CENTRE FOR ECOLOGICAL SCIENCES AND DAKSHIN FOUNDATION

MONITORING OLIVE RIDLEY TURTLES AT RUSHIKULYA, ODISHA

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Bangalore 560 092.

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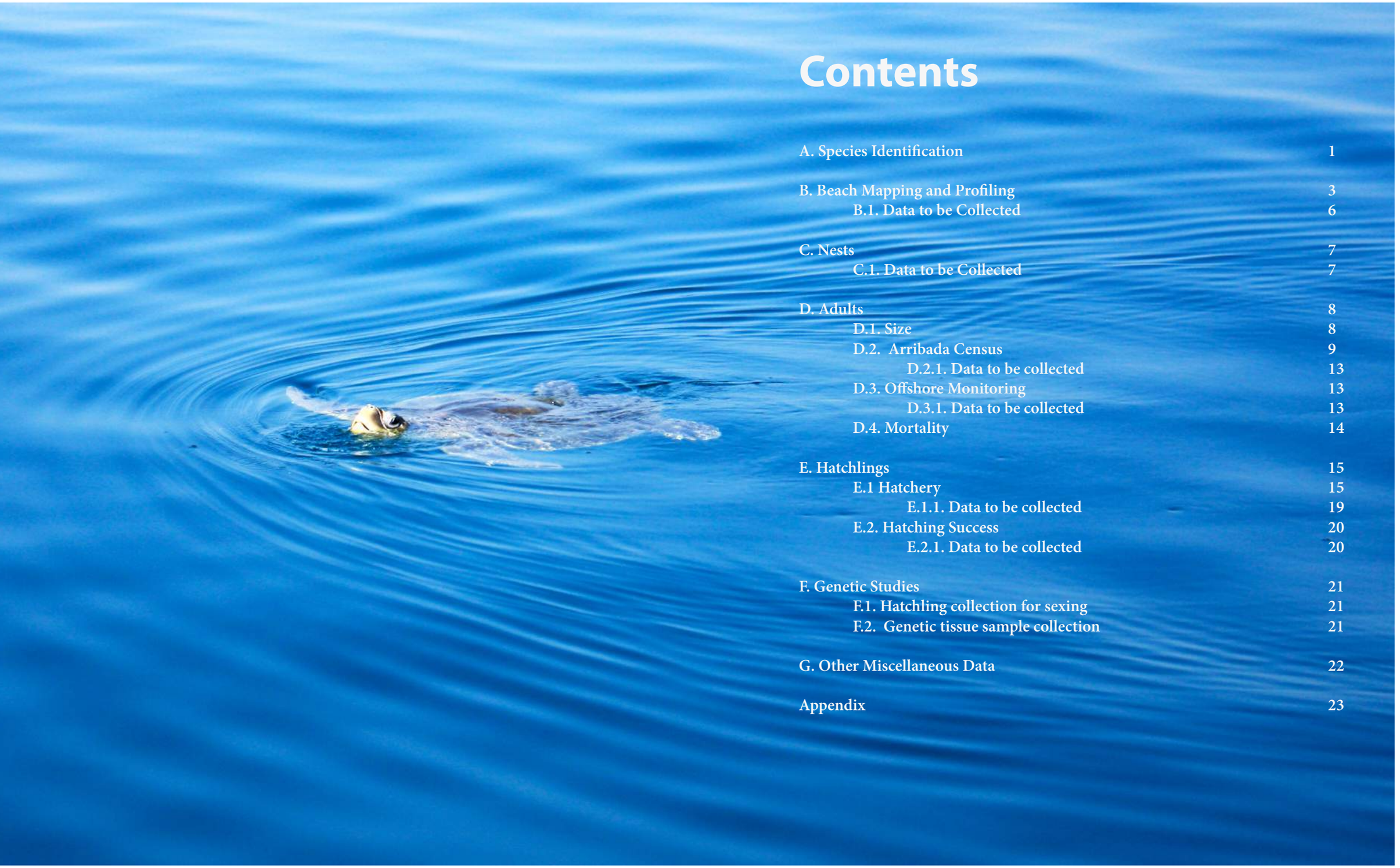
Citation:
Manoharakrishnan, M, A. Swaminathan, R. George
and K. Shanker. 2020. Monitoring olive ridley turtles at
Rushikulya, Odisha. Dakshin Foundation, Bangalore.

