



# National Ship Design & Research Centre

(Autonomous Society under the Admin. Control of Min. of Surface Transport, Govt. of India)  
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NSDRC/9284/0224

06 April, 2000

Dr. P.S. Rajasekhar,  
Assistant Professor,  
Environmental Sciences,  
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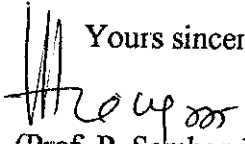
Dear Dr. P.S. Rajasekhar,

We have been informed that two turtle nests have been found on the R.K. Beach about 4m. from the road towards the beach adjacent to YMCA. From the information we have this is very strange to happen. However, we would like to seek your expert opinion on the above claim. We would like you to visit the site at your convenience and give your opinion on :

- 1) The natural processes and habits under which the turtles come to R.K. Beach.
- 2) The above claim of two turtle nests very close to the road and about 45m. away from the sea.

NSDRC would be willing to pay the consultancy charges towards the same.

Thanking you,

Yours sincerely,  
  
(Prof. P. Sambandan)  
Director

**Dr. P. S. RAJA SEKHAR**  
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This report has been made on the request of the District Forest Officer, Visakhapatnam, Indian Navy, Eastern Naval Command, Visakhapatnam and National Ship Design and Research Centre, Visakhapatnam.

The District Forest Officer requested me to inspect the nest of Olive Ridley Sea Turtles, supposed to be nearer to Submarine site at R.K. Beach at Visakhapatnam on the 09.04.2000 early morning. I conducted the Visual Observation of the eggs and latter conducted laboratory tests in detail of the conditions of the embryo's and eggs.

This report contains a detailed information of the observation, tests and conclusions.

  
Dr. P. S. Raja Sekhar.

**A Report on**

**STATUS OF NESTING ACTIVITY AND NESTS OF OLIVE  
RIDLEY SEA TURTLES, (LEPIDOCHELYS OLIVACEA) AT  
VISAKHAPATNAM URBAN BEACH ENVIRONMENT**

*Submitted By*

**Dr. P. S. RAJA SEKHAR**  
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Visakhapatnam

This report has been made on the request of the District Forest Officer, Visakhapatnam, Indian Navy, Eastern Naval Command, Visakhapatnam and National Ship Design and Research Centre, Visakhapatnam.

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Dr P.S Raja Sekhar.

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## A. VISAKAHAPATNAM BEACH ENVIRONMENT

### Geography & Morphology

Visakhapatnam is a fast growing Industrial city located on the east coast of India have a greater marítimal importance with establishment of (several Industries) the Hindustan Ship yard, Naval Dock Yards and Eastern Naval Command Head quarters. The coastline between Dolphins nose at southern point to Ocean Viewinn Hotel at Northern point is a stretch of 4 km shoreline of almost rocky, intermittently occupied with sand dunes .

### Beach Vegetation

This 4 km stretch of urban beach is lacking of prominent vegetation when compared to other adjacent beaches of undisturbed ones. A few species are randomly appeared at high elevated sands with species of *Ipomea pescaprae* (creeper and sand binder) *Spinifex littoreus* (Succulent grass).

### Pollution of Beach

**Oil pollution:** Fine sands of the beach are appeared in black colour due to the deposition of oil spills drifted from the shipping operations of Visakahapatnam port trust (VPT) and to a greater extent from the activities of fishing trawls. Further subsequent release of Iron ore particulate matter into the environment are deposited on the beach sands directly from conveyer belt operations under conducive conditions.

*Domestic sewage:* Domestic sewage and city runoff directly enter to sea waters through narrow creeks, polluting the beach environment with Non-degradable (Plastic articles and polythene bags) and Degradable domestic waste of coconut shells and vegetable peels.

*Beach erosion:* Visakhapatnam beach environment is greatly influenced by the cyclonic storms, frequently eroded the beach sands from one place and deposited in other place. The sand dunes are shifted from point to point to seasonally due to the permanent construction of break waters at outer harbour (entrance channel of the VPT).

