LESSER KNOWN NATURAL THREATS TO PROTECTED OLIVE RIDLEY NESTS IN COASTAL MAHARASHTRA

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Sea turtles are a significant component of the diverse life forms found along the 720km coastline of Maharashtra, India. Hawksbill, green turtle, leatherback and olive ridley turtles are reported from five coastal districts of Maharashtra (Giri & Chaturvedi, 2003). Of these, only the olive ridley has been observed nesting, mainly on the sandy beaches of the Raigad, Ratnagiri and Mal van districts of Maharashtra, where the beaches are sparsely populated and fishing activity is low (Giri *et al.,* 2006; Sanaye & Pawar, 2009; Katdare, 2012).

Since its establishment in Maharashtra in 1992, the environmental NGO Sahyadri Nisarg Mitra (SNM) has coordinated a number of marine turtle conservation programmes, including the protection of more than 600 nests and release of 29,234 hatchlings from 10 hatcheries throughout Raigad and Ratnagiri districts of Maharashtra between 2003 and 2011 (Katdare, 2012). Through the monitoring efforts of SNM and surveys conducted by other agencies, including the Bombay Natural Historical Society (BNHS) and the Forest Department, many natural and anthropogenic threats to sea turtles and their nests have been identified along the Maharashtra coast (Giri & Chaturvedi, 2003; Giri *et al.*, 2006; Sanaye & Pawar, 2009; Katdare, 2012). Some of the lesser known threats are worth reporting as greater awareness may be useful in improving nest management practices in India.

Beach morning glory (*Ipomea pes-caprae*), a perennial pan-tropical plant, is a fast growing, aggressive creeper vine which spreads in areas with extreme temperature, high salinity and nutritionally deficient environments (Devall & Thien, 2005). The roots of *I. pes-caprae* may penetrate one meter vertically into the sand so the plant can remain dormant even when the surface vegetation dies (Devall, 1992). *I. pes-caprae* is important among sand dune vegetation for its beach stabilisation potential. Around the world there are reports of *I. pes-caprae* destroying the nests of freshwater, estuarine and marine turtle species and a detailed study of its impact on leatherback sea turtle nests (see Conrad *et al*., 2011). Olive ridley turtles are known to nest near sand dune vegetation (Pandav *et al*., 1994; Subramanean, 2005; Islam *et al*., 2011) so *I. pes-caprae* is mechanically cleared from the interior and at least 20 feet surrounding hatcheries along the coast of Maharashtra prior to each nesting season. In March 2013, the invasive roots of *I. pes-caprae* were observed invading olive ridley turtle nests in hatcheries at Velas beach and Karde beach of Ratnagiri district, both penetrating and encircling the eggs. Upon examination, *I. pes-caprae* plants adjacent to the hatchery sites demonstrated lateral root growth instead of the typical vertical growth. There was no plant growth or runners towards the hatcheries observed above the sand. Such atypical growth of *I. pes-caprae* roots and destruction of turtle nests is being reported for the first time in India. This observation points to the need for additional efforts to eradicate *I. pes-caprae* near hatcheries by regularly monitoring the above and below ground plant growth throughout the nesting period and using intensive mechanical removal methods. Understanding variations in plant root morphology and growth in *I. pes-caprae* could also help plan improved management practices.

Another threat to sea turtle nests on the Maharashtra coast are ants (species not identified) that destroy nests and devour hatchlings. Ant-sea turtle interactions were observed for the first time in India at Karde Beach in the Ratnagiri district, Maharashtra. In March 2016, no hatchlings were produced in three of six nests protected in a hatchery. During the routine post-incubation inspections, ants were found to have invaded all three of the nests and were observed inside the eggs devouring the almost developed hatchlings in all 312 eggs. The presence of the ants had not been noted on the sand surface during day. This threat has not been reported from other beaches in India, but has been observed and studied in Florida and other places in USA and El Salvador, Central America

(Allen *et al*., 2001; Wetterer & Lombard, 2010; Wetterer *et al*., 2016). Some species of ants, including *Solenopsis geminate* and *S. invicta*, are known to have a negative impact on turtle nests and hatchlings (Allen *et al*., 2001; Wetterer *et al*., 2016). Further studies are needed at Karde Beach to identify the ant species, determine their ecology, and describe their invading behaviour (Hoffmann *et al*., 2016). Constructing the turtle hatchery away from dune vegetation (Wetterer *et al*., 2016) and closely monitoring the constructed hatchery for signs of ant activity during the night are recommended immediate conservation practices; applying a known fast degrading, low toxic (to vertebrates) formicide with an active ingredient such as Hydramethylnon (Plentovich *et al*., 2010; Wetterer *et al*., 2016) can be considered after thorough assessment of the risks.

Natural threats such as ants and *I. pes-caprae* may not affect a stable population of turtles adversely, but nest and hatchling loss may affect the overall size and viability of a small population of solitary nesting olive ridley turtles. Since 2006, the number of turtle nests on Karde beach of Ratnagiri district in Maharashtra has been slowly increasing (Katdare, 2008; www.snmcpn.org). On average, 4 to 6 nests are found on Karde beach each year, suggesting that it could be the most promising site for turtle nesting on the Maharashtra coast. However, the less obvious natural threats on this beach may add to the already known anthropogenic and natural threats, thus further reducing the hatching success and overall effectiveness of sea turtle conservation initiatives in this area. In conclusion, it is recommended that the impact of these natural threats be considered and detailed studies resulting in best management practices be implemented in turtle conservation programmes.

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