Cover Photo:
Adhith Swaminathan



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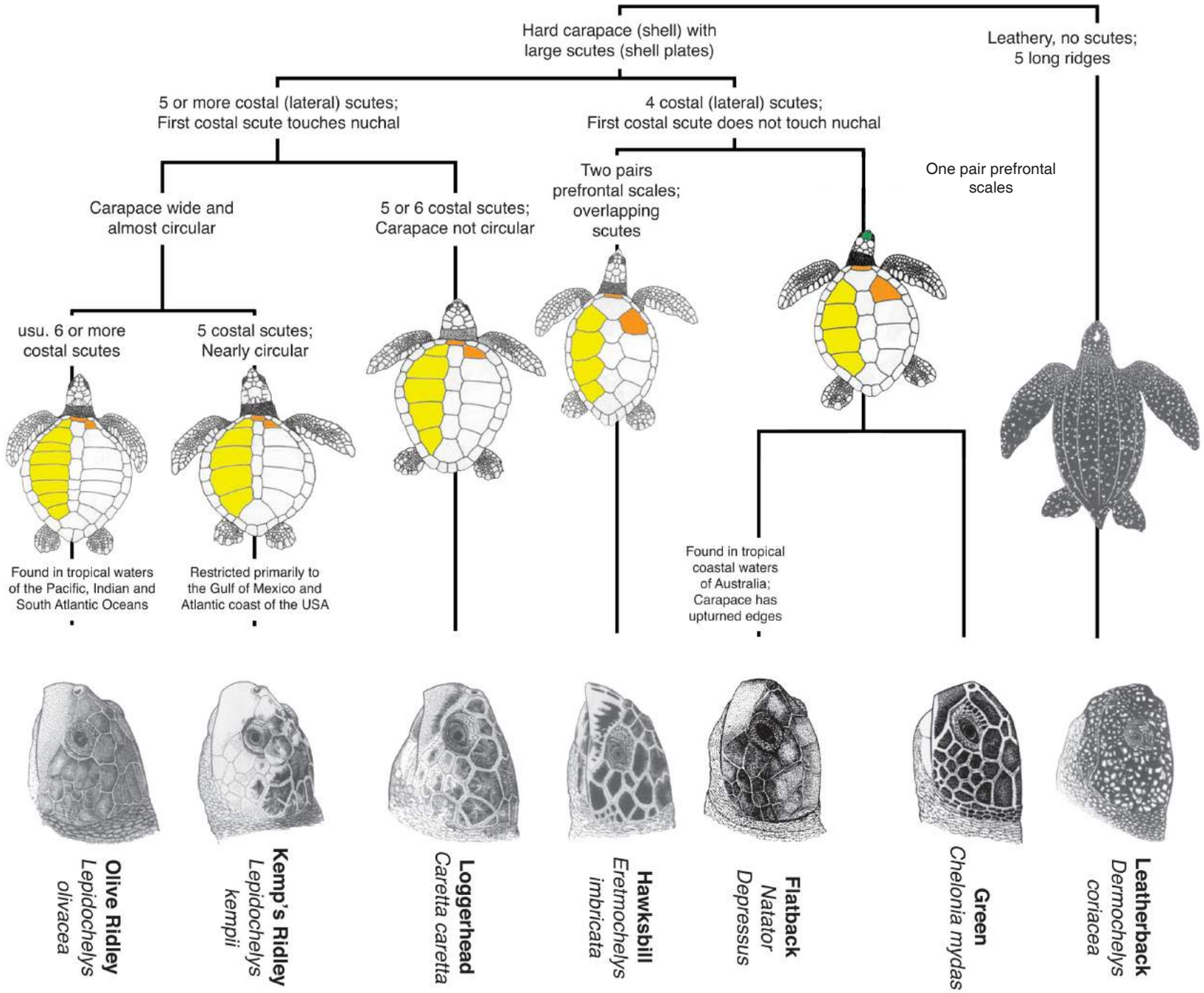
A. Species Identification



THREE OF THE SEVEN SPECIES OF SEA TURTLES HAVE BEEN RECORDED IN RUSHIKULYA, ODISHA, THOUGH ONLY OLIVE RIDLEYS NEST AT THIS ROOKERY:

1. Olive Ridley
(Lepidochelys olivacea)

2. Hawksbill
(Eretemochelys imbricata)

3. Green
(Chelonia mydas)

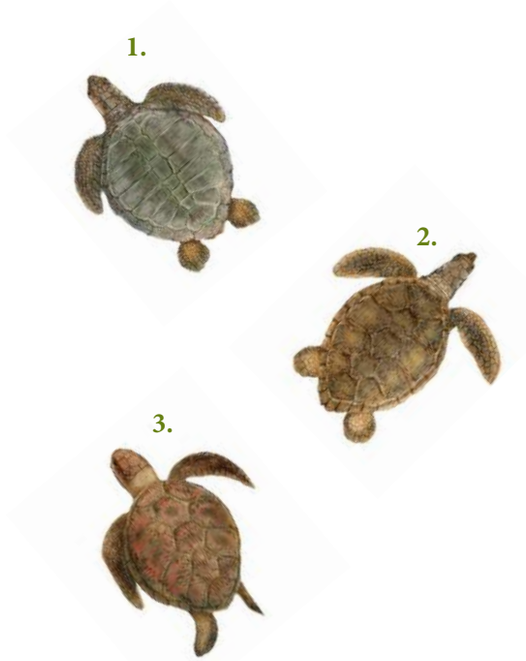


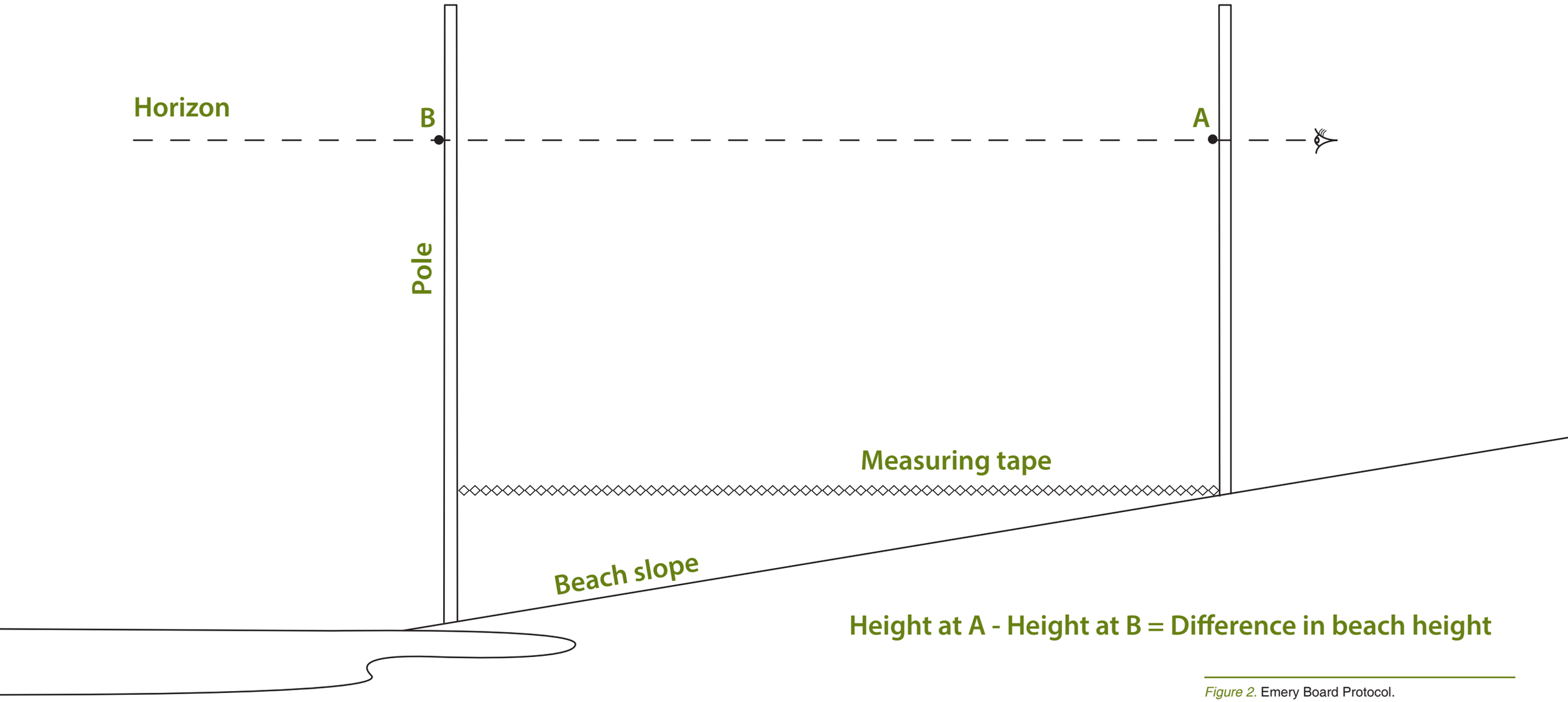
Figure 1. Species identification key.

