



An Introductory Manual to Sea Turtle Monitoring and Research Techniques

GREENPEACE

COVER PHOTO: Roger Grace

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Sea Turtles have fascinated one and all for as long as they have come into contact with each other. Unfortunately for most, the turtle's tryst with the land is brief. Once they hatch and return to the sea, females return only as adults to nest, and males may never return to land at all. Hence, knowledge of sea turtle biology has been confined to that small window when they leave the water i.e. their nesting biology.

Sea turtles are clearly in need of conservation today. Simple tools such as tagging have been used for decades to search for answers to questions related to sea turtle biology, habits and migration. In recent times, satellite telemetry and molecular genetic analyses have been used to address the same questions. Intensive research often needs extensive infrastructure and funding which may not be available to all field biologists. Fortunately, even the simplest of monitoring programs (like ours) can collect basic data on various aspects of their biology, which could be crucial to their conservation.

In 2006, from January to April, Greenpeace will undertake an ambitious project to showcase and thereby protect one of the world's last remaining Olive Ridley Turtle Mass Nesting sites – the Gahirmatha, Devi and Rushikulya beaches in Orissa. By establishing a Turtle Witness Camp at the Devi Region (one of the 3 turtle mass-nesting sites in Orissa), we will shine a spotlight on one of the last mass nesting sites of the Olive Ridley turtle, bearing witness to the wonder and magic of this natural phenomenon, and acting to stop the threats that this specie and the coastal and marine ecosystem and the communities dependent on it face. .

This camp would act as a hub for land based activities involving the monitoring of nesting patterns of the turtles and supporting the initiatives of community groups. This operation will be complemented with our boat patrolling the coastal waters of Orissa, monitoring and documenting the congregational patterns and mating behavior of the Olive Ridley turtle, to gather information pertaining to the mysteries of the Arribada cycle.

During this period (January – April 2006), there are opportunities to meaningfully support and further ongoing work of other constituents in general and research in particular. Our monitoring work will be driven by a certain basic scientific rigor to ensure that we have meaningful data at the end of an Arribada cycle.

This document outlines techniques and methodologies that can be adopted in our monitoring work with respect to aspects of Olive Ridley research. The manual provides the basic tools to identify sea turtle species, their tracks and collect basic information about congregational and mating patterns, mortality rates and nesting patterns. This module informs our monitoring and documentation work with a research component over the course of the turtle season at Orissa.

1.1 Broad Guidelines

By bearing witness and through the witness camp Greenpeace provides tremendous opportunities to engage wildlife enthusiasts, youth, supporters, school and college students and the general public who participate as active volunteers. As an induction process, a copy of the manual at the camp / online must be provided for volunteers to acquaint themselves with our operations.

The release of hatchlings is an exciting activity to involve people in. Hatchlings should be released at night or early in the morning. The release will be coordinated and under the supervision of camp coordinators. For large groups, one can cordon off a section of the beach,

effectively keeping people behind parallel lines, in the middle of which the hatchlings crawl to the sea.

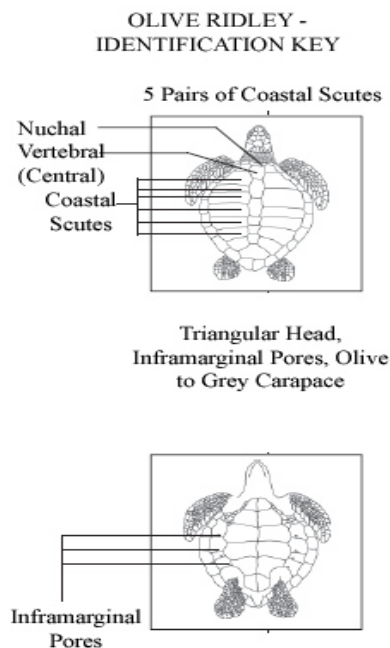
As envisaged, all operations locally at the camp will be run in consonance with and co-managed by the local community group active in the region. Given their field experience of over 5 years in this area, they will help in co-managing the monitoring aspect of our operations. This will work in tandem with other community programmes which are active regionally as well as synergistically with other turtle conservation programmes on the coast.

