

Changes in sediment texture by turtle mass nesting at Rushikulya rookery

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Received 02 August 2017; revised 08 January 2018

The sandy beach is one of the most rigorous habitats for organisms on earth; however, the number of species represented is limited due to sediment deposition, transport and erosion by wind, wave, tide, current and fluvial supplies. The nature of sediment type, compactness and its changes play a vital role in beach habitat and its stability. Several studies have been carried out by numerous researchers to find out textural behaviour and its variability along the coast over last decades^{1,2,3}.

The beach sediment changes that occur naturally and due to human interference are well studied whereas the change of textural behaviour due to the mass nesting (arribada) of Olive Ridley Sea Turtles are underestimated at the nesting site along Odisha coast. Olive Ridley sea turtles are gentle, ancient reptiles adapted to life in the ocean, identified as endangering species under threat. At certain times of the year, egg-bearing females must come ashore to lay eggs deep in the warm sand of tropical beaches. The nesting site is influenced by several environmental factors, such as moisture of the beach, sediment characteristics, compaction, temperature range, human activity⁴ and favourable conditions as beach slope, wind direction and sea level², which is observed in February to April, mostly for the site interest. The nest cavity dug with the rear flippers and ~ 100 to 150 eggs are laying and covered with sand⁵. Present study exhibit the changes on sediment environment due to *arribada* of Olive Ridley sea turtles at Rushikulya rookery (Fig. 1).

Olive Ridley turtles migrate every winter to the Odisha coast and nest en mass at three major rookeries, viz., Gahirmatha, Devi, and Rushikulya. Conspicuously, the major nesting sites fall either on islands or unstable beaches adjacent to river mouths. Rushikulya rookery along south Odisha coast (Fig. 2),

discovered as a world-wide mass nesting site for Olive Ridley sea turtle (*Lepidochelys olivacea*), extended approximate 5km of the beach located immediately north of the Rushikulya river mouth from Purunabandha to Kantiagada village⁶. A total of 3.09 lakh turtles nested in approximately ~1 km² (~5 km × ~0.2 km) area of Rushikulya nesting beach, between 11th and 18th March 2015, with huge enmass nesting about 1.23 lakh held on 14th March 2015 night (Report, 2015, Odisha Forest Department). It gives a clear idea that the subsurface sediment are dug by no of turtles for nesting in a small area, may changes the sediment characteristics of nesting beach (Fig. 1).

Sediment samples were collected along four transects starting from Gokharkuda to the Kantiagada for three positions of beach viz. foreshore (FS), midshore (MS) and backshore (BS) with an interval distance of 1 km as shown in Figure 2. A total of 24 samples collected during two periods as 10 days before and five days immediate after mass nesting of olive ridley sea turtle for the year 2015. The samples were washed with fresh water and dried at 70 to 80 °C in a hot oven. Washed sediments are treated by 10 to 30% of acid wash (HCl) to remove the carbon components from sediments. A weight of 100 g of dried sample was sieved at ½ Φ (phi) interval using automatic sieve shaker (AS 200) and A.S.T.M. (American Society for Testing and Materials) 20 cm diameter sieves for 10 minutes. The 8no sieves are used starting from mesh size 63µm to 1mm by separating ½Φ scale. The logarithmic Udden–Wentworth grade scale was used for sediment classification^{7,8}. The grain size of sediment was measured by Φ (phi) scale with the expression of logarithmic as $\Phi = -\log_2 D$, where D is the grain diameter in millimetre. The statistical parameters viz. mean, sorting, skewness and kurtosis were calculated by Folk and Ward method⁹ using GRADISTAT Program¹⁰.



Figure. 1 — Turtle mass nesting at Rushikulya rookery

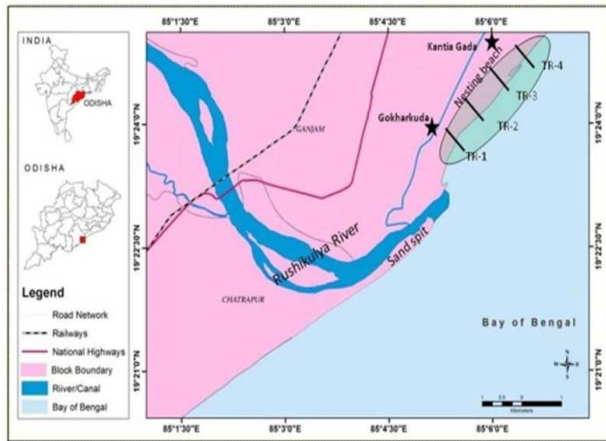


Figure. 2 — Study map with sampling stations

The sediment at all locations is unimodal in nature throughout the observations during both periods. Figure 3 depicts textural parameters and its changes during the two periods. A Significant difference in the mean size of sediment was found between before and after the mass nesting at the nesting beach. The mean size of sediment observed ranged from fine sand (2.8Φ) to very fine sand (3.4Φ) during and before the mass nesting (Figure 3a). After mass nesting, the entire nesting beach sediment changed to medium with a range of 1.1 to 1.8Φ . The sediment sorting (Figure 3b) was found well sorted (0.47Φ) to moderately sorted (0.96Φ) before the nesting due to continuous interactions of wind, wave, current and river flow. But the sediment observed moderately sorted (0.70 to 0.85Φ) after nesting, except at foreshore of transect-4 that was found moderately well sorted (0.62Φ). The sorting coefficients values increased after mass nesting, whereas the mean size decreased. The beach sediment varied from symmetrical (0.1) to coarse skewed (-0.2) before the mass nesting, and most of the

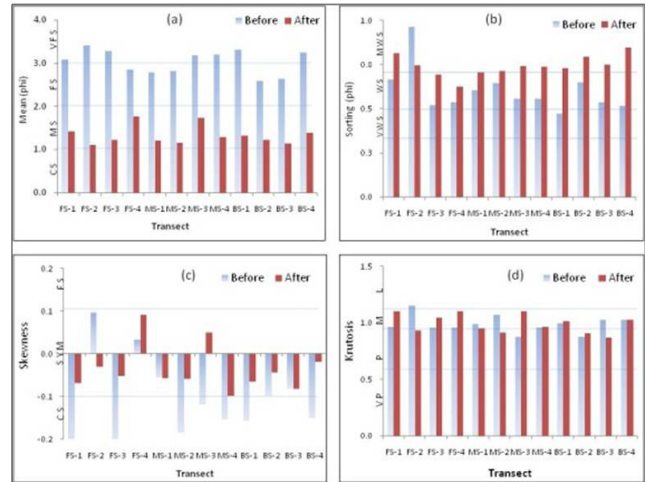


Figure. 3 — Sediment textural parameters a) Mean, b) Sorting, c) Skewness and Kurtosis (d)

sediment found as coarse skewed. After the nesting, the skewness of sediment observed as symmetrical (0.09 to -0.1). Mostly, during both periods, the sediment was negatively skewed, except that at transect-4 (Figure 3c). Kurtosis of beach sediment before nesting varied from platykurtic (0.88) to mesokurtic (1.10) while, mostly mesokurtic (0.91 to 1.10) at all locations after nesting (Figure 3d). As a result, the mean size is decreasing whereas sorting, skewness and kurtosis are increasing after the mass nesting. The study concluded that mass nesting of Olive Ridley Sea Turtles at Rushikulya have a significant impact on textural behaviour at nesting beach. The present study is helpful information useful in coastal habitat management further.

Acknowledgement

Authors would like to thank the *Department of Marine Sciences Berhampur University, Odisha* and *National Centre for Coastal Research, Chennai* for all the supports and facilities.

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