Source: Pritchard, P.C.H. and Mortimer, J.A. 1999. Taxonomy, External Morphology, and Species Identification. pp. 21-38. In: Eckert, K. L., Bjorndal, K. A., Abreu-Grobois, F. A. and Donnelly, M. (Eds.) 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4. Washington, DC: 235 pp.

B. Beach Mapping and Profiling

Beach mapping was initiated at Rushikulya in 2010, experimenting with various techniques, including the 'Emery board' method. Due to the dynamic nature of beaches located at estuarine areas, it has been difficult to set up permanent mapping points. Graduated aluminium poles are used for beach mapping, one placed at the vegetation line and the others along the contours of the beach until the low tide-line mark.

One observer stands at the first pole (A) and looks towards the second pole (B) where another observer moves a stick/pen until it matches the line of sight of observer 1 to a reference line (usually the horizon or with the dune crest if the beach slope is high).



Height at A - Height at B = Difference in beach height

Figure 2. Emery Board Protocol.

Figure 3. 1,2,3 : Observers mapping and profiling the beach using the Emery Board method.

B.1. Data to be Collected

GPS location of the beach mapping point (this should ideally be at the same location for every mapping event), height of pole (A) at observer 1, height of pole (B) at observer 2, distance between poles (standard distance used is 15m) and presence of vegetation. The slope of the beach at each point can be calculated using trigonometry.

TABLE 1. GPS LOCATION OF BEACH MAPPING SEGMENTS AT RUSHIKULYA

Segment ID	Latitude	Longitude
Nuagaon Village	19□21.366	085□02.737
Nuagaon End	19°22.337	085□04.339
Rushikulya River	19°22.010	085□03.896
Purunabandha	19□22.249	085□04.226
Gokhurkhudha	19□39.718	85□08.995
Podampetta	19□24.406	085□05.845
Bateshwar	19°25.393	085°07.123

C. Nests

C.1. Data to be Collected

1. DATE AND TIME
2. TIDE
3. NESTING / FALSE CRAWL
4. NEST NUMBER
5. CLUTCH SIZE
6. DISTANCE FROM TIDE LINE
7. SEGMENT NUMBER (SOUTHWARD) AND GPS LOCATION
8. PREDATION DATE AND TIME (IF APPLICABLE).

The observer(s) should conduct walks during night hours looking for nesting turtles and any nesting activity, while noting false crawls and covered nests. All nests encountered should be noted along with the segment number at which it was observed. The entire nesting beach must be covered at least once during the night patrol.

When a nest or turtle is encountered during a night patrol:

(1) Note down the date, time and the tide. The tide is marked on the basis of water movement i.e. when the tide is coming in and when the tide is going out.

(2) Assess the nesting area to check if the turtle has nested. If she has not nested, note it as a false crawl in the data sheet.

(3) Record the GPS location of the nest or, in the absence of a GPS, record the segment number (south of the nest). This can also be done during the day.

(4) Monitor each nest on a regular basis to record any evidence of predation. If a nest is predated, write down the date and nest number on the data sheet.

(5) If a turtle is encountered, follow the instructions in the next section.

D. Adults

D.1. Size

Upon encountering a nesting turtle, the observer(s) should record the Curved Carapace Length (CCL) and Curved Carapace Width (CCW) (to the nearest cm) whenever possible for all sea turtles encountered using a flexible tape measure.

CCL: The “notch to tip carapace length” is measured from the anterior point at midline to the posterior tip of the supracaudal scute. If the supracaudals are asymmetrical, then the measurement should be to the longer one.

CCW: Record the maximum distance between the lateral edges of the carapace, measured over the curvature of the shell, perpendicular to the longitudinal axis of the carapace at the widest point.

