Compilation of Research Information on

Biological and Behavioural Aspects of Olive Ridley Turtles along the Orissa Coast of India

- A Bibliographical Review for Identifying Gap Areas of Research -

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

IUCN International Union for Conservation of Nature

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FOREWORD

It was in 1974 that the conservation community came to know about world's largest congregation (arribade) of Olive Ridley turtles at a place called Gahirmatha, located on the eastern coast of Orissa. Subsequently, various issues relating to conservation of Olive Ridley turtles in this region came up for discussion in the World Conference on Biology and Conservation of Sea Turtles held in Washington DC in 1979. Various issues relating to this species including threats to its long term survival and ways to address it were also discussed there. The deliberations at the conference set in motion activities both on the management as well research and monitoring aspects. While the national government agencies initiated action on management front, the scientific community got engaged in studies on the species and its habitat.

Long term survival of Olive Ridley Turtles depends upon securing critical habitat requirements of the species in the eastern coast of India. However, as large number of developmental activities viz. Ports and oil exploration etc. are proposed in this region, conservation and long term survival of the species is a matter of concern. The scientific community therefore, has responsibility to provide credible information on various aspects of the species and its habitat which, in turn, would facilitate informed decisions on locating proposed development projects in the region.

Keeping in view the above, IUCN Asia engaged Wildlife Institute of India to review the available scientific literature on Olive Ridley Turtles in the eastern coast of Orissa and identify gap areas in the knowledge base about the species.

I hope, this compilation would provide biologists, managers planner, and administration, information on Olive Ridley Turtles which can be used for developing appropriate conservation strategies. It would also provide guidance to researchers on the future direction for conducting studies on this species.

I thank IUCN Asia and WII Scientists for their valuable inputs in bringing out this document.

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Director
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We are thankful to the Orissa Forest Department for access to some of the old reports on sea turtles of Orissa, and particularly thank Dr. C. S. Kar and Dr. Sudhakar Kar, Senior Research Officers of the department. Also, we are indebted to Dr. A. K. Pattnaik, Director and Shri. Arun Mishra, Assistant Director of the Nandankanan Zoological Park, Bhubaneswar for allowing us access to the Park Library & Documentation Centre. Some of the important literature on the subjects was made possible through individuals and Library & Documentation Centre-cum-Digital Repository Services of WII, Central Marine Fisheries Research Institute, & Central Institute of Fisheries Technology, Cochin; Madras Crocodile Bank Trust, Mammalapuram; International Collective in Support of Fishworkers, and Group for Nature Preservation and Education, Chennai; Zoo Outreach Organisation, Coimbatore; Salim Ali Center for Ornithology and Natural History, Coimbatore; Greenpeace, National Center for Biological Sciences, and The Ashoka Trust for Research in Ecology and Environment, Bangalore; Utkal University, Berhrampur University, Sambalpur University, North Orissa University, Orissa University of Agriculture and Technology and Andhra University. This work would have not been possible without the help of Dr. L. N. Acharjyo, Former Veterinary Officer of Nandankanan Zoological Park, who provided much of the older literature on the olive ridley turtles of Orissa. Our sincere gratitude also to Dr.(Mrs.)P. Mohapatra, Reader in Zoology of Utkal University; Dr. R. C. Panigrahy, Professor and Dr. Laxman Nayak, Reader of Marine Biology, Berhampur Univeristy; Dr. S. K. Dutta, Professor & Head and Dr. Gunanidhi Sahoo, Lecturer at Dept. of Zoology, North Orissa University; Dr. P. S. Rajasekhar, Associate Professor of Environmental Sciences, Andhra University; Shri. Ashis Senapati and Shri.Chitta Behera of Project Swarajya, Cuttack for providing us valuable literature on the work carried out earlier along Orissa coast. We are thankful to Dr. Nick Pilcher and Dr. Kartik Shanker for their comments and suggestions on the preliminary draft of this compilation.

Last but not least, we are thankful to the Computer & GIS Cell for providing us necessary printing facility, and WII library staff for reprographic help of some of the older literature.

The Project Team

1. INTRODUCTION

Five of the seven known species of sea turtles: leatherback turtle *Dermochelys coriacea*, hawksbill *Eretmochelys imbricata*, loggerhead *Caretta caretta*, green turtle *Chelonia mydas* and olive ridley *Lepidochelys olivacea* are reported from the Indian waters (Kar & Bhaskar, 1982). Except for the loggerhead turtle, all four other species are known to nest along the coast of the mainland and the Bay Islands of India (Kar & Bhaskar 1982, Biswas, 1982; Shanker & Choudhury, 2006; Tripathy, 2005). All the species of sea turtles found in India are presently endangered and are protected by law, and are included under Schedule I of the Indian Wildlife (Protection) Act, 1972. The Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS), also prohibits trade in turtle products by signatory countries, placing these species in Appendix I, and Appendices I and II of the conventions respectively.

1.1. Olive Ridley turtle in Orissa

The olive ridley turtles, the smallest and the most numerous of the seven species of sea turtles, are famously known for their unique behavior of forming enormous nesting aggregations – a phenomenon known as "*arribada*" (Spanish for arrival). And, along the Orissa coast of India, such unique, enoromous nesting aggregations occur at three sites *viz.*, Gahirmatha, Devi and Rushikulya.

The Gahirmatha rookery was once believed to be the largest reported *arribada* nesting ground for olive ridley turtles in the world (Bustard, 1976), although the number of nesting aggregations and the census methods are in question (Tripathy, 2002; Shanker *et al.* 2004). Estimates of turtles nesting at Gahirmatha have ranged between 100,000 to 800,000 in different years (Patnaik *et. al.* 2001; Orissa Forest Department, 2004 [http://www.wildlifeorissa.org.in]). Gahirmatha is a Marine Sanctuary and the nesting beach is part of the Bhitarkanika National Park. It is located at the mouth of the River Maipura, between the Dharma River and Paradeep, along the northern Orissa coast. The mass nesting of olive ridley turtles at Gahirmatha takes place between December and March and the first *arribada* at Gahirmatha is sometimes followed by a second one of much lower intensity after a gap of 35 – 60 days (Dash & Kar, 1990). However, recent trends in mass nesting at Gahirmatha indicate a failure of the second *arribada* (Bivash Pandav, unpublished information). Moreover, the mass nesting beach at Gahirmatha has undergone considerable changes in its beach morphology since its discovery in 1974. When first reported, nesting was observed to occur along 15 km of the mainland beach near the

Maipura river mouth, from Ekakula to Habalikhati. This beach got fragmented into two, during a cyclonic storm in 1989, following which mass nesting was restricted to a four km long beach, renamed as the Ekakula Nasi rookery. Again during the 1999 '*super-cyclone*' that hit the Orissa coast, the Ekakula Nasi further split into few smaller islands. And, presently, mass nesting takes place on these small islands, each less than one km in length.

The Devi rookery was discovered in 1981 (Kar, 1982), and is located at the mouth of the river Devi, along the central Orissa coast. The nesting beach extends from the Devi to Kadua river mouths, and is a sandy beach approx. 20 km long and bordered with Casuarina plantations. Following the discovery of this site, mass nesting there was reported only twice (Pandav & Choudhury, 2000), and in recent years only large number of sporadic nesting occurs. The southern most site along the orisssa coast, the Rushikulya rookery was discovered in 1994 (Pandav *et al*. 1994), and is approx. 5 km beach located immediately north of the Rushikulya river mouth from Purunabandha to Kantiagada village. Like the Gahirmatha site, mass nesting at the Rushikulya rookery has been regularly recorded. Neither the Devi nor the Rushikulya rookery sites are protected, though the Orissa Forest Department monitors these nesting beaches regularly, during the nesting period.

Besides these three nesting sites, smaller arribadas occur at other beaches in Orissa and olive ridley turtles also nest sporadically all along the Indian coast and in the Bay Islands.

1.2. WII's involvement in sea turtle research

Ever since the creation of the Wildlife Institute of India (WII) in 1982, it has been involved in sea turtle research and conservation in India. Prior to this, the satellite centre of WII at Hyderabad (formerly Crocodile Breeding & Research Centre) undertook status survey of sea turtles in the states of Andhra Pradesh and Orissa, and provided technical support to the sea turtle research and conservation programmes (Anonymous, 1982). However, a detailed survey of the olive ridley sea turtle and their nesting habitats along the Orissa coast was undertaken by WII in 1993-94 that resulted in the discovery of a new sea turtle rookery in Orissa (Pandav *et al.* 1994). Encouraged by this finding, the Institute commenced a long-term research project in the Orissa coast from 1995 to 2000 (Pandav & Choudhury, 2000). During 1999-2000, research on conservation genetics of the olive ridley sea turtles of Orissa was initiated. Also during the same time, the Government of India – UNDP Sea Turtle Conservation Programme was launched and implemented through WII. Under this project, apart from multi-sectoral approach for conservation, a countrywide survey of sea turtles and their nesting habitats was carried out under the WII leadership (Shanker & Choudhury, 2006). The application of new technology in wildlife studies (*i.e.* satellite telemetry of olive ridley sea turtles in Orissa) was executed by the Institute in 2001

in collaboration with the Orissa State Forest Department and the United States Fish and Wildlife Service (Shanker *et al.* 2003; www.wii.gov.in/webs/satindex.html). During 2001-2002, a sea turtle fisheries interface study along the Orissa coast was taken up for scientific experimentation of the efficacy of Turtle Excluder Device (TED), during mechanized trawl fishing (Gopi *et al.* 2002). Further, WII has continued to be involved in sea turtle research, with a current project being carried out since 2006 on determining the offshore distribution, migration and movement of olive ridley sea turtles along the east coast of India (Choudhary *et al*., 2007, 2008).

1.3. Other institutions involved in sea turtle research

Several other institutions and organizations have been involved in olive ridley turtle research along the Orissa coast. The nesting of turtles in Orissa was first reported by J. C. Daniels and S. A. Hussain of the Bombay Natural History Society in 1973. However, mass nesting at Gahirmatha was confirmed and made known to the scientific community by Dr. H. R. Bustard, an FAO consultant during his survey in the Bhitarkanika Mangroves for crocodiles (Bustard, 1974; FAO, 1976). Dr. Bustard initiated research programs in Orissa with several forest officers, most notably C. S. Kar, who carried out an indepth study on the olive ridley turtles. Many important biological aspects of olive ridley turtles came to light through his exhaustive research during 1978 to 1985, which is summarized in his book "*Turtle Paradise*" coauthored with Dr. M. C. Dash (Dash & Kar, 1990). During the study, Dr. Kar also flipper-tagged more than 10,000 nesting turtles to study their movements and migration. Prior to this study, S. Biswas of the Zoological Survey of India (ZSI) had carried out a survey of the nesting ground of olive ridley sea turtles of Bay of Bengal, which appeared in the bulletin of ZSI in 1982. Biswas *et al.* (1977) also carried out experiments on the incubation of olive ridley turtle eggs collected from along the Puri-Konark coast of Orissa and observed under both natural and artificial conditions. During the 1980s, research on the developmental biology of olive ridley turtles was initiated at the Utkal University (Diamond & Hejmadi, 1983; Hejmadi *et al.* 1984, 1985, 1989; Sahoo *et al.* 1996, 1998). The Central Marine Fisheries Research Institute (CMFRI) also initiated studies on olive ridley turtles at Gahirmatha during that time (Silas *et al.*, 1983; 1983; 1985). The other institutions who have been involved in sea turtle research are the Central Institute of Fisheries Technology (CIFT), Madras Crocodile Bank Trust (MCBT), Ashoka Trust for Research in Ecology and the Environment (ATREE), WWF-India, local universities *viz*. Utkal, Berhampur & Sambalpur University, Orissa University of Agriculture & Technology, Nandankanan Zoological Park, Regional Research Laboratory (RRL), Bhubaneswar, and few NGO's based in Orissa. Apart from the above, in recent years, there has been short term research projects carried out along the Orissa coast.

1.4. The need for this compilation

Information generated from the research carried out on sea turtles of Orissa has been published in several peer-reviewed national and international journals. Many other study findings are only available as grey literature or as unpublished reports. All of this information, although crucial, is often not accessible while formulating any conservation strategy or future action plans for the olive ridley turtles. In this context, the IUCN-Asia office requested WII to compile all scientific information on various aspects of olive ridley turtle biology and behavioural research carried out along the Orissa coast of India.

Further, several developmental projects are coming up along the Orissa coast and there is a concern for safeguarding the olive ridley turtles and their breeding habitats. Therefore, it is essential that results from the various research projects on olive ridley turtles carried out in the past are evaluated and a compilation is made of all the literature, and based on this, gap areas for future research on the species are identified. This will help in developing appropriate measures for the protection and management of the olive ridley turtles and their habitats along the Orissa coast.

2. OBJECTIVES

1. To prepare a bibliography of existing information on biology and behaviour of olive ridley turtles along the Orissa coast of India

2. To summarise all past and ongoing research on olive ridley turtles along the Orissa coast

3. To identify gap areas for research

3. PROCESS OF COMPILATION OF INFORMATION

3.1. The Project Team

The following members were involved in compilation of the sea turtle bibliographic work.

1. Prof. B. C. Choudhury
2. Prof. Anup K. Nayak
3. Dr. K. Sivakumar
4. Mr. R. Suresh Kumar
5. Dr. Basudev Tripathy

3.2. Information gathering

The project team collated all available information through a complete and in-depth search from various sources *viz*. international databases, Worldwide CD-ROM, WII Library and Documentation Centre and other institutional libraries, Archie Carr Centre for Sea Turtle Research-Online Bibliography and complete search of the *Marine Turtle Newsletters* (1973-2008). Universities of Orissa *viz*. Sambalpur University, Berhampur University, Utkal University, North Orissa University and other institutions within Orissa *viz*. Zoological Survey of India, Gopalpur-on-Sea and Regional Research Laboratory, Bhubaneswar and those outside Orissa (CMFRI-CIFT, Cochin; Fishery Survey of India (FSI), Visakhapatnam; SACON, Coimbatore; Madras Crocodile Bank Trust, Mammalapuram; International Collective in Support of Fishworkers (ICSF), Chennai; Andhra University, Visakhapatnam), Centre for Ecological Sciences, IISc were visited by two of the team members (Dr. Basudev Tripathy and Mr. R. Suresh Kumar) for collection of all available information on olive ridley turtles of Orissa. Besides, NGOs *viz*. Project Swarajya-Cuttack, Wildlife Society of India, WWF-India and individual researchers/scientists who have carried out past research and conservation works on olive ridley turtles in Orissa were also consulted. The information collected from various sources was either in the form of reprints, photocopies or as electronic copy of the publications.

3.3. Structure of the Bibliography

All literature collated was segregated into seven sections as listed below and is presented in that format. For the first two sections the publications were further segregated into: i. Research articles (full length papers that are based on original data); ii. Research communications and General review articles (these include short notes); and iii. News/Letters/Correspondence/Book review. The third section in the list is

further divided into two: i. Full length papers; and ii. Abstracts. Across these different sections and subsections the articles are arranged alphabetically by author, followed by the year of publication. Under each publication, a summary or abstract as given in the article is provided wherever available. In cases where there is no abstract provided by the authors, we have summarized the findings in brief. Few of the newsletter articles that have been published in *Marine Turtle Newsletter* are also published as such in the *Indian Ocean Turtle Newsletter* and the latter is only cited without any discussion on the article. In the Popular article section, no description or discussion of the contents of the article is given and it is only cited. Articles cited in this bibliography are published in widely circulated journals and newsletters, which are easily accessible, however still we have provided contact details of the primary or any of the other authors wherever possible for better access. For each of the section in the bibliography the contact details of the author(s) is given only once, eventhough there may be many publications by the same author under the same section. In case where the contact details of the author(s) is not available or difficult to approach, the details of the institutions/organizations to which they are or were affiliated is provided.

A total of 337 publications were gathered following a thorough literature search. These articles dealt with various aspects of olive ridley research *viz.*, Ecological studies; studies on conservation genetics; studies on conservation, management of sea turtles and policy issues; studies on sea turtles stranding and bycatch reduction; studies related to pollution and its effects on sea turtles; Physiology and biochemical studies; studies on sea turtles and human interactions; and studies on coastal geomorphology. These articles are segregated into different sections as listed below:

1. Publications in Peer Reviewed Journals
2. Publications in Newsletters
3. Seminar/Workshop/Symposium Proceedings
4. Books & Book Chapters
5. Technical Reports
6. Dissertations & Thesis
7. Popular Articles

4.1. Summary of the research findings on olive ridley turtles of Orissa

- An increase in mortality was documented from a few thousands in the early 1980s to more than 10,000 per year by the mid 1990s (Pandav, 2000). A review of data suggested that this population may be on the verge of a decline, based on evidence from the failure of *arribadas* in recent years, a decline in adult sizes and high fishery related mortality (Shanker *et al.*, 2004).

- Studies on trawl fishing and incidental capture of turtles showed a strong relationship between tow time and mortality of turtles, and suggest the effective use of TED (Gopi *et al.*, 2007). The study also found that with the use of TED the loss of catch was minimal (less than 5% of the overall catch). Alongwith mechanized fishing, motorized fishing using gill nets have also been found to be majorly responsible for turtle mortalities along the Orissa coast (Rajagopalan *et al.*, 1998).

- Near-shore surveys have shown that sea turtles occur in discrete areas which have been named as 'reproductive patches'. These reproductive patches have been located off the coasts of Gahirmatha (Pandav, 2000; Ram, 2000) and Rushikulya (Tripathy, 2004; 2005), and are expected to occur in the offshore waters of other mass nesting beaches such as Devi River mouth. The patches are about 50-75 km^2 in size, and extend to a distance of about 5-6 km offshore.

- A review of the methodology for census of olive ridley turtles during mass nesting and use of appropriate census technique indicate that the *arribada* estimate could be much lower than the annual figure from Gahirmatha and Rushikulya rookery. Such exaggerated figure could mislead the conservation of the species which is already meager (Shanker *et al.*, 2003, Tripathy, 2002; 2005; 2008).

- The Forest Department of Orissa flipper tagged ~15,000 nesting female turtles during 1980s, and the CMFRI have tagged nearly ~1,000 turtles, and further Wildlife Institute of India tagged ~22,000 nesting turtles and 1,670 mating pairs in the offshore waters of Orissa from 1995-2002. Results of all these studies showed that olive ridley turtles migrate between mass nesting beaches (Dash & Kar, 1990, Pandav & Choudhury, 2000; 2005, Tripathy & Pandav, 2008). Tagged turtles were recovered from Andhra Pradesh, southern Tamil Nadu and Sri Lanka, indicating that at least some of the olive ridleys that nest in Orissa migrate to these areas.

- From the satellite telemetry studies conducted in 2001, three of the four turtles remained in the offshore waters of Orissa between April and July, 2001, moving within 50 and 200 km of the coast, while the fourth turtle migrated to the coast of Sri Lanka in August 2001. The recent ongoing study on satellite telemetry along east coast of India confirms the post-nesting migration of olive ridley turtles at least up to the northern Indian Ocean and eastern Sri Lankan coast.

- Genetic studies confirmed the results from tagging and satellite telemetry studies and showed that there is no genetic difference between nesting populations in each of the mass nesting beaches. More significantly, the results revealed the distinctiveness of the population on the east coast of India, and suggested it may be ancestral to populations in the Atlantic and Pacific oceans (Shanker *et al.*, 2004).

- Satellite imagery studies suggest that the failure of mass nesting at Gahirmatha in 1997 and 1998 is due to natural causes such as erosion and reduction in the nesting habitat due to the impacts of successive cyclones (Prusty *et al.*, 2000; 2005, Rout & Behera, 2000; 2005).

- The study on the calcium metabolism in olive ridley eggshells during embryonic development suggests that calcium is the major inorganic constituents in the egg and embryo and movement of calcium from eggshell to embryo starts at about the 40^{th} day of development at 29.5^{0}C (Sahoo *et al.*, 1996).

- Also, the study on heavy metal on eggshell and beach sand suggests that beach sand contained higher levels of iron, zinc and lead concentration than cobalt, chromium, copper and nickel. Heavy metal accumulation was also found in hatchlings and suggests that embryo might accumulate these metals from the nesting beach during incubation (Sahoo *et al.*, 1996).

- Few studies that dealt with incubation and hatching success at the mass nesting beaches found that geomorphology and beach characteristics plays a significant role in the embryonic development and successful emergence of hatchlings. The studies also found that hatching success was higher in Rushikulya than that of Gahirmatha (Pandav and Choudhury, 2002; Tripathy *et al.*, 2003; Mohanty *et al.*, 2006).

- The study on the human-sea turtle interactions and community based conservation in Orissa indicated that use of turtles as a flagship species may drive conservation and social change in coastal Orissa. However, any community based conservation initiative needs further refinement in the process and strategy.

4. 2. Gap Areas of Research on the olive ridley turtle of Orissa

While most aspects of the biology of olive ridley turtles of the Orissa coast have been touched upon and there exists baseline information, there are still gaps in our knowledge of the turtles or their habitats in both onshore and offshore, which are addressed here.

4.2.1 In the onshore environment

- The foremost issue concerning turtles and the gaps in our knowledge is the cause for the continual decline in the nesting beach area, specifically those of the Nasi islands in the Gahirmatha rookery. Over the years, the nesting beach has become fragmented and considerably reduced in size. This is supported by the failure of the *arribada* or mass nesting in some years at this rookery. Is this a natural phenomenon especially that the sand bars and spits formed at the river mouth are likely to be dynamic, or is it that the erosive nature of the seas has accelerated as a result of global climate change, or is it that the formation of sand bars and spits becomes erratic as a result of developmental activities in the adjoining areas or due to those happening upstream. An in-depth study on the geomorphological changes affecting the nesting beaches is required. Further, this is also important to understand the nesting and hatching success.

- Though the Orissa coast is famously known for the three mass nesting sites, olive ridley turtles sporadically nest all along the coastline. A choice for such sporadic nest sites by turtles may be involved which is not clearly known. And, with extensive planting of *Casuarina* trees all along the coast, there may not be suitable beaches for turtles to nest sporadically. The Devi rookery is reported to have lost prime turtle nesting beach due to plantation activities. Is habitat modification or management required to improve turtle nesting in some sites? If so, then where? And for this, a clear understanding of the nest site selection by turtles is required.

- The last survey on nesting habitat along Orissa coast was conducted in 1993. Thereafter, the Orissa coastline has undergone significant changes due to natural and man-made alterations in the coastal geomorphology. Therefore, revisiting the coast of Orissa to assess the status of sea turtle nesting along the entire coast of Orissa is required.

- There is an additional problem in case of the sporadic nests and that is related to predation. Nearly 95 % of the sporadic nests recorded along a 25 km coastline along the Rushikulya rookery in 2007

nesting season were observed predated by feral dogs and jackals. It is believed that the dense casuarina plantations support high predator numbers. If then, are some prime nesting sites super abundant with predators? It is not clearly known. And, do these sites require active predator management?

- The estimation of nesting turtles during *arribada* has been undertaken by the Orissa Forest Department annually. The technique to estimate nesting turtles has been improvised over the years, however this requires further refinement and effective sampling to document the status of the *arribada* population in each of the nesting sites.

- It is well established that artificial illumination is a major deterent to nesting turtles and hatchlings at the nesting sites along the Orissa coast. A lighting oridinace to reduce the effects of the artificial illumination needs to be taken up.

4.2.2 In the offshore environment:

- From the few studies that have been carried out to understand the offshore aggregation of turtles, it has become evident that they occupy a small area in front of the river mouth or in front of the mass nesting beach. It is however not clearly known, as to why turtles occur in such large congregations there. It is also reported that gravid turtles use these sites to rest, but why? Whether any physico-chemical parameters in the offshore congregation sites play a role, or are these sites also rich in prey species on which the turtles feed? Indeed, do turtles feed at all during the nesting migration? These aspects are not known? An in-depth study on the feeding ecology and availability of prey for turtles in the near-shore waters is required. This can be done using techniques such as stomach flushing of live turtles or through autopsy.Whether the failure of *arribada* in some years is also a result of the offshore habitat conditions, is again not known. In such situations, it will also be important to know the reproductive status of the turtles, which can be done using laparascopic techiniques.

- The movement pattern and behavior (activity pattern) of turtles while they are in the congregations in the near shore waters is not known. This is crucial in order to provide effective protection to the turtles by identifying their home range or the congregation range in these waters. Identification and protection of these congregations from trawling and other harmful fishing practices will significantly reduce turtle mortality along the Orissa coast. Further, techniques to estimate the offshore population inorder to understand the gender ratios of the turtles arriving in coastal waters of Orissa needs to be taken up.

- While it is well established that mechanized trawl fishing is responsible for much of the turtle mortality in the offshore waters of Orissa, there is however no information on the impact of gill net fishing on the incidental capture and mortality of turtles in these waters. This is even more important as gill net fishing is practiced around the river mouths, which is where the turtles congregate. Therefore, a study on sea turtle-fisheries interface should look into the monofilament or multifilament, and any other gill net fishing practices in Orissa. Based on which, measures to reduce turtle by-catch in these fisheries can be devised.

- With over 100,000 turtles, all breeding adults, reported killed in the last decade along the Orissa coast, there are reports of a decline of large sized turtles in the population. A decrease in size of the nesting females observed over the years is thought to indicate the removal of the older population. This however needs to be supported with data on the age of turtles, and using osteological techniques, age of turtles can be determined, and this needs to be taken up for a better understanding of the population dynamics. Along with this an extensive flipper tagging program should be taken up.

- In recent years, a number of developmental projects have come up close to the coast, and a number of chemical industries and refineries have been set up or proposed to come up close to the *arribada* sites. The level of pollution in these waters due to the industrial discharge or effluents released from elsewhere and their effects on turtles using these areas is not known. Therefore, a study to monitor the level of pollutants or to assess the overall health of the near shore waters should be taken up.

- With the advancement and improvement in the technology available to track sea turtle movements, a long term satellite tracking program should be taken up. Even though, the recent tracking studies on the olive ridley turtles have shown that they migrate up to the south east coast of Sri Lanka, a clear understanding of their non-breeding area or foraging ground is not known. It is not known whether the turtles arriving in the near shore waters of Orissa undertake annual migration or not? Also, could this be related to the fluctuating numbers in the turtles nesting across years? It is not known. Further, an indepth molecular genetic study that will look into various issues such as population variation and multiple paternity needs to be taken up.

- Following the emergence of the hatchlings and their dispersal into the sea, the extent of offshore hatchling mortality is not known. Further, whether the hatchlings migrate and where are their developmental habitats is also not known? A sampling design to study the offshore mortality during the hatchling migration and when in their developmental habitats needs to be taken up, eventhough sampling for this aspect is highly complex and frought with logistic difficulties.

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Source: Dr. Prof. Priyambada Mohanty Hejmadi, GM-8, V.S.S. Nagar, Bhubaneswar - 751 007 (Orissa). Email: mohantyhejmadi@hotmail.com

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Source: As for previous

3. FRAZIER, J. G. (1980). Exploitation of marine turtles in the Indian Ocean. *Human Ecology* 8: 329-370.

Marine turtles have long been of great value to peoples of the Indian Ocean, nutrionally, economically, and culturally. Once directed primarily toward subsistence, the hunting of marine turtles for international trade has increased; today their populations are often so depleted that they are not only insignificant as resources, but are endangered. An understanding of exploitation is imperative to guarantee future populations, yet available information is sketchy. “Subsistence hunting” is an ambiguous term, since the most intense exploitation is for export. Historically this has involved Chelonia and *Eretmochelys*, whose populations are now much reduced. Yet, newly “discovered” populations (*Lepidochelys* especially) are being exploited, under the stimulus of new foreign markets (e.g. leather), and their fates seem even less hopeful than those of long exploited populations. Moreover “subsistence hunting” for immediate local consumption has led to depletion of nesting and feeding populations of turtles in areas where protein sources are in great demand and human population densities high. Neither the future nor the solution to this dilemma is clear, but it is obvious that economic considerations must be carefully considered, and ecological arguments alone are insufficient to manage these resources.

Source : Dr. Jack Frazier, Conservation & Research Centre, Smithsonian Institution, USA. Email : kurma@shentel.net

4. GOPI, G. V., B. PANDAV & B. C. CHOUDHURY. (2007). Estimated annual incidental captures of *Lepidochelys Olivacea* (Eschscholtz, 1829) in trawl nets along the Orissa coast, India. *Hamadryad* 31 (2): 212-215.

The incidental capture of sea turtles in marine trawl fishing has been identified as a major source for their large-scale mortalities worldwide. Since trawl operators in Orissa are reluctant to concur, we provide empirical data on incidental captures in the Orissa coastal waters. A total number of 76 trawling efforts were carried out between 6–35 fathoms between November 2001 to March 2002, which resulted in the capture of 26 *Lepidochelys olivacea*. An estimate has been made to extrapolate the number of turtles drowned annually during the nesting season. Of the three stratified study zones, estimates were higher in the Devi zones with 2,439, followed by the Gahirmatha zone with an estimate of 1,254, and lastly, the Paradip zone, with an estimate of 1,086 turtles.

Source: Gopi, G. V., Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun – 248001 (Uttaranchal), India. Email: gopigv@wii.gov.in.

5. GOPI, G. V., B. PANDAV & B. C. CHOUDHURY. (2006). Incidental capture and mortality of olive ridley turtles (*Lepidochelys olivacea*) in commercial trawl fisheries in coastal waters of Orissa, India. *Chelonian Conservation and Biology* 5: 276-80.

A shrimp trawl fishery study was conducted in the coastal waters of Orissa, India, from November 2001 to March 2002; 76 trawls in water of 6–35 fathoms resulted in the capture of 26 olive ridley turtles (*Lepidochelys olivacea*). Most turtle captures occurred within 5 km of the shoreline and at a depth of less than 10 fathoms, emphasizing the need for greater protection of these near-shore habitats. Data revealed a strong relationship between tow time and mortality of turtles.

6. GOPI, G. V., B. PANDAV & B. C. CHOUDHURY. (2007). Efficacy of turtle excluder devices on incidental captures of olive ridley sea turtles (*Lepidochelys olivacea*) in the trawl fisheries of Orissa, India. *Testudo* 6: 67-73.

This paper discusses on the issue of incidental capture of sea turtles in trawl nets and mortality resulting from such captures, and the use of Turtle Excluder Device (TED). They express concern that restricting trawl duration (<45 min) to avoid killing of turtles could never be enforced on commercial fisheries and therefore suggest the effective use of TED.

7. *HEJMADI, P. M. (1993). A study of ecology, breeding patterns, development and karyotype patterns of the Olive Ridley, *Lepidochelys olivacea*. *Pranikee* 9: 1-70.

The author provides a detailed report on the breeding biology and behaviour of the olive ridley turtles of the Gahirmatha rookery.