*Human activity:* Irrespective of seasons and days human activity is always present on the beach for recreation and fishing activity (Shore fishing, Dragnet fishing, Beach combing and drying of fishing nets on the shoreline).

*Vehicular traffic and Lighting:* The entire stretch 4 km of beach provided a passage corridor to vehicular traffic. Disturbed the environment with sound pollution and lighting. Apart from vehicular traffic the beach is illuminated in night times by Sodium vapour lamps (SVL) are permanently posted on the beach road at every 100 meters intervals.

## B. STATUS OF NESTING ACTIVITY OF SEA TURTLES

### Nesting frequency & density

Nesting frequency of Olive Ridley sea turtles are varied from month to month mostly depending on beach environment. Nesting activity of Olive ridleys in the Visakhapatnam URBAN BEACH is a rare phenomenon. Nesting densities are varied from 2 nests/km in December and January months to 4 nests/km in February and March. Nesting activity of Olive ridleys on this Urban Coastline is Purely SPORADIC while they are migrating to Orissa Coasts for MASS NESTING utilizing the nearer beaches (Those turtles could not travel longer distances or unable to reach the nesting sites) for nesting.

Density of sporadic nesting activity has greatly varied from Remote beaches (At larger River Mouths) to disturbed beaches (Urban beaches). For the last several years the Visakhapatnam 'Urban Beach' is provided only for sporadic Nesting activity of Olive ridleys, less than 20 nests/year for the entire stretch of 4 km shoreline.

### Predation of eggs

The eggs of Olive ridleys are disturbed either by predators or human for consumption. In urban areas the eggs are spoiled<sup>ed</sup> by dogs at any time during long incubation period (7-10 weeks). Besides, shore crabs and rodents are great menace to the nests and hatchlings of olive ridleys.



## **Light pollution**

Light pollution on nesting beaches is detrimental to sea turtles because it alters critical Nocturnal behaviours namely, how sea turtles choose nesting sites, how they return to the sea after nesting, and how hatchlings find the sea after emerging from their nests on artificially lighted beaches. Hatchlings become misdirected by light sources, leaving them unable to find the water and likely to incur high mortality from dehydration and predators. Artificial lighting on beaches is strongly attractive to hatchlings and can use hatchlings to move in the wrong direction (Misorientation) as well as interfere with their ability to orient in a constant direction (disorientation).

### C. STATUS OF NESTS ADJACENT TO SUBMARINE PROJECT SITE

#### Nest No. 1 : Laid on 26.03.2000

S.No.	Parameters	Observations	Remarks
1.	Distance from the hightide waterier mark	5 mts	At least 10 to 15 mts from hightide water mark
2.	Shape and size of the nests	Horizontal spread	Either cylindrical or oval or flask shape
3.	Layers of eggs	3 layers	Generally more than 4 layers
4.	Distribution of eggs	Evenly distributed	Uneven distribution of eggs from bottom to center and top of the nest layer in naturally laid nests
5.	Eggs condition	Some of the eggs are spoiled due to oozing of yolk material and infected by fungus	This happens to be only in shifting of eggs from place to place
6.	Clutch size	120 - 125 eggs	Normal size

From the evidences as pointed out in remarks the nest has been shifted / relocated from adjacent beaches and placed the eggs nearer to the site of submarine project. The nest have been found characteristically belongs to Olive Ridleys Sea Turtle but not laid by naturally.

## Nest No. 2 : Laid on 29.03. 2000

S.No.	Parameters	Observations	Remarks
1.	Distance from the hightide water mark	15 mts	-
2.	Shape and size of the nests	Horizontal spread	Either cylindrical or flask shape / oval
3.	Number of Layers of eggs	only 3 layers	Generally more than 4 layers
4.	Distribution of eggs in nest	Evenly distributed	Uneven distribution of eggs from bottom to center and top of the nest layer is naturally laid nests.
5.	Eggs condition	Milky weight	-
6.	Clutch size	77 eggs	Should be found more than 90

From the evidences as pointed out in remarks the nest has been shifted / relocated from adjacent beaches and placed the eggs nearer to the site of submarine project. The nest have been found characteristically belongs to Olive Ridley's Sea Turtle but not laid by naturally.