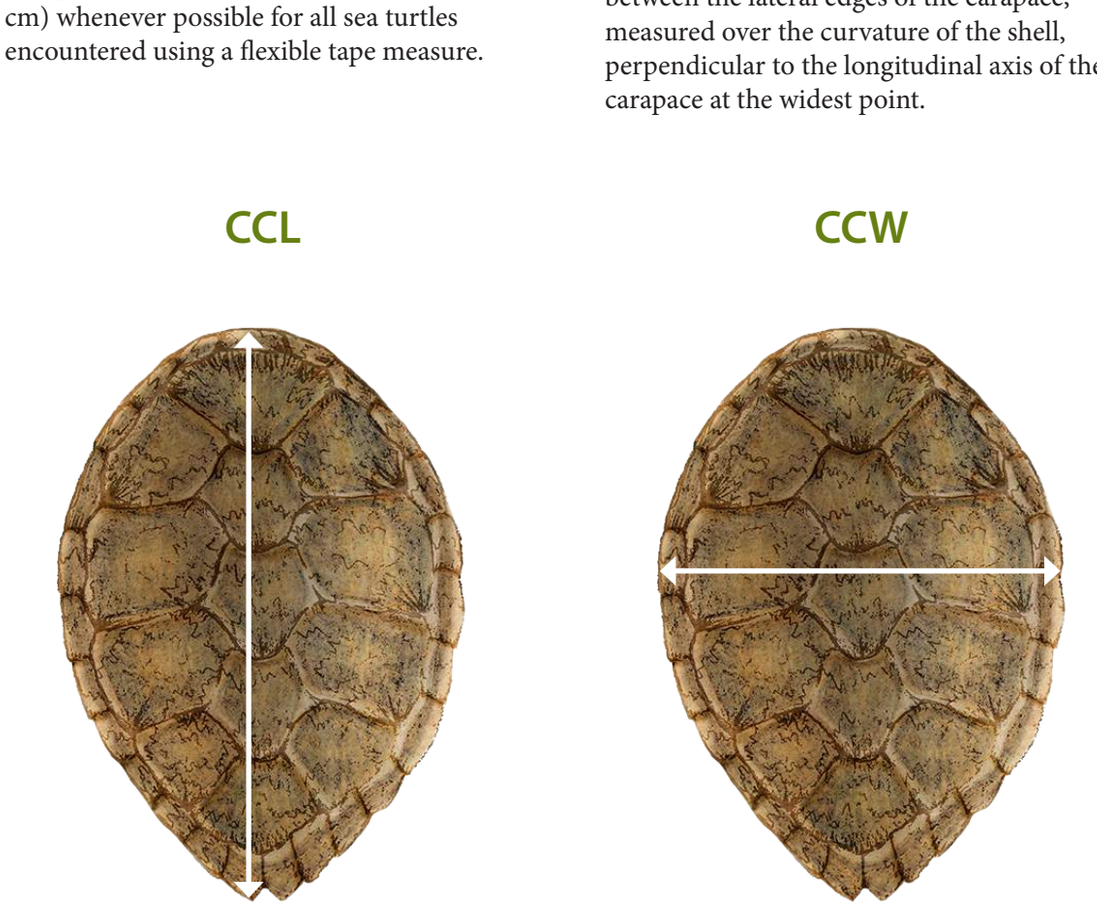


Figure 4. Carapace length and width measurements for hard-shelled turtles.

D.2. Arribada Census

The arribada counts should begin when more than 100 turtles are observed nesting at a given point of time. If > 100 turtles are observed during a single night, the team should be prepared to start conducting counts the following afternoon/evening. The beach should be divided into segments of 100m, and sub-segments of 5m and 20m should be marked. Hourly counts should be carried out in each sub-segment for the number of unambiguous egg laying females, determined by flipper position during oviposition (Figure 6).

