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Impacts of the Super Cyclone Philine on Sea Turtle Nesting Habitats at the Rushikulya Rookery, Ganjam Coast, India

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Abstract

The aim of this study was to describe possible impacts produced by the Philine super cyclone on olive ridlyes, *Lepidochelys olivacea*, at the Ganjam coast. An ecological impact assessment was conducted at Rushikulya rookery, an arribada nesting site for olive ridley and all along the Ganjam coast, from October 2013 to February 2014. The sand island where mass nesting use to occur was mostly submerged after Philine, located at the north of Rushikulya river mouth. At Rushikulya rookery a mini arribada evolving 20,594 olive ridleys occurred, and this mini arribada remained for only two days, between 10th and 11th February 2014. The failure of intermediate sporadic nesting prior to arribada, this activity adds a cue to mass nesting event every year. The failure of intermediate sporadic nesting and unexpected ending of arribada nesting after two days could be attributed to the fact of un-conducive beach. This may be due looseness of the newly formed beach, the process of rapid erosion and accretion influenced by anthropogenic factors as well as the impact of cyclonic storm such as Philine and Lehar preceding the mass nesting season. During this study it was found 0.02 sq.kms mass nesting area was eroded after Philine. Beyond this, the nesting pattern in Ganjam coast also changed in present season (2013/2014). Olive ridleys that used to nest at the area between Purnabandha and Podumpeta, but in this seasons Olive ridley nested at the north area (between Gokharkuda to Podumpeta) possible due to the high accretion and availability of larger nesting space, as the width of beach was more than 150 meters whereas the beach width from Purnabandha to Gokharkuda was only 40 meters. Changes in geomorphology can be the cause of these changes in behavior. Moreover, debris quantities became higher after the Philine, acting as a barrier for sea turtle nesters and hatchling process. Intensive surveys in next two-three years are extremely necessary to understand olive ridleys nesters patterns and the long term effects of the cyclones at nesting areas.

Keywords: Olive ridley; Rushikulya; Beach; Geo-morphology; Erosion; Accretion; Beach re-formation

Introduction

All sea turtle species are closely dependent on available terrestrial habitat for existence in this world. As female turtles have to emerge on beaches for laying several clutches of eggs over the course of a nesting season [1] and life of a marine turtles initiate from a sandy beach.

An increase in the proportion of extreme weather events in the most severe categories, such as cyclone/super cyclone [2,3], may cause significant loss/erosion of damage to shorelines. Such storms often make landfall in warm temperate and tropical areas [2,4], including those areas where marine turtles nest .

Cyclone/super cyclone can accelerate the cyclical loss of nesting beach, and decreasing hatchling success and hatchling emergence success could occur with greater frequency. However, susceptibility to storm-related threats may vary by species [5], such that species with lower nest-site fidelity (for example leatherback turtles *Dermochelys coriacea*, [6]) would be less vulnerable than those with higher site fidelity (for example hawksbill turtles, *Eretmochelys imbricata* [7]. Despite of the fact that some nesting beaches disappear between nesting years due to seasonal erosion and accretion processes, this natural phenomenon gets elicited by cyclone/storm resulting on complete loss of nesting area. Such conditions of behavioral flexibility may offer one of the most promising avenues for marine turtle's adaptation. Marine turtles are certainly able to colonize in new beaches near or far from the previous nesting beach. A shift and decrease in the area of nesting at Rushikulya rookery was recorded this year (2014) which was from Gokharkuda to Podumpeta. Prior this nesting was occurring from Purnabandha to Podumpeta in last few years [8]. Despite of this, there are no studies to our knowledge that examine the impact of beach fortification on regional turtle nesting populations. The objective of this study was to look at the geomorphologic changes in Rushikulya sea turtle rookery and impact on sea turtles after super cyclone.