8. JAMES, P. S. B. R., M. RAJAGOPALAN, S. S. DAN, A. B. FERNANDO & V. SELVARAJ. (1989). On the Mortality and stranding of marine mammals and turtles at Gahirmatha, Orissa from 1983 - 1987. *Journal of Marine Biological Association of India* 31(1&2): 28-35.

Observation on the stranded marine turtles and marine mammals in a stretch of 10 km at Gahirmatha beach, Orissa during 1983 to 1987 are reported here. The washed ashore marine turtles were due to the result of turtles getting entangled and drowned in fishing operations conducted off Paradip and adjacent areas, the carcasses drifting northwards and ashore at Gahirmatha. In 1983 around 7500 olive ridley *Lepidochelys olivacea* were washed ashore and the curved carapace length in cm varied from 51-72 (62.2) and the carapace width in cm varied from 48-63 (57.8). The number of stranded turtles was reduced to 360 in 1987 and this is due to the effective steps taken to enforce the Wildlife (Protection) Act by the State and Forest Department. Stranding of Humpback dolphin *Sousa chinensis*, Snubfin dolphin *Orcella brevirostris* and Finless porpoise *Neophocaena phocoenoides* were also recorded. Mortality of nesting females during *arribada* could have an adverse effect on the breeding population of olive ridley visiting the rookery and consequently on recruitment. A careful study is needed to take preventive and precautionary regulatory measures to be adopted in specific type of fishing operations during the nesting season of olive ridley.

Source: Central Marine Fisheries Research Institute, Post Box No. 1603, Ernakulam North P.O., Kochi-682 018.

9. JAMES, P. S. B. R., M. RAJAGOPALAN, S. S. DAN, A. B. FERNANDO & V. SELVARAJ. (1991). Observations on Mass nesting of the Olive ridley, *Lepidochelys olivacea*, at Gahirmatha, Orissa during the 1987 season. *Journal of Marine Biological Association of India* 33(1&2): 69-75.

Observation made during the *arribada* or mass nesting of the olive ridley *Lepidochelys olivacea* during 1987 at Gahirmatha, Orissa are reported. The first mass nesting occurred in a stretch of 5.7 km from 5th to 14th January and two lakh turtle nested. During the second mass nesting in stretch of 4.5km from 5th

to 15th March four lakh turtle nested. Hatching of fist mass nesting batch emerged after 60 days of incubation in March 1987 and the percentage of live hatchling emerged from the natural nests varied from 63.25 to 98.66 (87.22). The mean carapace length in mm from 20 clutches examined varied from 40.2 to 42.8 and carapace width varied from 32.7 to 34.5. The means weight in gm of the hatchlings varied from 14.75 to 19.10. The emergence of hatchlings of second mass nesting noticed after an interval of 50 days in May 1987 and the mean percentage of live hatchlings emerged varied from 17.95 to m90.38 (54.34). The mean carapace length in mm from 65 clutches examined varied from 36.48 t0 42.85 and the carapace width varied from 27.69 to 34.06. The mean weight of hatchlings in gm varied from 13.6 to 18.6 gm. The hatchling success of fist and second mass nesting occurred in 1987 at Gahirmatha was compared and the high percentage of spoilt and unfertilized eggs and dead hatchlings was observed in second mass nesting batch.

10. MOHANTY, A., S. K. SINGH, G. SAHU & R. C. PANIGRAHY. (2004). Hatching of olive ridley turtles in Rushikulya rookery, Orissa coast. *Journal of Indian Ocean Studies,* Vol. 12 (3): 457-468.

Of the four species of sea turtles (*Lepidochelys olivacea*, *Dermochelys coriacea*, *Chelonia mydas*, *Eretmochelys imbricate*) found along the Orissa coast, mass nesting of Olive Ridley takes place at three sites namely Gahirmatha, Devi river muhan and Rushikulya muhan every year. Rushikulya river muhan has been identified as a prominent mass nesting (*arribada*) site, where over 1,00,000 gravid mother Olive Ridleys lay their eggs between January and April every year. Since eggs and juveniles are deprived of parental care, knowledge on hatching success, successful emergence of hatchlings from their nests and their orientation on the beach constitute important components in sea turtle conservation measures. An attempt has been made to study the post nesting processes with respect to clutch size and the beach orientation of hatchlings at Rushikulya rookery during the post *arribada* period of 2004. The hatching success on this beach ranges from 63.79 to 100% yielding a mean value of 89.64 $\pm$ 7.87%. Majority (average 95.63%) of the newly born bay turtles can emerge out from the nests to move into the sea. Results on orientation studies show that 74.62 – 100% (average 91.97%) of hatchlings can move towards the sea and only 8.03% are lost owning to their disorientation. Results of this study indicate that the nesting site at Rushikulya is better conducive for post nesting processes of *Lepidochelys olivacea*.

Source: Dr. R. C. Panigrahy, Department of Marine Sciences, Berhampur University, Bhanja Bihar, Berhampur – 760 007 (Orissa). Email: rcpanigrahy@yahoo.com.

11. MOHANTY, P. K., U. S. PANDA, S. R. PAL & P. MISHRA. (2008). Monitoring and management of environmental changes along the Orissa coast. *Journal of Coastal Research* 24, No. 2B: 13-27.

Orissa, the maritime state along the east coast of India, has a coastline of 480 km. The southern part of the coast has a narrow shelf, but the north Orissa coast has an extended continental shelf. The coastline is bestowed with six major estuaries, India's second largest mangrove forest (Bhitarkanika Sanctuary), Asia's largest brackish water coastal lagoon (Chilka), extensive sandy beaches rich in heavy minerals, the world's largest rookery for the Olive Ridley sea turtle (Gahirmatha sandy beach within Bhitarkanika sanctuary), and two species of horseshoe crabs. In the last few decades there has been tremendous pressure on the coastal zone for the development of fisheries, aquaculture, ports, harbours, and urban settlements. These developments have led to environmental changes, some of which are irreversible, and thus have become issues of concern for the public as well as the state government. Some of the important environmental changes taking place, and which seriously affect the economy of the region, are tropical cyclones and associated storm surges, floods, decline in mangrove forests, accelerated shoreline changes, and transformation of the coastal lagoon ecosystem. This paper documents different coastal environmental feature and their changes, observed during the last few decades through secondary data, field surveys, and remote sensing observations, and suggest a framework for a coastal zone management programme in the state.

Source: Dr. P. K. Mohanty, Department of Marine Sciences, Berhampur University, Bhanja Bihar, Berhampur – 760 007 (Orissa). Email: pratap_mohanty@yahoo.com.

12. NAYAK, L. (2005). Loss of marine biodiversity – Conservation of sea turtles along the Orissa coast. *Journal of Indian Ocean Studies* Vol. 13(1): 141-146.

The coastline is one of the most spectacular gradients on earth since its forms and transition between the saline, aquatic environment of the ocean to the dry, air-exposed land over a distance of several meters. The total length of the world's coastline amounts to several million kilometers, the Indian coastline is about 8129 km and Orissa's coastline is 480 km. From the giant dolphin to the spectacular *Noctiluca* occurs in the marine waters of Orissa. Its marine water contains a diversity of life forms and communities.

Source: Dr. Laxman Nayak, Department of Marine Sciences, Berhampur University, Bhanja Bihar, Berhampur – 760 007 (Orissa).

13. PANDAV, B., B. C. CHOUDHURY & C. S. KAR. (1997). Mortality of olive ridley turtles, *Lepidochelys olivacea,* due to Incidental Capture in fishing nets along the Orissa coast. *Oryx* 31(1): 32-36.

The coastal state of Orissa, India, harbours three important mass-nesting beaches of the olive ridley sea turtle *Lepidochelys olivacea*. During a survey of sea turtle nesting beaches from December 1993 to May 1994, 5282 dead olive ridleys were counted along the 480 km coastline of Orissa. Almost all the dead were due to incidental capture in offshore fishing nets. Increased fishing activities in the coastal waters near important sea turtle nesting beaches pose a serious threat to th4e survival of this endangered sea turtle. It is therefore suggested that costal waters adjacent to major sea turtle nesting beaches be declared as closed areas for commercial fishing activities in order to ensure the sea turtle's long term survival.

Source: Dr. Bivash Pandav, Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun – 248 001, Uttarakhand, India. Email: pandavb@yahoo.com.

14. PANDAV, B., B. C. CHOUDHURY & K. SHANKER. (1998). The olive ridley sea turtle (*Lepidochelys olivacea*) in Orissa: An urgent call for an intensive and integrated conservation programme. *Current Science* 75(12): 1323-1328.

The Olive Ridley sea turtle, which nests along the east coast of India, is highly endangered today. This sea turtle is especially known for its mass nesting or arribada when several thousand turtles migrate to the breeding ground to mate and nest simultaneously. The rookery at Gahirmatha in Orissa is the largest in the world with annual nesting of hundred to five hundred thousand turtles, but there has been no mass nesting at this site for the past two years. Over the past five years, sea turtles have suffered mass mortality along the Orissa coast due to death by drowning as incidental catch in trawl-fishing nets. The first step in conserving this species would be the enforcement of the existing ban on near-shore mechanized fishing. The use of turtle excluder devices should be made mandatory for all trawlers operating in offshore coastal waters. Close monitoring and protection of the three major rookeries would curb predation of hatchlings, and the introduction of controlled lighting in these areas would greatly reduce hatchling mortality. Since the major cause of mortality of adult turtles is due to modern fishing practices which have also endangered traditional coastal lifestyles in addition to the turtles, a solution lies in encouraging the return of artisanal fishing to the Orissa coast.

15. PRUSTY, G., S. DASH & M. P. SINGH. (2007). Spatio-temporal analysis of multi-date IRS imageries for turtle habitat dynamics characterization at Gahirmatha coast, India. *International Journal of Remote Sensing* 28: 871-883.

This paper reports the conceptualization of a remote sensing based technique to map the spatio-temporal change pattern of the coastal landforms of Gahirmatha, India, the world's biggest olive ridley sea turtle rookery. Twenty-seven Indian Remote-sensing Satellite (IRS) multi-spectral satellite images

sampled between the period 1988–2001 are the basic input for the study. While the mapping of temporal change position of the landform centroids revealed the migrational behaviour of the landforms, the tide normalized change detection indicated the habitat surface area dynamics. The analysis revealed that the Ekakula spit of Gahirmatha estuary has undergone cyclone-induced mass erosion during its 14 years' evolutionary history, thereby destroying its nesting habitat. However, the Nasi barrier bar had shifted its position by about 6.85km without significant change in geo-environment including surface area and hence continued to be the favorable site for turtles' mass nesting. The results have aided in understanding the impact of natural processes on the nesting habitat dynamics.

Source: Dr. Ganesh Prusty, Defence Terrain Research Laboratory, Metcalfe House, Delhi – 110 054, India. Email: ganpru@yahoo.com.

16. SAHOO G., R. K. SAHOO & P. M. HEJMADI. (1998). Calcium metabolism in olive ridley turtle eggs during embryonic development. *Comparative Biochemistry & Physiology, Part A* 12: 191-97.

Analyses of calcium, magnesium, sulphur, potassium and phosphorus content of the eggshell, yolk-albumen and embryos of olive ridley turtle, *Lepidochelys olivacea*, have been carried out at various stages of embryonic development. Calcium is the major inorganic constituent in the egg (shell and yolk-albumen) and embryos. Other elements are present either in trace or in minute trace amounts. The egg contents (yolk and albumen) provide only 40% of the embryonic calcium requirement of the hatchling. The remaining 60% is provided by the eggshell. The eggshell also undergoes a similar reduction in its calcium content from laying to hatching. Elements other than calcium present in the yolk-albumen are sufficient for normal embryonic development. The movement of calcium from the eggshell to the embryo starts at about the 40th day of development at 29.5°C. Birds, turtles and crocodiles use their eggshell as the secondary source of embryonic calcium requirement. This dependence on the eggshell varies in different groups which is highest in birds and lowest in crocodiles.

Source: Dr. Gunanidhi Sahoo, North Orissa University, Shri Ram Chandra Vihar, Takatpur, Baripada, Distt. Mayurbhanj 757 003 (Orissa), India. Email: gunanidhi.nou@gmail.com

17. SAHOO, G., B. K. MAHAPATRO, R. K. SAHOO & P. M. HEJMADI. (1996). Ultrasturcture and characteristics of egg shells of the olive ridley turtle (*Lepidochelys olivacea*) from Gahirmatha, Orissa. *Acta Anatomica* 156: 261-267.

The structure of a chelonian eggshell is of prime importance for the developing embryo. It acts as a protective covering as well as mediator in the exchange of heat and water. The fresh eggshell of the olive ridley (*Lepidochelys olivacea*) turtle displays a variety of structural forms in their aragonite framework. Its netted substrate, loose texture and poorly organized crystallites favour the easy exchange of air and water during its development. The shell consists mostly of calcium in carbonate form and K, Mg, Fe, Ni, Pb, Zn, Co, Cr, Cu, Mn and Cd in traces. Ba and Sr in traces are also a feature of the thermal analysis graph. Phosphorus was not detected in the shell and its absence eliminates an earlier suggestion of it being a key factor in the development of aragonite crystals in the inorganic structure of marine turtle eggshells. Its combustion characteristics, which have not been previously reported, are recorded.

18. SAHOO, G., B. K. MOHAPATRA, R. K. SAHOO & P. M. HEJMADI. (1996) Contrasting ultrastructures in the eggshells of olive ridley turtles, *Lepidochelys olivacea*, from Gahirmatha, Orissa. *Current Science* 70: 246-249.

Normal and abnormal sized eggshells of olive ridley turtles, *Lepidochelys olivacea* from Gahirmatha have been studied for ultrastructure characteristics. Fresh eggshells exhibit nodular shell units on the upper surface followed by a membranous network of fibres and a thin shell membrane. These structures are not seen in hatched eggshells as the calcium is resorbed during embryonic development. Abnormal shells do not show any such structure excepting disoriented fibres in its lower surface due to inadequate calcification.

19. SAHOO, G., R. K. SAHOO & P. M. HEJMADI. (1996). Distribution of heavy metals in the eggs and hatchlings of olive ridley sea turtles, *Lepidochelys olivacea* from Gahirmatha, Orissa. *Indian Journal of Marine Science* 25: 371.

Shell and yolk-albumen of fresh eggs, hatched egg shells and newly emerged hatchlings of olive ridley sea turtle, *Lepidochelys olivacea*, along with eight nesting beach sand samples showed higher iron, zinc and lead concentrations than cobalt, chromium, copper and nickel. Beach sand samples recorded higher values of all metals than egg components. Newly emerged hatchlings also recorded higher values than the fresh eggs. Embryos might have accumulated these metals from the nesting beach during incubation.

20. SASAMAL, S. K. & R. C. PANIGRAPHY. (2006). Influence of eddies on the migratory routes of the sea turtles in the Bay of Bengal. *International Journal of Remote Sensing* 27, 15: 3115-3122.

The movement of sea turtle Olive Ridley (*Lepidochelys olivacea*) during their post-nesting period is studied with reference to oceanic eddies delineated from satellite-derived maps of sea surface temperature (SST), chlorophyll-a and mean sea level anomaly in the northwestern Bay of Bengal. Four turtles tagged off the coast of Orissa, India with an Argos platform terminal transmitter (PPT) were tracked by satellites in April 2001. The animals were tracked from April to August 2001. Transmission from three PTTs terminated in June 2001 in the offshore waters of Orissa, while the remaining PTT 14577 continued transmission until 10 August 2001 as far as the east coast of Sri Lanka. The cyclonic eddy and high productive features observed in satellite data were associated with anticlockwise rotation made by the animals off the coast of Orissa prior to June 2001. The turtle with PTT 14577 migrated further south to the coast of Sri Lanka through the boundary between offshore dipole eddies. The satellite data indicated the influence of eddies on the migration pattern of sea turtles in the western Bay of Bengal.

Source: Dr. S. K. Sasmal, National Remote Sensing Agency, Balanagar, Hyderabad, (Andhra Pradesh), India. Email: nrsa@nrsa.gov.in

21. SHANKER, K. & R. KUTTY. (2005). Sailing the flagship fantastic different approaches to sea turtle conservation in India. *In*: Frazier, J. (ed.), Marine Turtles as Flagships. MAST/Maritime Studies (Special Issue) 3/4: 213-240.

As a part of mythology, sea turtles are worshipped in many parts of India. In recent times, they have also become flagships for conservation, with champions amongst wildlife conservationists as well as local communities. Sea turtle conservation in India by the state and non-governmental organizations is about thirty years old. What started with a conservation programme by a group of dedicated individuals in Madras and a research programme by the state Forest Department at the mass nesting beaches in Orissa has now spread to most coastal states in India. While some turtle conservation projects are still run by the respective state Forest Departments, many are run by non-governmental organizations, ranging from students to animal activists to local communities. Of particular interest is a students' group in Madras, which has survived despite the lack of formal structure, principally due to the attraction of working with sea turtles. Of even greater interest are the fishermen of a small hamlet in Kerala, who started with a sea turtle conservation programme, and thanks in part to its success, are now leaders of their community on a number of social and environmental issues. On the other hand, the very visibility of sea turtles in Orissa may have promoted the creation of a rift between diverse communities of fishermen and conservationists; and the species has, instead of being a source of pride and valued heritage, become a bone of contention in a highly polarized and politicized battle. Hence, the use flagships can sometimes drive conservation and social change, and at others, be a detriment to both environmental and social development.

Source: Dr. Kartik Shanker, Centre for Ecological Sciences, Indian Institute of Science, Bangalore. E.mail: kshanker@ces.iisc.ernet.in

22. SHANKER, K., B. PANDAV & B. C. CHOUDHURY. (2004). An assessment of the olive ridley turtle (*Lepidochelys olivacea*) nesting population in Orissa, India. *Biological Conservation* 115: 149 -160.

Olive ridley mass nesting events or '*arribadas'* have been documented in Orissa, India since 1974. However, since standardized techniques have not been used to census turtles, actual population trends remain unknown. Herein, we summarize information on nesting populations in Orissa, using data from multiple sources to arrive at consensus estimates and to derive trends. We conducted a quantitative estimate of an arribada in March 1999, where nesting was estimated as _180,000 turtles by the strip transect method. Non-linear (quadratic) fits for arribada data from 1976–1999 and a recent decrease in the size of adults suggest a potential or imminent decline, consistent with fishery-related mortality of at least 90,000 turtles since 1994.Though statistical support for the recent decline is equivocal, efforts to reduce mortality and close monitoring of the population would be prudent. The absence of reliable data on which to base conservation action highlights an urgent need to train management personnel in data collection and estimation techniques for effective monitoring of status, threats and trends.

23. SHANKER, K., J. RAMA DEVI, B. C. CHOUDHURY, L. SINGH & R. K. AGGARWAL. (2004). Phylogeography of olive ridley turtles (*Lepidochelys olivacea*) on the east coast of India: Implications for conservation theory. *Molecular Ecology* 13: 1899-1909.

Orissa, on the east coast of India, is one of the three mass nesting sites in the world for olive ridley turtles (*Lepidochelys olivacea*). This population is currently under threat as a result of fishery-related mortality; more than 100 000 olive ridleys have been counted dead in the last 10 years in Orissa. In general, the globally distributed olive ridley turtle has received significantly less conservation attention than its congener, the Kemp's ridley turtle (*L. kempi*), because the latter is recognized as a distinct species consisting of a single endangered population. Our study of mitochondrial DNA haplotypes suggests that the ridley population on the east coast of India is panmictic, but distinct from all other populations including Sri Lanka. About 96% of the Indian population consisted of a distinct 'K' clade with haplotypes not found in any other population. Nested clade analysis and conventional analysis both supported range expansions and/or long-distance colonization from the Indian Ocean clades to other oceanic basins, which suggested that these are the ancestral source for contemporary global populations of olive ridley turtles. These data support the distinctiveness of the Indian Ocean ridleys, suggesting that conservation prioritization should be based on appropriate data and not solely on species designations.

24. TRIPATHY, B. (2006). Sea turtle research, biology and conservation in India. *Journal of Indian Ocean Studies* 14 (1): 116-128.

Although sea turtle research in India and in particularly along the Orissa coast is three to four decade old, there is not much scientific information available on the finer aspects of their life history, migration and mating behaviour. Literature search on an array of studies on the biology and behaviour of the olive ridley turtles along the Orissa coast suggests that more authentic research on the olive 4idley species and its habitat is essential and substantial information is required for formulating conservation and management plans for the olive ridley sea turtle in Orissa.

Source: Dr.Basudev Tripathy, Wildlife Institute of India, Post Box 18, Dehradun – 248001. E.mail: tripathyb@wii.gov.in

25. TRIPATHY, B. (2008). An assessment of solitary and *arribada* nesting of olive ridley sea turtles (*Lepidochelys olivacea*) at the Rushikulya rookery of Orissa, India. *Asiatic Herpetological Research* 11: 134-140.

The solitary and arribada population of olive ridley sea turtles at the Rushikulya rookery of Orissa of India was monitored for two nesting seasons. Mass nesting population census of turtles was carried out

using standard statistical technique. Curved carapace measurements of egg laying females were recorded. The sporadic nesting was documented at the rookery from December to April with peak in March and with no major intermediate nesting activities in between. The mass nesting census differs greatly as compare to the nesting figures projected by the state wildlife authority. There was a reduction in the size class of nesting females. Continuous monitoring of the beach for assessment of solitary nesting activities along with accurate methods of mass nesting census is required for proper assessment of the olive ridley population at the Rushikulya rookery of Orissa.

26. TRIPATHY, B. & A. K. MISHRA. (2007). Status and conservation of olive ridley sea turtle (*Lepidochelys olivacea*) at the Devi rookery of Orissa coast, India. *E-Planet* (1): 59-63.

The status of olive ridley turtles along the Devi rookery is meager known due to mere negligence of the area over the period of time since its discovery in 1908. Although the Wildlife Institute of India has been documenting the nesting processes at this rookery since 1998, there is no information available on the other aspects of olive ridleys at this important nesting ground. This paper highlights some of the interesting finding of the short time survey conducted at this rookery during the 2004-2005 nesting season.

27. TRIPATHY, B. & B. C. CHOUDHURY. (2007). A review of sea turtle exploitation with special reference to Orissa, Andhra Pradesh and Lakshadweep Island, India. *Indian Journal of Traditional Knowledge* 6(2): 285-291.

The abundance of sea turtles at a few sites gives the impression that they may not be endangered, but many nesting population are in a decline phase. Over exploitation of sea turtles is considered one of the most direct and easily identified of problem, and causes immense pressure on a population whether it is for commercial or non-commercial purpose. Intensive harvesting of *Lepidochelys* eggs has resulted in population declines in many parts of the world. The exploitation of sea turtle resources from northern Indian Ocean region area is known from early twentieth century. Although, historically for commercial purposes, sea turtles in recent times are considered a non-commercial resource because of its high rate of reduction in number throughout the region. The paper describes the traditional sea turtle exploitation practices in India with a focus on present exploitation trends in three important sea turtle regions of India. Stringent measures that are required to save sea turtles from exploitation have also been suggested.

28. TRIPATHY, B. & B. PANDAV. (2008). Beach fidelity and internesting movements of olive ridley sea turtles (*Lepidochelys olivacea*) at Rushikulya, India. *Herpetological Conservation and Biology* 3(1): 40-45.

We studied the beach fidelity of Olive Ridley Turtles (*Lepidochelys olivacea*) for three seasons at the Rushikulya rookery on the coast of Orissa in India between December and May (2003-2005). We monitored sporadic nesting and *arribada*s for tagged turtles. Multiple nesting by individual turtles and recapture of tagged turtles confirmed the beach site fidelity of Olive Ridley Turtles. The inter-nesting intervals ranged from 20-25 days and remigration intervals varied between 1-8 years. There was an inter-seasonal shift in movement of Olive Ridley Turtles from Rushikulya rookery. It is possible that beach exchange is part of a complex phenomenon that Olive Ridley Turtles use to colonize new areas or even move to another beach altogether.

29. TRIPATHY, B., B. PANDAV & R. C. PANIGRAHY. (2003). Hatching success and orientation in *Lepidochelys olivacea* (Eschscholtz, 1829) at Rushikulya rookery, Orissa, India. *Hamadryad* 27(2): 185-192.

The hatching success and beach orientation of olive ridley sea turtle (*Lepidochelys olivacea*) hatchlings were studied during a post *arribada* season (March 1996 - May 1996) at the Rushikulya rookery along the Orissa Coast, India. A total of 40 nests were observed for two weeks to obtain information on time of emergence of hatchlings and the hatching time lag, emergence success, and orientation of the

hatchlings. Additional 50 successful nests were excavated to determine hatching success. The emergence success observed during the study was 98 ± 18.86%. Hatchlings showed strong phototactic orientation (89%). Average clutch size of the nest was 126.00 ± 19.20 eggs. In majority of the excavated nests (99%), all the eggs had hatched, while in the remaining few nests, eggs had failed to hatch.

30. UPADHYAY, S. & V. UPADHYAY. (2002). International and national instruments and marine turtle conservation in India. *Journal of International Wildlife Law and Policy* 5: 65-86.

The authors have reviewed the national and international legal instruments for conservation and management of sea turtle and other marine resources with special emphasis on olive ridley sea turtle of Orissa. They have advocated strict implementation of Indian Wildlife (Protection) Act, 1972 along with the Marine Fishing Regulation Act, 1983 or Orissa and other federal and state marine and coastal regulation Act for safeguarding the species and its habitat.

Source: Sanjay Upadhyay & Videh Upadhyay, Enviro-Legal Defence Firm, 278, Sector-15-A, Noida-201301, Uttar Pradesh, India. Email: su@vsnl.com.

ii. **Research Communications/General Review Articles**

31. AGGARWAL, R. K., T. P. VELAVAN, D. UDAYAKUMAR, P. S. HENDRE, K. SHANKER, B. C. CHOUDHURY & L. SINGH. (2004). Development and characterization of novel microsatellite markers from the olive ridley sea turtle (*Lepidochelys olivacea*). *Molecular Ecology Notes* 4, 77-79.

Olive ridley turtles, although widely distributed globally and in Indian coastal waters, have undergone declines in recent years due to anthropogenic factors, particularly fishery related mortality. Assessment of genetic variability in existing populations is critical to the development of effective conservation strategies. Here we describe the development of six highly polymorphic micro satellite loci from a simple sequence repeat-enriched genomic DNA library of olive ridley turtle. Characterization of five of these loci using 83 individual olive ridley turtles revealed eight to 24 alleles per locus, high observed and expected heterozygosity values and broad cross-species amplifications. The sixth micro satellite was found to be monomorphic in the olive ridley samples but was polymorphic in two related marine turtle species. These micro satellites thus provide efficient genetic markers to understand the population structure, phylo-geography and species relationships of olive ridley and other marine turtle species.

Source: Dr. Ramesh K. Agarwal, Center for Cellular and Molecular Biology, Uppal Road, Hyderabad – 500007, India. Email: rameshrk@ccmb.res.in

32. BHASKAR, S. (1981). Preliminary report on the status and distribution of sea turtles in Indian waters. *Indian Forester* 107: 707-711.

This paper mentions the occurrence and nesting habitat of all five species of sea turtles along the Indian coastline including the islands. There is a mention of the *arribada* or mass nesting at Gahirmatha and the active turtle trade to markets in West Bengal for human consumption.

Source: Madras Crocodile Bank Trust, Mammalapuram, Tamil Nadu, India. Email: mcbtindia@gmail.com

33. BISWAS, S. (1982). A report on the olive ridley *Lepidochelys olivacea* (Eschscholtz) (Testudines Chelonidae) of Bay of Bengal. *Record of Zoological Survey of India* 79: 275-302.

The author provides detailed information on the biology of the olive ridley sea turtle (*Lepidochelys olivacea*) of the Bay of Bengal. And, the status of the species and their colony along the east coast of India, and specifically makes a mention of four major nesting grounds along the Orissa coast (Deltaic area of Brahmani & Baitarani rivers, Puri-Balukhand, Konark-Chadrabhaga and Chandipur-Burablang estuary).

Source: Zoological Survey of India, Prani Vigyan Bhawan, M-Block, New Alipore, Kolkata – 700053, West Bengal, India.

34. BISWAS, S., L. N. ACHARJYO & B. C. MAHAPATRA. (1977). Observation on incubating eggs of *Lepidochelys olivacea* (Eschscholtz) from Orissa coast in natural and artificial conditions. *Science and Culture* 43(1): 43-45.

Two observations were made by the authors, one on the laying of eggs by turtles and its incubation in field condition (66.66%), and another on the incubation of a clutch of eggs collected from the Konarak beach in the artificial laboratory condition (14.3%) at the Nandankanan Biological Park, Orissa. They also provided information in detail in on the development of the eggs during the incubation phase.

35. BUSTARD, H. R. (1976). World's largest sea turtle rookery. *Tigerpaper*. 3(3): 25

During a countrywide survey of crocodilians in 1974 for the Government of India, news of a large sea turtle rookery in Orissa was received by the author. He identified the species as the Pacific or olive ridley (*Lepidochelys olivacea*) from a skull, and also found that an enormous rookery occurred in the region, which nesting rookery in 1975 was included inside the Bhitar Kanika Sanctuary.

Source: TIGERPAPER, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road. Bangkok, 10200, Thailand.

36. BUSTARD H. R. & C. S. KAR. (1981). Annual nesting of the pacific ridley sea turtle (*Lepidochelys olivacea)* in Orissa, India. *British Journal of Herpetology*, Vol. 6: 139.

Based on the flipper tagging exercise carried out by the authors, they state that it is too early to conclude that *Lepidochelys olivacea* is an annual nester in the Bay of Bengal, especially that a large proportion of the 1977/78 nesting turtles - 24% - appear to have re-nested the following year.

Source: Dr. C. S. Kar, Senior Research Officer, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar – 751 002. Email: drcskar@gmail.com.

37. DUTTA, S. K. & L. N. ACHARJYO. (1990). Checklist of the herpetofauna of Orissa, India. *The SNAKE* Vol. 22, 26-43.

The rich forest ecosystem and the climate of Orissa offer unique habitat for the existence of 93 species of amphibians and reptiles in the State. There are 16 species of amphibians, 3 species of crocodilians, 10 species of turtles, 19 species of lizards and 45 species of snakes found in Orissa. The inclusion of some of these species in the present checklist is based on only published literature, but very little or nothing is known about their distribution in the State.

Source: Dr. S. K. Dutta, Professor & Head, Department of Zoology, Professor & Head, Department of Zoology, North Orissa University, Shri Ram Chandra Vihar, Takatpur, Baripada, Distt. Mayurbhanj - 757 003 (Orissa). Email: sk_dutta@yahoo.com

38. DUTTA, S. K. & L. N. ACHARJYO (1995). Herpetofaunal resources and their conservation in Orissa, India. *Zoos' Print*, Vol. X (7): July 1995: 5-8.