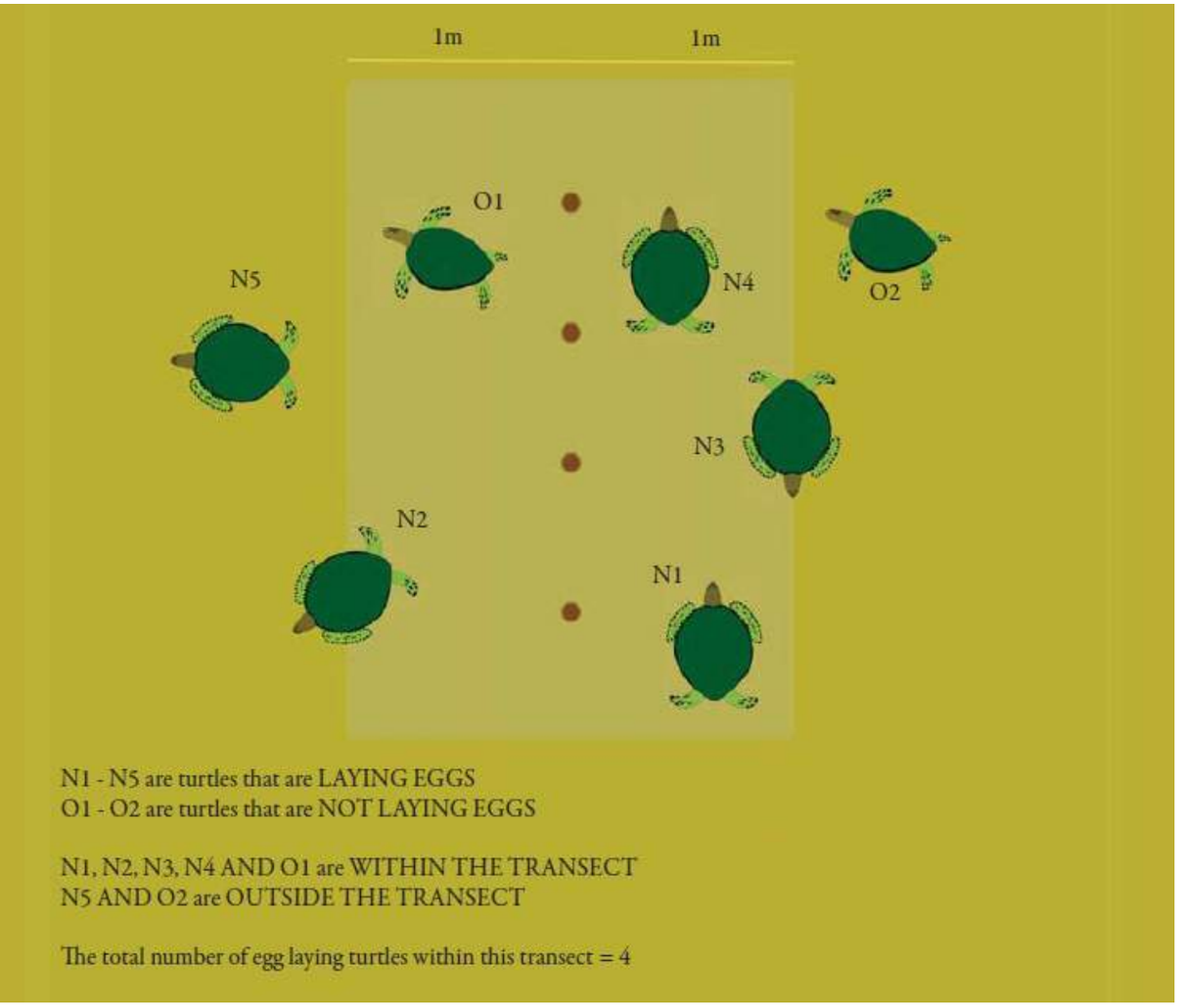


Figure 6. Arribada census techniques.

Ideally, a team of two people should patrol 5 segments and carry out counts every hour from the beginning of the nesting event till it stops (might be a period of 12 hours every day). These counts should take place over the entire mass nesting period (2-6 days).

Every night, at least one team should calculate the average oviposition duration (OPD) for nesting females (~30 per session). The oviposition duration is the time taken for a nesting female to begin laying her first egg up till she starts covering the egg chamber with sand. Morphometric measurements (Curved Carapace Length and Curved Carapace Width) should be recorded for all turtles for which OPD is recorded. Carapace measurements of an additional ~ 300 adult females should be recorded during the arribada.

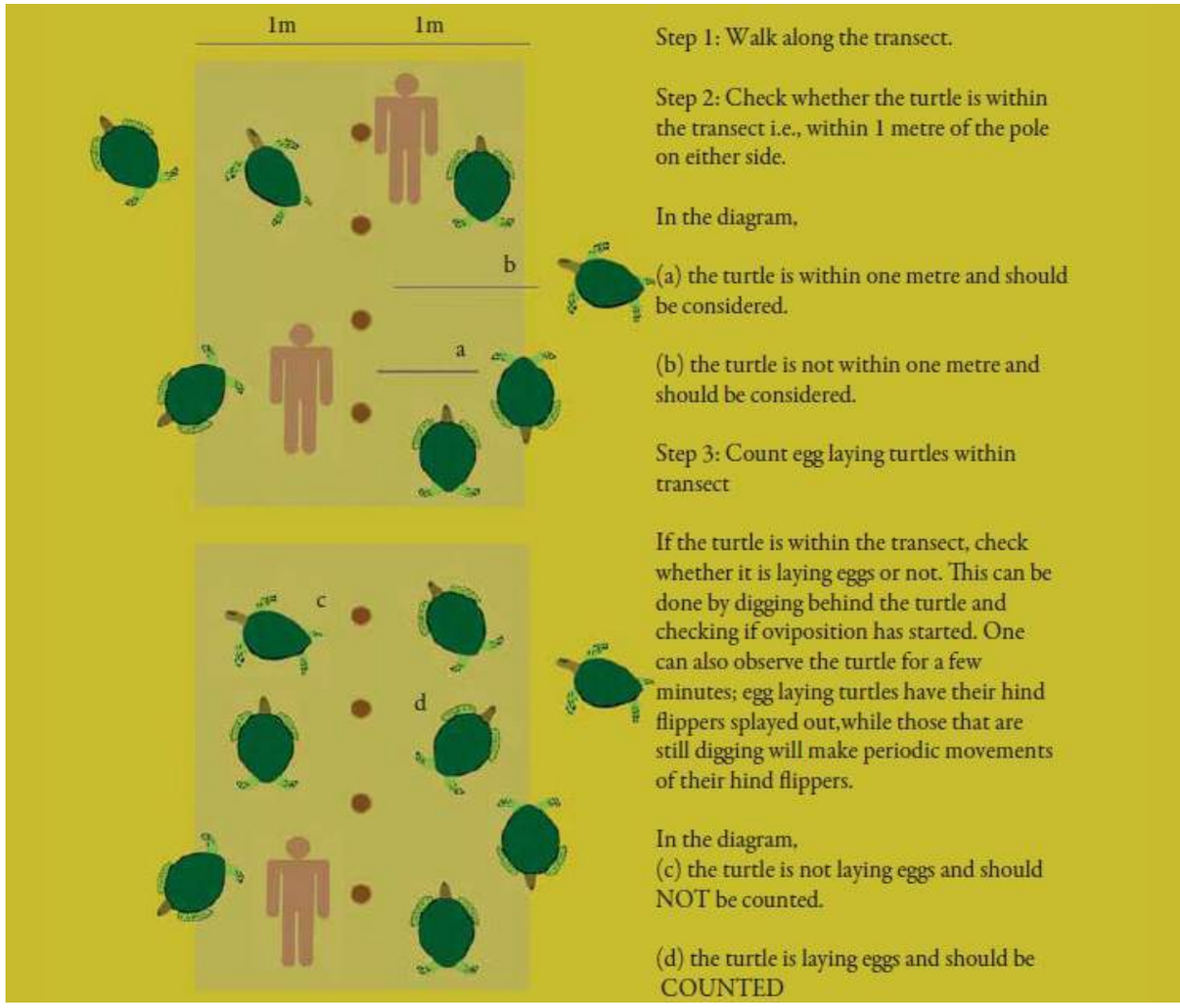


Figure 7. Marking and counting only ovipositing turtles during hourly counts.

Figure 8. Measuring and noting CCL of nesting turtles.