2. Identification of Turtles

2.1 Physical

If a turtle or a carapace is seen, it can be identified. Since there are only 5 species in Indian waters, and 4 in the Orissa waters, identification is fairly straightforward when the turtle or carapace can be examined. In all probabilities, in our encounters with nesting and dead turtles washed ashore, we would notice only the Olive Ridley, with the possibility of any other turtle specie on land or in the waters, very rare.

Length of the carapace (shell) and the number of scutes and prefrontal scales are key to the identification of the specie. The shape of the central or vertebral scutes also provides clues to the identification. Found on tropical beaches worldwide, they measure between 60-80 cms in length. Characterized by a colouration varying from dark Olive to grey, they weigh anywhere between 50-65 kgs. Hatchlings can be identified using the same characteristics as adults (number of costal scutes, etc) but one needs to be careful since coloration can vary considerably.



Source: Sea Turtle Conservation – Research and Management Techniques; a GOI UNDP Project Manual

2.2 Tracks

Even though sea turtles can be identified by their tracks, this can be tricky. Tracks can vary between populations and even between individual animals, and hence it is essential for volunteers and field investigators to observe nesting turtles and note the characteristics of their tracks. Important features of a track are its width, body pit, and symmetry.

While some species (loggerheads, hawksbills and ridleys) make shallow body pits, green turtles and leatherbacks make large deep body pits. A symmetrical track is formed when the front flippers of the turtle move synchronously to pull the turtle forward, while an asymmetrical track is formed when the front flippers move alternately.

If the hatching season has started, one must also be alert for hatchling tracks, which are, of course, small, but usually numerous as the hatchlings would have emerged and crawled to the sea simultaneously. One can follow hatchling tracks to a nest, which can be uncovered to examine nest contents and estimate hatching success.

3. Nesting Turtles

3.1 Nesting Biology

Male and female turtles begin the reproductive cycle by migrating from their feeding grounds to the breeding ground. Feeding and breeding grounds may be separated by several thousand kilometers. Courtship and mating occur in the offshore waters of the breeding ground. Both males and females may mate with several different individuals. Several weeks after mating, the females come ashore to nest, mostly at night. They crawl above the high tide line, find a suitable nesting site, clear away the surface sand, and dig out a funnel shaped nest with their hind flippers. This may be two to three feet deep depending on the size of the turtle. They lay about 100 – 150 eggs in the nest and fill it with sand.

Behaviour particular to the Olive Ridley - they thump the nest with their body to compact the sand.



A nesting Ridley – Bivash Pandav.

Once the turtle starts laying eggs, they go into a trance and are less easily disturbed during this stage. They then throw sand around the nest for camouflage and return to the sea. Most turtles

nest more than once during a season, with roughly two weeks separating each nesting event. After they have completed nesting, they return to their feeding grounds until the next breeding migration.

Beach selection is affected by accessibility of the beach as well as height and substrate. Different turtles prefer different types of beaches to nest. For example, Olive Rيدleys and leatherbacks prefer wide beaches and sand bars at river mouths, while hawksbills and green turtles prefer small island beaches.

Sea turtles emerge frequently on nesting beaches and return without laying eggs, sometimes having constructed several nests. Scoring non nesting crawls¹ as nests can give a false account of nesting density. The best way to identify a nesting crawl is to locate the nest and eggs. This may not always be possible and other signs can be used to identify nesting crawls that were successful.

A false crawl can be determined when there is little or no sand disturbed apart from the tracks itself or considerable sand disturbed but with the crawl exiting from the disturbed area or when considerable sand has been disturbed and a body pit² or an uncovered egg chamber³ is noticed.

Amongst Rيدleys, false crawls can usually be determined from the complete absence of a nesting area or from half or fully excavated nest chambers that have not been covered.

3.2 Measuring Sea Turtles

Sea turtles are measured for a number of reasons, to relate body size to reproductive output, to determine minimum size at reproduction, and to monitor nesting female size at a rookery. Changes in size can be indicative of either declining or in some cases an expanding population.