The authors reports on the occurrence of about 18 species of amphibians, 3 species of crocodiles, 11 species of turtles that includes three species of sea turtles (*Lepidochelys olivacea*, *Chelonia mydas*, *Eretmochelys imbricata*), 20 species of lizards and 45 species of snakes in the Orissa State. The authors make a mention on the various conservation measures taken up in the State.

39. FRAZIER, J. G. (1980). Sea turtle faces extinction in India Crying 'wolf' or saving sea-turtles? *Environmental Conservation* 7: 239-240.

This a short communication in response to an article published earlier in this journal "Sea-turtle faces extinction in India," where the author discusses the decline of sea turtles around the world due to increase in sea-turtle fisheries. And states that there is no debating that the future of sea- turtle populations is insecure, and the need for basic information and national management practices is therefore urgent. The author points out erroneous facts made in the earlier published article.

40. KAR, S. K. (1993). Studies on the mass nesting (arribada) of Pacific Ridley turtles, *Lepidochelys olivacea* in Bhitarkanika Wildlife Sanctuary, Orissa. *Indian Forester* 119(10): 853-857.

The author reports on the mass nesting of olive ridley turtles at the Gahirmatha beach in Bhitarkanika Wildlife Sanctuary. He also provides information on clutch size, incubation period, hatchlings and hatching success, predation of eggs and hatchlings. There is also a mention of the monel tagging program initiated with assistance from GOI/FAO/UNDP and on tag recovery. Further, there is mention of the mortality of turtles in the sea.

Source: Dr. S. K. Kar, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar- 751002 (Orissa).

41. PATNAIK, S. K. & L. N. ACHARYO. (1985). Wildlife conservation in Orissa. *Cheetal* Vol.27 (1&2): 38-44.

The authors have described about the extensive rookeries of the sea turtle at Gahirmatha and Puri-Konark sea coast. They have mentioned that this is a renewable natural resource of the state which has not been scientifically exploited. The sea turtle project is Orissa is investigating productivity and ecological parameters such as natural predation and devising methods to prevent such losses so that this species can be protected.

Source: Shri S. K. Patnaik, 51, Fishery Lane, Budheswari Colony, Bhubaneswar – 751 001 (Orissa), India. Email: sk_patnaik@yahoo.com.

42. SHANKER, K. (1999). Olive ridley in Orissa: Further comments. *Current Science* Vol. 76, 12: 1522-1523.

The occurrence of mass nesting of Olive Ridleys at Gahirmatha in March 1999 was a relief for turtle conservationists. However, turtle mortalities continued to be high despite the efforts of conservation groups and the Forest Department. The various agencies working for the conservation of turtles in Orissa should learn from mistakes of 1999 and work towards ensuring that mortality is substantially

reduced in the years to come and ensure that offshore breeding waters and the mass nesting beaches get some measure of permanent protection in the future, particularly during October to May.

43. TRIPATHY, B. (2002). Is Gahirmatha the world's largest sea turtle rookery? *Current Science,* 83(11): 1299.

A comparison of data of the three *arribada* population of the world raises questions as to whether Gahirmatha is indeed the world's largest sea turtle rookery. Furthermore, declaring a nesting population to be largest in the world by improper estimation may result in the down listing of species in the Indian Wildlife Protection Act and IUCN's Red List. This may result in the reduction of protection for the olive ridley in their breeding ground which is already meager. This also raises concerns that the olive ridley mortality on the Orissa coast – over 90,000 turtles since 1994 may not be taken seriously by various agencies. Therefore, standard and accurate techniques for mass nesting censuses are urgently required for monitoring of status and trends in Gahirmatha to ensure appropriate conservation measures.

44. TRIPATHY, B. (2006). The olive ridley conservation: An integrated community approach at the Rushikulya sea turtle rookery of Orissa coast in India. *Testudo* 6 (3): 80-87.

Wildlife conservation methodologies have so far ignored the social component of conservation, i.e. the human population that depends on the natural resources as much as the wildlife that conservationists want to protect, although they are the major stakeholders. Until recently, conservationists have failed to address the needs of the people, who have as much right as that of wildlife to natural resources. The present study has explored the possibility of community participation in sea turtle conservation.

iii. News/Letters/Correspondence/Book Reviews

45. ANONYMOUS (1984). *Arribada* - the arrival. *Hamadryad* 9(2): 12.

The author reports on the nesting of about 250,000 turtles at Gahirmatha within a 5 km stretch of beach. There is also a mention of the visit of the then Chief Minister of the Orissa State – J. B. Patnaik to witness the mass nesting. And, there is also a mention of the turtle protection measures being taken up then.

Source: Madras Crocodile Bank Trust, Mammalapuram, Tamil Nadu, India. Email: mcbtindia@gmail.com

46. ANONYMOUS (1984). Mrs. Gandhi writes about turtles. *Hamadryad* 9(3): 21.

This is a response to Professor Archie Carr's request to protect turtles in India from Mrs. Gandhi the then Prime Minister of India. Mrs. Gandhi states - "I have received your letter of the 11th March. There have been other similar letters about the protection of marine turtles. Even before these reports were received last year, I called for immediate action through the Orissa State Government and the Coast Guard of the Indian Navy to prevent the hunting of these turtles or for collection of eggs by beachcombers. All coastal States in our country have been asked to be vigilant in this matter. You will be glad to know that our States have also started taking steps to collect the eggs and get these hatched in a central hatchery and release the young ones into the sea. We are aware of the importance of this endangered species to our eco-systems. Our concerned Ministries here and in the State Governments have been asked to take the required measures to see that the olive ridley turtle, which is an endangered species, is looked after."

Source: Madras Crocodile Bank Trust, Mammalapuram, Tamil Nadu, India. Email: mcbtindia@gmail.com

47. DAS, I. (1984). Ridley hatchlings at Gahirmatha. *Hamadryad* 9(2): 20.

The author reports on finding turtle hatchlings swimming at least 10 km upstream of the river flowing from Bhitarkanika. There is a mention of the predators of the emerging hatchlings: Ghost Crab, Jungle Crow, Black-headed Gull, Brown-headed Gull, Great Black-headed Gull, Caspian Tern and feral dogs

Source: Dr. Indraneil Das, Institute of Biodiversity, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia. E.mail: idas@ibec.unimas.my

48. DAS, I. (1985). Marine turtle drain. *Hamadryad* 10(1&2): 17.

The author reports on the trade of olive ridley turtle in the turtle markets of West Bengal and that most of the turtles were reportedly caught of the coast of Orissa and transported by trucks to Howrah. And the turtles were sold to retailers for Rs. 60/- (U.S. $ 5.00) each.

49. DAS, I. (1986). Rockets at the Gahirmatha Rookery? *Hamadryad* 11(1&2): 17.

This report mentions the shifting of the rocket testing range from Balsore district due to protests by local people to Sathabaya in Kendrapada subdivision, which is located close to the Gahirmatha beach. Further the author states that “Location of the rocket testing range in Bhitarkanika, or its vicinity would spell disaster to the unique and fragile mangrove and marine ecosystems and ecologists and environmental crusaders will, no doubt, fight against so myopic a move”.

50. HEJMADI, P. M., (2003). Saturation of Olive Ridley nesting sites. *Current Science* 84 (8): 972.

This is a note by the author in response to an article published in the same journal on “Is Gahirmatha the world’s largest sea turtle rookery?” The author reports on the downlisting of four species of sea turtles including the olive ridley turtle by the IUCN Red List Standard and Petitions Sub-committee.

51. HEJMADI, P. M., (2007). Book Reviews: Marine Turtles of the Indian Subcontinent. *Current Science* 92(7): 1010-12.

The author provides an indepth review of the book “Marine turtles of the Indian Subcontinent”

52. KAR, S. K. (1980). A note on a Hawksbill turtle (*Eretmochelys imbricata*) at Gahirmatha beach of Bhitarkanika Wildlife Sanctuary, Orissa. *Journal of Bombay Natural History Society* 83(3): 670.

The author describes about the occurrence of a dead leatherback turtle (*Dermochelys coriacea*) in 1984 and a live sub-adult hawksbill turtle (*Eretmochleys imbricata*) on the beach of the Shortt’s Island, not far from Gahirmatha turtle nesting beach in 1986.

53. KAR, S. K. (1991). Research and management of Pacific ridley sea turtles, *Lepidochelys olivacea* at the Marine Turtle Research Centre, Puri, Orissa. *Zoos’ Print* Vol. VI (6) 17-18.

The author describes about the project on the Pacific ridley sea turtles taken up by the forest department during the year 1976 following the advice of the FAO expert Dr. H. R. Bustard. The author provides in detail the aims and achievements of the research and management programme. There is also a mention of the setting up of the Marine Turtle Research Center at Puri, where turtles (two year) were kept in captivity.

54. PANIGRAHY, R. C., R. GOUDA, S. MISRA, & L. NAYAK. (1990). Availability of marine turtle eggs near Rushikulya River mouth, east coast of India. *Indian Forester* 116(6): 515-516.

The authors report availability of sea turtle eggs near the Rushikulya river mouth and suggested for a detailed survey covering the area between Bahuda river mouth to Chilka river mouth to have a full understanding, and evolve suitable strategies to conserve this endangered sea fauna.

*** Article not available**

ARTICLES PUBLISHED IN NEWSLETTERS

i. Research Communications/General Review Articles

1. HEJMADI, P. M., M. T. DIMOND, & J. KANUNGO. (1984). Biochemical constituents of serum of young female hatchlings of olive ridley *Lepidochelys olivacea*. *Marine Turtle Newsletter, Canada* 27: 4-5.

The authors undertook some studies on biochemical aspects of olive ridley turtle eggs and hatchlings and are reported in this note. The serum constituents of female hatchlings of the olive ridley turtles are provided and they found that the values in general are well within the range of those reported for the adult.

Source: Dr. Prof. Priyambada Mohanty Hejmadi, GM-8, V.S.S. Nagar, Bhubaneswar - 751 007 (Orissa). Email: mohantyhejmadi@hotmail.com

2. KAR, C. S. (1982). The Gahirmatha sea turtle rookery, Orissa. *Makara* 3(1): 20-23.

The author describes the Gahirmatha sea turtle rookery and mentions on the research activities such as population estimation and flipper tagging taken up. He also mentions the extent of turtle mortalities happening at that time and a 3 km wide strip of coastal water to be made off limits to all fishing activities during the months from September to March.

Source: Dr. C. S. Kar, Wildlife Wing, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar- 751002 (Orissa). E.mail: drcskar@gmail.com

3. KAR, C. S. & G. S. PADHI. (1992) Biology, life history and conservation strategy of the olive ridley sea turtles in Orissa. *Ori-Forest* 36-40.

An overview on the biology, life history and conservation of olive ridley sea turtles of Orissa have been presented by the authors.

4. KAR, S. K. (1991) Research and management of Pacific ridley sea turtles, *Lepidochelys olivacea* at the Marine Turtle Research Centre, Puri, Orissa. *Zoos' Print* Vol. VI (6): 17-18.

The author has given a brief account of the ecological study on olive ridley sea turtle at Puri-Konark undertaken by the Wildlife Wing of the Orissa Forest Department.

Source: Dr. S. K. Kar, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar- 751002 (Orissa).

5. *KAR, S. K. (1992). Ecological studies on the olive ridley sea turtle *Lepidochelys olivacea* (Eschscholtz, 1829) on the Orissa coast. *Zoos' Print* 6 (1): 28-30.

The author has given a brief account of the ecological studies on olive ridley sea turtle at Gahirmatha undertaken by the Wildlife Wing of the Orissa Forest Department.

6. MOLL, E. O., S. BHASKAR & J. VIJAYA. (1983). Update on the olive ridley on the coast of India. *Marine Turtle Newsletter* 25: 2-4.

The authors have given a brief summary on sea turtles nesting at Gahirmatha, and report on the exploitation of olive ridley turtle for turtle meat trade in West Bengal.

Source: www.seaturtle.org/mtn

7. MROSOVSKY, N. (2001). When *arribadas* fail to arrive. *Kachhapa* 5: 17.

The author questions the failure of mass nesting in some years and that as to what the turtles do in those years, and believes that they may nest elsewhere along the coast in those years.

Source: Dr. N. Mrosovsky, University of Toronto, Ontario, Canada. Email: mro@zoo.utoronto.ca.

8. NAYAK, L. (1996). Sea Turtle – Threatened species in India. *Coastal Management News-Asia/Pacific*. March 1996.

The author has given a general description of the sea turtles of India, their biology and threats faced by the turtles.

Source: Dr. Laxman Nayak, Berhampur University, Bhanja Vihar, Berhampur – 760 007, Orissa, India.

9. PANDAV, B. (2001). An Overview of Wildlife Institute of India's Sea Turtle Research Program in Orissa. *Kachhapa* 5: 12-13.

The author reports on the findings of the sea turtle project in Orissa by the Wildlife Institute of India. He provides in brief information on the offshore aggregations of olive ridleys, site fidelity to breeding ground, movement between nesting beaches, tag recaptures, hatching success, beach erosion, and large scale mortality of turtles due to fishing.

Source: Dr. Bivash Pandav, Wildlife Institute of India, Post Box 18, Dehradun-248001. Email: pandavb@yahoo.com

10. PANDAV, B. (2001). Rushikulya Sea Turtle Rookery - A status report. *Kachhapa* 4: 5-7.

The author has given an brief description of the Rushikulya sea turtle rookery and also reports on the intensity of nesting at the site. He also provides information on the incubation success, tagging study and the conservation significance of this rookery.

11. PANDAV, B. & C. S. KAR. (2000). Reproductive span of Olive Ridley turtles at Gahirmatha rookery, Orissa. *Marine Turtle Newsletter* 87: 8-9.

The authors report on finding five olive ridley turtles during 1999 that had flipper tags and which were earlier tagged between 1978 and 1983. From which recaptures, they found that olive ridley turtle in India to be reproductively active for decades (up to 21 years).

12. PANDAV, B., K. BANUGOPAN, D. SUTARIA & B. C. CHOUDHURY. (2000). Fidelity of male olive ridley sea turtles to a breeding ground. *Marine Turtle Newsletter* 87: 9.

The authors report on the strong site fidelity of olive ridley males that were flipper tagged during previous years in the same breeding ground and was subsequently recaptured. Based on the recaptures the remigration interval of olive ridley males were obtained (0.99 years), which is much shorter compared to that of Green turtles (2.08 1.14 years; Limpus, 1993).

13. RAJAGOPALAN, M. & K. VIJAYAKUMARAN. (2001). Conservation of marine turtles and shrimp export. *Marine Fisheries Information Service, T & E Service* 170: 12-16.

The authors in the paper has mentioned about the development of TED for safeguarding the sea turtles from incidental capture in the wake of the US embargo on shrimp export from India. They have also touched upon the WTO ruling and implementation of TED in India and protection of sea turtles in Orissa coast.

Source: Central Marine Fisheries Research Institute, Post Box No. 1603, Ernakulam North P.O., Kochi-682 018.

14. RAJAGOPALAN, M., E. VIVEKANANDAN, S. K. PILLAI, M. SRINATH & A. B. FERNANDO. (1996). Incidental catch of sea turtles in India. *Marine Fisheries Information Services, T & E series* 143: 8-16.

The authors give a general description of all sea turtles found in India and give details of the nesting period and intensity. They also provide information on extent of exploitation and predation, and incidental catch of turtles during fishing operations.

15. RAM, K. (2000). Offshore studies on olive ridley sea turtles in Gahirmatha, Orissa. *Kachhapa* 3: 13-15.

The author has summarised his offshore studies on olive ridley turtles along the Gahirmatha coast of Orissa. The off-shore congregation did not exceed 57 sq.km. and congregation was situated at a depth of 8-65 feet.

Source: Contact: Wildlife Protection Society of India, S-25, Panchsheel Park, New Delhi - 110017. E.mail: wpsi@vsnl.com

16. SANKARAN, S. B. TRIPATHY & K. SHANKER. (2005). A bibliography for sea turtles on the mainland coast in India. *Indian Ocean Turtle Newsletter* 2:16-33.

A bibliographical detail on the sea turtle biology and conservation work undertaken by various organizations and individuals have been presented.

Source: Ashoka Trust for Research in Ecology and the Environment, 5th A main, Hebbal, Bangalore. E.mail: aarthi@atree.org

17. SEKAR, K. J. (1987). Orissa's rare reptiles. *MYFOREST* Vol. 23(3): 145-148.

The author has mentioned about the mass nesting of olive ridley turtles at Gahirmatha rookery in Bhitarkanika wildlife sanctuary of Orissa and states the need for safeguarding the rookery.

Source: MYFOREST

18. SHANKER, K. (2000). Conservation genetics of olive ridleys on the east coast of India. *Kachhapa* 3: 9-10.

The author provides information on the preliminary findings of a study relating to the conservation genetics of olive ridley turtles along the east coast of India. The study revealed the presence of a dominant haplotype (K), the most ancient lineage in ridley turtles suggesting that the olive ridley population on the east coast of India to may be the source for contemporary global populations of ridleys.

Source: Dr. Kartik Shanker, Centre for Ecological Sciences, Indian Institute of Sciences, Bangalore. E.mail: kshanker@ces.iisc.ernet.in

19. SHANKER, K. (2002). Where do all the hatchlings go? *Kachhapa* 6: 19.

The author reports on the sea finding ability of the hatchlings. At the Gahirmatha site in 1999, the author observed hatchlings that emerged from an area where there were no light cues to enable them to find seaward direction. He stated that it is not unreasonable to hypothesize that some proportion of hatchling do end up in the river mouth, and they may use other cues for sea finding.

20. SHANKER, K. (2003). Tracking olive ridleys on the coast of India. *Reptile Rap* 5: 3.

The author has mentioned about the results of the tracking study on olive ridley turtles on the east coast of India and their post nesting migration to the southern Bay of Bengal and eastern Sri Lankan area.

21. SHANKER, K. & N. J. PILCHER. (2003). Marine turtle conservation in South and Southeast Asia hopeless cause or cause for hope? *Marine Turtle Newsletter* 100: 43-51.

The authors have mentioned about the marine turtle conservation and management in south and south-east Asia and the current status of sea turtles in these countries. In the article, the authors also give in detail issues relating to olive ridley turtles of Orissa.

22. SHANKER, K., B. TRIPATHY & B. PANDAV. (2005). Biological studies on sea turtles on the coast of Orissa. *Indian Ocean Turtle Newsletter* 1: 10-11.

The authors provide a summary of the relevant findings of a decade olive ridley turtle research in Orissa and also provide conservation recommendations.

23. SILAS, E. G., M. RAJAGOPALAN & A. B. FERNANDO. (1983). Sea Turtles of India - Need for a crash Programme on conservation & effective management of the resource. *Marine Fisheries Information Service, T & E Service* 50: 1-12.

The authors have mentioned about the grim situation of olive ridley sea turtles in Orissa and need for a crash programme for conservation and effective management of the population along with strict implementation of the wildlife and fisheries act in the state.

Source: Central Marine Fisheries Research Institute, Post Box No. 1603, Ernakulam North P.O., Kochi-682 018.

24. SILAS, E. G., M. RAJGOPALAN, A. B. FERNANDO & S. S. DAN. (1983). Marine turtle conservation and management: A survey of the situation in Orissa 1981-82 and 1982-83. *Marine Fisheries Information Service, T & E Service* 50: 1-35.

The authors have presented the results of the survey conducted in Orissa on the situation of turtles during 1981-82 seasons and recommendation made for conservation and management of the sea turtle resources of Orissa.

25. SILAS, E. G., M. RAJGOPALAN, S. S. DAN & B. FERNANDO. (1985). On the large and mini *arribadas* of the olive ridley *Lepidochelys olivacea* at Gahirmatha, Orissa during the 1985 session. *Marine Fisheries Information Service, T & E Service* 64: 1-16.

The authors give detailed information on *arribada* occurring at the Gahirmatha coast in Orissa. They also provide information on the emergence of hatchlings, hatching success, and reported on the illegal exploitation of sea turtles.

26. SRIDHAR, A., B. TRIPATHY & K. SHANKER. (2005). A review of legislation and conservation measures for sea turtles in Orissa, India. *Indian Ocean Turtle Newsletter* 1: 1-7.

The authors have given a brief summery of the legislations by federal and state government of Orissa on conservation measures undertaken for protection of olive ridley turtles and their habitats in Orissa.

Source: Aarthi Sridhar, ATREE, 5th A main, Hebbal, Bangalore. E.mail: aarthi@atree.org.

27. TRIPATHY, B. (2006). Celebrating the YEAR OF TURTLE-2006. *Wildlife Institute of India Newsletter*, July-September 2006, 13(3): 6-7.

The author has mentioned about the year of the sea turtle-2006 and the past, present and future activities on sea turtle conservation and management in India and in particular along the Orissa coast.

Source: Dr. Basudev Tripathy, Wildlife Institute of India, Po Box 18, Dehradun-248001. E.mail: tripathyb@wii.gov.in

28. TRIPATHY, B. (2007). Olive ridley sea turtle and their habitat protection through community involvement at Rushikulya rookery of Orissa, India. *Reptile Rap-Newsletter of the South Asian Reptile Network*, December 2007, 8: 1-3.

The author has mentioned about the involvement of local community in protecting the olive ridley nests at the Rushikulya rookery. He also mentions of the various activities that the local people undertake: beach debris cleaning, nest monitoring, *in-situ* and *ex-situ* protection of nests, releasing of disoriented hatclings, and community participation in conservation.

29. TRIPATHY, B. M.A. OOMMEN, B. PANDAV & K. SHANKER. (2005). A bibliography of literature on sea turtles in Orissa, India. *Indian Ocean Turtle Newsletter* 1: 28-36.

The authors provide a bibliography of olive ridley sea turtle conservation, research and management along the Orissa coast of India.

ii. News/Letters/Correspondence/Book Reviews

30. ALEYA, K. (2005). Initiatives towards consensus - The Orissa marine resource conservation consortium. *Indian Ocean Turtle Newsletter* 1:12-13.

The author has mentioned about the Orissa Marine Resource Conservation Consortium formed in Orissa by various conservationists, biologists, fish workers, NGOs and individuals for protection of olive ridley and safeguarding rights of the communities living along the coast of Orissa.

Source: Orissa Traditional Fish Worker's Union, Sana Aryapali, PO: Bada Aryapali, Via: Ganjam, Orissa, 761 020. E-mail: otfwu@hotmail.com./ATREE, Bangalore

31. ALEYA, K. (2005). Perspectives of the traditional fish workers on sea turtle conservation. *Indian Ocean Turtle Newsletter* 1:7-8.

The Orissa Traditional Fish Worker's Union (OTFWU) is the largest union in the State representing the interests of traditional fish workers of Orissa. Recently the union has actively advocated for the traditional fish workers stating that excessive turtle conservation measures have impacted their livelihoods. They have articulated our responses to the official sea turtle conservation measures in Orissa.

32. ANDREWS, H. A. (1993). Olive ridleys threatened in India: Letters needed. *Marine Turtle Newsletter* 61: 5-6.

The author appealed all those concerned with sea turtles to write to the Government of Orissa and Government of India protesting about the developmental activities that are coming up near Gahirmatha coast and protecting the olive ridley turtles of Orissa.

Source: Centre for Herpetology, Madras Crocodile Bank, Post Bag No. 4 Mamallapuram - 603 104, T.N., South India.

33. ANONYMOUS. (1977). Notes on Turtle Conservation in India. *Marine Turtle Newsletter* 5: 3.

The author mentioned about the government of Orissa's proposal to take up measures for conservation of olive ridley turtles at Gahirmatha and some commercial use of turtles for exploitation.

Source: www.seaturtle.org/mtn/

34. ANONYMOUS. (1982). Stop Press: More From India. *Marine Turtle Newsletter* 23: 6.

An article by S. Biswas, entitled "A report on the olive ridley, *Lepidochelys olivacea* (Eschscholtz) (Testudines: Cheloniidae) of Bay of Bengal", had appeared in Rec. Zool. Surv. India 79: 275-302 (1982). Among interesting points were that on the basis of stomach contents the adult is herbivorous and that many fully formed hatchlings are unable to get out of their nests on account of overcrowding and obstructions. He recommends annual quotas of turtle catch and egg collection, with the State Departments enforcing and supervising the exploitation.

35. ANONYMOUS. (1986). Rockets and Ridleys False Alarm? *Marine Turtle Newsletter* 38:4.

The author has informed about the Government of India's clearance for setting up the national rocket and missile testing site at Balasore, Orissa, instead of at Gahirmatha, which is one of the world's largest ridley rookeries.

36. ANONYMOUS. (1993). "Urgent and Immediate Action" Needed to safeguard the World's largest aggregation of nesting sea turtles. *Marine Turtle Newsletter* 63:S1-2.

The author has expressed about the concern for olive ridley turtles of Orissa. He has warned that the proposed development could literally spell the end of the unrivaled nesting beach and this is certainly an issue of global concern.

37. ANONYMOUS. (1993). Nesting ground of turtles threatened. *Marine Turtle Newsletter* 63(Supplement): 3-4.

The author has mentioned about the environmentalists from various countries fear that the world's largest nesting ground of Olive Ridley sea turtles located at Gahirmatha beach in Orissa is in imminent danger of being completely lost.

38. ANONYMOUS. (1994). Concern rises over threat to Indian turtles. *Marine Turtle Newsletter* 64: 1-3.

The author has expressed his concern for the impact of new developmental projects in Orissa on olive ridley turtles. The Orissa Government had Talchua development and there was a concern that the jetty will attract more people and cause more destruction. He requested reader to appeal to India's Minister of the Environment and Forests, New Delhi for action.

39. ANONYMOUS. (2000). A new port at Dhamra. *Kachhapa* 2: 16.

The author has expressed about an urgent need for the port construction to be reviewed with detailed environmental impact assessment studies Neither Bhitarkanika nor the Olive Ridleys can be compromised. The port must simply stop or go elsewhere.

Source: Orissa Krushak Mahasangh, Parivesh Bhavan, 14, Ashok Nagar, Bhubaneshwar 751009. India/WPSI, New Delhi.

40. ANONYMOUS. (2000). Resolution on the urgent need to reduce trawling related mortality of olive ridley sea turtles on the coast of Orissa, India - March 2000, 20th Annual Sea Turtle Symposium, March 1-4, 2000, Orlando, Florida, USA. *Kachhapa* 3: 11-12.

The members of the 20th Annual Sea Turtle Symposium, Orlando, Florida resolved that: *Entreat* the Forest Department, Fisheries Department and Coast Guard to work together in Orissa to strictly enforce the ban on mechanized fishing within the Gahirmatha Marine Sanctuary and the 5 km near-shore fishing ban, both of which would drastically reduce sea turtle mortalities with immediate effect.

Source: 20th Annual Sea Turtle Symposium, Orlando, Florida, USA www.seaturtle.org

41. ANONYMOUS. (2000). Resolution on the urgent need to review coastal development plans in order to conserve olive ridley sea turtles as well as critical nesting habitat for the turtles and other endangered species on the Orissa coast, India - March 2000, 20th Annual Sea Turtle Symposium, March 1-4, 2000, Orlando, Fl, USA. *Kachhapa* 3: 12-13.

The members of the 20th Annual Sea Turtle Symposium, Orlando, Florida resolved that: Request the Government of India to review the Dhamra port project, subject the proposal to objective Environmental Impact Assessment and have the proposal passed through the proper channels of the Ministry of Environment and Forests; and Request that since other sites for the construction of the port have been

identified, these sites are objectively considered and evaluated as alternatives; and Request the Government of India to reassess the Crude Oil Terminal at Rushikulya which threatens one of the most important nesting beaches of olive ridleys in Orissa.

42. ANONYMOUS. (2001). First Indian satellite telemetry study on sea turtles in Orissa. *Journal of Nature and Wildlife Conservation Society of Orissa* January-June 2001, 6.

Information about the deployment of four PTTs on olive ridley turtles at Orissa for satellite telemetry study has been provided in the note.

Source: NWCSO, Mayur Bhawan, Saheed Nagar, Bhubaneswar – 751 007, Orissa, India.

43. ANONYMOUS. (2001). News And Reports A national workshop for the development of a national sea turtle conservation action plan for India, GOI-UNDP Sea Turtle Project. *Kachhapa* 5: 28.

A detail report on the workshop conducted under the GOI-UNDP sea turtle project at Bhubaneswar by the Wildlife Institute of India and Orissa Forest Department has been provided in the note.

Source: GOI-UNDP Sea Turtle Project, Wildlife Institute of India, Po Box 18, Dehradun – 248001. E.mail: bcc@wii.gov.in

44. ANONYMOUS. (2001). News. India: Carcasses of 3,500 turtles found strewn on Orissa beach. *Marine Turtle Newsletter* 93: 48.

A report presented that mention that carcasses of over 3,500 olive ridley sea turtles have been found strewn on Orissa's (eastern India) Gahirmatha beach in Kendrapara district, Wildlife Department.

45. ANONYMOUS. (2003). Workshop-cum-Demonstration on Turtle Excluder Device for trawl owners and operators of the Orissa coast, February 2002. *Kachhapa* 8: 24-25.

A report mentioning about the workshop on TED demonstration at Visakhapatnam by MPEDA & WII as part of the GOI-UNDP Sea Turtle Project.

Source: MPEDA, Cochin & Wildlife Institute of India, Dehradun. E.mail: bcc@wii.gov.in

46. ANONYMOUS. (2005). Turtle conservation from the perspective of Orissa's trawling industry. *Indian Ocean Turtle Newsletter* 1: 8-9.

This note provides details of the trawler associations perspective on the use/dissatisfaction of TED in Orissa.

Source: Project Swarajya, Ganesh Ghat, Barakhabad, Cuttack, Orissa, India

47. ANONYMOUS. (2008). Letter to IUCN from conservationists and NGOs in India. *Marine Turtle Newsletter* 121:11-12.

Given the grave problems that threatening the future of critical protected areas in Bhitarkanika and Gahirmatha, the credibility of the IUCN in India and the livelihoods of ten thousands marginalized people, the IUCN and MTSG members of India call upon to IUCN to issue statement regarding safeguarding the area by abides by the precautionary principles.

48. ANONYMOUS. (2008). Response from IUCN: Dhamra Port Project: The Role of the International Union for Conservation of Nature. *Marine Turtle Newsletter* 121:12-13.

This note deals with the response of IUCN on Dharma port project raised by the Indian NGOs and IUCN & MTSG members from India.

49. ANONYMOUS. (2008). Response from IUCN: Dhamra Port Project: The Role of the International Union for Conservation of Nature. *Indian Ocean Turtle Newsletter* 8: 5.

This is the same article as that of the Marine Turtle Newsletter article listed above.