D.2.1. Data to be collected

1. SEGMENT-WISE HOURLY COUNTS OF OVIPOSITING FEMALES.
2. BEACH WIDTH OF EACH SEGMENT AT THE WIDEST SECTION.
3. AVERAGE OVIPOSITION DURATION (ONLY DURING MASS NESTING).
4. MORPHOMETRICS (IN PARTICULAR CCL) OF AS MANY INDIVIDUALS AS POSSIBLE.

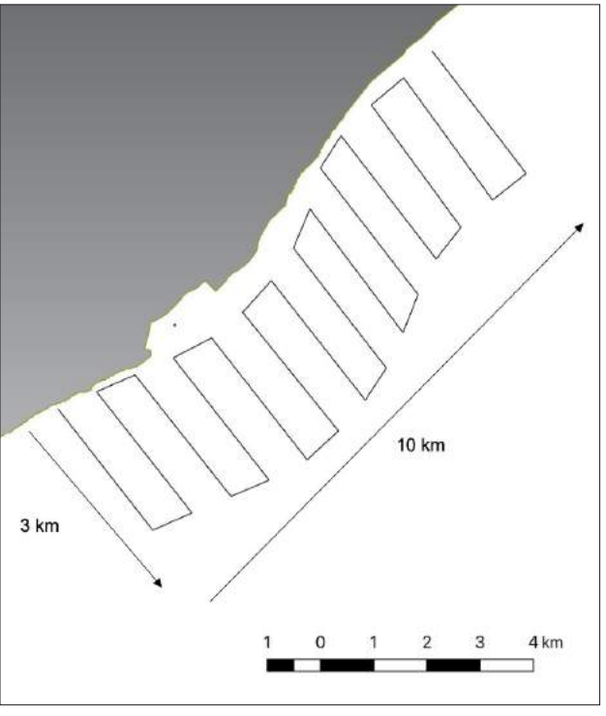


Figure 9. Transect design.

D.3. Offshore Monitoring

A line transect approach is followed to measure the offshore abundances of turtles during the breeding season. Offshore sampling is carried out along the entire Odisha coast during some years. The sampling locations at each major river mouth where turtles congregate have been pre-drawn. Suitable sampling locations have been pre-drawn using GIS platforms from every major river mouth where turtles congregate. A total of 9 locations are to be sampled namely Bahudha, Rushikulya, Chilika, South Devi, Devi, Jatadhara, Hukitola, Gahirmatha, and Chandipur.

There are 14 perpendicular transects (each 3km long) and 800m apart. The transects are in a zigzag pattern and cover an area of ~30 km^2. Offshore transects at all sites are to be carried out ideally once a season for all sites within a span of ten days. The offshore transects at Rushikulya are to be carried out at least once a month between December and March.

The boat must traverse the transect at a constant speed (6-10km/h) while one observer on either side of the boat records observations and data (described below). Make sure that there are an adequate number of data sheets and extra batteries for the GPS.

D.3.1. Data to be collected

As the transect starts, the following data should be noted: sea condition (qualitative information on a Beaufort scale), the time of transect, etc. Upon sighting a turtle, the sighting distance (visual estimation to an approximation of 50m), sighting angle (visual estimation to an approximation of 10 degrees), direction (left/port or right/starboard side of the boat), and distance to be covered till end of the transect should be noted (estimated based on GPS movement). Distinguish between single surfacing turtles and mating pairs. One should collect water samples for salinity, conductivity measurements (TdS), and measure water depth using a depth sounder at every 1km segment along the transect. All samples are to be stored in suitable storage vials.

Figure 10. Observing turtles on either sides of the boat during offshore transects.

D.4. Mortality

The observer must also collect data on dead turtles washed ashore. The observer must look for signs of injury or any other evidence to infer cause of death and collect CCL and CCW (see above) when dead turtles are encountered depending on convenience and decomposition of the carcass.

E. Hatchlings

E.1 Hatchery

A basic hatchery accommodating 30 nests can be built for ~ INR 5000 (estimated in 2020). The hatchery can be setup with a small mesh-size net (smaller than a hatchling's head to prevent entanglement after emergence), approximately 6-8 feet high, and of the appropriate length. Wooden stakes (e.g. Casuarina poles) can be used to support the net along four corners. 1 foot of the fencing net needs to be buried in the sand along the sides to prevent entry of predators. A simple door of sticks and a chain and lock can be used for the entrance. Each relocated nest must be placed ~2m apart and placards containing the nest details can be used to mark each nest site in the hatchery.

The onset of the southerly winds (after mid-February) could cause high accumulation of sand in an enclosed hatchery. This can be prevented by placing a small barrier on the southern facing side of the hatchery (cloth stitched along the bottom 2 feet of the fence on one side is sufficient or *Pandanus* bushes or palm leaves will suffice if maintained well). Further, placing strong bamboo baskets with their base cut off (to prevent the basket from shading the nests and altering their incubation temperatures) over each nest can prevent the nests' burial by the southerly winds. This also helps during hatchling emergence as all hatchlings from each nest can be collected separately and released into the sea, thus, helping keep track of number of hatchlings emerging per nest.