As with all other data, measurements need to be precise. Error can creep into the measurements in many ways. Ideally the turtle should be measured by taking repeated measurements (by the same and different field investigators). In the event of a tape being utilized, it should be ensured that the tape measure is longer than the carapace, so that the reported length is the result of a single measurement. If any irregularity (such as deformity in the shell of the turtle) affects the measurement, it should be noted, and the measurements should not be used in the analysis.



Carapace of a dead Ridley – Harald Zindler

Carapace measurements One of the most common and accepted methods is the measurement taken from the anterior point at the mid-line to the posterior tip of the supracaudal. If the supracaudals are asymmetrical, then the measurement should be to the longer one. The

¹ tracks made by the sea turtle (not evidence of successful nesting)

² Excavation made by the turtle prior to digging the egg chamber. Rيدleys make practically no body pit at all, while loggerheads and hawksbills make very shallow body pits that may be difficult to detect. Green turtles and leatherbacks usually make deep body pits.

³ Cavity into which the turtle deposits the eggs (not evidence of successful nesting)

Curved Carapace Length (CCL) is measured using the same points on the turtle's shell. Carapace Width is measured at the widest part of the shell. Both the Straight Carapace Width (SCW) and Curved Carapace Width (CCW) should be measured with the turtle resting naturally on its plastron.

Tail Length The Total tail length is the distance from the midline of the posterior edge of the plastron to the tip of the tail following the curvature of the tail. The post cloacal tail length is the distance from the mid cloacal opening to the tip of the tail. Both measurements are taken using a flexible tape measure. Since tail length is a secondary sexual characteristic in turtles, the ratio of TTL to PTL is greater in mature males than in mature females, and can also be greater in immature males that are beginning to show sexual characteristics.

Hatchling turtles Hatchlings if measured, should be measured as described above, using calipers. Care should be taken not to distort the shell of the hatchling, which is very flexible.

3.3 Recommended Ground Survey Methodology

Locating a series of index beaches, daily monitoring on the index beach and periodic surveys conducted at regular intervals on the other stretches. The stretches of beach we will monitor on a daily basis are representative and accepted examples of index beaches. The monitoring of this identified stretch will provide much needed information on mortality rates, nesting trends and to a minor extent??(sentence incomplete?). The Devi region has been identified over the years as an important nesting beach area, representative of the nesting in Orissa. For the purpose of systematic and regular monitoring which is feasible, we have identified stretches of beach, which include *The Devi River Mouth to the Kadua River Mouth*, *The Kadua River Mouth to Chandrabagha*, *The Devi River Mouth area to Paradeep*. Monitoring of this kind is certain to provide critical and detailed information of nesting activity and density as well as mortality rates from direct observations as well as from track and nest counts. Appended below are templates which will be used to capture information.

3.4 NESTING STUDY – INDEX BEACH (DAILY)

DATE _____ TIME (Start & End) _____

FIELD INVESTIGATOR / TEAM _____

BEACH ZONE / STRETCH _____

SL #	DISTANCE FROM HIGH TIDE LINE	MEASUREMENT (CCL / CCW)	LOCATION OF NEST (INUNDATION / VEGETATION)	REMARKS / TAGS

COMMENTS



Nesting Beach at Gahirmatha inundated by tidal action – Bivash Pandav

patterns off-shore in this area. However, the company is planning to start construction on the Dhamra Port Project shortly.



Dead Turtles, trapped in Gill Nets – Bivash Pandav.

4.1 Methodology

A commonly used index of threats to sea turtle populations is enumeration of stranded turtles i.e. turtles that wash up injured or dead on the beach after drowning in fishing nets. It may be difficult to deduce what kind of net (gill net, trawl net, etc.) the turtle was trapped in. Furthermore, many turtles that die in fishing nets may never wash up on the beach. Some estimates suggest that as few as 10 % of the turtles that drown as incidental catch wash up on the beach. Even so, the number of dead turtles during a season can provide a good index of the degree of threat and whether conservation activities are having an impact.