Study Area

Ganjam, southernmost district of Odisha state has a coastline of 60 km from Prayagi to Pattisonapur (Andhra Pradesh border), characterized by a narrow shelf area, broad sandy beaches and open surf beaten shores. Rushikulaya, second largest sea turtle rookery belongs to Ganjam district towards the northern beach stretch of river Rushikulaya mouth opening. The beach stretch is spread over a length of 6 Km. This beach stretch has three coastal fishermen villages: Punabandha, Gokharkuda and Podumpeta (Figure 1).

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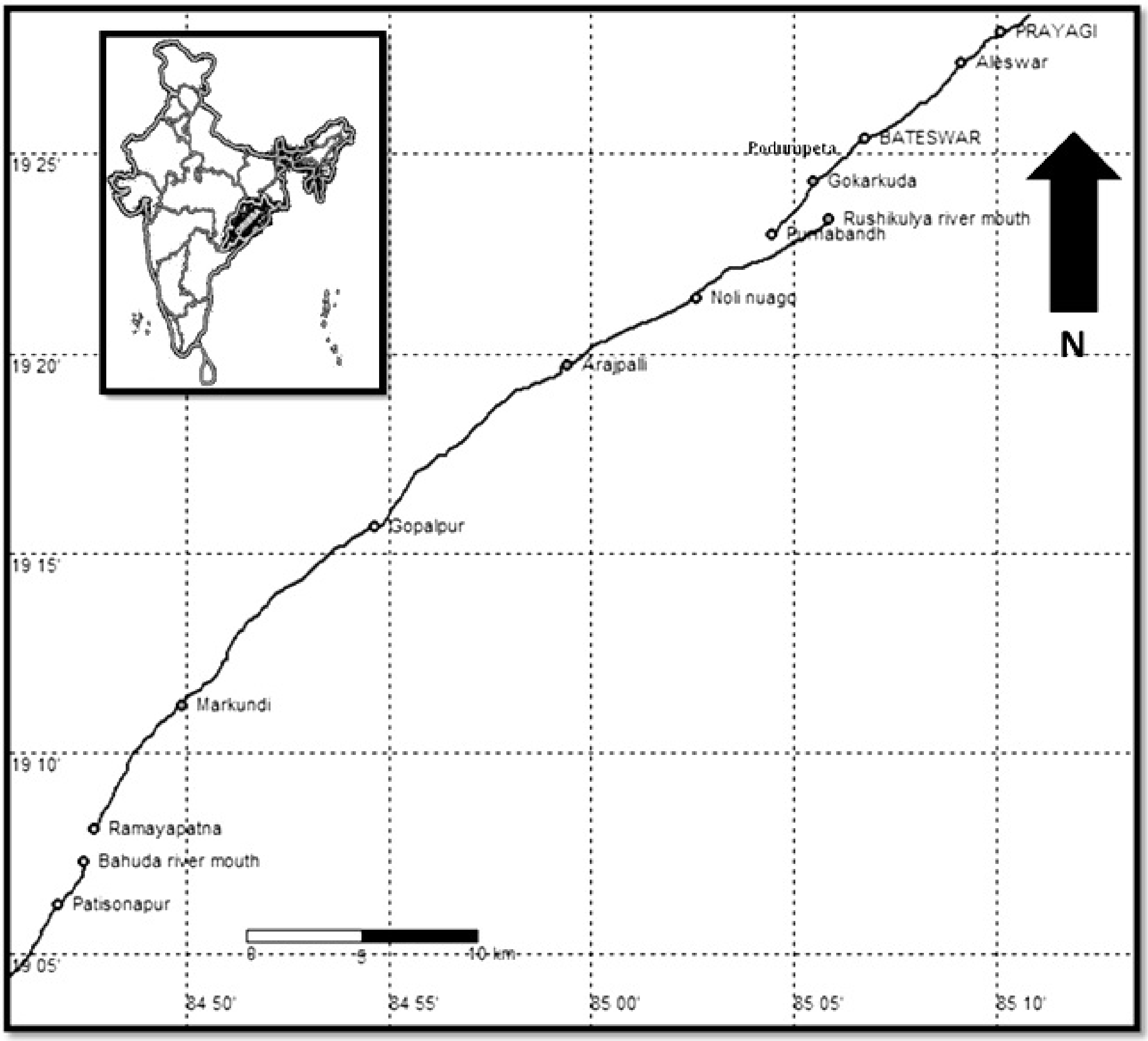

Figure 1: Showing the entire Ganjam coastline and the eleven points of survey after Oct Philine.