Source: Indian Ocean Turtle Newsletter www.seaturtle.org/iotn/

50. BEHERA, C. (2000). Indigenizing the Turtle Excluder Device for Indian waters. *Kachhapa* 2: 9-11.

The author has urge for indigenization of Turtle Excluder Device for Indian waters for better acceptance by the mechanizing fishing community and safeguarding both interests of turtles and fishing industry.

54. BJORNDAL, K. (1993). Future of the Gahirmatha *arribadas* a matter of international concern. *Marine Turtle Newsletter* 63:S3.

The author has expressed her concern about the grim situation of olive ridleys of Orissa. In her note she has written that 'based on the information provided to us by our colleagues in India, the seriousness of this threat cannot be questioned. We must convince the government officials in India of the devastating effects the proposed development would have on olive ridleys in Orissa'.

55. BUSTARD, H. R. (1980). Should sea turtles be exploited?. *Marine Turtle Newsletter* 15: 3-5.

The Government of India/FAO/UNDP large scale project – crocodile breeding and management was able to protect some very large *Lepidochelys* rookeries in Orissa. But their survival depends on the protection of the rookery and the species as well.

55. CHADHA, S. K. & B. MOHANTY (2001). The management of olive ridley sea turtles at Devi river mouth, Orissa. *Kachhapa* 5: 26-28.

The authors in their conclusion in the paper given emphasis that despite financial and infrastructure constraints, better protection is given to the turtle population in the Devi river rookery by actively involving the district administration. Much is need to be done towards up-gradation of the enforcement and involving local fishermen in turtle protection. The area has to be declared as protected to strengthen the legal provisions. Use of turtle excluder device (TED) at Nuagarh and Paradeep has to be enforced strictly.

56. CHOUDHURY, B. C. (2003). Editorial: TEDs in India from conflict to consultation. *Kachhapa* 8: 1-2.

The author has highlighted the progress and achievement of TED initiation and implementation in the country including Orissa and past, present future development of TED and turtles.

57. DAS, B. B. (1997). Struggle to Protect the Bhitarkanika Ecosystem is ongoing. *Marine Turtle Newsletter* 76: 18-20.

The author has mentioned about the struggle to protect the Bhitarkanika and Gahirmatha rookery to safeguard the olive ridley sea turtles and their nesting habitat from future developmental activities in the area.

58. DAS, B. B. (1998). Present Status of Gahirmatha beach in Bhitarkanika Sanctuary, Orissa. *Marine Turtle Newsletter* 79: 1-2.

The author has given an overall representation of present status of Gahirmatha beach which is the largest mass nesting rookery for olive ridley turtles. He has mentioned about the need of involvement of Indian Coast Guard, Navy and use of TED for protect olive ridley from mortality.

59. DAS. B. B. (2000). A new port at Dhamra. *Kachhapa* 2: 18.

The author has pointed out about urgent need for the Dhamra port construction to be reviewed with detailed environmental impact assessment studies for protection of Bhitarkanika and Gahirmatha.

60. DAS, I. (1986). Action Alert: Rockets to dislodge ridleys at Gahirmatha. *Marine Turtle Newsletter* 36: 1.

The author has mentioned about the effort to shift the proposed national rocket testing range from Baliapal in Balasore to Satabhaya in Cuttack which is close to the mass nesting site at Gahirmatha and its impact on the biodiversity of Bhitarkanika.

61. DAVIS, T. A. & R. BEDI. (1978). India: Mass slaughter of sea turtles. *Hamadryad* 3(3): 8. Reprinted in (1979), *Marine Turtle Newsletter* 12: 5.

The authors have mentioned about the mass killing of olive ridley turtles due to illegal intake of turtles from the Bhitarkanika wildlife sanctuary.

62. DUBLIN, H. T. (2008). The Dhamra Port Issue: Some views from the Chair of the IUCN SSC. *Marine Turtle Newsletter* 121:26.

This note describes about the view points of the IUCN SSC on the Dharma port development and MTSG involvement in the process.

63. DUBLIN, H. T. (2008). The Dhamra Port Issue: Some views from the Chair of the IUCN SSC. *Indian Ocean Turtle Newsletter* 8: 25-27.

This note describes about the view points of the IUCN SSC on the Dharma port development and MTSG involvement in the process.

64. DUTTA, A. (2008). Dhamra Port: The Other Perspective. *Indian Ocean Turtle Newsletter 8:* 27-28.

The author has expressed his view on the Dharma port and mitigatory measures along with other threats to the olive ridley turtles of Orissa.

65. DUTTA, A. (2008). Dhamra Port: The Other Perspective. *Marine Turtle Newsletter* 121:27-28.

The author has expressed his view on the Dharma port and mitigatory measures along with other threats to the olive ridley turtles of Orissa.

66. EPPERLY, S. & J. FRAZIER. (2000). Resolutions of the members of the 20th Annual Symposium on sea Turtle Biology and Conservation. *Marine Turtle Newsletter* 88:22-26

The authors report on the resolution passed during the 20th Annual Symposium on Sea Turtle Biology and Conservation, on the safeguarding of the olive ridley turtles and their habitats along the Orissa coast.

67. FERNANDES, A. (2008a). IUCN-TATA Partnership - Undermining Conservation. *Marine Turtle Newsletter* 121:20-21.

The author mentioned about the Dharma port and sea turtle and urge for an independent EIA for the area before any activities on the port front.

68. FERNANDES, A. (2008b). IUCN-TATA Partnership - Undermining Conservation. *Indian Ocean Turtle Newsletter* 8: 17-18.

The author mentioned about the Dharma port and sea turtle and urge for an independent EIA for the area before any activities on the port front.

69. FRAZIER, J. (2008). Why do they do that? Ruminations on the Dhamra Drama. *Marine Turtle Newsletter* 121:28-33.

The author has expressed his view on the Dharma port development issue.

70. FRAZIER, J. G. (2008). Why do they do that? Ruminations on the Dhamra Drama. *Indian Ocean Turtle Newsletter* 8: 29-38.

The author has expressed his view on the Dharma port development issue.

71. FRAZIER, J. & M. TIWARI (1999). Workshop on olive ridley turtles in the Indian ocean (4th march 1999). *Marine Turtle Newsletter* 85: 15-17.

A note on the lunch time workshop on sea turtle of Indian Ocean held during the 19th Annual Sea Turtle Symposium and the outcome & recommendation of the workshop is presented by the authors.

72. GOPI, G. V. (2006). Take of sea turtles in Tamil Nadu and Kerala. *Indian Ocean Turtle Newsletter* 4:28.

The author reports here his observations of olive ridley turtles caught for the turtle meat trade at many coastal villages in the Tuticorin district of Tamil Nadu.

73. GORE, K. (2006). A brief update of sea turtle conservation activities of the Vasant J. Sheth Memorial Foundation. *Indian Ocean Turtle Newsletter* 4: 14.

The author has mentioned about the activities of his organization towards sea turtle conservation in Orissa.

74. HEJMADI, P. M. (1983). SOS from sea turtles from Orissa. *Marine Turtle Newsletter* 25 2.

The author reports on the steps taken by the Orissa Forest Department in collaboration with the Indian Navy and the Forest Department of West Bengal to prevent poaching of turtles in the Gahirmatha area.

75. HEJMADI, P. M. (1984). Conservation of sea turtles with special reference to the olive ridley. Newsletter of Nature and Wildlife Conservation Society of Orissa Vol. 2, No. 3 &4: 5-6.

The author has mentioned about the olive ridley sea turtle of Gahirmatha and various conservation programmes that have been taken up by the state government of Orissa along with research programme undertaken by Utkal University.

76. HEJMADI, P. M. (1987). Unique second *arribada* at Gahirmatha. *Marine Turtle Newsletter* 40 7-8.

The author reports on the occurrence of the second *arribada* at Gahirmatha during the 1987 nesting season. Details on the time and date of emergence of the nesting turtles and the number of turtles that nested are provided.

77. HEJMADI, P. M. (1994). Latest Word on the Talachua Jetty, Orissa. *Marine Turtle Newsletter* 67: 1.

The author has expressed her concern on the upcoming developmental activities near Gahirmatha turtle nesting site, and on a bill being brought up by the Government of Orissa before the State Assembly to remove sections of the Bhitarkanika Sanctuary from protected area status.

78. HEJMADI, P. M. (2000). Earliest Record of Gahirmatha Turtles. *Marine Turtle Newsletter* (88) 11-12.

The author reports on a book entitled “A New Account of the East Indies” by Captain Alexander Hamilton, in which there is a mention of the enormous number of turtles (given in it as Sea Tortoises) nesting between Cunnaca (now known as Kanika) and Balasore Rivers.

79. HEJMADI, P. M. (2001). Olive ridley turtles make first day cover. *Marine Turtle Newsletter* 91: 14.

The author reports on the olive ridley turtles being featured on an Indian First Day Cover and domestic rate postage stamp on the 29th January 2000.

80. HEJMADI, P. M. (2008). Olive Ridley’s churning of the Ocean. Marine Turtle Newsletter 122:11.

The author has expressed her concern on the Dharma port development and also on the Sethu Samudram project, and its possible impact on migratory route of olive ridley turtles and the biodiversity of the area.

81. HEJMADI, P. M., M. BEHERA, & S. K. DUTTA. (1989). Commensals on the olive ridley sea turtle. *Marine Turtle Newsletter* 45: 11-13.

The authors report on six species of commensals that were found on the carapace of olive ridley turtles observed at Gahirmatha.

82. HUTCHINSON, B. J. R. B. MAST & N. J. PILCHER. (2007). IUCN-SSC Marine Turtle Specialist Group Quarterly Update (Gahirmatha Turtles and Port Development). *Marine Turtle Newsletter* 117:13-14.

The authors provide an update of the MTSG involvement in the Dhamra port development issue in Orissa.

83. HUTCHINSON, B. J. N. J. PILCHER & R. B. MAST. (2008). IUCN-SSC Marine Turtle Specialist Group Quarterly Update (Update on MTSG involvement in the Dhamra Port development in Orissa, India). *Marine Turtle Newsletter* 119:18-19.

The authors updated the MTSG involvement in the Dhamra port development issue in Orissa.

84. HUTCHINSON, B. J. R. B. MAST & N. J. PILCHER. (2008). IUCN-SSC Marine Turtle Specialist Group Quarterly Update (IUCN Lighting Mission to Dhamra Port, 2008 & Dhamra Port Stakeholder Meeting in Planning). *Marine Turtle Newsletter* 121:36-38.

The authors report on the visit of the Co-Chair of the IUCN SSC Marine Turtle Specialist Group to Orissa to help DPCL with the design of a lighting plan to minimize the emitted light and potential downstream impacts to nesting adult turtles and emerging hatchlings at the Gahirmatha mass-nesting site.

85. HYKLE, D. (2008). India's Dhamra Port Controversy Heats Up Again. *Indian Ocean Turtle Newsletter* 8:2-3.

The author reports on the controversy attached to the Dhamra post development near the Gahirmatha turtle nesting site

86. HYKLE, D. (2008). Trade India’s Dhamra Port controversy heats up again. *Marine Turtle Newsletter* 121:10-11.

The author reports on the controversy attached to the Dhamra post development near the Gahirmatha turtle nesting site

87. KAR, C. S. (1980). The Gahirmatha Turtle Rookery along the coast of Orissa, India. *Marine Turtle Newsletter* 15: 2-3.

The author reports on his observation of the olive ridley turtle nesting at Gahirmatha and nearby areas of Barunei, Hukitola along with nesting in other beaches of central and south Orissa coast.

88. KAR, C. S. (1982). Discovery of second mass nesting ground for pacific ridley sea turtles in Orissa, India. Marine Turtle Newsletter, Canada 23: 3. Reprinted in *Tigerpaper* 9(1): 6-7, in 1982.

The author reports on another mass nesting ground of olive ridley turtles that he had discovered at Devi, during his course of research work along the Orissa coast.

90. KAR, C.S. (1980). Another notched ridley found, *IUCN/SSC Marine Turtle Newsletter, Canada* 14: 5.

The author reports on coming across a fresh dead turtle with a V shaped notches on the left and right marginal scutes in the carapace.

91. KAR, S. K. (1998). Gahirmatha Beach declared a Marine Sanctuary! *Marine Turtle Newsletter* 79: 3-4.

The author has expressed his concern for the olive ridley turtles of Gahirmatha in spite of the area declared as a marine sanctuary.

92. KAR, S. K. (1988). A brief note on hawksbill turtle. Wildlife Today - *Journal of Nature and Wildlife Conservation Society of Orissa* 1(1): 7-8.

The author has mentioned about a live hawksbill turtle that he come across during February 1986 along the Gahirmatha coast.

93. KAR, S. K. (2000). Know Your Protected Area: Gahirmatha (Marine) wildlife sanctuary. *Newsletter - Nature and Wildlife Conservation Society of Orissa* (April 1999 – December 2000). pp. 4.

The author has given an outline of the Gahirmatha (marine) Wildlife Sanctuary in Orissa along with status of olive ridley nesting and mortality.

94. KUMAR, B. P. (2001). Sea Turtle Arribadas: For massacre or conservation? *Marine Turtle Newsletter* 56: 11-13.

The author reports on the wanton killing of sea turtles by all inhabitants of coastal villages in India. He also reports on the killing of turtles in the Digha beach and Gahirmatha for the turtle trade.

95. LENIN, J. & R. WHITAKER. (2008). Membership Excluder Devices. *Indian Ocean Turtle Newsletter* 8: 15-17.

The authors have expressed about their dissatisfaction on the involvement of IUCN in the Dharma port development issue and in the process sidelining the MTSG members of India from it.

96. LENIN, J. & R. WHITAKER. (2008). Membership Excluder Devices. *Marine Turtle Newsletter* 121:19-20.

The authors have expressed about their dissatisfaction on the involvement of IUCN in the Dharma port development issue and in the process sidelining the MTSG members of India from it.

97. MOHANTY, B. (2000). More news from Dhamra. *Kachhapa* 3: 8-9.

The author has mentioned about the decision of the Hon'ble Orissa High Court to review the environmental clearance given to the proposed Dharma port project.

98. MOHANTY, B. (2000). *Operation Kachhapa*: First work report for 1999-2000 turtle season. Reporting Period - 1st November,1999 to 24th November,1999. *Kachhapa* 2: 4-5.

The author has mentioned about the activities of *Operation Kachhapa* towards protecting the olive ridley turtles and their habitats along the Orissa coast.

99. MOHANTY, B. (2002). *Casuarina* forests ruin turtle nesting beaches in Orissa. *Kachhapa* 7: 20-21.

The author writes on the proliferation of *Casuarina* plantations in the coastal districts and expresses his concern on the loss of the prime sea turtle nesting beaches in Orissa due to this activity.

100. MOHANTY, B. (2002). News & Reports: Effluent from Oswal fertilizers threatens olive ridley sea turtles on the Orissa coast. *Kachhapa* 7: 22.

The author has expressed his concern on unchecked effluents released from the Oswal fertilizer industry in Paradeep, and its impact on the olive ridley turtles of Gahirmatha and Devi rookery.

101. MOHANTY, B. & B. WRIGHT. (2001). The wandering minstrels of Orissa – Singing to save sea turtles. *Kachhapa* No. 5: 21

The authors report on the awareness campaign for the fishing communities to protect sea turtles along the Orissa coast taken up by two minstrels as part of the activities Operation Kachhapa.

102. MOHAPATRA. S. (1977). Bountiful tidal forests of Bhitarkanika. *Orissa Review* Vol. XXXIV, No.3, 9-12.

The author has mentioned about the Bhitarkanika flora and fauna along with the olive ridley rookery at Gahirmatha which is also part of the Bhitarkanika tidal forest.

Source: Orissa Review, Department of Public Relation and Information, Bhubaneswar, Orissa, India.

103. MROSOVSKY, N. (1979). Editorial. *Marine Turtle Newsletter* 12: 1-2.

The author reports on the possible extinction of *arribadas* and olive ridley turtles due to threats.

104. MROSOVSKY, N. (1982). Editorial. *Marine Turtle Newsletter* 23: 1-2.

The author urges the general public to write letter to the Prime Minister of India expressing their concern about the grim situation of olive ridley turtles in India.

105. MROSOVSKY, N. (1983). Editorial. *Marine Turtle Newsletter* 25: 1.

The author has expressed his concern for the olive ridley turtles of Orissa and hopes for the Indian authorities to take stringent steps towards protection of the turtles.

106. MROSOVSKY, N. (1983). Olive ridleys in India. *Marine Turtle Newsletter* 24:17.

The author expresses his concern for the situation of turtles at the Gahirmatha.

107. MROSOVSKY, N. (1993). World's Largest Aggregation of sea turtles to be jettisoned. *Marine Turtle Newsletter* 63: S2-3.

The author expresses his concern for the situation of turtles at the Gahirmatha, with respect to the proposal for construction of a jetty that is large enough to accommodate 500 mechanized fishing boats and shrimping trawlers.

108. MROSOVSKY, N. (2001). Guest Editorial: The future of ridley arribadas in Orissa From triple waste to triple win? *Kachhapa* 5: 1-3.

The author has mentioned about the future of olive ridley *arriabadas* in Orissa in the wake of massive killing of turtles due to fishing, and reports a way-out to save them from extinction.

109. MROSOVSKY, N. (2002). Editorial: Hype. *Marine Turtle Newsletter* 96: 1-4.

The author has pointed out his view on the decline in population of olive ridley turtles that still aggregate in numbers in Costa Rica, Mexico, and India. And, believes to say that sea turtle populations have been pushed to the brink of extinction world-wide is hype. But perhaps this is true of particular species?

110. MROSOVSKY, N. (2008). Continuing Controversy Over Ridleys in Orissa: *Cui bono? Marine Turtle Newsletter* 121:13-15.

The author presents his views on the ongoing controversy relating to the construction of the Dharma port Orissa, and questions the effectiveness of the several campaigns taken up to protect turtles in the region. He also suggests ways to deal with the issue by managing the nesting population.

111. MROSOVSKY, N. (2008). Continuing Controversy Over Ridleys in Orissa: *Cui bono?. Indian Ocean Turtle Newsletter* 8: 6-7.

This is the same article published in the Marine Turtle Newsletter listed above.

112. PANDAV, B. (1995). Know Your Wildlife: Olive ridley sea turtle. *Newsletter-Nature and Wildlife Conservation Society of Orissa* (June-July 1995). pp. 3.

The author has given a general description of the olive ridley turtle, their biology and threats faced along the Orissa coast.

113. PANDAV, B. (1995). Wildlife Institute of India starts new research project on sea turtle in Orissa. *Zoos' Print* Vol. X (7): 50.

The author reports on the initiation of a sea turtle research project in Orissa by the Wildlife Institute of India.

114. PANDAV, B. (2005). *Casuarina* plantations along sea turtle nesting beaches in Orissa. *Indian Ocean Turtle Newsletter* 1: 27-28.

The author has expressed his concern regarding the extensive plantation of *Casuarina* being undertaken following the super cyclone in Orissa, and its possible impact on olive ridley nesting beaches.

115. PANDAV, B. & B. C. CHOUDHURY. (1995). A note on the occurrence of sub-adult Olive ridley turtles along the Gahirmatha coast. *Marine Turtle Newsletter* 71: 15-17.

The authors report on the occurrence of sub-adult olive ridley turtles along the Gahirmatha coast during their survey along the Orissa coast.

116. PANDAV, B. & B. C. CHOUDHURY. (1998). Olive ridley tagged in Orissa recovered in the coastal waters of eastern Sri Lanka. *Marine Turtle Newsletter* 82: 9-10.

The authors report on the first flipper tag recovered of an olive ridley tagged along the Orissa coast on 27 April 1997, and recovered from 22 nautical miles from the beach of Kalmunai, eastern Sri Lanka. This recapture site is a straight line distance of about 1500 km from Gahirmatha from where the turtle was tagged.

117. PANDAV, B. & B. C. CHOUDHURY. (1999). An update on the mortality of the olive ridley sea turtles in Orissa. *Marine Turtle Newsletter* 83: 10-12.

The authors report on the extent of olive ridley turtles being killed along the Orissa coast due to illegal mechanized fishing in the near-shore coastal waters.

118. PANDAV, B., B. C. CHOUDHURY & C. S. Kar. (1994). Discovery of a new sea turtle Rookery in Orissa, India. *Marine Turtle Newsletter* 67: 15-16.

The authors report here of the discovery of the third mass nesting sites for olive ridley turtles in Orissa that is near the Rushikulya river mouth.

119. PATNAIK, S. K. & HEJMADI, P. M. (1999). Know Your Wildlife: The return of arribadas in Orissa. *Newsletter - Nature and Wildlife Conservation Society of Orissa* (January-March 1999), pp. 3.

The authors report on the *arribada* of olive ridley turtles at Gahirmatha during 1999 season and the protection measures undertaken by the state wildlife authority.

120. PEER-GROVES, L. (2001). Orissa Coastal Management Initiatives Protection of near shore fishing areas and turtle breeding ground through the deployment of artificial reef units. *Kachhapa* 5: 15-16.

The author reports on the large scale mortality of turtles, and urges the deployment of artificial reef as a measure to protect the near shore fishing areas and turtle breeding. The author also propose a conservation and management initiative, focusing largely on education and awareness programmes for local communities, including a test site for artificial reefs as one component.

Source: Linda Peer-Groves, 1192, 2nd Lane, Ratnakar Bagh, Tankapani Road, Bhubaneswar, Orissa, India.

121. PILCHER, N. (2008). The MTSG and its involvement in the Dhamra Port, Orissa, India. *Marine Turtle Newsletter* 121:24-25.

The author has mentioned about the IUCN/MTSG's involvement in Dhamra port development issue in Orissa. The author states that without the MTSG involvement in Dhamra, there would have been significant impacts to turtles. But with MTSG expertise, we have been able to guide development, and keep in check those activities which might have impacted turtles.

122. PILCHER, N. (2008). The MTSG and its involvement in the Dhamra Port, Orissa, India. *Indian Ocean Turtle Newsletter* 8: 24-25.

This is the same article as that of the Marine Turtle Newsletter article listed above.

123. RODRIGUEZ, S. & A. SRIDHAR. (2008). Dhamra Port: How environmental regulatory failure fuels corporate irreverence. *Marine Turtle Newsletter* 121:21-24.

The authors discuss in detail on the controversies surrounding the Dharma port and state it as a result of lacunae in the environmental laws, litigation processes and in the nature of engagement over environmental decision-making in the country. The authors highlight the irregularity in the EIA carried out for the project.

124. RODRIGUEZ, S. & A. SRIDHAR. (2008). Dhamra Port: How environmental regulatory failure fuels corporate irreverence. *Indian Ocean Turtle Newsletter* 8: 19-23.

This is the same article as that of the Marine Turtle Newsletter article listed above.

125. SEKHSARIA, P. (2005). The Dhamra Port in Orissa. *Indian Ocean Turtle Newsletter* 1: 14-16.

The author reports on the proposed Dhamra port in Orissa and provides chronology of events related to Dhamra port since its first notification in 1881.

126. SHANKER. K. (1999). Its turtle time in Orissa again. *Kachhapa* 1: 1.

The author has mentioned about the starting of the newsletter *Kacchapa* for bringing out news and articles on sea turtle and related issues from Orissa and India.

127. SHANKER, K. (2005). Editorial. *Indian Ocean Turtle Newsletter* 1: 1.

The author has given an outline of the new newsletter on sea turtle of Indian Ocean region and the current involvement of various institutions, NGOs and individuals for conservation and management of sea turtle resources.

128. SHANKER, K. (2008). My Way or the Highway!!! Where corporations and conservationists meet. *Marine Turtle Newsletter* 121:16-18.

The author has expressed his view on the Dharma port and sea turtle issue and involvement of IUCN on the Dharma controversy.

129. SHANKER, K. (2008). My Way or the Highway!!!. Where corporations and conservationists meet. *Indian Ocean Turtle Newsletter* 8: 10-14.

The author has expressed his concerns over the setting up of the Dharma port and its impacts on the mass nesting beach.

130. SHANKER, K. & B. MOHANTY. (1999). Guest Editorial: *Operation Kachhapa*: In search of a Solution for the Olive ridleys of Orissa. *Marine Turtle Newsletter* 86: 1-3.

The authors have mentioned about the role and achievement of *Operation Kacchapa* towards safeguarding the olive ridley turtles and their nesting beaches in Orissa.

131. SHANKER. K. & B. WRIGHT. (2000). Editorial: Operation Kachhapa: new problems, new solutions? *Kachhapa* 2: 3.

The authors have mentioned about the involvement of Operation Kachhapa for finding out new solutions for the olive ridley turtles of Orissa.

132. SINGH, L. A. K. (1977). Notes on turtle conservation in India. *IUCN/SSC Marine Turtle Newsletter* 5: 5.

The author mentions about the government of Orissa's plans for management of a huge rookery there (he likely refers to Gahirmatha). He also mentions local fishermen along the Puri coast of Orissa catching 40-50 green turtles everyday and these being sent to West Bengal (the green turtles mentioned here is erroneous and are surely the olive ridleys).

133. TRIPATHY, B. (2005). Letters to the Editor: Lighting and sea turtle hatchlings in Rushikulya. *Indian Ocean Turtle Newsletter* 1: 26-27.

The author has expressed his view on the lighting and sea turtle hatchlings issue in Rushikulya and barricading of the area for protection of hatchlings by local people and NGOs involved at the Rushikulya rookery.

134. VIJAYA, J. (1982). Turtle slaughter in India. *Marine Turtle Newsletter* 23: 2.

The author reports on the gruesome killing of the olive ridley turtles at a market in Calcutta, West Bengal.

135. WRIGHT, B. & B. MOHANTY (2002). Olive ridley mortality in Gill nets in Orissa. *Kachhapa* 6: 20.

The authors have mentioned about the impact of gillnet fishing and olive ridley mortality in gillnets along the Orissa coast.

136. WRIGHT, B. & B. MOHANTY. (2005). *Operation Kachhapa* & the sea turtles of Orissa. *Indian Ocean Turtle Newsletter* 1: 16-18.

The authors have mentioned about the activities undertaken under the *Operation Kacchapa* programme for conservation of olive ridley turtles in Orissa.

137. WRIGHT, B., B. MOHANTY & S. MATHESON. (2001). An update on turtle conservation activities in Orissa. *Kachhapa* 4: 10-13.

The authors have mentioned about the activities undertaken under the *Operation Kacchapa* programme for conservation of olive ridley turtles in Orissa.

*** Article not available**

SEMINAR/WORKSHOP/SYMPOSIUM PROCEEDINGS

i. Full Length Papers

1. BEHERA, C. (2000). Towards averting the doom's day imminent for olive ridleys: Indigenizing the Turtle Excluder Device and reforming the gillnetting practice along the Orissa coast of India. pp 215-216. *In*: Kalb, H.J. & T. Wibbels (compilers). Proceedings of the Nineteenth Annual Symposium on Sea turtle Conservation and Biology, U.S. Department of Commerce. NOAA Technical Memorandum. NMFS-SEFSC-443, 291 p.

Two simple and inexpensive reforms, namely an indigenous TED and mesh regulation of the gill nets, though conceived and worked on since 1996 by the government are still not in effect, due to the typical bureaucratic manner of handling a highly sensitive and complicated cause like protecting the sea turtles. Had these reform measures been translated into reality in a timely manner, they could have prevented the ongoing catastrophic massacre of olive ridleys from ever happening and thereby saved the image of a bio-rich India from its further disgrace before the international community.

2. BEHERA, C. (2002). Olive ridleys facing ravages of both natural and man in Orissa coast, India. pp. 357-358. *In*: Andrea, M., A. Foley & B. Brost (compilers), Proceedings of the Twentieth Annual Sympoisum on Sea Turlte Biology and Conservation. NOAA Technical Memoradum NMFS-DEFSC-477, 369 p.

The entire intervening year since the mass nesting of March-April 1999 up to the early March 2000 was just lost away without any tangible progress having been made either for the turtles or for the fisher folk living along Orissa coast. Of course, the migrating turtles were seen mating on the Orissa waters by the middle of November 1999, but at the same time ever increasing numbers of their dead bodies were also noticed all along the coast day by day. The fate of the turtles is thus determined by the vagaries of man and nature in the coast of Orissa, without any visible solution in foreseeable future.

Source: Chitta Behera, Project Swarajya, Ganesh Ghat, Barakhabad, Cuttack, Orissa, India.

3. BEHERA, C. (2007). Trawl guard: A probable substitute of TED for Indian waters. pp. 187. *In*: Mast, R.B., B.J. Hutchinson & A.H. Hutchinson (compilers), Proceedings of the Twenty Fourth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-567, 205 p.

Efforts for implementing TEDs in Indian maritime fisheries, in response to the US trade embargo have passed through several phases. The coast of Orissa which is credited with the large nesting grounds of olive ridley turtles, but which in recent years earned the notoriety of being the killing field of these innocent animals, has witnessed a series of hot and cold battles between the trawling industry and the turtle conservationists over the issue of implementation of the TED. Several efforts at indigenizing the TED technology with a view to reduce the fish escape have so far not contented the trawling community of Orissa. The present paper, while discussing the arguments of the trawling industry, seeks to suggest a few alternative options including the need for trial of a new device called Trawl Guard, with a view to end the much tangled controversy over the TED.

4. CHOUDHURY, B. C., K. SHANKER & S. K. MUKHERJEE. (2004). A National project on sea turtle conservation in India – A collaboration between the UNDP and the Government of India. pp. 137-138. *In*: Coyne, M., & R.D.Clark (compilers), Proceedings of the Twenty-First Annual Sympoisum on Sea Turlte Biology and Conservation, NOAA Technical Memoradum NMFS-DEFSC-528, 368 p.

A national project on sea turtle conseration was launced by the UNDP in collaboration with the Ministry of Environment & Forests, Government of India in january, 2000. The Wildlife Institute of India serves as the impenting agency, whose primary role is to coordinate the activitis within the project.

Source: B. C. Choudhury, Wildlife Institute of India, Dehradun. E.mail: bcc@wii.gov.in

5. HEJMADI, P.M. (2000). Agonies and ecstasies of 25 years of sea turtle research and conservation in India. pp. 83-85. *In*: Kalb, H. J. & T. Wibbels (ed.), Proceedings of the Nineteenth Annual Symposium on Sea turtle Biology and Conservation, U.S. Department of Commerce. NOAA Technical Memorandum, NMFS-SEFSC-443. 291 p.

Up to the 1970s our knowledge on the sea turtles that visited the coasts of India remained limited. However, the endangered status of the sea turtles led to a spurt of activity and therefore, we have considerable data on the activities of the sea turtles that visit the coasts for nesting. Unfortunately, our knowledge of their habits, migratory routes and activities of both the hatchlings and the adults after they leave the coast, remain negligible. However, at the moment the threats to sea turtles in India include fishing by trawlers and gill netters in coastal waters, lighting in ports, jetties, industries and coastal development activities, damage by predators and disturbances by local people. Increase in fishing related mortality and no *arribada* in two successive years (1997, 1998) are matters of great concern at present. The great question is whether all the efforts that are being made can save the spectacular *arribadas* to see in the next millennium.