Our land-based operations would include maintaining a detailed census of dead turtles washed ashore; to provide a good index of the mortality in the Devi region. Field investigators would be required to note information about carcasses which may help identify the source of the threats. The total stranding (mortality on shore) count is still useful, since it can be combined with other information to deduce what the threats are.

We would be in a position to provide detailed information, given our presence over 4 months. Data can be used to identify sources of mortality, document locations of conservation concern, evaluate the effectiveness of regulations, and help make management decisions. The local community groups will assist, acting as regional coordinators for our team, training participants and assisting in coordinated data collection. The mortality survey will be carried out from January to April, on a daily basis. Dead turtles, which have been recorded will be marked / painted to ensure that there is no duplication and to avoid recounting.

Some of the parameters for data collection would include:

- *Observer's name and contact information*
- *Stranding date*
- *Stranding location with reference to local landmark (where relevant) and GPS position if possible.*

- *Species identification*
- *Sex identification.*
- *Condition of turtle (Alive, fresh dead, moderately decomposed, severely decomposed, dried carcass, skeleton or carapace)*
- *Tags, if any*
- *Remarks (gear or debris entanglement, oil or tar, wounds, propeller damage...)*
- *Final disposition of turtle (painted - left on beach; buried; salvaged for cold storage; unpainted - left on beach)*

Appended below is the template which is used to capture information pertinent to stranding (mortality statistics on shore).



Rising Mortality Count - Decomposed Olive Ridley on Devi Beach

4.2 MORTALITY STUDY DATA SHEET

DATE _____ TIME (Start & End) _____

BEACH NAME / ZONE / STRETCH _____

FIELD INVESTIGATOR / TEAM _____

DISTANCE STUDIED _____

SL #	SEX	MEASUREMENT (CCL / CCW)	STATE OF CARCASS	REMARKS / INJURY / TAGS

COMMENTS

5. Hatchlings

Mortality is highest during the early phase of a turtle's life. They are most vulnerable to anthropogenic factors. Even under natural conditions, only one in a thousand hatchlings is believed to survive to adulthood. The hatchlings develop in their nest over a period of 7 to 10 weeks. They hatch over a few days and then emerge from the nest together usually at night. Predators include crabs, birds, jackals, feral animals on land, and many fish once they are in the sea. Once in the sea, the hatchlings spend the first couple of days in a juvenile frenzy when they use stored energy reserves to get to the open sea. Beyond this, they spend many years in a variety of habitats until they join other adults at feeding areas.

Temperature dependent Sex Determination Lower temperatures produce males, higher temperatures produce females. The sex of the hatchling is determined during the second trimester of development.

Orientation and Navigation Hatchling emergence is nocturnal to avoid predators and sunlight. Sea finding is visual and the hatchlings seek a "brighter horizon", usually the moon or starlight reflecting off the surface of the sea. They also use silhouettes of sand dunes to orient themselves

towards the sea. As soon as they enter the sea, they find the open sea by swimming against the direction of the waves.

The Lost Years Hatchlings spend their lives in a variety of foraging habitats. Sargassum drift lines (seaweed rafts) have been found to be particularly important. The juveniles and sub adults of some species spend many years in near shore developmental habitats after the pelagic stage. Development to maturity may take 10 to 15 years in most turtles and maybe 30 years or more in the herbivorous green turtles.



Hatchlings emerging from the nest – Bivash Pandav

5.1 Monitoring of Nests

Information gathered on nests is crucial as well. Turtles sometimes lay some abnormal eggs, including yolkless eggs (which are much smaller than usual) and multi-yolked eggs. Yolkless eggs should not be counted, while multi-yolked eggs are counted as single eggs. In natural nests, the clutch size⁴ can be estimated after the emergence of hatchlings.

Excavation As part of our monitoring work, as hatchlings emerge, another area where we could contribute to critically is in the monitoring of nests, to estimate emergence and success rates of hatching.