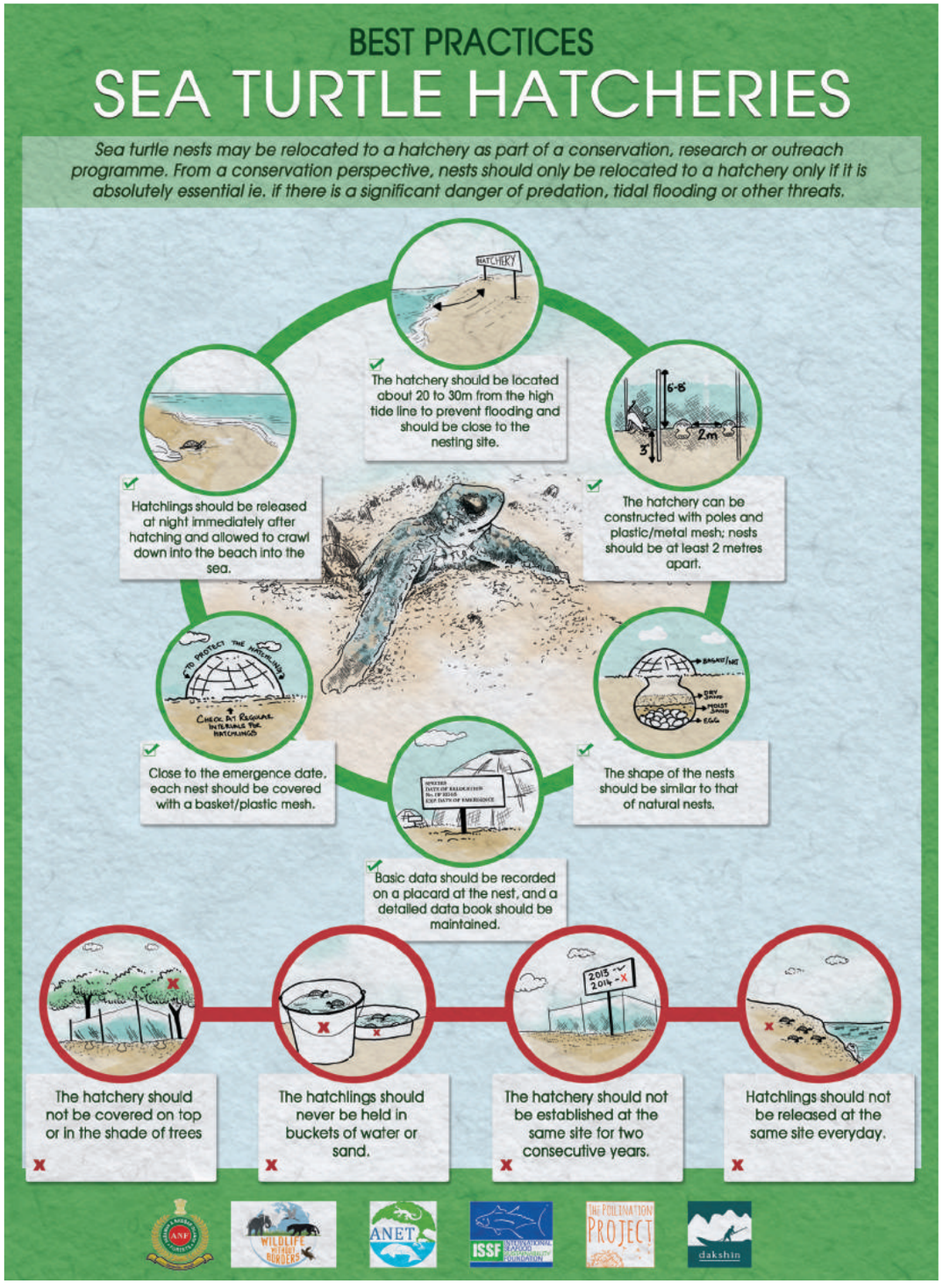


Figure 11. Best practices for sea turtle hatcheries.

Figure 12. 1. Excavation of freshly laid nest and relocating eggs, 2. Excavating nest in hatchery using measurements from wild nests, 3. Maintain distance between nests within hatchery, 4. Label and note down details of all relocated nests.

E.1.1. Data to be collected for nests relocated to the hatchery

Care should be taken while collecting the eggs before relocating the nest using globally approved standard protocols and, if the nesting female is encountered, its morphometrics should be recorded. Measurements (to the nearest cm) of the nest dimensions (total depth, neck depth, chamber width and neck width) should be recorded to replicate the nests in the hatchery. Any abnormal, yolkless and multi-yolked eggs are to be noted separately and not included in clutch size. The clutch size, date and time of nest being laid should be noted and the expected date of hatching can be calculated (~45-50 days). If data loggers are placed in the clutch, they should be located at the bottom of the nest cavity on the seaward side or in the middle of the egg mass. Nests are to be collected equally spaced over time (10 in December and 10-15 during mass nesting and after mass nesting till mid- March).

Once the hatchlings emerge, they should be counted and released close to the high tide line. All other details for calculating hatching as well as emergence success for the hatchery have to be collected (Total emerged, Shells, Live in nest, Dead in nest, Live in pipped egg, Dead in pipped egg, and Unhatched)

Dead hatchlings from the nests are to be collected and preserved in 10% formalin solution, with all the nest details noted and labelled on sample collection jars. If blood/ tissue samples are being collected from live hatchlings as well as adult females for assessment of paternity or other studies, these are to be preserved in alcohol and labelled accordingly.

E.2. Hatching Success

After emergence of hatchlings from any nest on the beach, hatching success should be determined. Each individual nest can be identified by a depression in the sand caused after the hatchlings emerge and/or from hatchling tracks around the nest.

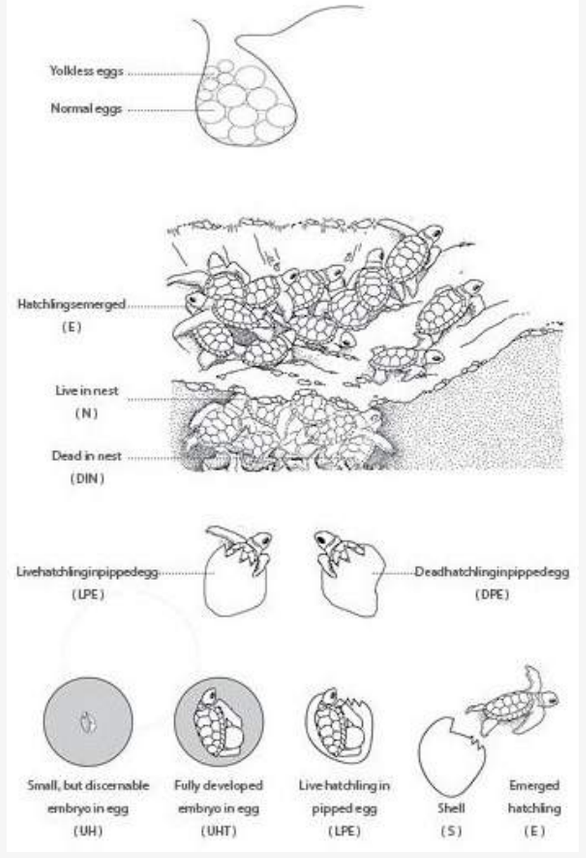


Figure 13. Contents of a hatched nest.