### Nest No. 3 : Freshly laid on 09.04. 2000

S.No.	Parameters	Observations	Remarks
1.	Distance from the hightide water mark	12 - 15 mts	-
2.	Crawl Tracks	Single track with a width of 60 cm only. Not shallow one, a superficial track, no asymmetrical and no tail drag with a return (descending) track	Olive ridley tracks in Revert 'U' shape / Rectangular shape with a false nest pit found nearer to the newly laid nests to mislead the predators
3.	Clutch size	60 eggs	Should be in between 80 - 120 eggs
4.	Eggs morphology	Round in shape, no mucus on the eggs surface and adhering of sand particles in between the eggs	Generally the eggs are bright yellow in colour, adhering with sand particles on the egg surface due to the presence of mucus.

Crawls marks made by nesting turtles indicates the nest position and time of nesting. Freshly laid nest (on the day of inspection on 09.04.2000) crawls is not a natural track made by female nesting turtle.

\*\*Weights of eggs, yolk and albumen and embryo of Olive Ridley eggs from the nests of 1 & 2 laid on 26th and 29th March 2000.

Nest No. dated	Days of eggs (age)	Size (mm)	Eggs weight (gm)	Yolk + Albumin weight (gm)	Embryo weight (gm)	Remarks*
26.3.2000	15	33.40	32.22	29.80	2.42	25 days old
29.03.2000	12	34.20	30.20	29.00	1.20	18 days old

\*From the development of eggs' embryonic stages the nests' age was estimated 25 days and 18 days old.

\*\* for further details please see Annexure-I.

#### D. LIFE HISTORY OF MARINE TURTLES

Marine (sea) turtles belongs to group of *Reptiles*, order *Chelonidae* lead a completely aquatic existence and carnivorous in habit. Sea turtles are known to man from the habit of coming ashore to laid their eggs under the sands of the sea shore. Marine turtles are mainly tropical in distribution throughout the world, except in temperature waters. India has five kinds of sea turtles, each presenting its own distinctive external characteristics, habits and distribution.

The most abundant in the World as well as in India - is the Olive ridley turtle (*Lepidochelys olivacea*) are generally found at larger river mouths with fringes of mangrove forests and turbid waters of a low salinity. Foraging grounds of the Olive ridley sea turtles are located in the vicinity of Larger river mouths (Krishna and Godavari of Andhra Pradesh, Mahanadi and Rushikulya of Orissa) deep and soft bottomed areas provided diversity of Invertebrate fauna (Crabs, Prawns and other crustaceans) on which ridleys feeding.

#### **Breeding Ecology**

Olive ridleys migrating (1000 to 10,000 km) from Pacific and Indian Oceans to the Breeding grounds at Tropical Beaches to lay eggs. Mass nesting sites of the Olive ridleys are Located in:

- (1) Pacific Coasts of Costa Rica & Mexico
- (2) Orissa beaches of Bay of Bengal in India : (Gahirmatha, Ekakulansi and Rushikulya beaches of Orissa)

*Courtship activity:* Courtship activity begins in the months of November and lasted for nearly three months until January at offshore waters nearer to mass nesting sites.

*Nesting habitat :* Olive ridleys preferred to nest on small isolated beaches, find hard sands, sufficient moisture, usually within the vegetated strand lay their eggs high up on the beach (elevated slopes of sand dunes).