KEY

- | | |
|--|---|
| * S -Shells (No. of hatched out empty shells) | * E -EmergEd (Hatchlings that have emerged from the nest). |
| * LIN -Live in Nest (Live Hatchlings in nest) | * DIN -Dead in Nest (Dead Hatchlings in nest) |
| * DPE -Dead hatchling in pipped egg | * LPE -Live Hatchling in pipped egg. |
| * P -Predated (Open, partial) | * UD -Unhatched, undeveloped eggs with no obvious embryo |
| * UH - Unhatched eggs with obvious small embryo | * UHT - Unhatched full term embryo |

Definitions

- **Pipping** - The breaking / opening of the shell by the hatchling
- **Shells** - The number of hatched shells (shells are also left broken? from predation) is difficult to count. Only shells that are > 50 % of the egg must be counted; small fragments must not be counted.
- **Undeveloped eggs** - Some of these may be either infertile, but others may have a very small indiscernible embryo, which cannot be discerned without careful, detailed examination, and adequate equipment and training.

5.2 Calculation of Clutch Size

Based on the above key, a clutch size can be determined quite easily. In the scenario where the number of emerged hatchlings is known, the clutch size is calculated on the basis of a simple formula $CS = (E + LIN + DIN) + (UD + UH + UHT + DPE + LPE) + P$. In the event where the number of emerged hatchlings is not known, this number could be estimated with the following calculation $E = S - (LIN + DIN)$

Calculating hatching & emergence success

If the clutch size determined by counting hatchlings, then **Emergence success (%)** = $(E / CS) \times 100$ and **Hatching success (%)** = $((E + LIN + DIN) / CS) \times 100$. If the clutch size is determined by counting egg shells, then **Emergence success (%)** = $(S - (LIN + DIN)) / CS) \times 100$ and **Hatching success (%)** = $(S / CS) \times 100$. The following template will be used for the capture of information pertaining to nests.

5.3 NEST DATA SHEET

DATE _____	TIME _____
FIELD INVESTIGATOR / TEAM _____	
NEST LOCATION _____	DISTANCE FROM HTL _____
DIMENSIONS OF NEST _____	
CLUTCH SIZE _____ (Refer to the Key)	
COMMENTS	

6. Marine Monitoring

The Ridley population that occurs along the coast of Orissa has suffered severely over the past decades. Apart from the threats faced while nesting, marine turtles are particularly vulnerable when they aggregate offshore. The interactions between turtles and the fisheries sector are inevitable in a region like Orissa, the outcome of which has not always been favorable for the turtle. The heavy human induced mortality of several thousand breeding individuals along the coast of Orissa has been an alarming concern over the past several years. Incidental capture and mortality resulting from such capture are the most profound threats to the ridley.

While most conservation efforts have focused on protecting nesting habitats, protection in the marine environment has been minimal. Any information on the offshore ecology of the ridley is crucial. Given the complexities at sea, as part of our ongoing monitoring and documentation, we will adopt a minimalistic research component to aid in the ongoing conservation effort (from a

scientific perspective). Information of this kind would help to some extent in getting an idea of the intensity of off-shore congregation and mating that occurs in the vicinity of the rookeries for the turtle season of 2005-2006.

MARINE MONITORING – REGULARLY (6.1; 6.2; 6.3; 6.4)

CONGREGATION	Sighting (Number)	
	Location (GPS)	
	Date	
	Time	
	Plot Recordings (With respect to GMS and Distance from Coast)	



A solitary ridley turtle surfaces in the congregation zone – Biswajit Mohanty.

MATING	Sighting (Number)	
	Location (GPS)	
	Date	
	Time	
	Plot Recordings (With respect to GMS and Distance from Coast)	



Mating pair of turtles in the congregation zone

CETACEANS	Sighting (Number)	
	Location (GPS)	
	Date	
	Time	
	Plot Recordings (With respect to GMS and Distance from Coast)	

TURTLE MORTALITY	Sighting (Number)	
	Location (GPS)	
	Date	
	Time	
	Mortality (Cause / Type of fishing gear involved if any)	

FISHERY VIOLATION	Name of Vessel	
	Type of Vessel	
	Location	
	Date	
	Time	
	Plot Recordings (With respect to GMS / No Fishing Zone and distance from Coast)	

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