Chapter VI

CONCLUSION & SUMMARY
CONCLUSION AND SUMMARY

1) The present research study deals with the environmental relationships associated within the high intensity nesting beaches of sea turtles along the Indian coast including the bay islands of Andaman and Nicobars and Lakshwadeep. This is the first of the kind where all the coastal states have been taken into consideration with regard to environmental influences on nesting intensities.

2) The environmental factors studied were based on nesting beach Topography and climate factors such as Tidal ranges and moon phases.

3) The Topographical factors studied reveal that nesting space is of utmost importance to turtles, as compared from the many high intensity nesting beaches.

An approximate beach breath ranging between 50-75 meters is desirable for higher nesting intensities and this
was the most common and highest found range found on high intensity nesting patches, particularly along the east coast of India.

4) Beach breadth along the high intensity nesting patches surveyed ranged between 3-10 Kms and this particularly does not have much significance as compared with beach breadth. However the study hypothesizes that longer and broader the beach the more reflection of land is seen under moon and star lights, which helps turtles travel towards land.

5) Beach vegetation does not deter nesting in any way if located 30-50 meters away from the high tide line. But particular vegetation like *Pandanus ordoratissimus* is extensively found, particularly in high intensity nesting locations, around the Rushikulya area in Orissa, Srikakulam area in northern Andhra Pradesh bordering the mass nesting area of Orrisa, Little Andamans and south Andamans in the Andaman and Nicobar Islands and around the Minicoy belt of Lakshwadeep Island.
6) On the West coast such Pandanus patches are less extensive in intensity but are commonly found.

7) The occurrence and intensity of the Pandanus species, suggests certain soil characteristics suitable for their growth and perhaps the same characteristics are suitable for high intensity nesting. This aspect of investigation would require further research of analyzing all Pandanus occurring belts to those where it is absent.

8) The higher nesting areas had some degree of slope ranging from 20-30°, than with completely flat natured beaches.

9) Beaches with extensive sand dunes, such as in Gujarat, were preferred by Green turtles and like those in Andhra Pradesh around the Srikakulam area and Ekakulanasi in Orissa were preferred sites of Olive ridleys. As these are the turtle species documented by earlier studies to be nesting in higher intensities in these areas.

10) Analyzing soil characteristics of sand dunes with regard to turtle nesting areas involves extensive research
and would have to be taken up by future studies, in comparison with dune less areas.

11) Most sand dunes of these high intensity nesting areas ranged between 10 – 15 feet.

12) Most of the high intensity areas are, except Kerala which has not had detailed studies, closer to river outlets and is about 3 – 4 kilometers within the range. Though this aspect has been mentioned before in other studies, not all surveys have recorded this with relation to high intensity nesting areas. The study further adds that salinity level of the soil and sediment characteristics may have some role in nesting intensities, as the rivers bring in large amount of silt and clay that are deposited on the beaches close to the emptying points.

13) More over the study also hypothesizes that lower salinity may be preferred by hatchlings as they emerge into the surrounding water, if the incubation grounds are less saline. This may help in acclimatization of hatchlings to salinity, as they eventually move from less saline areas to higher salinity areas in the open ocean. This area of
research may open major clues in beach selection of turtles and on higher nesting intensities.

14) The tidal ranges for the last ten years were compared and matched with resting seasons of particular coastal states.

15) First the highest values of tides falling during day and night for every month were observed.

16) It was seen that some months in a year had higher tides dominating in the day and some higher tides during particular months dominating in the night.

17) The Nesting seasons were matched with these months and the majority of them except for West Bengal and Kerala were found coinciding with months where higher tides prevailed in the night.

18) This has also been found matching with each individual species of the four turtles occurring in India.
19) As green turtles are also recorded to nest during day, a particular tidal range has been determined for their high nesting at places like, Gujarat, Andaman & Nicobar Islands and Lakshwadeep.

20) West Bengal is only place where most of the Tidal values have been higher during daytime except for the month of December where some high tides are fond falling during day and some during night. However a certain tidal range 3.71 meters to 4.54 meters are found prevalent in the nesting between December to March, after which the tides appear rapidly increasing reaching up to 6.0 meters.

21) The tidal range of 4.71 meters is found to be the maximum range used by turtles and this values s seen from tidal ranges of Maharashtra where it is second to West Bengal in higher Tidal ranges.

22) Tidal ranges are also found varying with species in particular high intensity nesting places.
23) Green turtles in the high nesting coastal states travel to nesting grounds in a tidal range from 1.5 meters to 2.41 meters. This is particularly observed in states of Gujarat, Lakshwadeep and Andaman and Nicobar islands. However Green turtles also nest during day

24) The nesting grounds of Leatherbacks are in the Andaman and Nicobar islands. The tidal ranges for Leather Back nesting has been found to be 2.33 - 2.42 meters occurring in the season between November and February, after which the higher tide cycle reverses to the day time.

25) Hawksbills are found to travel to nesting places in tidal ranges between 2.02 - 2.37 m in Andaman and Nicobar in July - September and between 1.26 - 1.57 meters in the Lakshwadeep islands in the season between October - March. These tidal ranges imply that Hawksbills are probably migrating between the Andaman and Nicobars and Lakshwadeep islands for nesting as seen from the continuity of the nesting seasons i.e., July - September in the Andaman Nicobars and October to March in the Lakshwadeep islands. Future intensive tag studies on this aspect can give more clues.
26) The tidal range for Olive ridley nesting at the Orissa ranges between 2.55 and 2.75 meters in the nesting season between January and March. After which all higher tides fall during day, a time quite unsuitable for Olive ridleys. And this particular tidal range is peculiar to Orissa where the mass nesting of Olive ridleys takes place.