Methods

The survey was conducted along Ganjam coast after the super cyclone Philine, from October 2013 to February 2014. Eleven sites were selected at various points along the entire coastline and data was recorded considering the physical and biological parameters. The physical data had six sections including data of general physical characteristics (beach width and height) and background characteristics (vegetation composition and height, sand dune height), offshore feature. The offshore monitoring work was accomplish using boat transects. Twenty kilometers long 6 lines transects at the interval of 1 km, parallel to the shore, were marked and monitored with motorized boat powered with a 9 hp outboard motor engine at offshore water of Rushikulya, and for nesting of turtles each sites was monitored on daily basis to enumerate the nesting turtles and non-nesting turtles (False crawl) if any.

Results and Discussion

In a general mass nesting phenomenon where hundred and thousand turtles emerge synchronously to nests over a night and there is gradual increase in numbers of nesters and the nesters numbers reaches peak on 2nd or 3rd night of nesting. Afterwards there is gradually decrease in number of nesting turtles [9-11] during the last and final night of mass nesting it is generally seen lamed and injured turtles emerging for nest [10].

At Rushikulya rookery, the intensity of intermediate sporadic nesting increase prior to the beginning of mass nesting [12]. However, the females emerging on nights prior to mass nesting are responding to arribada cues (cue such as southerly strong wind, cloudy weather and strong wave action in the sea). During the present study, there was no major intermediate sporadic nesting events observed prior to mass nesting at Rushikulya rookery except three nights where hundreds of turtles emerged to nest but most return back without laying eggs to sea. In the eleven sites along the Ganjam coast it was found that no nesting activity was found in Arjapalli and the two beaches stretch Prayagi and Aleswar, where turtles were observed on beach but no nesting activity tool place (Figure 2). This study also found that the intermediate sporadic nesting was higher in the southern beaches of Ganjam in comparison to beaches near Rushikulya rookery. Although the mini arribada occurred at Rushikulya rookery but behavior of turtles prior to arribada and during the whole season it was found that nesters were low in number than non-nesting (false crawls) turtles. This behavior of turtle put evidence for the incompatibility of beach for nesting. There are various parameters that govern the nesting, beach slope, elevation, compactness, sand particle size, humidity etc. which need a continuous research monitoring in near future.