Source: Dr. Prof. Priyambada Mohanty Hejmadi, GM-8, V.S.S. Nagar, Bhubaneswar- 751 007. Email: mohantyhejmadi@hotmail.com

6. HEJMADI, P. M., & G. SAHOO. (1994). Biology of the olive ridleys of Gahirmatha, Orissa, India. Pp. 90-93. *In*: Bjorndal, K. A., A. B. Bolten, D. A. Jhonson & P. J. Elaazar (compilers), Proceedings of the Fourteen Annual Symposium on Sea Turtle Biology and Conservation, NOAA technical memorandum NMFS-SEFSC-351, 323 p.

At Gahirmatha, although trade in turtles and eggs is not there any more, considerable number of turtles are dying due to fishing activities in this area. Even then, if one considers the number of nesting turtles from year to year, it is reasonable to say that the population nesting at Gahirmatha has not been adversely affected by these activities. However, one of the major concerns for the population is the drastic geographic change in the main nesting areas of Gahirmatha which is now cut off from the main land since 1989. In addition, considerable numbers of eggs are destroyed by overlapping nesting activities due to restriction of space. It is necessary to assess these aspects now so that alternative arrangements can be made for transfer and incubation of eggs in appropriate places.

7. HEJMADI, P. M. & G. SAHOO. (2000). Ultrastructure and biochemical study of egg shell calcium utilization during embryogenesis in the olive ridley (*Lepidochelys olivacea*) sea turtle. pp.112-113. *In*: Kalb, H. J. & T. Wibbels (compilers), Proceedings of the Nineteenth Annual Symposium on Sea turtle Conservation and Biology, U.S. Department of Commerce. NOAA Technical Memorandum. NMFS-SEFSC-443, 291 p.

During the development of the turtle eggs, the absorbed water and the pore spaces in the shell help capillary exchange of water with environment while the netted substrate and the loosely packed crystallites support adequate air circulation to prevent building up of carbon dioxide around the egg. The olive ridley turtle eggshell is constituted solely of aragonite. The inorganic profile of the olive ridley eggshell shows calcium being the major constituent and present in a higher proportion (21%) than reported for green turtles. Well-defined aragonite crystals without any phosphorus in the olive ridleys in the present study do not support this view.

8. HEJMADI, P. M., M. BEHERA & M. T. DIAMOND. (1985). Temperature dependent sex differentiation in the olive ridley *Lepidochelys olivacea* and its implications for conservation. pp. 260-263. *In*: Silas, E. G. (ed.), Proceedings of the Symposium on Endangered Marine Animals and Parks, Marine Biological Association of India, Cochin, 505 p.

Temperature is a controlling factor that has important effects on sex differentiation in embryos of most turtle species. In general, females are produced at the higher end of the range, and males at the lower. The sex is determined by their temperature during the middle third of development. The effect of three temperatures, 26-28^{0}C, 29-30^{0}C and 31-32^{0}C showed that females only were produced at the high incubation and males only at the low with both sexes developing at the intermediate temperature. Both studies on the transplanted beach nest showed that only females were produced in the nest. Both laboratory and field studies have important implications for the conservation of the endangered sea turtles in general.

9. KAR, C. S. & M. C. DASH. (1984). Conservation and status of sea turtles in Orissa. pp. 93-107. *In*: Silas E. G. (ed.), Proceedings of the Workshop on Sea Turtle Conservation, CMFRI, Cochin, Special Publication No. 18: 120 p.

Conservation of wildlife is achieved through the following main approaches. First, by protecting the endangered species by law from being distured, killed or otherwise exploited and by its proper implementation nationally and internationally. Secondly, by setting aside core areas of each habitat s Nature Reserve, Sanctuaries, National Marine Parks and Biosphere Reserves etc.where wildlife can continue to exist in a purely natural state. Thirdly by educating the lay man who interact with wildlife about the need for both conservation and research, as without their involvement and co-operation wildlife conservaiton would be impractical. Finally, by undertaking in-depth scientific research to understand the behaviour and basis biological needs of the species in order to formulate future management programmes based on sound footings.

Source: Dr. C. S. Kar, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar - 751002 (Orissa). E.mail: drcskar@gmail.com.

10. KAR, C. S. & M. C. DASH. (1984). Mass nesting beaches of the olive ridley *Lepidochelys olivacea* (Eschscholtz, 1829) in Orissa and the behavior during an *arribada*. pp. 36-48. *In*: Silas E.G. (ed.), Proceedings of the Workshop on Sea Turtle Conservation, CMFRI, Cochin, Special Publication No. 18: 120 p.

Although the factors which synchronize large aggregation of olive ridleys is still remain unclear, most authors attribute a survival value to this trait as a means to swamp predation with a very temporary over a abundance of food. Various authors have also mentioned that survival value of the trait may be that local predator populations are bewildered by the sudden hug a abundance of potential prey – the adult turtles, their eggs, or two months later the hatchlings p and although they may consume all they can, the manifestation is over so rapidly that many of the turtles will still survive, and excessively high predator population levels will be inhibited simply because they cannot be sustained by one or two big meals a year. This paper briefly described about the mass nesting processes of olive ridley turtles at the Gahirmatha rookery of Orissa.

11. KAR, C. S. & S. BHASKAR. (1982). The status of sea turtles in the eastern Indian Ocean. pp. 365-372. *In*: Bjorndal, K. A. (ed.), The Biology and Conservation of Sea Turtles, Smithsonian Institution Press, Washington DC, 615 p.

Five sea turtle species have been reported from the eastern Indian Ocean. Their populations are believed to be declining steadily everywhere. Although sea turtles in India and Sri Lanka have been accorded total legal protection, many difficulties beset enforcement. These result from the remoteness

of nesting beaches; the resistance to protective governmental statutes among traditional exploiters of sea turtles; widespread poverty in the region which makes sea turtles, their eggs and derived products an attractive source of income and which precludes the use of adequate staff and facilities to control poaching and illegal trade; and the paucity of knowledge relating to the locations of nesting beaches and feeding areas where detrimental human activity occur.

One of the largest olive ridley breeding populations in the world is being depleted by the thousands off the coast of Orissa, India for meat. Human overpopulation has resulted in the colonization of many sea turtle nesting beaches, especially on islands.

12. KAR, C. S. (2001). Review of threats to sea turtles in Orissa. pp. 15 –19. *In*: Shanker, K. & B. C. Choudhury (eds.), Proceedings of the Workshop for the development of a National Sea Turtle Conservation Action Plan, Wildlife Institute of India, Dehradun.

Following the first world conference on the Biology and Conservation of Sea Turtles in 1979, a number of international, national and regional level conferences have been held in the last two and half decades to review the threat to sea turtles. Several steps have also been taken by both government of India and government of Orissa to mitigate the above threats. However, due to ever increasing human populations, detrimental human activities have occurred in around sea turtle's breeding, feeding, developmental habitats and their migratory paths. Therefore, it is high time to review the threats to sea turtles to take stock of the present status of our knowledge about the time and places where detrimental human activities occurs, type of other direct/indirect threats to both the species of sea turtle and their habitat. This is essential in order to chalk out and help develop meaningful strategies and programs for their future conservation and management based on sound scientific principles.

13. PANDAV, B. & B. C. CHOUDHURY. (2000). Can the Olive ridley turtles in Orissa be saved - A Review of the Scientific facts available. pp 71-72. *In*: Kalb, H. J. & T. Wibbels (compilers), Proceedings of the Nineteenth Annual Symposium on Sea turtle Conservation and Biology, U.S. Department of Commerce. NOAA Technical Memorandum. NMFS-SEFSC-443, 291 p.

Despite the legal protection given to the sea turtles, the sea turtle populations migrating to the coastal water off Orissa have been declining in recent years. The biggest cause of mortality is the incidental capture of adult turtles in trawling nets. A second cause of disturbance is artificial lighting along the coastline. Developmental activities such as establishment of a missile test range and construction of a major port near Gahirmatha and mushrooming growth of aquaculture farms and chemical industries near Rushikulya rookery have resulted in increased lighting near the nesting beaches. Heavy predation on sea turtle nests by feral dogs and jackals take place at Rushikulya rookery after mass nesting. The plantation of *Casuarina* trees in some prime nesting grounds has further restricted the nesting space available. The first step towards solving these problems is strict enforcement of the ban on mechanized fishing in near-shore areas and areas with high sea turtle concentration. The use of TED should be made mandatory for trawlers operating in the coastal waters beyond 5 km from the shoreline. A major step would also be giving protected area status to the sea turtle nesting beaches as well as the coastal waters having high sea turtles. Protection of all the three nesting sites is crucial for the survival of turtles in Orissa.

Source: Dr. Bivash Pandav, Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun – 248001. Email: pandavb@yahoo.com

14. PANDAV, B. & B. C. CHOUDHURY. (2000). Tagging studies on olive ridley sea turtles in Orissa, India. pp 257-258. *In*: Kalb, H. J. & T. Wibbels (compilers), Proceedings of the Nineteenth Annual Symposium on Sea turtle Conservation and Biology, U.S. Department of Commerce. NOAA Technical Memorandum. NMFS-SEFSC-443, 291 p.

Results of the tagging study suggest a greater degree of nesting site fidelity in olive ridleys using the Rushikulya rookery. Ridleys generally placed their nests within 100-300 m of their previous nest with a

range of 0 to 100 m (n=44). Ridleys tagged at nesting beaches in Orissa exhibited movement between the rookeries. Males recaptured during offshore tagging at Gahirmatha also exhibited an annual cycle. The tag returns from turtles of Orissa suggests that ridleys move southward along the coast after the commencement of nesting season.

15. PANDAV, B. & K. SHANKER. (2001). Review of threats to sea turtles – estimating numbers accurately. pp. 20. *In*: Shanker, K. & B. C. Choudhury (eds.), Proceedings of the Workshop for the development of a National Sea Turtle Conservation Action Plan, Wildlife Institute of India, Dehradun.

Reliable methods are now available to accurately estimate turtles during arribadas. These methods should be used in future with collaborations between scientists and the forest department, with trained frontline staff to collect the data, so that reliable information is available for the conservation of olive ridleys in Orissa.

16. PANDAV, B. & B. C. CHOUDHURY. (2005). Ecological status and impact of anthropogenic activities on the olive ridley sea turtle in Orissa. pp. 109-115. *In*: Jhala, Y. V., R. Chellam and Q. Qureshi (eds.), Wildlife conservation, research, and management, A technical publication of the Wildlife Institute of India, Dehradun, RR-05/001, 155 p.

Olive ridley sea turtle (*Lepidochelys olivacea*) nests *en-masse* at three major rookeries (Gahirmatha, Devi and Rushikulya) in Orissa. Monitoring of the nesting sea turtle population at these three rookeries was initiated in 1995. The number of sea turtle nesting during an arribada was estimated using the fixed strip nesting turtle count method. Over the past four years the Orissa coast has witnessed a drastic decline in the number of nesting sea turtles. Since 1994, over 33,000 adult olive ridleys have been washed ashore the Orissa coast after being incidentally captured in fishing nets. Over 5,000 ridleys have been double tagged at five tagging sites in Orissa since 1997. The factor that olive ridleys use more than one beach for nesting in a single season has been established by tag recoveries at these three mass nesting beaches. Elimination of human related disturbance factor is extremely crucial for the survival of olive ridleys, especially since this could be a single population that is nesting in Orissa.

17. PANDAV, B. GOPI, G. V. & B. C. CHOUDHUARY. (2003). Sea, shrimp and sea turtles – A case study of a solution approach using TEDs in trawl nets in Orissa. pp. 220. *In*: Pilcher, N. J. (compiler), Proceedings of the Twenty Third Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-536, 261 p.

Extremely large numbers of olive ridleys get killed along the Orissa coast, India every year during the breeding season. The incidental capture during shrimp trawling has been identified as a major reason for this wanton killing of sea turtles in Orissa. While the trawl operators are still reluctant to agree to the fact that trawl fishing is indeed a major cause of sea turtle mortality, they are also reluctant to use TEDs. To substantiate the efficacy of indigenously designed CIFT-TED on turtle exclusion and level of fish catch loss, experimental trawling with and without TEDs was conducted in the coastal waters off Orissa during November 2001 to March 2002.

18. PRUSTY, G., S. DASH & S. S. PRASAD. (2005). Tide normalized change detection using multi-temporal satellite imagery to decipher the turtle rookery dynamics of Gahirmatha, India. pp. 561-566. *In*: Kurnaz, S. F. Ince, S. Onbasioglu & S. Basturk (eds.), Proceedings of the 2nd International Conference on Recent Advances in Space Technologies (RAST 2005), Istanbul, Turkey.

A GIS based tide normalized change detection method is developed and tested for analyzing multi-temporal satellite imagery to decipher the morphological change pattern of the two major *Olive Ridley* sea turtle nesting landforms, namely Ekakula spit and Nasi sandbar situated in the Gahirmatha coast, India. The shoreline position of the coastal landforms at the time of satellite capture is variable as it is dependent on the dynamic nature of the tidal conditions. To normalize the tidal effect, reference Digital

Elevation Models (DEM) were constructed from seven-change position of the shoreline, derived from the satellite images sampled between Dec'98 and March'99 under varied tidal conditions. According to the associated tidal levels of the historical images, the corresponding Reference shorelines were extracted from the constructed DEM for quantitative estimation of change in surface area. The methodology has recorded an error up to 4% in the self-consistency check. The ephemeral nature of the rookery was deciphered from the change computation of surface area from the 25 historical images sampled between the years 1988 and 2004 and demonstrated that the geo-morphological characteristic of the rookery is one of the major deciding factors for the mass-nesting of the turtles.

Source: Dr. G. Prusty, Defence Terrain Research Laboratory, Metcalfe House, Delhi-110 054, India. E.mail: ganpru@yahoo.com

19. RAJAGOPALAN, M., E. VIVEKANANDAN, K. BALAN & K. N. KURUP. (2001). Threats to sea turtles in through incidental catch. pp. 12-14. *In*: Shanker, K. and B. C. Choudhury (eds.), Proceedings of the National Workshop for the development of a National Sea Turtle Conservation Action Plan, Bhubaneswar, Wildlife Institute of India, Dehradun.

In the absence of information on the stock size of the sea turtle population along the Indian coast, it may not be possible to assess the extent of damage the incidental catch may cause to the stock. A proper assessment of the total stock is required, which would be helpful for formulating fishery management measures without affecting the livelihood of about 5 million marine fishermen, who are directly or indirectly involved in fishing.

20. RAM, K. & B. PANDAV. (2004). Studies on the offshore ecology of the olive ridley sea turtle (*Lepidochelys olivacea*) in the Gahirmatha marine sanctuary, Orissa, India. pp. 69. *In*: Coyne, M., & R. D. Clark (compilers), Proceedings of the Twenty-First Annual Sympoisum on Sea Turlte Biology and Conservation, NOAA Technical Memoradum NMFS-DEFSC-528, 368 p.

We studied the olive ridley mating asseblages in the offshore waters off one of the most important mass nesting rookeries for *L.olivacea*. Data was collected over a 4-year period from 1996-2000, during which 3325 (1,689 males and 1,636 females) turtles were captured and tagged. Males exhibited fidelity to a particular coutship area. Our recaptures indicate that females tagged while mating mating in this breeding unit tend to nest in the nearest rookery. We estimated the number of pairs present in these assemblages using line transect methodology. Mating pair surface density in 1999-2000 was 26 pair (CV=11.4%) per sq.km. with an encounter rate of 3.9 pairs/km. Sex ratios of turtles stranded during the breeding period were skewed more towards males. Capture locations pooled over a 4 year period suggests that the size of the assemblage does not vary significantly between seasons. The size of the breeding patch, esimated using capture/sighting locations was 57.8 sq.km. In this paper we present the results of our offshore study and suggest that the area may be an important mating ground and that it would be beneficial to monitor these mating areas on a ragular basis to assess trends in population over the short term.

Source: www.seaturtle.org

21. SHANKER, K. & B. C. CHOUDHURY (2001). Proceedings of the National Workshop for the Development of a National Sea Turtle Conservation Action Plan for India. *In*: Shanker, K. & B. C. Choudhury (eds.). Proceedings of the National Workshop for the Development of a National Sea Turtle Conservation Action Plan for India, GOI-UNDP Sea Turtle Project, April 2001, Bhubaneshwar, Orissa. Wildlife Institute of India, Dehra Dun. 103 p.

This workshop, as part of the UNDP Project, brought together conservationists and biologists from all over India for the first time since the IUCN-MTSG Northern Indian Ocean Sea Turtle Workshop in 1997, also at Bhubaneswar. While problems of sea turtles in Orissa and elsewhere in India are still numerous,

the level of awareness, especially amongst the media, the level of concern in various sectors is encouraging. However, this concern has to be translated into action at the local and governmental level to achieve the long term goals of turtle conservation in India. The workshop was a success due to the steering efforts of various people including the participants.

22. SHANKER, K. & B. PANDAV (2004). How precise is natal homing – speculation on the nesting migrations of olive ridleys on the east coast of India? pp. 327-328. *In*: Coyne, M., & R. D. Clark (compilers), Proceedings of the Twenty-First Annual Sympoisum on Sea Turlte Biology and Conservation, NOAA Technical Memoradum NMFS-DEFSC-528, 368p.

Multiple fingerprinting, RAPD analysis did not reveal any population structure in olive ridley populations along the east coast of India. Mitochrondrial DNA analysis did not reveal population structure along the east coast of India. Turtles tagged in Orissa in 1970s have been observed nesting in Madras, more than 1000 km south along the coast. In Orissa, turtles have been recorded nesting at more than one nesting beach within and between seasons. First, the data may be explained by imprecise natal homing in olive ridley turtles. However, recaptures at nesting beaches in Orissa suggest that this is not true.

23. SHANKER, K., B. C. CHOUDHURY, B. PANDAV, B. TRIPATHY, C. S. KAR, S. K. KAR, N. K. GUPTA & J. G. FRAZIER. (2003). Tracking olive ridley turtles from Orissa. pp. 50-51. *In*: Seminoff, J. A. (ed.), Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-503. 308 p.

The tagging data demonstrates that ridley turtles that nest in Orissa migrate to southern Tamil Nadu and Sri Lanka during the non-breeding season. The occurrence of tagged turtles in these waters during the breeding season and the absence of population genetic structure raise questions about the precision of natal homing in these turtles. However, it is the satellite telemetry study that provides evidence about the exact migratory route taken by turtles, including important data such as travel rates and offshore distance from the coast. During their post nesting movement, they may come into near-shore waters and are thus vulnerable to trawling related mortality.

24. SHANKER, K., R. K. AGGARWAL, B. C. CHOUDHURY & L. SINGH. (2002). Conservation genetics of the olive ridley sea turtle (*Lepidochelys olivacea*) on the east coast of India. pp. 21-22. *In*: Andrea, M., A. Foley & B. Brost (compilers), Proceedings of the Twentieth Annual Sympoisum on Sea Turtle Biology and Conservation, NOAA Technical Memoradum NMFS-DEFSC-477, 369 p.

The elucidation of the population structure of olive ridleys on the coasts of India would facilitate the development of a management strategy for this endangered species. Conservation priorities need to be assigned on the basis of genetic diversity and population size. The migration routes and origin of these populations would help in the identification of agencies, both national and international which would have to collaborate to ensure the survival of this species. Identifying molecular markers for various species would help in the molecular resolution of marine turtle stock composition in fishery by-catch and in the forensic identification of meat, shell and other products. The first phase of this project has amply demonstrated the usefulness of these techniques in providing answers to conservation related questions. The preliminary results suggest that a comprehensive study is required to provide guidelines for the conservation of olive ridleys in India. Preliminary results also suggest that questions related to behavior and mating systems can be answered using these techniques.

25. SHANKER, K., R. K. AGGARWAL, B. C. CHOUDHURY & L. SINGH. (2004). Orissa-The source of the world's olive ridley populations. pp. 325-327. *In*: Coyne, M. & R. D.Clark (compilers), Proceedings of the Twenty-First Annual Sympoisum on Sea Turlte Biology and Conservation, NOAA Technical Memoradum NMFS-DEFSC-528, 368 p.

Haplotype K and the new haplotypes form a distinct cluster that is most closely related to the Kemps ridley. Haplotypes K is the deepest lineage within olive ridleys, representing half the divergence with kemp's ridleys and is dominant in the Indian olive ridley turtles. There was no difference in the haplotype frequencies in Orissa and Madras, further south along the coast. The Indian population is distinct from the Sri Lankan population which is its closest geographical neighbour. The fact is that Haplotype K is clearly the most dominant of the haplotypes in the Orissa, the size of the population and the region's stability suggest that this population is the ancestral source for global ridley populations.

26. SILAS, E. G., M. RAJAGOPALAN, S. S. DAN & A. B. FERNANDO. (1985). On the second mass nesting of the olive ridley *Lepidochelys olivacea* at Gahirmatha, Orissa during 1984. pp.234-241. *In*: Silas, E. G. (ed.), Proceedings of the Symposium on Endangered Marine Animals and Parks, Marine Biological Association of India, Cochin, 505 p.

Observations carried out on the second mass nesting of the olive ridley along the Gahirmatha beach towards the end of March 1984 are recorded here. The mass nesting occurred in general along the same stretch where the first mass nesting had earlier taken place from 25th January to 6th February 1984, with a peak activity along about one kilometers of the stretch of the beach. Minimum destruction to earlier nests and emerging hatchlings was noted in this area of overlap. Some observations made during this phase on emerging hatchlings of the first mass nesting are also reported here.

27. WRIGHT, B., B. MOHANTY & K. SHANKER. (2002). *Operation Kachhapa* and the olive ridleys of Orissa (India): Short and long term management plans. pp.343-345. *In*: Andrea, M., A. Foley & B. Brost (compilers), Proceedings of the Twentieth Annual Sympoisum on Sea Turtle Biology and Conservation, NOAA Technical Memoradum NMFS-SEFSC-477, 369 p.

Patterns of mass nesting, tag recoveries and genetic data suggest that olive ridleys in Orissa use more than a single nesting beach during a season. Further, the possibility of their nesting at new beaches seems real – there were two small arribadas at Barunei, 30 km south of Gahirmatha, in March (8000 turtles) and April (20,000 turtles), 1999. This particularly suggests that any conservation strategy must take into account the changing nature of the beaches and the changing patterns of nesting. It is important that key areas are assessed at the beginning of the season to determine turtle aggregations, so that these areas can be patrolled to protect turtles in offshore waters. Nearby nesting beaches can also then be monitored for nesting and mortality. There is a need to persist with current strategies (monitoring and enforcement) until some of them bear fruit, while others may need to be revamped completely (e.g. management within sanctuaries). It is hoped that initiatives such as *Operation Kachhapa* can bring together a combination of policy makers, activists, researchers and local communities who can work together to ensure the conservation of the olive ridley in India.

28. YADAV, M. R. (2002). Conservation perspectives, problems and priorities of Indian marine turtles. pp. 127-128. *In*: Andrea, M., A. Foley & B. Brost (compilers), Proceedings of the Twentieth Annual Sympoisum on Sea Turlte Biology and Conservation, NOAA Technical Memoradum NMFS-SEFSC-477, 369 p.

In the present paper, focus has been made towards the multifaceted problems related to anthropogenic activities, habitat degradation and disturbances, illuminations, mortality, predation, over-exploitation, domestic and international trade, Use of TEDS, patrolling, effective enforcement of existing rules and regulations, awareness and education services among the benefited people and fishermen along the coastal regions of Indian Union.

ii. Abstracts

29. ACHARJYO, L. N. (1978). Wildlife research activities of Orissa. *In*: Souvenir - XXI Indian Veterinary Conference (5^{th} to 8^{th} June 1978), Cuttack, p. 21-23.

The author mentions about an ongoing sea turtle research project in Orissa at Gahirmatha and Puri-Konarak stretch for determining the population and reducing poaching of olive ridley turtles along Orissa coast.

Source: Dr. L. N. Acharjyo, M-71, Baramunda Housing Board Colony, Bhubaneswar – 751 020, Orissa, India.

30. AGGARWAL, R. (2004). Genetic analysis of olive ridley (*Lepidochelys olivacea*) populations from the east coast of India using microsatellite markers and haplotyping of mitochondrial d-loop control region. Annual Research Seminar-2004, Wildlife Institute of India, Dehradun.

Sea turtles are globally threatened, following the decline and extirpation of many local populations. Though > 100,000 olive ridley turtles (*Lepidochelys olivacea*) have been reported to nest during mass nesting events at Gahirmatha in Orissa on the east coast of India, this population currently suffers severe fishery related mortality. In general, the globally distributed olive ridley turtle has received significantly less conservation attention than its congener, the Kemp's ridley turtle (*L. kempi*), because the latter is recognized as a distinct species consisting of a single endangered population.

In this study attempts to understand the genetic structure of olive ridley turtle populations along the east coast of India. For the purpose, olive ridley sea turtles sampled from four major nesting sites, three in Orissa and one in Tamil Nadu, were analyzed using cross-species microsatellite markers and also nucleotide diversity in the mitochondrial control region. The microsatellite analysis revealed moderate to high level of polymorphism among the 80+ individuals from four sites. Interestingly, all the samples exhibited heterozygosity for at least one micro satellite loci analyzed in the study. The observations thus suggest that olive ridley turtles in Indian waters have reasonably wide genetic base and represent a genetically vibrant population. Further, allelic diversity at micro-satellite loci as well as the mitochondrial haplotypes were found randomly distributed across the samples, suggesting that there is no genetic differentiation between the populations from different nesting sites and that these probably represent the continuum of the same one large interbreeding population all along the East coast of India. This observation provides support to the field data that olive ridley sea turtles routinely use more than one nesting beach in Orissa.

Further, our study of mitochondrial DNA haplotypes suggests that this large and distinct Indian population is likely to be the ancestral source for contemporary global populations of olive ridley turtles as a result of recent (re)colonization events from the Indian Ocean. Nested clued analysis and conventional analysis both support range expansions from the Indian Ocean clades to other oceanic basins. Moreover, the occurrence of a signature 7 bp index in the Indian haplotypes, which is shared with Kemp's ridleys and other marine turtles, supports their ancestry to other olive ridley turtles. The data supports the distinctiveness of the Kemp's as well as Indian ocean ridleys whereby both populations need to be prioritized, suggesting that conservation decisions should be based on appropriate data and not solely on designations of certain populations or groups of populations as species.

Source: Dr. Ramesh K Aggarwal, Centre for Cellular & Molecular Biology, Uppal Road, Tarnaka, Hyderabad, AP, India 500 007.

31. AGGARWAL, R., K. SANKER, J. RAMADEVI, V. VELVAN, B. C. CHOUDHUARY & L. SINGH. (2003). Genetic analysis of the olive ridley (*Lepidochelys olivacea*) populations from the east coast of India using micro-satellite markers and mitochondrial D-loop haplotype. pp. 109. *In*: Pilcher, N. (compiler), Proceedings of the Twenty Third Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-536, 261 p.

The conservation genetics of olive ridley sea turtles (*Lepidochelys olivacea*) on the east coast of India, particularly Orissa, has been a matter of great concern due to large scale trawling mortality over the past few years. The Orissa coat has three major mass nesting sits, of which Gahirmatha is among the largest in the world. This study attempt to understand the genetic structure of these populations along the east coast of India. For the purpose, olive ridley sea turtle sampled from four major nesting sites, three in Orissa and one in Tamil Nadu, were analyzed using cross-species micro-satellite markers and also nucleotide diversity in the mitochondrial control region. The micro-satellite analysis revealed moderate to high level of polymorphism among the >80 individual from four sites. Interestingly, all the sample exhibited hetero-zygosity for at least one micro-satellite loci analyzed in the study. This observation, in conjunction with the considerable variability seen earlier in the multi-locus fingerprints, suggest that olive ridley turtles in Indian waters have reasonably wise genetic base and represent a genetically vibrant distributed across the samples, suggesting that there is no genetic differentiation between the populations from different nesting sites and that there probably represent the continuum of the same one large interbreeding population all along the east coast of India. This observation provides support the field data that olive ridley sea turtles routinely use more than one nesting beach in Orissa.

32. ANONYMOUS. (1985). Symposium on Endangered Marine Animals and Parks – Recommendations. *In*: Silas, E.G. (ed.), Proceedings of the Symposium on Endangered Marine Animals and Parks, pp. xvi-xxii. Marine Biological Association of India, Cochin, 505 p.

The Recommendations are:

Strategies for conservation and management of the sea turtle resources of India through habitat preservation, enforcement of prevalent laws and regulations, researches on the resource and through education, training and extension identified and recommended in the Workshop on 'Sea Turtle Conservation' held in Madras in February, 1984 be implemented immediately.

The massive Arribada nesting of the olive ridley turtles along the Bhitarkanika and Konark coasts in Orissa is an unique phenomenon and is one of the most interesting features in the animal and biological realm. To provide protection and proper management and conservation measures to this breeding population, the Conference urges to elevate the status of Bhitarkanika and Konark Sanctuaries to that of National Parks and to extend the seaward boundary of these areas to 10 nautical miles all along the Gahirmatha-Konark coast so as to afford seasonal protection to the nesting olive ridley.

Source: Marine Biological Association of India, C/o Central Marine Fisheries Research Institute, Post Box No. 1603, Ernakulam North P.O., Kochi-682 018.Cochin.

33. ANONYMOUS. (1995). Resolution 1: India, *Lepidochelys olivacea*. Resolutions at the International Congress of Chelonian Conservation. *In*: Proceedings of the International Congress of Chelonian Conservation, 6-10 July 1995, Gonfaron, France.

Resolution-1. WHEREAS Gahirmatha beach in Bhitarkanika Wildlife Sanctuary, Orissa, India, has the world's largest nesting population of the olive ridley sea turtles (*Lepidochelys olivacea*), and;

WHEREAS the Bhitarkanika Wildlife Sanctuary includes one of the few intact mangrove ecosystems in continental south Asia, and

WHEREAS, the recent and proposed development and construction of roads, jetties, and aquaculture facilities in the region threaten the integrity of this valuable and unique ecosystem and its extraordinary turtle populations,

NOW THEREFORE BE IT RESOLVED THAT, in order to save these natural resources from progressive destruction, there should be enacted:

i) a moratorium on further construction of industrial facilities of all kinds within and around the Bhitarkanika Wildlife Sanctuary;
ii) protection of the turtle nesting beach from development, disruption, or collection or take of turtles and their eggs;
iii) appropriate restrictions on commercial fisheries within the reserve waters; and
iv) mandatory use of TED on all trawlers operating within the marine waters of the state of Orissa.