*Nesting :* Nesting season for Olive ridleys on the East Coast of India is between December and March. Peak nesting occurs in February and March. The mass nesting of the Olive ridleys in India is among the most dense sea turtle nestings in the World. It is estimated that on an average about 2-3 lakhs female Olive ridley nest every year in the Gahirmatha beach, Orissa in a phenomenon called "Arribada". The turtles cover the entire southern part of the East Coast of India to reach the mass nesting beaches in Orissa coast during January and February. A Olive ridleys nesting in Tamilnadu and Andhra Pradesh coast SPORADICALLY during migration from Indian ocean to Gahirmatha beaches of Orissa.

*Crawl tracks/marks:* The arrivals (ascending) and retreat (Descending) of female olive ridleys formed crawl marks on the sandy beaches and these tracks are more clear and visible on the sands in undisturbed conditions. Track width typically about 80 cm, very shallow, with alternative (asymmetrical) diagonal marks made by the front flippers.

**Nests :** Freshly laid eggs have a coat of albumen -like mucous covering in between each dropping of egg and at the end of egg laying process also such droppings are left on the eggs by the nesting animal before the nest is closed. Sand Adhering to the mucous may play function in preventing sand from infiltrating the space between the eggs and there by create an effective 'air' chamber 'which could maintain temperature and moisture conditions.

Nest pit of Olive ridley is either oval, flask shaped or a cylindrical one. The width of the pit varied from 30-37 cms at the widest part of the egg chamber and 20-30 cms at the neck of the egg chamber and the depth of the pit varied from 35-85 cms. The upper most eggs in the nest are 15-50 cms below surface.

**Eggs :** Number of eggs [clutch size] are varied from nest to nest and season to season. The distribution of eggs in the nest chamber unevenly from Bottom to Centre of the nests and Top of the nest. Monthly means of the clutch size varied slightly from 80 to 125. Eggs of the Olive ridleys are white in colour and round in shape (looks like Table Tennis balls) with a diameter ranging from 37 to 46 mm and weighs between 24-37 gms. The shell of the egg's is porous, delicate and slightly flexible.

**Incubation :** Under natural conditions (In Situ) the eggs hatched after 48 to 68 days (7 - 10 weeks) depending on the temperature gradients of the beaches, presence of moisture content and distance from the high tide water mark. The



Incubation period and the sex of the resulting hatchlings is a function of the temperature of the surrounding sand.

Changes in eggs during incubation. During the 7-10 weeks long incubation period the eggs of olive ridleys have showed several variations in the size, weight and colour. the size and weight of the eggs increased gradually for the first two weeks. The total weight increase during the period was 2.1 g. Before hatching eggs lost their weight with mean reduction of 3.7g. Diameter of the egg increases to 1.2 mm at 2nd week to a mean decrease of 2.6 mm before hatching.

*Temperature vs. Sex determination* : Sex of the hatchlings is determined by the temperature of the nests and its micro environment.  $< 29^{\circ}\text{C}$  gives males  $> 31^{\circ}\text{C}$  produce females. Normally a balancing sex ratio is obtained in Natural nests (with any disturbances to the nests/relocation of nests the sex of the hatchlings is imbalanced).

*Hatching* : Hatchlings develop in their nest over period of 7 to 10 weeks they hatch simultaneously over a period of a couple of days and then emerge from the nest together usually at night. Hatchlings attracted towards the brighter horizon of sea waters and spend to first couple of days in a "Juvenile Frenzy" when they use stored reserves to get into the open sea. Beyond this they spend many years in a variety of Juvenile habitats [the lost years] until they join other adults at feeding areas.

***Hatchlings*** : Immediately after emergence from the eggs, the hatchlings are black in colour and weighs between 18 to 21 gms (in healthy condition) had a size range of 37 to 41 mm in carapace length and 35-40 mm of carapace width. Hatchlings have a single claw on all the flippers and a small unabsorbed yolksac, provided nourishment to the hatchlings upto seventh day as the hatchlings do not feed until 8th day.

## E. CONCLUSIONS

### Relocated nests vs Negative impacts

Relocation of olive redley sea turtle eggs from Natural sites [In situ] to other areas {beaches) is a detrimental one :

*Changes in eggs direction* : Disturb the axial orientation of eggs (Normally 5 hours after laying, the embryo developed on the upper surface of the egg) with frequent rotations while carrying the eggs from place to place tearing the embryos.