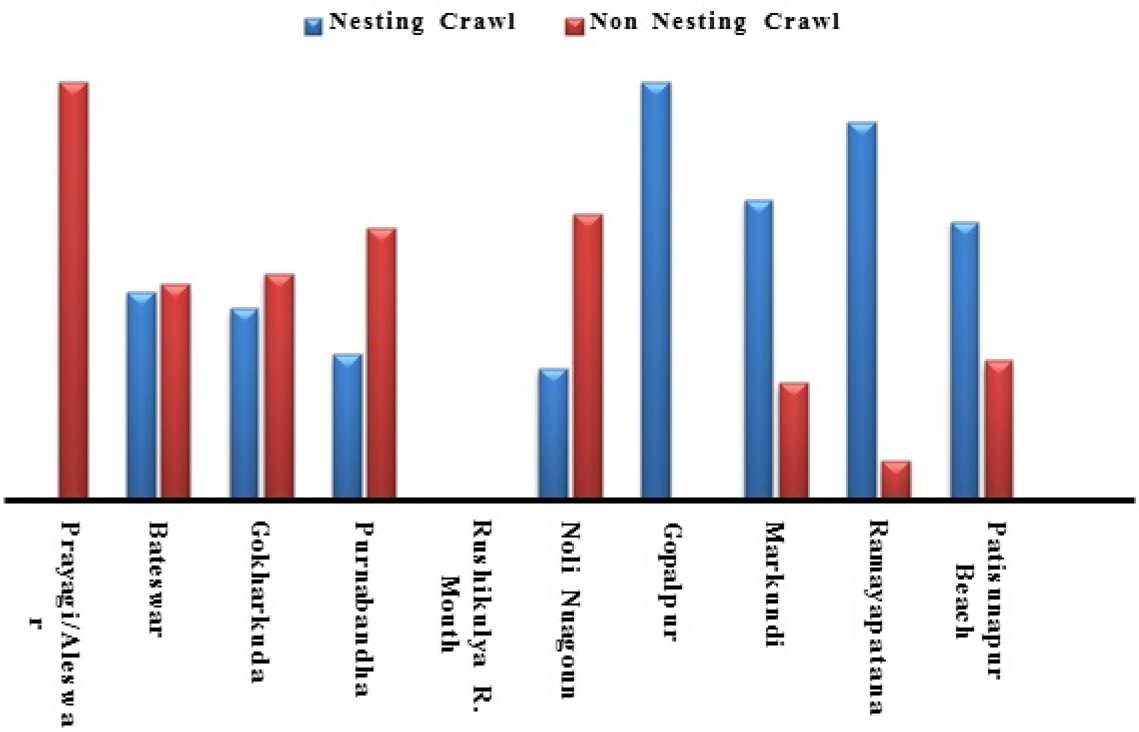

Figure 2: Showing the intermediate sporadic nesting and non-nesting (False crawl) turtles activity at Rushikulya Rookery and Ten study sites.

Sandy beach of Ganjam coast was heavily impacted by the Philine super cyclone. Most of the beach along the Ganjam coast was eroded due to high waves reaching the forest line i.e. casuarinas plantation along the coast. But most of the beaches started reforming soon after Philine, as the super cyclone was followed by annual accretional phase. As most of the beaches of south Odisha, Ganjam coast are mostly accretional, with intermittent erosion during SW monsoon (June to September) [13]. All other beaches of Ganjam coast except mass nesting island of Rushikulya rookery reformed after Philine. This sandy mass nesting island beach was formed during 2011 [8] and this island beach was completely eroded and submerged during October 2013 super cyclone Philine (Figure 2). Mass nesting island beach in front of Purnabandha to Gokharkuda village was 3.27 km long and the average width of the beach was 150 meters during last mass nesting season 2012/13. The other beach stretch where turtle nested was from Gokharkuda to Podumpeta village. This beach stretch was 1.56 km in length and the average width was 150 meters and the total available nesting area at Rushikulya rookery was 0.43 Sq.kms during last season 2012-13 (Figure 2).

After the super cyclone the available nesting beach length from Purnabandha to Gokharkuda was only 1.2 km and average beach width was 40 meters. The beach stretch from Gokharkuda to Podumpeta was 2.70 Km. and the average width was 150 meters, due to high accretion after super cyclone. The total available nesting area at Rushikulya rookery during 2013-14 nesting season was 0.41 Sq.Kms (Figure 2). The total nesting beach loss was 0.02 Sq.km. after super cyclone. Erosion at Rushikulya rookery had resulted in loss of nesting area [14,15]. During this mass nesting season turtles did not preferred to nest in total available nesting area (Purnabandha to Podumpeta), nesting occurred in a selective area of 0.27 Sq.kms beach which was from Gokharkuda to Podumpeta, as this part of the beach was wider and average width of beach was 150 m in comparison to other beach Purnabandha to Gokarkuda which was only 40 meters wide in an average and no mass nesting occurred in this beach stretch.

