI may be identified for evolving the mechanism and for implementing the programme.

(ii) Fishing off Gahirmatha by the Paradip based mechanised vessels may be totally banned during peak mating and nesting season of the Olive ridley, i.e. during October-March. This will

NATIONAL MARINE LIVING RESOURCES DATA CENTRE (NMLRDC)

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN-682 014

PROFORMA I

DATA ON SEA TURTLES AT FISH LANDING CENTRES

Species : NMLRDC's Code No

Location : Sex :

Date : Dead or Live :

Evidence of any previous tag : Yes/No
If yes, give details of Tag number, etc :

New tag number if tagged
and released:

Carapace length (Straight Line) : cm Total weight : kg

Carapace width (Straight line) : cm

Evidence of any injury : Yes/No. If Yes, give details.....

If incidental catch in fishing gear, type of
fishing craft and gear used :

Any turtle trade in that area : Yes/No. If yes, give details.....

Any turtle egg trade in that area : Yes/No.
If Yes give details:

Any incident of turtle poisoning : Yes/No. If yes, give details.....

Remarks :

Investigator :

NATIONAL MARINE LIVING RESOURCES DATA CENTRE (NMLRDC)

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN-682 014

PROFORMA II
DATA ON SEA TURTLES

Species : NMLRDC's Code No

Location : Sex :

Date : Time : From To

Whether condition :

Surf Temperature : Sand temperature :

Evidence of any previous tag : Yes/No. If yes, give details of Tag number, etc :

New tag number if tagged and released:

Carapace length (Straight Line) :cm Total weight : kg

Carapace width (Straight line) :cm

Evidence of any injury : Yes/No. If Yes, give details :

If incidental catch in fishing gear, type of fishing craft and gear used :

Surf Condition : Distance of nest high water line : (m)

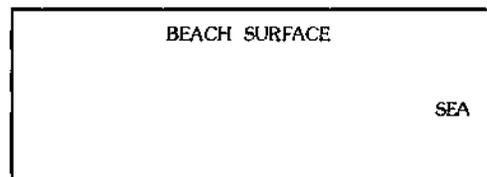
Number of eggs :

Any predation of eggs on nesting beaches : Yes/No. If Yes, give details:

Remarks :

Investigator :

NATURE OF CRAWL (Draw a sketch of crawling pattern in the box)



NATIONAL MARINE LIVING RESOURCES DATA CENTRE (NMLRDC)

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN-682 014

PROFORMA III

DATA ON SEA TURTLES TAKEN AS INCIDENTAL CATCH IN FISHING AND TAGGING OPERATIONS

Species : NMLRDC's Code No

Location : Sex :

Date : Depth :

Time of capture : Time of release :

Gear operated : Depth at which operated :

Evidence of any previous tag : Yes/No.
If yes, give details of Tag number, etc :

New tag number if tagged and released:

Carapace length (Straight Line) : cm Total weight : kg

Carapace width (Straight line) : cm

Evidence of any injury : Yes/No. If Yes, give details :

Evidence of any ectoparasite : Yes/No. If Yes, give details :

Any sighting of matching of
turtles in that area : Yes/No. If Yes, give details:

Remarks :

Investigator :