Source: International Congress of Chelonian Conservation, 6-10 July 1995, Gonfaron, France/ Library of the Madras Crocodile Bank Trust, Mammalapuram, Chennai.

34. ANONYMOUS. (1996). Proceedings of the Workshop on Turtle Excluder Device. Department of Fisheries, Government of Orissa & Project Swarajya, Cuttack, 11 - 14 November 1996.

After detailed discussions and deliberations, the following recommendations were adopted in the above workshop:

i) Imperative need to protect and conserve the sea turtles
ii) Recognizes the need to reduce the incidental catch of sea turtles in trawl nets of shrimp fishing vessels
iii) Recognizes urgent need for policy retooling, policy implementation and policy enforcement
iv) Recommends that coastal waters which are breeding grounds for turtles should be included in the Coastal Zone Management Plan (CZMP)
v) The use of TED should be made mandatory and a proper and effective monitoring system be developed.
vi) A uniform policy for all the Indian coastal waters including maritime states to be formulated and implemented expeditiously.
vii) Formation of a coordinating body comprising turtle specialists, ecologists, environmentalists, economists, social scientists and representatives from Government and Non-government Organizations.
viii) To appoint the Chairman of this workshop to head the proposed Coordinating Body to conduct similar workshops in other Coastal regions
ix) Appropriate technologies interfacing with the existing TED be identified, developed and popularized.
x) Need for undertaking collaborative studies, research and training, and recommends action towards a cost-benefit analysis study of the shrimp fishing operation with and without the use of TED; survey of incidental catch of sea turtles in different type of nets; and training, extension and information dissemination activities on TED technology
xi) Different departments to introduce adequate schemes for enhanced extension activities to popularize the need to protect sea turtles
xii) Organize a brainstorming session with private sector for deciding their role and responsibilities in the protection and conservation of sea turtles
xiii) Concerned departments to provide incentives by way of sales tax concession, duty exemption, and tax holiday etc. to units investing in turtle protection and conservation measures including the use of TED.
xiv) Different departments to formulate appropriate and timely policies to ensure the implementation of a regulatory programme for incidental catch of sea turtles in commercial shrimp trawl fisheries and regulate shrimp harvest in a manner not harmful to sea turtles.
xv) Develop a model training programme with a core group of technical and non-technical experts in the field.

Source: Project Swarajya, Ganesh Ghat, Barakhabad, Cuttack, Orissa, India.

35. ANONYMOUS (2001). 2nd SEAN Symposium and Workshop on Sea Turtle Conservation and Biology - RESOLUTION. *In*: Pilcher, N. J. & G. Ismail (eds.), Sea turtles of the Indo-Pacific Research, Conservation and Management, pp. xxi. ASEAN Academic Press, London, 361 p.

RESOLUTION: Representatives, concerned scientists and participants from countries of the Indo-Pacific and Indian Ocean region, including Southeast Asian member nations, having met at Kota Kinabalu, Malaysia, to participate in the 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation;

Record their appreciation to the Government of India and the State of Orissa for their efforts made to curtail olive ridley mortality and the return of ridleys to the Gahirmatha coast;

While appreciating the initiation of the national Sea Turtle Programme of India, the Workshop urges the authorities of the GOI and State of Orissa to safeguard the new nesting sites in Orissa resulting out of changing coastal geomorphologic processes.

The workshop further urges rapid enforcement of existing coastal fishing regulations to curtail near-shore mechanized fishing and to accelerate the development of TED programme in India.

Source: ASEAN Academic Press, London/Dr. Nicholas Pilcher, MRF-Asia, Kota Kinabalu, Malaysia. E.mail: npilcher@mrf-asia.org

36. BEHERA, C. (2003). Trawl Guard, a substitute to the TED? pp. 209. *In*: Pilcher, N. J. (compiler), Proceedings of the Twenty Third Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-536, 261 p.

Notwithstanding the vigorous campaign for TEDs, the Indian trawlers are still hesitant to use them. The TED was designed basically for exclusive shrimp trawling, and they argue it is unsuitable for the mixed catch they invariably target. Other than TEDs, any device would be accepted provided it does not critically hamper their mixed catch. At this critical juncture of the ill fitted TED India, a ray of hope is now visible, with the emergence of a new device: the Trawl Guard, claimed by its inventors to contain the virtues of TED minus its vices. The new device, a brain-child of two Oriya coastal fishermen, seems to be a foolproof mechanism for disposal of all large-size objects including turtles, while allowing both shrimp and fish into the net. Originating in the aftermath of Orissa Super-Cyclone 1999 and in response to the vexing problem the trawlers experienced from obstructions by big logs that accumulated on the seabed, the device not only protects trawl nets from accidental damage by such obstructions but also disallowed inadvertent movement of turtles while retaining the full mixed catch of shrimp and fish in the net. Unlike the metallic TED, fitted ingenuously at the throat of a bifurcated trawl-net, the inexpensive Trawl Guard is made of roughly 4 kg of nylon rope only and fitted at the mouth of net. Any average fisherman can prepare, install and maintain it with ease. Trawl Guards, if promoted further, might solve the long-drawn-out TED tangle, at least for Indian trawlers.

37. BEHERA, S. K. (2008). Feeding ecology of Olive Ridley *Lepidocheyls olivacea* and Hawksbill *Eretmochelys imbricata* turtles at Devi Rookery, Orissa, India. Annual Research Seminar-2008, Wildlife Institute of India, Dehradun.

Olive Ridley marine turtles migrate to offshore waters along the Orissa coast every year for breeding. Though, several studies on nesting ecology of this species have been carried out along Orissa coast in the last two decades or so (Pandav & Choudhury, 2002), very little is known about their feeding ecology, especially diet. Although, a few attempts were made to study the feeding ecology of Olive ridley, that too in Pacific Ocean (Hughes, 1974, Pritchard, Trebbau, 1984, Montenegro Silva, 1986 and Bjorndal, 1997) and two studies in Indian Ocean (Deranyagala, 1953 & Biswas, 1982), there has been no detailed information on the diet of this species which is crucial for their long term conservation.

In this connection, this study was carried out to find out the diet of olive ridley by conducting gut content analysis on freshly stranded dead turtles ashore from February to April 08 at Devi rookery, following standard methods (Forbes 1999; Limpus and Forbes 1993; Balaz, 1980 and Garnett, 1985).

Gut content analysis was conducted on 34 Olive ridley, which included one male and 33 female, and two Hawksbill turtles. All analyzed turtles were classified into four size groups based on their curved carapace length (CCL) (< 49cm, 50-59 cm, 60-79 cm, and >80cm). Attempts were made to study the variation in the diet of turtles belong to different size classes. Diet of Olive Ridleys of Orissa confirmed that they were omnivores but largely survived on animals food (63.93%) followed by 29.36% of vegetation. Among animal food, fish dominated in the diet followed by mollusk. Wide varieties of molluscan species were eaten by the Olive ridleys, and it was found that about 12 families of molluscan in the diet of these turtles. Among molluscan, family *Muricidae* dominated in the diet. Apart from fish and molluscan, arthropods and possible annelids were also found in the ridleys diet along with algae. There was no significant difference in the diet of turtles belong to different size classes of Olive ridley. Diet of two Hawksbill turtles have shown they are omnivores and fed largely on fish (58.63%) followed by plants (23.19%). Presence of materials of fishing gear (9.09%) in the diet of analyzed Hawksbill reveals that these turtles may have been killed because of fisheries interface.

Source: Subrat K. Behera, Wildlife Institute of India, Post Box #18, Chandrabani, Dehradun – 248001. E.mail: subb@wii.gov.in

38. GOPI, G. V. (2002). Sea turtle and marine fisheries interface - case study of a solution approach using Turtle Excluder Device (TED) in Trawl Nets in Orissa. Annual Research Seminar-2002, Wildlife Institute of India, Dehradun, India.

The incidental capture of sea turtles in marine trawl fishing has been identified as a major source of their large-scale mortalities all over the world. While the trawl operators everywhere were reluctant to agree to the fact that trawl fishing is indeed a major cause of mortality of sea turtles, they are also reluctant to use TEDs in trawl nets designed to minimize trawl related mortalities. Their apprehension that significant percentage of fish catch loss will result if TEDs are used in trawl nets is not based on empirical data. To substantiate the efficacy of the indigenously designed CIFT-TED, on turtle exclusion and level of fish catch loss from trawl nets, this study was conducted in the coastal waters of Orissa during Nov'01 to Mar' 02.

Experimental design involved conducting trawling without TED and with TED. Of the 51 trawling efforts with TED carried out between 6 to 13 fathoms in stratified study zones resulted in 21 turtle captures and 100% escape. Of the 25 trawling efforts without TED conducted between 12 to 35 fathoms depth resulted in 5 captures. The data reveals that most turtle captures occur within 5 Km range from shore and below 10 fathom depth emphasizing such marine habitats to be safeguarded. The fish catch loss in all three zones with TED ranged from 2.3 to 10.3 %. The need for non-invasive TED demonstration and extension, free or subsidized distribution of TED to marine fisher folks and a clear demarcation of no fishing zones in time and space is proposed as a strategy for acceptance of TED as a solution approach for fisheries and sea turtle interface.

Source: Gopi, G.V., Wildlife Institute of India, Post Box #18, Chandrabani, Dehradun – 248001. Email: gopigv@wii.gov.in.

39. KUMAR, R. S. (2007). An investigation on the relationship of off-shore distribution patterns of olive ridley turtles and mass nesting along the Rushikulya Rookery. Annual Research Seminar-2007, Wildlife Institute of India, Dehradun.

The offshore distribution of a globally important population of olive ridley sea turtle *Lepidochelys olivacea* off the Rushikulya mass nesting site, southern Orissa was investigated from November 2006 to May 2007. This was carried out as part of a larger study on “Determining the offshore distribution, migration and movement of the olive ridley sea turtle along the east-coast of India”. An area of approx. 120 sq. km was systematically monitored for turtle presence using line transects running parallel to the

coastline and up to five km offshore. A total of 52 transects in 35 sampling days were carried out. 3106 surfacing turtles were recorded, which included mating pairs, groups of two, three, and more than three turtles. In this presentation, information on the spatio-temporal distribution, and surface densities of the turtles observed in the area during the period will be presented.

Source: R. Suresh Kumar, Wildlife Institute of India, Post Box #18, Chandrabani, Dehradun – 248001, Uttaranchal, India. E.mail: suresh@wii.gov.in

40. KUMAR, R. S. (2008). Population estimation and offshore congregation patch dynamics of the olive ridley sea turtles off the Rushikulya rookery, Orissa. Annual Research Seminar-2008, Wildlife Institute of India, Dehradun.

The offshore distribution and congregation patch dynamics of a globally important population of olive ridley sea turtle *Lepidochelys olivacea* off the Rushikulya mass nesting site, southern Orissa was investigated during two breeding seasons (2006-2007 & 2007-2008). This was carried out as part of a larger study on "Determining the offshore distribution, migration and movement of the olive ridley sea turtle along the east-coast of India". An area of approx. 120 sq. km was systematically monitored for turtle presence using line transects running parallel to the coastline and up to five km offshore. Along with this regular monitoring for presence of turtles was also carried out up to 25 km offshore. In this presentation, information on the spatio-temporal distribution and population estimation of the turtles observed in the area during the two breeding seasons are presented. A four fold increase in the number of turtles was seen during the 2007-2008 season in comparison with the 2006-2007 in which season mass nesting did not occur in the area. Offshore monitoring data exhibits that turtles arrived in the near shore waters during the first week of December, and turtles occurred aggregated in front of the mass nesting beach in a depth range from 20 to 30m within 3 km from the coastline during the season. The overall number of surfacing turtles during 2007-2008 season was highest in the 1 and 2 km transects with 5575 and 3346 turtles respectively. An estimate of the at-sea density and abundance of the turtles were also made during the season. There was no other congregation or aggregation of turtles in the area, and neither local fisherman reported of any turtle congregations elsewhere beyond the 5 km zone.

41. NAYAK. A. (2003). Conservation and management of olive ridley turtles at Gahirmatha, Orissa, India. pp. 82. *In*: Pilcher, N. (compiler), Proceedings of the Twenty Third Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-536, 261 p.

Gahirmatha is located in the north-eastern part of Orissa, and is the world's largest known nesting ground for olive ridley turtles. It is estimated that about 50% of the world population of olive ridleys nests in India between January and May, and about 90% of these nest in Gahirmatha. The Gahirmatha Marine Sanctuary, declared in 1997, encompasses an area of 1435 sq. km. Olive ridleys usually arrive at Gahirmatha during October/November and remain until April/May during which patrols are carried out by sanctuary staff. The entire beach is divided into segments, monitoring camps are set up and trained workers engaged to monitor mortality and sporadic nesting of sea turtles. Protection camps are also set up at vantage locations. Turtle monitoring committees are convened for coordination and joint patrols. Workshops and awareness camps are also organized in peripheral fishing villages. In-situ conservation efforts include protecting the nesting sites along the coast engaging local youth as well as fencing off certain places to prevent entry of predators. Ex-situ conservation measures have been taken up in the last years through hatcheries at four places. Turtle tourism is being promoted involving children at accessible locations for awareness and education. Threats at Gahirmatha are due to proliferation of mechanized fishing, beach erosion, northward shifting of nesting sites, light pollution from outer wheeler island and Paradeep, loss of mangrove in Mahanadi delta, predators and water pollution by industries at Paradeep.

Source: Anup Nayak, Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun–248 001. Email: anup@wii.go.in

42. PANDAV, B. (1995). Olive ridley sea turtle (*Lepidochelys olivacea*) and their arribada along the Orissa coast – A review of the 1995 nesting season. Annual Research Seminar-1995. Wildlife Institute of India, Dehradun.

Mass nesting population of olive ridley sea turtle *Lepidochelys olivacea* were studied at two rookeries (Gahirmatha and Rushikulya) along the Orissa coast during the 1995 nesting season. The number of nesting turtles was estimated using 100 m line count method. An estimated 35,000 and 50,000 olive ridleys nested at Gahirmatha and Rushikulya rookeries respectively during 1995. Because of certain biases involved in the 100 m line count method that has been followed by the state forest department, a new method to enumerate that nesting turtles during an arribada is suggested.

43. PANDAV, B. (1996). Hatching and emergence of *Lepidochelys olivacea* hatchlings and the impact of coastal development on their seaward orientation. Annual Research Seminar-1996. Wildlife Institute of India, Dehradun.

Hatching success of olive ridley (*Lepidochelys olivacea*) eggs, emergence of the hatchlings from the nest and behaviour of the hatchlings after emerging from the nest were studied at Gahirmatha and Rushikulya rookeries along the Orissa coast during 1995-96 nesting season. Lag period for olive ridley hatchlings (time spent by the hatchling inside the nest after hatching out of the egg till emergence from the nest) was observed in transparent nest. For the 20 transparent nests monitored, an average of 3.6 days lag period was found. Percentage hatching success varied from 0 to 100. Percentage hatching success when compared between areas inundated by tidal waves, with areas having low o no tidal inundation showed a significant difference. Effect of artificial lighting on the seaward orientation of olive ridley hatchlings was studied at these two major turtle nesting beaches. All the hatchlings emerging from the nests were recorded moving towards the source of light on land, resulting in high hatchling mortality. It is recommended to stop artificial lighting near the sea turtle rookeries along Orissa coast during hatchling emergence period to prevent large scale hatchling mortality. In places like Rushikulya rookery where hatchlings get disoriented by the glow of light coming from a nearby township, it is suggested that a rise of fence along the beach on the land ward side to prevent straying away the hatchlings from the nesting beach.

44. PANDAV, B. (1999). Conservation and management of olive ridley sea turtle (*Lepidochelys olivacea*) in Orissa. Annual Research Seminar-1999. Wildlife Institute of India, Dehradun.

Olive ridley sea turtle nest in low densities along the eat coast of India. However, the most important nesting beaches lie in Orissa where the arribada or mass nesting occurs. The three mass nesting sites in Orissa at Gahirmatha, Devi river mouth and Rushikulya have received considerable attention mostly due to the large scale morality of adult sea turtles and the decline in number of nesting females. As part of Wildlife Institute of India's sea turtle research programme, the turtle nesting beaches in Orissa ware monitored and the ridleys were tagged from 1995 to 1999. Number of nesting females was estimated using 20 m fixed strip nesting turtle count method. During the study duration of mass nesting failed twice at Gahirmatha with considerable fluctuation in the number of nesting females at the other two rookeries, the possible reasons behind the failure of mass nesting at Gahirmatha rookery are discussed.

45. PANDAV, B. (1997). Preliminary results of tagging studies on olive ridley sea turtles in Orissa. Annual Research Seminar-1996. Wildlife Institute of India, Dehradun.

Offshore as well as on the beach tagging of olive ridley sea turtles was carried out from November 1996 till April 1997. Monel metal cow ear tags were used to tag the turtles. 255 mating pairs were captured and tagged within a maximum of four kilometers off Gahirmatha coast over a period of 15 days during the pre nesting period (November-December 1996). 2800 nesting females were also tagged at five different nesting beaches along Orissa coast. All the turtles were double tagged. Recovery of turtle tagged at Rushikulya from the Robert island sea turtle rookery near Devi river mouth, followed by another recovery of a turtle tagged at Robert Island from the Gahirmatha rookery indicates some degree of inter rookery movement of turtles during their annual nesting interval of 41.8 days (n=6).

Recovery of a turtle tagged in March 1997 at Robert Island from Kalmunai, Eastern Sri Lanka during April 1997 gives an indication of the post nesting movement of olive ridleys.

46. SENAPATI, A. (2007). Missile test fire endangers mass nesting of sea turtles at the Gahirmatha beach of Orissa, India. pp. 88. *In*: Mast, R. B., B. J. Hutchinson & A. H. Hutchinson (compilers), Proceedings of the Twenty Fourth Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-567, 205 p.

India's missile development programme has, as such, nothing to do with sea turtles. But, the test firing of missiles and the bright light from defense establishment in Wheeler's island in front of Gahirmatha beach, the rookery of olive ridley turtles, has put a question mark on the future of the mass nesting of the olive ridleys. Gahirmatha missed the nesting turtles in three consecutive years in the recent past. Dr. Abdul Kalam, then advisor to Defense Ministry, now the President of India speaking in course of the Northern Indian Ocean Sea Turtle Workshop at Bhubaneswar, Orissa in 1997 assured that the Central Defense authorities would take all necessary action to ensure that the turtles were safe. As of now, the Defense authorities have failed to keep up his assurance. Again, the state government of Orissa handed over Wheeler Island to the Defense Ministry in 1990 without obtaining a clearance from the Ministry of Environment & Forests. Last year, a coordination meeting was held with the defense personnel on the initiative of the forest officials regarding the light pollution and test firing during the turtle congregation period and allied matters. Nothing substantial has come of the meetings as of this writing.

Source: Ashis Senapati, Project Swarajya, Ganesh Ghat, Barakhapad, Cuttack, Orissa.

47. SENAPATI, A. (2007). Missile test fire endangers mass nesting of sea turtles at the Gahirmatha beach of Orissa, India. pp. 88. *In*: Mast, R. B., B. J. Hutchinson & A. H. Hutchinson (compilers), Proceedings of the Twenty Fourth Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-567, 205 p.

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Source: Ashis Senapati, Project Swarajya, Ganesh Ghat, Barakhapad, Cuttack, Orissa.

48. SHANKER, K., B. PANDAV & B. C. CHOUDHURY. (2003). A re-assessment of the olive ridley turtle (*Lepidochelys olivacea*) nesting population in Orissa, India. pp. 95. *In*: Pilcher, N. J. (compiler), Proceedings of the Twenty Third Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-536, 261 p.

Olive ridley mass nesting events or 'arribada' have been documented in Orissa, India since 1974. However, since standardized techniques have been used to census turtles, population trends are

actually unknown. Here, we summarize information on nesting populations in Orissa, using data from multiple sources to arrive at consensus estimates and to derive trends. We also carried out a census during an arribada in March 1999, where nesting was estimated as 1, 80,000 turtles using the strip transect method. Non-linear fit for arribada data from 1976-1999 and a decrease in the size of adults between 1996-1998 suggest a recent decline, which is consistence with fishery related mortality of at least 90,000 turtles since 1994.

Source: Dr. Kartik Shanker, Centre for Ecological Sciences, Indian Institute of Science, Bangalore. E.mail: kshanker@ces.iisc.ernet.in

49. TRIPATHY, B. (2006). A study on the ecology and conservation of olive ridley sea turtle (*Lepidochelys olivacea*) at the Rushikulya rookery of Orissa coast, India. pp. 205. *In*: Frick, M., A. Panagopaulou, A. F. Rees & K. Williams (compilers), Book of Abstract. Twenty Sixth Annual Symposium on Sea Turtle Biology and Conservation, International Sea Turtle Society, Athens, Greece. 376 p.

A study was carried out at the Rushikulya rookery of Orissa between 2003 – 2005, which critically analyzed the offshore and onshore biology and behaviour of olive ridley sea turtles at the rookery. The at-sea distribution of olive ridley sea turtles off the coast of the Rushikulya rookery, Orissa, was studied during the breeding season. The estimated surface density of olive ridleys in the water was 35.067 per sq. km and the encounter rate was 3.68/km. The area of maximum utilization for mating pairs was 57.92 km2. Sporadic nesting was documented throughout the season and arribada was observed for both seasons. This study found the mean IP (inter-nesting period) to be ~19 days. Emergence success of hatchlings was recorded higher than that of the Gahirmatha rookery. Data collected on abiotic and biotic factors influencing adult turtles and hatchlings shows that non-human predation, beach erosion and egg loss, artificial illumination, *Casuarina* plantation and anthropogenic activities influence both habitat and the species. An effective protection of reproductive patch would be the best solution for protecting the breeding turtles in the offshore waters of the Rushikulya rookery. Continuous beach monitoring, accurate counting of nesting turtles for population estimation, protecting nests from mammalian predators and checking the artificial illumination on the beach are urgently necessary for the rookery. Along with this, strict implementation of the various protection acts will be effective measures for the conservation and management of the olive ridley sea turtles of the Rushikulya rookery of Orissa coast.

Source: Dr. Basudev Tripathy, Wildlife Institute of India, Po Box 18, Dehradun – 248001. E.mail: tripathyb@wii.gov.in

50. TRIPATHY, B. (2008). The deployment of satellite transmitters on olive ridley turtles along the Orissa coast and the current status of their response. Annual Research Seminar-2008, Wildlife Institute of India, Dehradun.

As a part of the first phase of transmitter deployments exercise, between March and May 2007, a total of 30 female olive ridley sea turtles (Lepidochelys olivacea) along the Orissa coast were fitted with Kiwisat 101 Marine Turtle PTTs obtained from SIRTRACK. Movement of all PTT tagged turtles were monitored through ARGOS Satellite Tracking System. The movement patterns of all PTT fitted turtles indicate that their nomadic behaviour and movement all over Bay of Bengal. Many of the turtles observed moved towards the south east coast of India since their deployments. However, a greater number of PTTs also stopped giving signals in the last quarter of data acquisition. The reason of such PTT response failure from a range of reasons including mortality of turtles due to fishing in deep sea, battery failure, antenna failure or other technical faults are being examined. This presentation deals with detailed performance status of PTTs on olive ridley turtles since its deployment in Orissa and compared with other global case studies on sea turtle telemetry and PTT performance.

BOOKS AND BOOK CHAPTERS

1. BEHERA, C. (2006). Beyond TEDs: The TED controversy from the perspectives Orissa's trawling industry. Pp. 238-243. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent, Universities Press, Hyderabad, India, 415 p.

The TED controversy in Orissa has led to questions about the manner in which the TED programme, and its entire range of allied legislations and policies of the government in the marine fisheries sector has been designed and implemented. This chapter of the book deals with the workshop conducted by Project Swarajya on TED and success/failure, the interim year of PIL on non implementation of the TED mandatory in fishing gear, the second workshop on TED under the banner of GOI-UNDP Sea Turtle Project, the perspective of the trawling community, the trawling industry's critique of the CIFT-TED and the alternate device introduction of Trawl Guard as a subsidiary to TED.

Source: Chitta Behera, Project Swarajya, Ganesh Ghat, Barakhabat, Cuttack, Orissa.

2. CHADHA, S. & C. S. KAR. (1999). Sea turtle conservation and management project. Pp. 187-223. *In*: Chadha, S. & C. S. Kar (eds.), Bhitarkanika: Myth and Reality, Natraj Publisher, Dehradun. 388 p.

A section on the book deals with sea turtle conservation and management project in Orissa. The authors have provided a comprehensive history of sea turtle documentation in Orissa since 1974 with its legal status, past management of the sea turtle resource, exploitation of adults and magnitude of the trade, turtle fishing areas, turtle fishing methods and the fishing season at Gahirmatha, nesting and mass nesting grounds of sea turtles in Orissa, the shifting of Gahirmatha, mating and breeding ground of sea turtles in Orissa, the achievement and activities of Wildlife Wing of Orissa towards sea turtle conservation and management, cause of concern for olive ridley turtles of Orissa, suggestions for protection of sea turtles, and action under the Project Sea Turtle implemented through the Wildlife Wing of Orissa Forest Department, Government of Orissa.

Source: Dr. C. S. Kar, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar - 751002 (Orissa). Email: drcskar@gmail.com

3. CHOUDHURY, B. C., S. C. SHARMA & S. K. MUKHERJEE. (2000). The sea turtle conservation agenda of India. *In*: Pilcher, N. J. & G. Ismail (eds.), Sea turtles of the Indo-Pacific Research, Conservation and Management, pp. 100-106. ASEAN Academic Press, London, 361 p.

This chapter reviews the status and history of conservation of marine turtles in India, which dates back to the early 1970's. In 1975, the Gahirmatha olive ridley rookery was provided legal protection, being designated part of the Bhitarkanika Wildlife Sanctuary. Only in the late 1990's, sea turtle conservation activities moved beyond the coastal nesting beaches into areas of offshore breeding congregation. National and international concern over sea turtle mortality along the Indian coastline prompted the Indian Government to launch the "National Sea Turtle Conservation Project" in 1998. The project envisages activities encompassing both onshore and offshore critical habitats for sea turtles. The strategy includes survey and documentation of critical nesting, breeding and feeding habitats and their protection; assessment of sea turtles and marine fishing interface problems and development of turtle friendly solutions; implementation of TED legislation and extension programme, a cross sectoral government agency, local community and NGO participation in sea turtle conservation programmes; development of a national sea turtle conservation education and awareness programme; support for sea turtle research and creation of a scientific database for management needs, and support for regional and international cooperation and collaboration of sea turtle conservation.

Source: B. C. Choudhury/Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun-248001, Uttarakhand, India. Email: bcc@wii.gov.in/wii@wii.gov.in

4. CORNELIUS, S. E., R. ARAUZ, J. FRETEY, M. H. GODFREY, R. MÁRQUEZ M. & K. SHANKER. (2007). Effect of land-based harvest on *Lepidochelys*. Pp.231-252. *In*: Plotkin, P. T. (ed.). Biology and Conservation of Ridley Sea Turtles. Johns Hopkins University Press, Baltimore. 356 p.

Though generally not prized for food or shell as are most other sea turtles, *Lepidochelys olivacea* has been severely impacted by humans. The olive ridley's widespread solitary nesting distribution and mass nesting (known as *arribazones* in Mexico and *arribadas* elsewhere) at over a dozen locales have supported extensive subsistence use and facilitated commercial harvests in much of its range. The nesting of Kemp's ridley (*Lepidochelys kempi*), historically at a single site in the western Gulf of Mexico, has likewise contributed to its vulnerability to overuse. As both olive ridley and Kemp's ridley emerge from the sea to lay eggs, land-based harvesting of adult females and their eggs occur at nesting beaches. This chapter reviews the nature of exploitation at ridley nesting beaches and explores its impacts on regional population and by extension, on the global survival of the species.

Source: Biology and Conservation of Ridley Sea Turtles (ed. P. T. Plotkin), John Hopkins University Press, Baltimore, USA.

5. DANI, C. S. & C. S. KAR. (1999). Conservation of sea turtles and environmental relationship of *arribadas* of olive ridley, *Lepidochelys olivacea* (Eschsholtz, 1829) in relation to Bhitarkanika mangrove ecosystem of Orissa coast. *In*: Behura, B. K. (ed.), Bhitarkanika - The Wonderland of Orissa. pp. 98-120. Nature and Wildlife Conservation Society of Orissa, Bhubaneswar. 123 p.

Studies on the olive ridley sea turtle, *Lepidochelys olivacea* on the coast of Orissa, India during the last 15 years (1976-1991) reveals that Gahirmatha baceh is the largest rookery of sea turtles in the world. An estimated 6.10 lakh female turtles made their nesting emergencies on an isolated 3.2 km beach of the Bhitarkanika sanctuary during March, 1991. From observations made at Gahirmatha rookery it can be inferred that mass nesting and mass nesting of olive ridleys occur in areas experiencing a low temperature (25°C-28°C) and 21%-29% salinity range in the coastal waters with a very wise sandy sea beach preferably at river mouths (average beach width 50-60 m). Environmental parameters associated with mass emergence of sea turtles are discussed.

Source: Dr. C. S. Kar, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar - 751002 (Orissa). Email: drcskar@gmail.com

6. DASH, M. C. & C. S. KAR. (1987). Conservation and management of sea turtle resource in Orissa coast. Pp. 303-316. *In*: Environment and Ecotoxicology. Academy of Environmental Biology, India.

A general account on the conservation and management of sea turtle resource in Orissa coast has been presented in this book chapter. The authors have mentioned about the different nesting beaches of Orissa with beach environment characteristics. They have also emphasized on turtle fishing areas in Orissa and the fishing communities, turtle fishing methods and fishing season at Gahirmatha, exploitation of eggs and adult for meat in the past and finally conservation and management strategy for the olive ridley sea turtle resource of Orissa coast of India.

7. DASH, M. C. & C. S. KAR. (1990). The Turtle Paradise – Gahirmatha (An Ecological Analysis and Conservation Strategy). Interprint, New Delhi. 295 p.

The main purpose of the book was to present an ecological analysis and conservation strategy for the sea turtles in Orissa coast. This book presented some of the basic observations on the olive ridley biology *i.e.*, nesting, incubation, hatching, sex determination, nutrition, predation and threats.

8. FRAZIER, J. G., R. ARAUZ, J. CHEVALIER, A. FORMIA, J. FRETEY, GODFREY, M. H., R. MARQUEZ-M., B. PANDAV & K. SHANKER. (2007). Human-Turtle interactions at sea. pp. 253-294. *In*: Plotkin, P. T. (ed.). Biology and Conservation of ridley turtles. Johns Hopkins Press, USA. 356 p.