However unlike other years Rushikulya offshore water had a congregation prior to the nesting season and we found the density of turtles was 4.87 turtle/km which was higher than the study made by Tripathy during 2003-04 [16] and during 2003-04 season 1, 20,000 turtles nested at Rushikulya rookery over a period of four nights [17]. Although the offshore congregation was higher than previous study and the mass nesting was observed for only two days i.e. 10th & 11th of February 2014. It was also observed that female nesters stopped suddenly after second night and completion of mass nesting phenomenon was not confirmed. As during last and final night of

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mass nesting phenomenon lame and injures turtles emerge to nest on beach. There are reports on mini arribada at this rookery which remained for two days but there is no description on the ending of mini mass nesting [12]. During this year 20,594 numbers of turtles laded eggs and had a sudden peak of about 11,000 nesting turtles in 2nd night of arribada, 11th February 2014, and no nesting turtles on the beach were observed on 12th February 2014. This could be due to various possible factors like changing in beach geo-morphology, inclination and the sand compactness may be the reason for the abrupt discontinuous arribada.

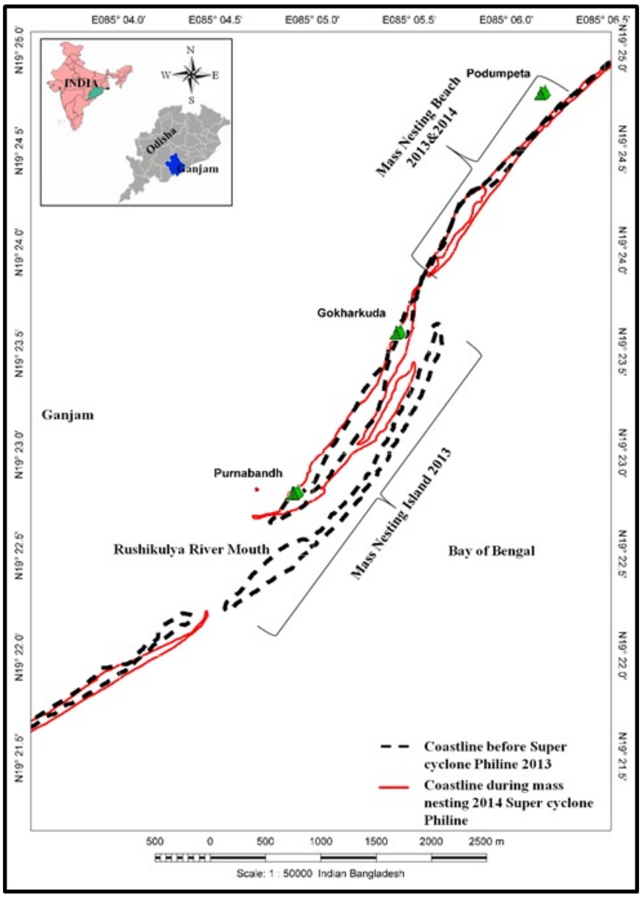

Figure 3: Map showing the coastline change of Rushikulya Rookery after Super Cyclone Philine and the changes in Mass nesting area after and before Philine.

After the Philine and the flood in the Rushikulya River had drawn the attention of the Researchers, Managers due to large deposition of litter left over the 6 km mass nesting beach both (biodegradable and degradable) where the nesting was natural and no in situ were practiced litters were huge so no quantification could be made on this. Marine debris can be buried in the sand due to sand deposition made by wind. This large amount can not only be hindrance in the nesting/ nest selection processes [18,19] (plastic bottles, nets, ropes, glass, medical disposed etc.) of the gravid female which may led to failure of nesting processes in this beach and many of them may get injuries during crawling in the beach itself.

Marine debris can also affect the hatchling process [20], as too much of humus can hold the moisture and increase the nest causing the early death of the. For the successful and safe nesting the Divisional Forest office, Berhampur, involved people from the 3 villages besides mass nesting ground to clean the debris. It was also done for the rest of the beach stretch in Ganjam coastline.

Although it is too early to give detailed management recommendations, careful protection of coastlines along with turtles nest should be considered, as should the protection of beaches that produce turtle hatchlings in mass. Beach-stabilizing technologies may negatively affect nesting females by blocking beach access, disorientating turtles, or by rendering sand inappropriate for nesting. So more research and monitoring is needs to be carried out in regular intervals to determine the factors that is responsible for the set off the erosion processes if any in feature. But the deposition after Philine is an episode and soon after one-two years the beaches will be reformed.

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