27) In Northern Andhra Pradesh bordering the mass nesting areas, the nesting season is similar to that of Orissa's but the tidal range values are much lower ranging between 1.14 meters to 1.71 meters. This indicates that the mass nesting batch of turtles prefer a higher tidal range that is seen at Orissa, resulting in lesser intensity nesting at northern Andhra Pradesh.

28) For Tamil Nadu, the nesting season for Olive ridley is similar to that of Orissa and Andhra Pradesh, but higher tidal ranges during night, during this season is lower than that of Andhra Pradesh and is found ranging between 1.20 to 1.36 meters, where again nesting intensity is lower.
29) For other Olive ridley nesting areas such as Karnataka and Goa, tidal ranges for the seasons between October and April (for Goa until March) are between 2.04 to 2.38 metres. This again is unlike the mass nesting tidal range of Orissa.

30) The nesting season for Maharashtra is though similar that of Goa and Karnataka, has a very high tidal range between 4.52 – 4.17 meters. This again accounts for lower nesting. This tidal range is also similar to that of West Bengal, with the only difference that most of the higher tidal values are during day for Bengal.

31) These findings show that Tidal values that favour higher nesting intensities are specific for turtle species and for particular seasons, leading to mass nesting or higher nesting intensities on the East coast of India, while lesser intensities on the west coast of India.

32) The same holds true for topographical factors, where wider beaches, rivers and dominant vegetation types are such as the Pandanus are found.
33) The impact of Tsunami in December 2004 has also had opposite and negative impact on nesting turtles.

One, it has led to submergence of land which has wiped out several nesting habitats of Leatherbacks in Great Nicobar.

Two, where the impact was minimal on nesting beaches such as Point Calimere, Tamil Nadu, where land has not been submerged, there has been heavy destruction to the vegetation such as *Prosopis chilsensis* which was quite extensive on the coast.

But this has led to an increase of nesting space, as observed by the current study, and reports from the forest staff and field biologist monitoring turtles there, have recorded higher nesting of Olive ridley than usual.

34) Anthropogenic factors have also accounted change in nesting intensities across places and off late have been adversely affecting turtle population across India. The major areas are in the rapid increase of trawl fishing all over the Indian coastline, Global warming leading to erosion of nesting patches, along with killing of nesting females has become major concern. The major problem areas to be corrected with these aspects are: Catering to
the basic necessities of fishing communities; fundamental areas are in clearing fishery related debts and improving their shelters; providing rations, drinking water supplies and sanitary facilities such as construction of toilets and health centers for medical aid. Without addressing these issues, education and alternative sources of income for fishermen, makes very little difference in effective turtle conservation.

35) The monitoring of nesting is mostly carried out by the forest staff. But interactions with various forest staff across coastal states revealed a deficiency of personnel to monitor turtle nesting and to keep vigil of protected areas from poachers. Moreover there is low motivation level particularly among the field staff; they are poorly paid compared to the efforts they put in.

36) The current study recommends increasing avenues in forest service along with a pay commensurate to the efforts of the field staff pay

37) Trawl fishing has been found increasing rapidly and also replacing traditional methods of fishing all over the
coastline. This activity has led to large scale turtle deaths all across the coast. The Turtle Excluder devices, used for fitting in trawl nets in order to save turtles has not been successfully implemented in many coastal states, as it has met with conflict from fishermen in that there is a loss of fishing catch. The current study recommends an improved fishing gear, which are appropriate needs of fishermen in all coastal states. This is an urgent need in the conservation of turtles.

38) Developmental activities in many ecologically sensitive areas are gaining strength, particularly the construction of ports, like the Dhamra, near turtle nesting sites along with the construction of tourism resorts, which are polluting the environment with plastics and lighting. The study recommends that developmental activities to be seriously reviewed by a committee of diverse groups comprising committed environmentalists and biologists (constituted by the government) to balance development with the needs of conservation.

39) The current study recommends tourism to be taken up by the fishing community, where they can
independently profit, if trained to engage in eco tourism. These environment friendly tourist structures of fishermen can help wean them away from destructive fishing activities, and give them better scope for livelihood.

40) The current study also recommends the engagement of fishermen in research and conservation activities, such as gathering basis data, with the use of instruments. As this activity matches more to their fishing activities at sea, they would feel further motivated to carry out, provided there is proper pay and recognition given to them. This is an area, which needs serious consideration, and the youth of the village may be ideal targets of these goals. Such activities may also inspire fishers to the long-term conservations of turtles.

41) With the increasing trends of human population and un-eco friendly life styles, the resultant global warming and subsequent rise of sea levels is an alarming factor to all life on the earth and particularly for the sea turtle nesting habitats, which are being eroded. In this context, the current study recognizes both low nesting intensity
areas of turtles, and high nesting areas as equal concern for conservation and habitat preservation.

42) While tidal factors, found in the study, help in the directive movement of turtles to their nesting habitats, it is the beach quality such as sufficient space and sediment characteristics involving vegetation that determines the selection of beaches by turtles. This is irrespective of the genetic factors, controlling the nesting of turtles in particular habitats.

43) Thus the high intensity nesting of turtles basically requires and is dependent on environmental factors such as beach space, vegetation types, slope for approach, and rivers in proximity for nesting along with certain tide ranges that directs their travel. But on the long run it is the anthropological issues that not only determine intensities, but the very survival of this endangered sea turtle population.