This chapter deals with the human-turtle interactions at sea, specifically of both the species of *Lepidochelys*. It gives an overview of the distribution of both Kemp's ridley turtle *Lepidochelys kempii* and Olive ridley turtle *L. olivacea* as a whole and emphasizes on the human-turtle interactions of each of the population of the two species. The interactions discussed in the paper deal with direct take of turtles, incidental capture and others such as marine pollution, dredging, power plant intakes, boat strikes in nearshore and estuarine areas, and sonic pollution.

Source : Dr. Jack Frazier, Conservation & Research Centre, Smithsonian Institution, USA. Email : kurma@shentel.net

9. HEJMADI, P. M., & M. T. DIAMOND. (1986). Temperature dependent sex-determination in the olive ridley turtle. Pp. 159-162*In*: Progress in Development Biology, Part A, Alan R. Liss, Inc.

Temperature influences sexual differentiation in turtles. Incubation temperature during a critical series of stages determines the sex. Clutches of eggs were removed from nests at Gahirmatha and translocated to the laboratory. Sex was determined by morphological characteristics of the gonads followed by histological examination. Karyotypic analyses indicate that the diploid number in male is 56 with bimodality consisting of 24 macro and 2 microchromosomes. The karyotype pattern conforms to the pattern reported for other chelonids.

Source: Dr. Prof. Priyambada Mohanty Hejmadi, GM-8, V.S.S. Nagar, Bhubaneswar 751 007 (Orissa). Email: mohantyhejmadi@hotmail.com

10. KAR, C. S. (1999). Ecological relationship between mangroves and mass nesting of olive ridley sea turtle *Lepidochelys olivacea* (Eschscholtz, 1829) in relation to Bhitarkanika mangrove ecosystem of Orissa Coast. *In*: Behura, B. K. (ed.), Bhitarkanika - The Wonderland of Orissa. pp. 83-97. Nature and Wildlife Conservation Society of Orissa, Bhubaneswar. 123 p.

Orissa is the only maritime state in India which holds several mass nesting grounds of the olive ridley turtle *Lepidochelys olivacea*. The results of continuing studies by the Wildlife Wing of Forest Department of the state indicate that there are two important mass nesting grounds located at northern and southern extreme ends of the undivided Cuttack district (now split in0to Kendrapara and Jagatsinghpur districts). The rookery at Gahirmatha coast of Bhitarkanika wildlife sanctuary is considered as the largest mss nesting ground of the turtle species throughout its circum-global arrange. There are also two more mass nesting grounds at Devi river mouth and Rushikulya river mouth. Besides, sporadic nesting in considerable number also takes place near Jatadhara muhan of Kujanga coast, at the spandspit of Hukitola Island (Agarnasi) in False point, in Chilika coast and at the sandspits of other river mouths in Orisssa. The present paper deals with the ecological relationship between

mangroves and mss nesting of olive ridley turtles and suggests some conservation measures for their protection and management.

11. KAR, C. S. (2000). Sea turtles and their habitats in Orissa, India. *In*: Untamed Orissa. *Wild Orissa*, Bhubaneswar, Orissa. pp. 105-122.

In the chapter in the above book, the author describes about the general features of the Orissa coast with species of sea turtle found. He has also emphasizes upon the legal status of sea turtles of Orissa. There is a generalized description on the nesting and mass nesting ground (rookeries) of sea turtles along with the biology and behaviour, mating and breeding ground and breeding season in Orissa. Research and monitoring activities by Wildlife Wing of Orissa Forest Department along with various measures taken up by the Government of Orissa for protection and conservation and management of sea turtles have also been highlighted in the chapter.

12. KUTTY, R. (2006). Community based conservation of sea turtle nesting sites in India: Some case studies. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent.Universities Press, Hyderabad, India. pp. 271-289.

If there is a lot of cash generated by the threats, then the threshold amount of cash that would need to be generated should be higher in order to wean the violators away from ecologically harmful practices. This was acknowledged as a failure of the part of the Orissa state government in order to break the prawn seed collection network. Non-cash benefits can be as important as cash benefits for conservation success. Pride and self esteem area important wage employers patrolling the nesting beach form part of this strategy. Though a plan for CBC is presented in the paper, this is not a general model that can be adopted for every turtle nesting area. There are no guarantees that an intervention that works in Rushikulya will work equally well at another site since each area has specific ecological and social factors.

Source: Roshny Kutty, Kalpavriksh-Environmental Action Group, 908 Deccan Gymkhana, Pune – 411 004, Maharashtra, India. Email: roshi73@rediffmail.com

13. MISHRA, C. G., S. K. PATNAIK, S. K. SINHA, S. K. KAR, C. S. KAR & L. A. K. SINGH. (1996). Wildlife wealth of Orissa. Wildlife Wing, Orissa Forest Department, Government of Orissa, Bhubaneswar. pp. 1-185

An account of the four species of sea turtles found in Orissa along with their systematics, habit and habitat, and conservation needs are presented in the book.

Source: Orissa Forest Department, Wildlife Wing, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar - 751002 (Orissa).

14. MOHANTY, S. C., C. S. KAR, S. K. KAR & L. A. K. SINGH. (2003). Sea Turtle. *In*: Wildlife Conservation in Orissa, Wildlife Wing, Forest Department, Government of Orissa, Bhubaneswar, pp. 26-27.

The authors have highlighted the plight of the sea turtles of Orissa. A systematic account on the funds and budgetary provision along with programme of activities undertaken by the Orissa Forest Department, Government of Orissa towards protection of turtles have been mentioned.

Source: Orissa Forest Department, Wildlife Wing, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar - 751002 (Orissa).

15. NAYAK, L. (2001). Turtle Resources of India. 163-179 p. *In*: Nayak, L., Recent Trends in Aquaculture. Berhampur University, Bhanja Bihar, Berhampur, Orissa. 211 pp.

This chapter in the book gives a generalized account of sea turtles of India with taxonomic details of various species occurring in India, their distribution along the mainland and island coast, their breeding season, migration and movement, food of turtles, turtle fishery and conservation of the sea turtle resources of India.

Source: Dr. Laxman Nayak, Berhampur University, Bhanja Bihar, Berhampur – 760 007, Orissa, India.

16. PANDAV, B. & B. C. CHOUDHURY. (2006). Migration and movement of olive ridleys along the east coast of India. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent. Universities Press, Hyderabad, India, pp. 265-379

The results of the tagging and telemetry studies indicate that at least some of the ridleys nesting in Orissa migrate to and from the coastal waters of Sri Lanka. Recovery pf turtles tagged in Orissa from Sri Lanka and the Gulf of Mannar indicate that these could be feeding areas for the ridleys that migrate to the Orissa coast every winter. Also tag returns at different nesting beaches in Orissa clearly show that ridleys move between nesting beaches as well as in coastal waters. Result of the satellite telemetry study indicate exact migratory route taken by turtles, including important data such as travel rates and offshore distance from the coast. Nevertheless, multi-pronged strategy serves best to understand their biology and to conserve these animals and their habitats.

Source: Dr. Bivash Pandav, Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun – 248 001, Uttaranchal, India. Email: pandavb@yahoo.com

17. PATNAIK, S. K. & KAR, C. S. (2000). Status and conservation of sea turtles in Orissa, India. *In*: Pilcher, N. J. & G. Ismail (ed.), Sea turtles of the Indo-Pacific Research, Conservation and Management. ASEAN Academic Press, London, pp. 13-14.

Orissa is a maritime state located on the eastern coast of Indian peninsula and is rich in natural resources. The marine turtles are represented by four species belonging to the families *Cheloniidae* and *Dermochelidae*. Results of a continuing study from 1976 to 1999 by the Wildlife Wing of Forest Department indicate that there are three important mass nesting grounds of the olive ridley sea turtle *Lepidochelys olivacea* at the mouths of river Dhamra, Devi and Rushikulya. Sporadic nesting is also takes place at other locations. The rookery at Gahirmatha (Dhamra river mouth) is considered one of the largest mass nesting grounds for olive ridleys throughout their range. The nesting beach is a protected area which forms part of the Bhitarkanika wildlife sanctuary and National Park. The nearshore breeding area was also given protected area status by the state government in 1997 and is known as the Gahirmatha (Marine) Wildlife sanctuary. This paper outlines the present status of marine turtles and their habitats in Orissa and highlights conservation measures in place and emerging threats, and suggests additional steps needed for turtle protection and management.

Source: S. K. Patnaik, 51, Fishery Lane, Budheswari Colony, Bhubaneswar – 751 001 (Orissa), India. Email: sk_patnaik@yahoo.com/Wildlife Wing, Orissa Forest Department, Bhubaneswar.

18. PATNAIK S. K. (2000). Sea turtles – The long distance visitors. *In:* Tiwari, A. N. (ed.), Reference Orissa. Enterprising Publishers, Bhubaneswar. 2nd Edition, pp. 637-639.

This chapter in the book deals with olive ridley sea turtle of Orissa and outlines their migration and movement during breeding season in Orissa coast of India.

19. PATNAIK, S. K. C. S. KAR & S. K. KAR. (2001). A quarter century of sea turtle conservation in Orissa. Wildlife Wing, Forest Department, Government of Orissa, Bhubaneswar. pp. 1-34.

This book describes the quarter century of sea turtle conservation in Orissa by the Wildlife Wing of Orissa Forest Department, Government of Orissa. The publication highlighted on the species of sea turtles found in Orissa, their legal status, past history and exploitation, the mass nesting of olive ridleys and their records from 1974 since 2000 by the Forest Department, documentation of nesting at Devi and Rushikulya, threats to sea turtles and their habitats, measures taken up by government of India for protection of sea turtles, measures taken up by government of Orissa for research, protection and conservation of sea turtles, the achievements of wildlife wing towards sea turtle conservation in Orissa, management strategies, further action needed to conserve marine turtles and the existing act and rules for protection of sea turtles and their habitats in Orissa.

20. PRUSTY, B. G. & S. DASH. (2006). The effect of rookery geomorphology on olive ridley nesting in Gahirmatha, Orissa. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent. Universities Press, Hyderabad, India, pp. 384-392.

This chapter in the book deals with the geomorphological changes of the rookery and their impact on olive ridley turtles nesting at Gahirmatha. Presently, the Nasi barrier bars situated in the Gahirmatha estuary posses ten typical favorable geo-environmental parameters conducive for mass nesting. Since the Nasi bars are under the threat of natural processes of erosion and frequently occurring cyclonic event, a need rises to identify alternate sites based on the Nasi rookery's geo-environmental features. The sparingly used Sahana spit and northern spits of the Devi and Rushikulya River are potential sits for mass nesting. Ekakula spit, on the mouth of the Maipura river, and Babubali Island are the other prospective sites.

Source: Dr. Ganesh Prusty, Defence Terrain Research Laboratory, Metcalfe House, Delhi – 110 054, India. Email: ganpru@yahoo.com

21. RAJAGOPALAN, M., K. VIJAYAKUMARAN & E. VIVEKANANDAN. (2006). Fishery-related mortality of sea turtles in India: An overview. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent. Universities Press, Hyderabad, India, pp. 227-237.

The complex linkage of fishing activities with the objectives of different sectors and interests of multiple stakeholders makes it difficult to plan and execute conservation measures in isolation. To initiate feasible measure, the causative factors and ramifications of conservation action have to be clearly understood. In this paper, the authors have traced the development of the marine fisheries sector, which has culminated in excessive fishery-related mortality of sea turtles. The authors have provided a framework to evolve possible approaches to achieve the objectives of conservation.

Source: Dr. M. Rajagopalan, Central Marine Fisheries Research Institute, Tatapuram P.O., Cochin-682014.

22. ROUT, D. K. & G. BEHERA. (2001). Characterization of olive ridley nesting beaches in Orissa using remote sensing. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent. Universities Press, Hyderabad, India, pp. 380-392.

The main spatial classes which occur in the coastal tracts are plantation, mangrove, sandy beach and agricultural land. Developmental activity close to the coast such as construction of roads, tourist resorts and aquaculture ponds results in the loss of nesting habitats. Plantations close to the nesting beaches have also resulted in drastic decline in nesting at these beaches. All the three rookeries are located at river mouths with a common distribution of land use/land cover classes. Similarly, the common geo-

morphological classes are coastal sand dunes, beach sand, channel islands, mangroves and channel bars. The integration of spatial and non-spatial databases of the existing nesting beaches in a GIS environment has identified suitable common parameters such as presence of river mouth and estuaries, undisturbed long beaches, beach composition varying from coarse to find sand, slope of the beach ranging from 0-2°, and availability of sand bars and strand line in the river mouths. Based on these parameters, two more sites, Jatadhara river mouth and Hansua river mouth, have been identified as potential nesting sites.

Source: Orissa Remote Sensing Application Centre, Bhubaneswar

23. SANKARAN, S., A. SRIDHAR & B. TRIPATHY. (2005). Orissa Marine Conservation Legislation - A manual on Sea Turtle and Fisheries Legislation. Ashoka Trust for Research in Ecology and the Environment, Bangalore, India. 20 p.

This publication deals with the general life history of olive ridley turtle in Orissa with threats to the associated marine environment. Measures for protecting marine environment through regulation of boats and nets, monitoring of turtle reproductive patches and implementation of CEC regulations on coastal development have been suggested.

Source: Ashoka Trust for Research in Ecology and the Environment, 5th A Main, Hebbal, Bangalore-560024, Karnataka, India.

24. SHANKER, K., B. PANDAV, & B. C. CHOUDHURY. (2006). A review of olive ridley nesting and mortality in Orissa. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent. Universities Press, Hyderabad, India, pp. 357-365.

Marine turtles become accessible to humans for brief episodes in their life history, when they leave the open oceans and lumber onshore to nest. These giant air-breathing turtles belong to the most ancient line of living reptiles; however, poaching and egg depredation, development along ocean and coastal zones, and the rapid expansion and mechanization of the fishing sector in the last few decades have severely endangered these tenacious survivors. Five of the world's seven species of marine turtles occur on the Indian subcontinent. Many of these form part of regionally or globally important populations. Unfortunately, information for most sites and populations is unavailable or outdated, deriving from the initial path-finding surveys that were conducted between the early '70s and '90s.

A GOI–UNDP-sponsored project was carried out between 2000–02, to update information on the status of India's marine turtles and to provide an impetus to participatory conservation. This book documents the results of surveys carried out under that Sea Turtle Project.

Source: Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun-248001, Uttarakhand, India. Email: bcc@wii.gov.in

25. TRIPATHY, B. (2006). Reproductive biology of olive ridley sea turtle (*Lepidochelys olivacea*) Insights from research in Orissa coast of India. *In*: Gupta, V. K. & A. K. Verma (eds.), *Perspectives in Animal ecology and reproduction*. Daya Publishing House, New Delhi, pp 432-458.

Reproductive biology forms a critical part in the life cycle of the living organisms. The reproductive biology and behavior of sea turtle is complex and interesting. While courtship and mating takes place in the water, nesting takes place on land. The various processes in reproduction include ovi-position, non-attended incubation, hatching, hatchlings emergence and return to the sea. The hatchlings thereafter remain in the sea until they reach maturity and females the return to their natal beaches to nest. Together, all these phases form an ecologically successful reproductive strategy. Orissa, on the east coast of India, is well known for the seasonal mass aggregation of migratory endangered olive ridley sea turtles for reproduction. Along the Orissa coast, the reproductive biology and behaviour of olive

ridley sea turtles have been studied for the last two decades. This paper provides a comprehensive account of the offshore and onshore reproductive biology and behaviour of olive ridley sea turtles with a special focus on the studies conducted along the Orissa coast of India.

Source: Dr. Basudev Tripathy, Wildlife Institute of India, Dehradun. Email: tripathyb@wii.gov.in

26. UPADHYAY, S. & V. UPADHYAY. (2006). Law and marine turtle conservation in India. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent. Universities Press, Hyderabad, India, pp. 305-323.

The laws relating to conservation of marine areas include both laws that protect marine habitats and laws that protect species (marine turtle). These two categories are not mutually exclusive and a comprehensive understanding of the entire gamut of laws that protect the coastal environment is required. In this chapter of the book, laws related to the conservation of marine areas, laws related to use of marine areas, the international legal regime on marine areas and international laws on the protection of marine habitats have been discussed briefly.

Source: Sanjay Upadhay & Videh Upadhyay, Enviro-Legal Firm, Noida. Email: su@vsnl.com

27. WRIGHT, B. & B. MOHANTY. (2006). Operation Kachhapa: An NGO initiative for sea turtle conservation in Orissa. *In*: Shanker, K. & B. C. Choudhury (eds.), Marine Turtles of the Indian Subcontinent. Universities Press, Hyderabad, India, pp. 290-302.

During the early 1990s, conservationists and biologists started to observe an increasing number dead turtles being washed ashore along the Orissa coast. With the aim of preventing these tragic deaths, the WPSI launched *Operation Kachhapa* in 1998. This chapter of the book summarizes the various activities conducted by *Operation Kacchapa* from monitoring and research, protection of nest sites, involvement of traditional fisherfolk and on the legal initiative fronts for conservation of olive ridley sea turtles in Orissa.

Source: Operation Kachhapa, WPSI, New Delhi/Wildlife Institute of India, Dehradun. Email: bwright@vsnl.com

TECHNICAL REPORTS

1. ANONYMOUS. (1996). Save the olive ridley sea turtles, guard the coastal ecosystem – Popularizing the use of Turtle Excluder Devices in coastal Orissa. UNDP/GEF Small grant programme, Project Swarajya, Cuttack, Orissa.

One of the 24 projects funded under the UNDP/SGP Phase-I in 1996 was "Popularizing the use of Turtle Excluder Devices in coastal waters of Orissa". Project Swarajya, an NGO, in coastal Orissa has implemented this project. The project involved enhancing public awareness about the actual operation of TED in sea fishing through print and mass media.

Source: Project Swarajya, Ganesh Ghat, Bakharabad, Cuttack-753002, Orissa, India. Email-projectswarajya@sify.com, dollidash@rediffmail.com

2. ANONYMOUS. (1997). Survey on ongoing depletion of olive ridley turtle rookery: In Rushikulya mouth in Ganjam district, Orissa. Project Swarajya, Cuttack, Orissa. 5 pp.

Being alarmed by the growing threat to the life of sea turtles in Orissa coast, Project Swarajya, an NGO based at Cuttack in Orissa conducted a 3 phase survey the Rushikulya rookery during the breeding season of 1997 with particular reference to the threats posed to the nesting and hatching practice of olive ridleys. The survey results indicate that easy accessibility to the mass nesting beach made it vulnerable to all sorts of external interferences biotic or abiotic. Predation was found to be major pressure on the olive ridley eggs during incubation. There is some amount of gillnet fishing operation going on in this area which could be dangerous to olive ridleys while they are in the offshore waters. Also, the developmental activities increasingly taking place unchecked in and around the nesting beach such as construction of houses and prawn gherries emerged as a potential threat to the Rushikulya rookery. Based on the finding of the survey, specific recommendations have been made to safeguard the olive ridley and their habitat at the Rushikulya rookery of Orissa.

Source: Project Swarajya, Address as above

3. ANONYMOUS. (2000). Study on the distribution of sea turtles, their incidental mortality in fishing nets and use of Turtle Excluder Device in fishing trawlers. Report of the Expert Scientific Panel, Ministry of Agriculture, Government of India, New Delhi.

In pursuance of the US ban on import of shrimps from countries not complying the use of Turtle Excluder Device in shrimp trawlers, the Government of India, Ministry of Agriculture, Department of Animal Husbandry and Dairying constituted an Expert Scientific Panel (ESP) to conduct detailed study on the distribution of sea turtles, their incidental mortalities in fishing nets and use of TED in fishing trawlers etc. The study was coordinated by Director, CMFRI, Cochin. A team of experts comprising of various scientific institutions viz. CMFRI, CIFT, Department of Fisheries, Govt. of Orissa etc. were also visited to the field site in Orissa and examined about various aspects of TED and discussed about the fish catch loss in particular. The expert team recommended that Fishery Survey of India, and CIFNET should carryout study on TED along Orissa coast.

Source: Ministry of Agriculture, Government of India/CMFRI, Cochin

4. ANONYMOUS. (1999). Distribution and Incidental Mortalities of Sea Turtles. Report submitted to Ministry of Agriculture, Government of India. Central Marine Fisheries Research Institute, Cochin. 10 p.

The data collected by CMFRI during the period January 1997 to December 1998 on incidental catch of sea turtles along the Indian coast (barring Gahirmatha coast) indicated that the incidental catches of

turtles were very rare and confined only to a few pockets of the peninsular region. Similarly, stranding of turtles was very few and confined to a few maritime states. The annual incidental catch along the Gahirmatha coast ranged from 360 to 16000. The turtles were washed ashore due to entanglement in fishing operations conducted off Paradeep and adjacent fishing areas. The mortality was maximum during December – February.

Source: Central Marine Fisheries Research Institute, Cochin

5. ANONYMOUS. (2003). Interim Directions Dated 7th March 2003. Central Empowered Committee, Government of India, New Delhi. Application No 46.

The Committee is of the view that sufficient steps have not been taken by the State Government for safeguarding the turtles. Unfortunately, the detailed directions given in the judgment of the Orissa High referred to above, have by and large remained un-complied with. But for the involvement and dedication shown by the Coast Guards, the turtles would have been in a precarious situation. Under these circumstances immediate steps are required to be taken in order to safeguard the present congregations of turtles at Gahirmatha, Devi river mouth and Rushikulya mouth and favorable conditions should be created to facilitate the mass nesting.

Source: Central Empowered Committee, Paryavaran Bhawan, CGO Complex, Lodi Road, New Delhi – 110 003.

6. ANONYMOUS. (2004). Orissa Traditional Fish Worker's Union (OTFWU)-Annual Report-2004. Orissa Traditional Fish Worker's Union, Orissa.

Full details not available

7. ANONYMOUS. (2004). Visit of Central Empowered Committee to Orissa from February 10-14, 2004. Central Empowered Committee, Government of India, New Delhi. February 2004.

Following suggestions were made during the visit in 2004 by the Central Empowered Committee constituted by the Hon'ble Supreme Court of India on the conservation and management of olive ridley sea turtles of Orissa.

State Government could on a selective basis make it mandatory for the trawlers to install tracking devices on board such as the Vessel Monitoring System (VMS) sets. The Forest as well as Fisheries Department must involve the traditional fishing community in conservation efforts highlighting at the same time that certain restrictions will ensure their long term livelihood security. Public meetings, chaired by the respective Range Officers must be held once a month between November 1 and May 31 each year with the local fisherfolk at the Devi River Mouth and Rushikulya River Mouths. The non-mechanized traditional fishermen and fisherfolk cooperatives must be involved immediately in monitoring turtle congregation and nesting. The Wildlife Department must prepare and implement an "*Olive Ridley Nesting Beach Monitoring and Protection Plan*" from December to May (six months). All nesting beaches identified over the last ten years (where over 200 turtles have nested) along the Orissa coast must have a monitoring unit. The Department of Environment, the Orissa State Pollution Control Board (OSPCB) and the Forest Department should jointly prepare a status report on the existing threats to the survival, conservation and protection of Olive Ridley Turtles from the existing and the proposed industries and planned developmental activities along the sea coast and the offshore waters in this sensitive stretch of Orissa Coast. Carcasses of turtles have been buried at the Devi river mouth nesting beach, apparently hidden by some unidentified person a few days prior to the visit of the Committee. Similar reports have been received from Gahirmatha beaches too. The Forest Department should not bury or allow anyone else to bury dead turtles without specific permission from the Wildlife Warden of the area as such acts are likely to be used to cover up actual mortality numbers. Since the traditional fishing community is being called upon to regulate itself, the question of alternative sources of livelihood may be looked into urgently. The Orissa Forest Department should work with the Orissa Traditional Fish Workers Union (OTFWU) to arrive at a list of facilities/schemes/programmes to be provided by the

Orissa Government as also the Government of India that will benefit the traditional fishing community. The proposed Dhamra Port is to be located close to the Gahirmatha National Park. The routes that will be used by shipping will necessarily be through the turtle congregation areas offshore. Oil spills and sundry pollution will inevitably occur in the event of a large port being set up. The present site will seriously impact Gahirmatha's nesting turtles and could lead to the beach being abandoned by the marine creatures. It is therefore necessary that an alternative site is located for this port. It has been reported that a Reliance Gas Handling Facility is being thought of at Rushikulya: This facility could cause serious problems for the turtles through pollution, increased shipping traffic and light pollution. It is also learnt that BPCL crude oil terminal is planned at Kantiagada near Rushikulya. No new licenses for industries which will cause pollution should be granted along this sensitive stretch of the coast from Gahirmatha to Rushikulya. Turtle-friendly shore armouring must replace the stone armouring on Wheeler Island. There could be "Project Turtle" on the lines of "Project Tiger/Project Elephant". A comprehensive turtle protection and conservation programme could than be undertaken to study feeding, biology, migration pattern etc. of the turtles. Experts could be engaged for this purpose.

Source: Central Empowered Committee, Paryavaran Bhawan, CGO Complex, Lodi Road, New Delhi – 110 003.

8. ANONYMOUS. (2005). Orissa Traditional Fish Worker's Union (OTFWU)-Annual Report-2005. Orissa Traditional Fish Worker's Union, Orissa.

Full details not available

9. ANONYMOUS. (2006). Scoping mission to the Dhamra port project. Business and Biodiversity Programme, Asia. The World Conservation Union (IUCN), Asia Regional Office, Bangkok. Available at http://iucn.org/places/asia.htm (assessed 10th November 2008).

In July 2006, Aban Marker Kabraji, IUCN Regional Director for Asia met Mr. Ratan Tata, Chairman of the TATA Sons in Mumbai to discuss various aspects of environment and corporate social responsibility for TATA's operations. This also included the conservation of turtles in view of the impending development of Dhamra Port in Orissa State, on the east coast of India. The project is to be implemented by the Dhamra Port Company Limited (DPCL) as a joint venture between L&T and Tata Steel. The ensuing communication exchanges between IUCN and TATA Steel led to an agreement between DPCL and IUCN for the latter to undertake a mission for scoping out the issues that could be followed by the setting up of an independent scientific review panel (or some other intervention) organized by IUCN, should the two organizations so agree. Accordingly, the objectives of the Scoping Mission, undertaken during Nov 29 – Dec 02, 2006 were to:

a. Develop an understanding of the Dhamra port project and its implications for the environment in general and for the conservation of turtles in particular;
b. Develop an understanding of the debate and efforts undertaken thus far between the NGOs, DPCL and the Government, and establish a list of key outstanding issues that remain to be addressed;
c. Establish the need and expectations of key stakeholders, in particular DPCL, as to the potential IUCN intervention and support;
d. Clarify with DPCL the conditions, requirements and schedule for potential follow up work (should such a follow up be agreed between IUCN and DPCL); and
e. Establish the scope for the agreed follow up.

Source: IUCN Asia Regional Office 63, Soi Prompong, Sukhumvit 39. Wattana, Bangkok-10110, Thailand.

10. ANONYMOUS. (2007). Biodiversity assessment of Dhamra port site and surrounding areas, Orissa. Greenpeace India, Bangalore. 38 p.

This study was concerned with the Dhamra port site in Bhadrakh district, near the mouth of the Dhamra River, and surrounding areas. The proposed port site is nearly 10 km. away from Dhamra town. The port site is located on the mainland, north of the Dhamra River mouth and west of Kanika Sands. The Dhamra River itself is formed by the confluence of the Brahmani and Baitrani rivers. Dhamra discharges to sea through two distinct river channels, a north and a southern channel, which are further separated by an island in the sea named Udabali or Kanika Sands. The proposed port site is a unique habitat in that it has long stretches of inter-tidal mudflats from the site up till the river mouth. The inter-tidal zone is in some places as wide as two kilometers, and serves as an important breeding ground for king crabs. The port will be about 13 km. away from the nesting beaches of the Gahirmatha Marine Sanctuary. The port will also lie less than 5 km. from the northern boundary of the Bhitarkanika Sanctuary. The Dhamra port is proposed to be one of the largest deep water ports in India and South Asia, with a total capacity of 83 million tonnes per annum within ten years. It would require the construction and maintenance of a 19 km long approach channel up to a depth of 18 m. It will be located at approximately 20°50′ N and 86°58′ E on the Orissa coast of the Bay of Bengal. Given the size of the port and the broader plans for industrialization of the area following the port's development, concerns have been raised in various quarters about the possible impacts on the environment, biodiversity and wildlife in the surrounding areas, particularly given the site's location in an ecologically sensitive zone on the border of the Bhitarkanika and Gahirmatha Sanctuaries. However, while there has been much public debate and conjecture, there has been hitherto little or no reliable scientific data on which to base claims of potential damage or otherwise. The rationale for the study arose from the complete paucity of scientific information on the area in question, particularly with regard to its biological values, species found in the area and the overall ecological significance of the area and its surroundings. The rapid biodiversity assessment was conducted from February 10 to March 22, 2007, to gather information about the present diversity of flora and fauna of the area. The study has thrown up several animal and plant species that had not yet been reported from the area, or the state. There were even some species that were the first records for mainland India as a whole.

Source: Greenpeace India, 3360, 13th B Main, Indiranagar, HAL II Stage, Bangalore, 560 038. Email: ashish.fernandes@in.greenpeace.org

11. ANONYMOUS. (2004). Report of the multidisciplinary expert group to assess the impact of offshore drilling for hydrocarbon in the Bay of Bengal on olive ridley turtles in Orissa. Ministry of Environment & Forests, Government of India, March 2004. 14 p, (with annexure).

The Orissa coast receives a large number of olive ridley turtles and mass nesting is noted along the beaches of Gahirmatha, Devi River mouth and Rushikulya. Considering the extreme sensitivity of the conservation of olive ridley turtles both globally as well as nationally and in the light of news facts on the behavioural pattern of turtles brought out by the WII, Dehradun, the proposal of exploratory drilling operations for oil and gas in off-shore exploratory block MN-DWN-98/2(MD-10) and NEC-OSN-97/2(NEC 25) in the Bay of Bengal of Orissa coast nees in-depth examination from environmental angel. Assuming that the exploratory work would eventually lead to further developmental activities, it has been decided to constitute a multi-disciplinary Expert Group to asses the likely impacts of exploratory drilling and to suggest possible mitigative measures additionally for protection the natural life cycle of the turtles. The MEG reviewed identified possible likely impact of exploratory drilling and other related work in the area as below.

i. Disorientation of migrating adult and hatchling sea turtles due to illuminations from drilling rigs.
ii. Oil pollution during exploratory drilling and accidental oil spills and blow outs during exploratory and production phase.
iii. Damage to marine environment & benthic fauna due to large scale dumping of drilling cuttings.
iv. Additional impact on displacement of fishing community and fishing ground.

Specific recommendation and additional mitigatory measures were suggested by the MEG for safe environmental practices.

Source: Ministry of Environment & Forests, Government of India, New Delhi.