*Balance of Sex ratios*: Hatchlings sex ratios may be disturbed due to changes in the temperatures gradients of the nests.

*Misorientation of Hatchlings* : Misorientation of hatchlings to artificial light source leads to higher mortality rates.

*Lasting of imprinting stage* : Loss of imprinting stages if we placed the hatchlings directly in sea water {hatchlings should be allowed to crawl across the beach, if possible to allow them for imprinting stage).

*Higher rates of mortality* : Difficult to avoid the mortality rates of hatchlings in relocated nests, producing premature embryos with large unabsorbed yolk sac (unhealthy hatchlings below the normal sizes between 12 to 13 grms). It is difficult to provide a micro habitat for nest incubation as similar as possible to the natural nest, is beyond the human control.

- Visakhapatnam Urban Beach environment is not suitable for nesting activity of Olive Ridleys when compared to the other adjacent remote beaches.
- Beach sands are polluted with oil spills and domestic sewage is not a congenial environment for incubation of olive ridleys sea turtles (7 to 10 weeks of long incubation period) are vulnerable to fungal and bacterial infections.
- Even the eggs are hatched on the beaches the hatchlings are misoriented towards brighter illumination of sodium vapour lamps (SVL) posted permanently on the existing road.
- Olive ridley turtles migrating from Indian Ocean towards Gahirmatha and Rushikulya beaches for mass nesting - a natural process occurring centuries together.
- Migrating turtles are subjected to indiscriminate exploitation for subsistence economy to the local fishermen communities depending on turtle eggs, meat, shell and calipee of entire coastal districts of Andhra Pradesh and Tamilnadu.
- Relocation of sea turtle eggs from natural nests (in situ) is detrimental to the eggs as well as newly born hatchlings.
- Eggs are susceptible to fungal and bacterial infections.
- Produce immature hatchlings (not fully grown ones) is very difficult to crawl on the beach sands in a 'FRENZY' from nest to sea. These hatchlings are to be released physically directly in to sea.
- Even after releasing into sea the hatchlings are likely to be washed ashore (mortality rates are high).

- Extinction of a species can be determined on several aspects - not considering a single factor. Depletion of sea turtle population is mainly from the following threats.
  - Incidental mortality at off-shore waters from trawl fishing.
  - Consumption of meat and eggs.
  - Poaching of eggs and live turtles.
  - Marine pollution.
  - Lighting pollution (disorientation of both adults and hatchlings)
- No where in India, the Forest Department has not granted the permission for relocation of sea turtle eggs to any agency under wildlife (protection) Act, 1972.

**Determination of eggs age (Actual days of nest laying) on the basis of Embryonic development in the eggs  
(Length and Weight of Embryos) of Olive Ridleys sea turtles**

S. No.	Nest/dated by VSPCA	Eggs Age on 9.4.2000	Size of eggs (mm)	Eggs wet weight (gms)	Yolk + Albumin wet weight (gms)		Embryo wet weight (gms)	Size of the Embryo (cm)		Estimated age (days)	Remarks
					Albumin weight (gms)	Yolk weight (gms)		Embryo length (cm)	Embryo width (cm)		
1.	26.03.2000	15	33.40	32.22	29.80	2.42	1.98	2.42	1.98	25 - 30	Nest laid on <sup>V<sub>0</sub></sup> around 10 to 12th March.
2.	29.03.2000	12	34.20	30.20	29.00	1.20	1.42	1.20	1.42	18 - 24	Nest laid on around 20th to 23rd March.

**Conclusions**

As per the development of the embryonic stages of eggs (on 09.04.2000, inspection conducted by Forest Officials), the age was estimated between 25 - 30 days of nest dated 26.03.2000 and 18 - 24 days of nest dated 29.03.2000 instead of 15 days and 12 days respectively.