E.2.1 Data to be collected

Each nest should be carefully excavated and all the following information from the nest should be recorded:

E= Emerged Hatchlings, T= Tracks, S = Shells, LIN = Live in Nest, DIN = Dead in Nest, DPE = Dead hatchling in pipped egg, LPE = Live hatchling in pipped egg, UD = undeveloped eggs with no obvious embryo, UH = Unhatched egg with obvious small embryo, UHT = Unhatched egg with full term embryo, P = Depredated

The following metrics can then be calculated:

CS (Clutch size) = S + (UD + UH + UHT + DPE + LPE) + P + UF
OR (E + LIN + DIN) + (UD + UH + UHT + DPE + LPE) + P

Note: Any abnormal, yolkless and multi-yoked eggs are to be noted separately and not included in clutch size.

Hatching success (%) =
(S+LPE/ CS) x 100

Emergence success (%) =
[S – (LIN+ DIN) / CS] × 100

F. Genetic Studies

F.1. Hatchling collection for sexing

IMPORTANT NOTE: LABEL ALL SAMPLES LEGIBLY AND DOUBLE CHECK TO MAKE SURE ALL SAMPLE BOTTLES & VIALS ARE SEALED PROPERLY & NOT LEAKING.

(1) Dead hatchlings from each nest must be collected and counted after excavation.

(2) Dead hatchlings must be sliced under the forelimbs such that the majority of their torso, along with the hindlimbs and the tail, remain as one piece.

(3) The portion containing torso, hindlimbs and tail can be placed in a hatchling sample bottle with 10% formalin solution.

(4) The hatchling sample must be completely immersed in the formalin solution.

(5) Only hatchlings from a single nest in the hatchery should be placed together in a bottle. Samples collected from nests on the beach can be placed in a single large container, if necessary.

(6) The details on the bottle must be recorded using a permanent marker.

(7) The data sheet must be filled corresponding to every hatchling sample bottle.

F.2. Genetic tissue sample collection

(1) Cut a small portion of the forelimb of a dead hatchling before preserving in formalin. It is best to collect some muscle tissue, which can be obtained by taking a piece from near the shoulder rather than the tip of the flipper.

(2) Place it in a cryopreservation vial (small tubes).

(3) Immerse it in absolute alcohol.

(4) Take tissue samples from two dead hatchlings per nest where possible, and make sure that the vial numbers are correctly identified against the nest identity in the data sheet.

(5) If tissue is also collected from the nesting female, it is best to collect some muscle tissue, which can be obtained by taking a piece from near the shoulder rather than the tip of the flipper. The sample vials with the maternal tissue and the corresponding hatchling tissue should be labelled appropriately and placed together.

I. Other Miscellaneous Data

Other miscellaneous data e.g. injury scars on turtles, unusual behaviour, poaching of live turtles, etc. can be recorded in the data sheets. For additional experiments, e.g. light and hatchling orientation, the protocol followed and data collected should be noted in detail and communicated to the project supervisor.

Figure 14. Conducting orientation experiments using hatchlings.

Appendix

1. Sample Data Sheets with Examples

A. BEACH MAPPING DATA SHEET

Segment	Segment ID		Distance (m)	Coordinates	Elevation (cm)	Elevation (m)	Vegetation(cm)	Comments
1	I	A	15	160	54	0.54	No	
		B		106				
	II	C	15	144	-13	- 0.13	No	
		D		157				
	III	E	15	128	- 24	- 0.24	No	
		F		152				
	IV	G	15	173	22	0.22	No	
		H		151				
	V	I	15	175	95	0.95	No	
		J		80				
2	I	A						
		B						
	II	C						
		D						
	III	E						
		F						

B. NEST DATA

Date	Nest No.	Species	Tide	Encounter Time	Nested/ False Crawl	Distance from HTL (M)	Nest Condition	Date of Event	GPS ID
25/12/2019	2	Olive Ridley	H.T	12:30 A.M	Nested	12	Protected	25/12/2019	1766

C. ADULTS

Tag No. New	Tag No. Old	Tissue Sample	Left Flipper External tag no.	Right Flipper external tag no.	CCL	CCW	O.P.D (Mins:secs)	Remarks
0007719DFB	NA	O.R-1	1756	1757	167	145	9:30	
000771E208	0007719FC2	O.R-2	1799	1800	160	140	N.A	Turtle had finished nesting

D. CLUTCH SIZE AND EGG MEASUREMENTS (mm)

Nest No.	Species	No. Of Eggs (Normal)	No. of Abnormal Eggs	Total No. of Eggs	Egg 1	Egg 2	Egg 3	Egg 4	Egg 5	Egg 6	Egg 7	Egg 8	Egg 9	Egg 10
30	OR	90	32	122	55	54	55	56	55	55	55	54	53	56
38	OR	70	10	80	52	51	50	53	52	52	52	53	51	51

E. HATCHING SUCCESS

Date	Hatched Date	Species	No. of Normal Eggs	No. of Abnormal Eggs	No. Small/UF (S)	Live	LIN	DIN	DPE	LPE	UH	UF (B)	UF (S)	SHELLS	TRACKS	HS %	Remarks
11/14/2010	1/22/2011	OR	120	82	38		67	2	4		9		38	69		57.5	
11/17/2010	1/25/2011	OR	85	85			70	4	2		9			74		87.05882	Roots in Nest

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WITHOUT
BORDERS