12. ANONYMOUS. (2004). Revised Report of the multidisciplinary expert group to assess the impact of offshore drilling for hydrocarbon in the Bay of Bengal on olive ridley turtles in Orissa. Ministry of Environment & Forests, Government of India, August 2004. 11 p., (with annexure).

Same as above

13. ANONYMOUS. (2008). Status of biology, ecology, migration and mortality of olive ridley sea turtles found along Orissa coast, India- A Resume. Report submitted by *Project Swarajya* to National Institute of Oceanography, Visakhapatnam Regional Centre, Visakhapatnam. 71 p.

Full details not available

14. ANONYMOUS. (1995-2008). Annual Reports of Project Swarajya. Project Swarajya, Cuttack, Orissa.

Project Swarajya, an NGO based at Cuttack in Orissa has been involved in sea turtle conservation and management in Orissa their various activities such as popularization of use of TED in trawl to reduce turtle bycatch related mortality, survey of mortality of turtles along the three rookeries and conservation and awareness workshops in coastal villages. All these activities have been reflected in their Annual Reports.

Source: Project Swarajya, Ganesh Ghat, Bakharabad, Cuttack-753002, Orissa, India. E-mail-projectswarajya@sify.com, dollidash@rediffmail.com

15. BUSTARD, H. R. (1974). India - A preliminary survey of the prospects of crocodile farming. FAO Report IND/71/033, FAO, Rome. 66 pp.

Large sea turtle rookeries occur coastally adjacent to Bhitarkanika contiguous with the sea coast saltwater crocodile habitat. The expert's advise concerning management of these was sought. It recommended that, if the state government wishes to carry out sustained yield exploitation of this resource, it is first subject to census by a tag-recapture operation. Following this a management plan can be prepared.

Source: FAO/UNDP

16. CHOUDHURY, B. C. & PANDAV, B. (1998). Tagging studies on olive ridley sea turtle (*Lepidochelys olivacea*) in Orissa, India. Wildlife Institute of India, Dehradun, November 1998. 18 p.

The result of the tagging study revealed the movement of sea turtles between rookeries and has proved the fact that turtles use more than one beach for nesting during the same breeding season. Thus, protection of the three rookeries is extremely crucial for the survival of sea turtles in Orissa which could be a single population. Therefore, a major step towards saving this population would be giving protected area status to the sea turtle nesting beaches as well as the coastal waters having high sea turtle concentration. Further tagging and monitoring of sea turtle nesting beaches in Orissa will help in giving us a better understanding of various aspects of sea turtle biology such as the degree of inter-

rookery movement, rate of mortality, tag loss correction factor and estimation of male and female turtle population visiting Orissa coast.

Source: Dr. Bivash Pandav, Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun – 248 001, Uttaranchal, India.

17. CHOUDHURY B. C., A. K. NAYAK, K. SIVAKUMAR, C. S. KAR, B. TRIPATHY, R. S. KUMAR, S. K. BEHERA & S. R. MISHRA. (2007). Determining the offshore distribution and migration pattern of Olive Ridley Sea Turtle (*Lepidochelys olivacea*) along the east coast of India (*Interim Report; Part-I & Part II*). Wildlife Institute of India, Dehradun.

The project 'Determining the offshore distribution and movement pattern of Olive Ridley Sea Turtle (*Lepidochelys olivacea*) along the East-coast of India' was initiated in the month of October 2006. Firstly, a 10-day reconnaissance survey was carried out, following which three field camps were established at Gahirmatha, Devi and Rushikulya that are the known turtle rookeries in Orissa. A main base camp at Bhubaneswar was also established from where activities at the three field sites were co-coordinated.

Both offshore distribution and on onshore nesting activities of olive ridley turtles were monitored from November 2006 to May 2007. A systematic monitoring of the offshore distribution of turtles could however be carried out at the Rushikulya and Devi rookeries. Due to logistic difficulties the same could not be carried out regularly at Gahirmatha. Large congregations of olive ridley sea turtles were observed in the offshore waters at all the three field sites, and most turtle sightings during the study there were within 5 km from shoreline. During the months of December and January large number of turtle mating pairs were observed in all three sites, suggesting the mating period of the turtles in the area. Mass nesting or "*arribada*" occurred only at Gahirmatha site this year, and occurred in the second week of February. A high number of sporadic nesting was observed at the Devi site, where a total of 514 turtle nesting were recorded. While in Rushikulya a total of 176 turtle nesting were observed.

A total of 30 PTTs procured from SIRTRACK Ltd., were fixed on turtles, at the highest and front end of the carapace. Turtles were fitted with the transmitters in batches and over a period of two months from March through April. Movement of all PTT tagged turtles are being monitored through Argos Satellite Tracking System. Most turtles fitted with PTTs had completed nesting, and were observed to soon leave the breeding grounds or the offshore waters of Orissa since release. All turtles moved southwards and few reached the south east coast of Sri Lanka and appeared to move into the Indian Ocean when last location was received. One tagged turtle entered the Palk bay and the last location received was close to the Jaffna peninsula along the North West coast of Sri Lanka. One another turtle reached close to Andaman Sea. And, from where it started to move up towards the coast of Myanmar and then moved up to Bangladesh, and finally returned back to the offshore waters of Orissa when last location was received. In general, the present movement pattern of tagged turtles shows that the olive ridley sea turtles move all over Bay of Bengal. Many of the 30 PTTs fixed have stopped giving signals soon after deployment. The reason for the failure of the transmitters is not known and is being analyzed. Similarly such PTT failures have also been reported from other studies elsewhere.

Source: *B. C. Choudhury/Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun-248001, Uttarakhand, India. Email: bcc@wii.gov.in/wii@wii.gov.in*

18. CHOUDHURY B. C., A. K. NAYAK, K. SIVAKUMAR, C. S. KAR, B. TRIPATHY, R. S. KUMAR, S. K. BEHERA, S. R. MISHRA & S. R. BEHERA. (2008). Determining the offshore distribution and migration pattern of Olive Ridley Sea Turtle (*Lepidochelys olivacea*) along the east coast of India (*Annual Report*). Wildlife Institute of India, Dehradun.

A better understanding of the distribution, habitat requirement and movement pattern of olive ridley sea turtles in the coastal waters off Orissa coast is essential for their long term conservation and also for

rational planning of developmental activities such as the possible hydrocarbon exploration in this region. In this connection, the Wildlife Institute of India, Dehradun (WII) under the direction of Ministry of Environment & Forests (MoEF), Government of India and in collaboration with the Wildlife Wing of the Orissa Forest Department (OFD), Government of Orissa, has initiated this two-year study which is being funded by the Director General of Hydrocarbon, Ministry of Petroleum & Natural Gas, Government of India.

During the first phase of the project, a total of 30 female olive ridley sea turtles (*Lepidochelys olivacea*) along the Orissa coast were deployed with Kiwisat 101 Marine Turtle PTTs obtained from SIRTRACK, during March-May 2007 to study their movement pattern. Movement of all PTT tagged turtles were monitored through ARGOS Satellite Tracking System. Most of the tagged turtles were observed to leave the breeding grounds or the offshore waters of Orissa by April-May. Most of the tagged turtles moved southwards and of them few reached the south east coast of Sri Lanka. Of these, one tagged turtle entered the Palk Bay and the last location received was close to the Jaffna peninsula along the North West coast of Sri Lanka. Another turtle reached close to Andaman Sea, from where it started to move up towards the coast of Myanmar and then moved up to Bangladesh, and finally returned back to the offshore waters of Orissa when last location was received. In general, the present movement pattern of tagged turtles shows that the olive ridley sea turtles move all over Bay of Bengal. Unfortunately, receiving signals from PTTs stopped by end of September 2008 perhaps due to mortality of turtles because of fishing in deep sea, possible battery failure, antenna failure or other technical faults of PTTs or even falling off of PTTs from the turtles. Second phase of the PTT deployment could not be carry out in the 2008 nesting season due to difficulty in obtaining PTTs, which is now being postponed to the next nesting season *i.e.* November 2008-March 2009 provided the permission for project extension is agreed to by the DGH.

Source: B. C. Choudhury/Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun-248001, Uttarakhand, India. Email: bcc@wii.gov.in/wii@wii.gov.in

19. *DANIEL, J. C. & S. A. HUSSAIN. (1973). The crocodiles of Bhitar Kanika, Orissa. Unpublished report, Bombay Natural History Society, Bombay.

20. DUTTA, S. K. (2005). A status survey of mass nesting sites of the olive ridley turtles in Orissa. *In*: Kaul, R. & V. Menon (eds.), The ground beneath the waves: Post tsunami impact assessment of wildlife and their habitats in India. Wildlife Trust of India, New Delhi, Volume 1: 72-80.

The assessment and survey of post tsunami impact of sea turtle do not indicate any direct affect of tsunami on the nesting activity of the olive ridleys. However, several side effects were observed due to tsunami. Some major changes were found in the beach profile (beach erosion at Gahirmatha) but not at the site of the nesting. It is hypothesized that nesting activity has been intensive during 2005 due to less human interference at the nesting localities. In fact, after tsunami, the local fishermen and outsiders involved in illegal fishing were afraid of fishing during January and February 2005. That is perhaps why the turtles could mate safely in the sea and the ultimate end product was successful mass nesting.

Source: Dr. S. K. Dutta, Professor & Head, Department of Zoology, Professor & Head, Department of Zoology, North Orissa University, Shri Ram Chandra Vihar, Takatpur, Baripada, Distt. Mayurbhanj 757003 (Orissa). Email: sk_dutta@yahoo.com

21. DUTTA, S. K. (2007). Biodiversity assessment of Dhamra port site and surrounding areas, Orissa. Greenpeace India, Bangalore (available on-line at http://www.greenpeace.org/.

Same as Report No. 10

Source: Dr. S. K. Dutta, Address as above

22. GOPI, G. V., B. PANDAV & B. C. CHOUDHURY. (2002). A quantitative analysis of incidental turtle mortalities during commercial shrimp trawling in the coastal waters off Orissa. Final Report, Wildlife Institute of India, Dehradun. 40 p.

The result of the study conducted indicates that majority of the turtle captures occurred in less than 5 km range. 70% of the turtle captures occurred in less than 5 kilometers from the shore and remaining 30 % of the catches were recorded at varied distances from the shoreline. Majority of the captures occurred below 10 fathoms depth. Turtle captures were high in shallow waters than in deeper waters, most of the turtle captures were recorded below 10 fathoms. As Tow time increases mortality also increases. There was a steep increase in the mortality rate when the duration of the trawl was extended beyond 2 hours. TEDs Efficacy TED was 100% efficient in excluding the turtles that were caught in the net. The Perceived economic loss to the fishing industry was very minimal in all the three stratified study zones. There exists a strong relation between the Sea turtle stranding and the spatio-temporal pattern of shrimp fishery. Stranding was higher in the zones where there is heavy interface between marine fishing and Sea turtle abundance and vice-versa while the interface was low. Based on the study conducted by the wildlife Institute of India in collaboration with the Orissa Fisheries Department on use of TED and reduction in sea turtle mortality, the following recommendations are suggested.

1. Initiation of a National TED demonstration and extension programme by the state fisheries departments of maritime states and by the wildlife Departments of maritime states and by the wildlife Departments in coastal protected areas, where sea turtle mass nesting takes place.
2. Setting up a centralized database on results of TED used trawl nets. This could be done through a proper extension programme and supply of simple pro-forma to trawl operators for return to fisheries departments.
3. Subsidized or no cost supply of TED to trawl operators along with simple instruction manual on how to use and operate TED fitted trawl nets.
4. Creating a network of independent agencies to monitor use of TED and its impact on reduction of Sea turtle mortality and fish catch loss.
5. Constitution of inter ministerial group consisting of MOEF, MOC, MOA, MSW to develop a proper action plan for responsible marine fishing that will not jeopardize fisheries and ecological concerns.
6. Initiate studies to determine other causes of sea turtle mortality and their intensity.

Source: Gopi, G. V., Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun – 248001 (Uttaranchal), India. Email: gopigv@wii.gov.in. Full report available at www.wii.gov.in

23. IUCN. (1998). Indian Ocean/Southeast Asia – Pacific Sea Turtle Conservation Survey-1998-Result Summary. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland.

As part of its ongoing support to sea turtle conservation programs of Indian ocean/southeast Asia-Pacific states, IUCN is assessing the role that it can play in promoting sea turtle conservation in the Indian ocean/southeast Asia-Pacific region, including the formulation of a sea turtle conservation arrangement. Two days workshops were convened in the region by the IUCN/SSC Marine Turtle Specialist Group, in conjunction with the Convention of Migratory Species (CMS), IUCN and other agencies, have recognized the need for greater regional and international cooperation in research, conservation and management of turtles.

Source: IUCN Washington Office, 1630 Connecticut Avenue, 3rd Floor, Washington, D.C. 20009, USA.

24. IUCN. (2001). A marine turtle conservation strategy and action plan for the northern Indian Ocean. IUCN/SSC Marine Turtle Specialist Group Publication No.3, 33 p.

ORISSA DECLARATION: Representatives and concerned citizens of countries of the Northern Indian Ocean (Bangladesh, India, Malaysia, Maldives, Oman, Pakistan, South Arabia, Sri Lanka and Thailand) having gathered at Bhubaneswar, Orissa, India to participate in the Northern Indian Ocean Sea Turtle Workshop RECOMMENDED that:

The Government of all the nations of the Northern Indian Ocean recognizes the historic, cultural, religious, economic, and ecological value of marine turtles in this region.

The government of that nation encourage those nations unable to share this occasion to support the goals of *A Marine Turtle Conservation Strategy and Action Plan for the northern Indian Ocean*, and

Endorse this declaration and undertake the responsibility to provide official support and encouragement for all the actions required to successfully execute *A Marine Turtle Conservation Strategy and Action Plan for the northern Indian Ocean*.

Source: IUCN/SSC Marine Turtle Specialist Group, 1725 De Sales Street NW#600, Washington, DC 20036, USA

25. IUCN (2007). Scoping mission to the Dhamra Port project. Bangkok, IUCN, Buisness and biodiversity programme, Asia http://cmsdata.iucn.org/.

Same as Report No. 9

Source: IUCN, Asia Office, Bangkok.

26. IUCN (2008). IUCN lighting mission to DPCL, March 2008. http://cms.iucn.org/.

The following represents a summary of key activities and discussion points during the recent IUCN mission to India (as part of the greater IUCN / DPCL agreement) to address the environmental mitigation efforts related to lighting and potential impacts to turtles. The Mission was conducted between March 20 and 27, 2008, headed by Dr. Nicolas J. Pilcher, Co-Chair, IUCN SSC Marine Turtle Specialist Group, along with Blair Witherington, Florida Fish and Wildlife Conservation Commission and IUCN SSC MTSG Member, and Erik Martin, Scientific Director of Ecological Associates, Inc. and IUCN SSC MTSG Member. The objectives of the Mission were to assist DPCL with the design of a lighting plan to minimize the emitted light and potential downstream impacts to nesting adult turtles and emerging hatchlings at the Gahirmatha mass-nesting site. The team travelled to India from various points in the world and convened in Mumbai on March 19th, arriving in Bhubaneswar on the morning of March 20th. A few days earlier Dena Dickerson had arrived and travelled directly to Dhamra to follow-up on dredging activities. Her visit overlapped the lighting mission, but concentrated entirely on ensuring the drag head deflector was working properly, and to further train the observers in NOAA reporting standards.

Source: IUCN Asia Regional Office 63, Soi Prompong, Sukhumvit 39. Wattana, Bangkok-10110, Thailand. http://www.dhamraport.com/download/Lighting%20Mission.pdf

27. JOHNSTON, P. & D. SANTILLO (2007). The Dhamra-Chandbali Port Expansion Project, Orissa, India: Critique of the Environmental Impact Assessment. Greenpeace Research Laboratories (Greenpeace International), Greenpeace India, Bangalore. 15 p.

Consideration of the Dhamra Port EIS and detailed Project Report indicate some extremely serious omissions and shortcomings in the analysis of impacts. These conspire to undermine fatally the analysis, suggesting in turn that the decision to permit the development may be seriously misguided. The most important problems relate to:

i) Failure to describe fully the baseline ecological conditions (Bhitarkanika, Gahirmatha)
ii) Failure to identify fully the potential ecological impacts
iii) Failure to consider potential extreme weather events and impacts of climate change.

Overall, while many of the issue areas addressed by the report apparently conform superficially to the requirements of an Indian EIA and perhaps even an EU EIA/EIS, in practice, the level of evidential support and analysis in these documents fall well short of the required standards and of the quality necessary to support an informed and reliable judgment on the suitability and acceptability of the development. Accordingly, given the national importance of the Bhitarkanika Reserve and the global importance of the Gahirmatha turtle breeding beaches, there is a need for the assessment to be repeated and reworked completely in order to accommodate the issues identified above in a suitably comprehensive manner. The documents would also benefit from substantial restructuring, correct prioritization of issue areas, and proportionate analysis based upon this prioritization.

Source: Dr. Paul Johnston & Dr. David Santillo, Greenpeace Research Laboratories, School of Biosciences, University of Exeter.

28. KANUNGO, B. C. (1976). An integrated scheme for conservation of crocodiles in Orissa, with Management Plan for Satkosia Gorge and Bhitarkanika Sanctuary. Forest Department. Government of Orissa.

The state government of Orissa on the advise of Dr. H.R.Bustard, FAO consultant had submitted a scheme for farming of crocodiles in Orissa during June 1974. Besides, Dr. Bustard had reiterated that conservation of crocodiles is closely associated with the creation of sanctuaries in the area and scientifically managing the same. The state government had accordingly created the Bhitarkanika sanctuary. It was felt that along with conservation measures for crocodiles, a detailed management plan for the sanctuaries should be prescribed keeping in view of the wild flora and fauna including the olive ridley turtles that occur at the Gahirmatha area.

Source: Orissa Forest Department, Government of Orissa.

29. KUTTY, R. (2001). Community based conservation of sea turtle nesting in Goa, Kerala and Orissa. Final Report of the GOI-UNDP Sea Turtle Project, Kalpavriksh, Pune. 47 p.

Details not available

30. MATHEW, S. (2004). Socio-economic aspects of management measures aimed at controlling sea turtle mortality: a case study of Orissa, India. Report of the Expert Consultation on Interactions between Sea Turtles and Fisheries within an Ecosystem Context. Appendix-C, Document # 8, pp. 18. FAO Fisheries Report No. 738 FIRM/R738 (En), 38 p.

The main objective of this Expert Consultation was to summarize present knowledge on sea turtle conservation status, population trends, major sources of mortality and their relative importance, the role of fisheries in sea turtle conservation where sea turtles and fisheries coincide, advise on possible management measures, legal and socio-economic aspects of managing sea turtle mortality due to fisheries.

Source: Food & Agriculture Organization (FAO), Rome, Italy/ International Collective in Support of Fishworkers, 27 College Road, Chennai – 600 006, India. Email: icsf@vsnl.com.

31. MISHRA, S. K. & S. K. KAR. (1986). Research Report on Sea Turtles at Gahirmatha Beach. Unpublished Report. Orissa Forest Department, Bhubaneshwar, India.

There are many intriguing aspects in turtle life history, particularly breeding biology and population structure which needs objective study to formulate sound conservation management policies. With this view some studies were undertaken at Gahirmatha beach during 1984-85 turtle nesting season. The aspects that were studies were i) Nesting olive ridleys and Gahirmatha round the year, ii) Estimation of female turtles during mass nesting, iii) Time log of turtle nesting activity, iv) Emergence of turtles by time, v) Arrangement of eggs in the egg pit, vi) Egg size and egg weight, vii) Hatching success during mass nesting, viii) Tag recovery data, ix) Dead turtle data, x) Body size of Gahirmatha population, xi) Reasons of turtle deaths at Gahirmatha waters, xii)Growth data of hatchlings, xiii) Damage of nests by beach predators, xiv) Experiment to assess the impact of high sand dune and herbivorous beach vegetation thereof, and xv) Recruitment of hatchlings at Gahirmatha beach and population turnover.

Source: Orissa Forest Department, Government of Orissa.

32. PANDAV, B. & B. C. CHOUDHURY. (2000).Conservation and management of olive ridley sea turtle (*Lepidochelys olivacea*) in Orissa, India. Final Report. Wildlife Institution of India, Dehradun.

A survey of the olive ridley turtle *(Lepidochelys olivacea)* and its nesting beaches along the Orissa coast was carried out between December 1993 and May 1994. The entire coastline (480 km) was covered once on foot and three times on bicycle. Important sea turtle nesting sites were visited several times to document sea turtle nesting activity. The survey was conducted in three phases - a pre-nesting survey including collection of secondary information, followed by nesting and post- nesting surveys. We discovered a new olive ridley rookery at the mouth of river Rushikulya where mass nesting occurred during March 1994. We confirmed the continuation of mass nesting at the rookery near the Devi River mouth, about which information was available since its discovery in 1981. We were also able to document nesting intensity all along the Orissa coast. The survival of olive ridley populations along the Orissa coast is under threat due to various factors, particularly as incidental catch in fishing nets. Existing and planned fishing jetties near important nesting beaches and *Casuarina* plantations on the nesting beaches spell danger for the survival of sea turtle nesting habitats in Orissa. In order to make conservation measures effective, a network of protected areas along the Orissa coast and eco - friendly coastal development in conformity with Coastal Regulation Zone (CRZ) guidelines are recommended. Other measures such as proper coordination of beach patrolling, use of Turtle Excluder Devices (TED) in fishing nets, control of coastal *Casuarina* plantations, research and monitoring of sea turtle populations and their nesting beaches and developing public awareness programmes on sea turtles are suggested for ensuring the survival of the olive ridley turtles in Orissa.

Contact: Dr. Bivash Pandav, Wildlife Institute of India, post Box # 18, Chandrabani, Dehradun – 248 001, Uttaranchal, India. Email: pandavb@yahoo.com. Full report available at www.wii.gov.in

33. PANDAV, B. (2000). Post cyclone situation in coastal Orissa with special reference to marine turtle conservation. Report submitted to GOI-UNDP sea turtle project. Wildlife Institute of India, Dehradun. 14 p.

Data were collected during field visits to the nesting beaches in Orissa as well as from secondary sources in two phases (December 1999 and April 2000) on the impact of super-cyclone on sea turtle nesting habitat along Orissa coast. All the three mass nesting beaches and two sporadic nesting beaches were covered. During the survey a count of dead turtles washed ashore was also taken into account. Fish landing centres along the coast were visited and officials of the fisheries and forest department were interviewed to ascertain the damage caused to fishing crafts and conservation infrastructure during the cyclone. The entire coastal vegetation as well as the conservation infrastructure or Orissa Forest Department in the coastal stretch of Orissa was devastated during the

cyclone. Apart from beach profile changes in Devi and Gahirmatha rookery, no direct evidence of supercyclone affecting marine turtle was noticed. However, the indirect impact of cyclone on marine turtle conservation was quite evident.

Source: Dr. Bivash Pandav, Wildlife Institute of India/GOI-UNDP Sea Turtle Project.

34. PANDAV, B., B. C. CHOUDHURY & C. S. KAR. (1994). A status survey of olive ridley sea turtle (*Lepidochelys olivacea)* and its nesting habitats along the Orissa coast, India. Wildlife Institute of India, Dehradun. 48 p.

A survey of the olive ridley turtle *(Lepidochelys olivacea)* and its nesting beaches along the Orissa coast was carried out between December 1993 and May 1994. The entire coastline (480 km) was covered once on foot and three times on bicycle. Important sea turtle nesting sites were visited several times to document sea turtle nesting activity. The survey was conducted in three phases - a pre-nesting survey including collection of secondary information, followed by nesting and post- nesting surveys. We discovered a new olive ridley rookery at the mouth of river Rushikulya where mass nesting occurred during March 1994. We confirmed the continuation of mass nesting at the rookery near the Devi River mouth, about which information was available since its discovery in 1981. We were also able to document nesting intensity all along the Orissa coast. The survival of olive ridley populations along the Orissa coast is under threat due to various factors, particularly as incidental catch in fishing nets. Existing and planned fishing jetties near important nesting beaches and *Casuarina* plantations on the nesting beaches spell danger for the survival of sea turtle nesting habitats in Orissa. In order to make conservation measures effective, a network of protected areas along the Orissa coast and eco - friendly coastal development in conformity with Coastal Regulation Zone (CRZ) guidelines are recommended. Other measures such as proper coordination of beach patrolling, use of Turtle Excluder Devices (TED) in fishing nets, control of coastal *Casuarina* plantations, research and monitoring of sea turtle populations and their nesting beaches and developing public awareness programmes on sea turtles are suggested for ensuring the survival of the olive ridley turtles in Orissa.

Source: Dr. Bivash Pandav, Address as above

35. ROUT, D. K. & G. BEHERA. (2001). Satellite remote sensing application for chararacterisation of the nesting beaches of olive ridley sea turtle in Orissa coast. Final Report of GOI-UNDP Sea Turtle Project. Orissa Remote Sensing Application Centre, Bhubaneswar, Orissa.

The mass nesting of olive ridley sea turtle occurring in the four existing rookeries have similar land climatic characteristics in many aspects. All the habitats are located in river mouths and estuary areas having common distribution of land use/land cover classes viz. coastal sands, plantations, less density of settlement with vegetation, mangrove forests etc. Similarly, the common geomorphological classes e.g. coastal sand dunes, beach sand, channel island, mangroves, channel bar etc. are also equally distributed in these rookeries. Besides the beaches are almost flat having the width of 60m to 250 m and composed of coarse to fine sand with slope ranging from 0^0 to 2^0. It is presumed that the mass nesting of the sea turtles are suitable during the dry periods of the winter season having very les rainfall and temperature.

Source: Orissa Remote Sensing Application Centre, Bhubaneswar/GOI-UNDP Sea Turtle Project, Wildlife Institute of India, Dehradun

36. SRIDHAR, A. (2004). Sea turtle conservation and fisheries in Orissa, India. SAMUDRA Monograph, International Collective in Support of Fishworkers, Chennai. 40 p.

All over the world, the pressure to conserve ecosystems and their resources has been steadily rising. This has, in turn, led to conflicts between conservation imperatives and the livelihoods' needs of the communities that interact with these ecosystems. An example of the impasse that such a state of opposition can lead to can be found in Orissa, India, where the moves to implement official sea turtle

protection measures along the coast have resulted in mounting conflicts involving fisher folk, government departments and conservationists. This study analyzes the existing sea turtle conservation measures in Orissa and the implications of conservation approaches for the livelihoods of fisher folk, particularly for traditional fishing communities and the women in them. The study concludes with an assortment of views and strategies that could help achieve the goal of turtle conservation, while sustaining the endeavors of fish workers and fishing communities to maintain their livelihoods.

Source: International Collective in Support of Fish workers, 27 College Road, Chennai – 600 006, India. Email: icsf@vsnl.com.

37. TRIPATHY, B. (2004). A study of the offshore distribution of olive ridley turtles (*Lepidochelys olivacea*) in the coastal waters of Rushikulya rookery along the Orissa coast, India. Final Report submitted to Wildlife Conservation Society-India Programme, Centre for Wildlife Studies, Bangalore, India, 34 p.

The at-sea distribution of olive ridley sea turtles off the coast of the Rushikulya rookery, Orissa, was studied during the 2003-04 turtle-breeding season. Line transects were laid perpendicular to the shore every alternate day, to estimate the surface density of sea turtles. Locations of mating pair assemblage were taken to estimate the extent of the reproductive patches and to identify spatio-temporal changes in the distribution of olive ridley turtles in the offshore waters off Rushikulya. Parameters such as area, water depth, air and sea surface temperature, length and mesh size of the net, duration of netting and turtles entanglement in nets, if any, were taken into account. The estimated surface density of olive ridleys was 35.067 per sq. km (CV 11.22 %) and the encounter rate was 3.68 per km. The reproductive patch was found to be dynamic, with a periodic shifting in the coastal waters off the Rushikulya mass-nesting beach. The area of maximum utilization for mating pairs was 57.92 sq. km (90% MCP). The mating pairs observed were patchily distributed in the offshore waters at a depth between 16-28 m ($\overline{X}$ = 26 m ± S.E. 9.9). Maximum sea turtle congregation occurs between 2-5 km from the shore. The turtle congregation formed initially at 10 km north off the Rushikulya rookery during November, and then shifted towards the south, at a distance of 3 km off the mass-nesting beach during February. Maximum mating pairs were sighted between 11.00hr to 13.00hr and at sea surface temperature between 25° and 26° C ($\overline{X}$ = 24.6°C ± S.E 1.04). Factors such as time of the day, sea surface temperature and sea states were found to be the limiting factors influencing sea turtle congregation. Long-term offshore population monitoring should be carried out to understand the population trends. Although no impact of traditional fishing on the turtle congregation was documented during the survey, more precise information is required on the sea turtle-fisheries interface.

Source: Dr.Basudev Tripathy, Wildlife Institute of India/WCS-India Programme, Centre for Wildlife Studies, 823, 13th Cross, Jayanagar, 7th Block West, Bangalore – 560 082, Karnataka, India. info@wcsindia.org

38. TRIPATHY, B. (2004). Awaiting arribada – Protection of olive ridley turtles (*Lepidochelys olivacea*) and their habitat at Rushikulya rookery in Orissa. An occasional report on a Rapid Action Project of the Wildlife Trust of India, New Delhi funded by Anisha Nature Fund. 16 p.

The present piece of conservation work was undertaken along the Rushikulya sea turtle rookery of Orissa from January to June 2004. The project aimed at protection of Olive Ridley sea turtles, their nests, eggs as well as nesting beach during the breeding season. The entire six kilometer mass nesting beach of Rushikulya was made free from garbage. Round-the-clock protection was given to the sporadic and congregated nests on the beach. *Ex-situ* conservation of eggs was undertaken for safeguarding the eggs from inundation and non-human predation. Sea turtle hatchlings were protected from disorientation and stranded hatchlings on the beach were released back to the sea safely. Community participation for sea turtle conservation was also attempted at the adjoining villages of Rushikulya sea turtle rookery along the Orissa coast.

39. TRIPATHY, B. (2004). The olive ridley sea turtle: Towards an integrated community-based conservation program along the Rushikulya rookery of Orissa, India. Report submitted to World Turtle Trust, Honolulu, USA, 23 p.

The present piece of conservation work was undertaken along the Rushikulya sea turtle rookery of Orissa from January to June 2004. The project aimed at protection of Olive Ridley sea turtles, their nests, eggs as well as nesting beach during the breeding season. The entire six kilometer mass nesting beach of Rushikulya was made free from garbage. Round-the-clock protection was given to the sporadic and congregated nests on the beach. *Ex-situ* conservation of eggs was undertaken for safeguarding the eggs from inundation and non-human predation. Sea turtle hatchlings were protected from disorientation and stranded hatchlings on the beach were released back to the sea safely. Community participation for sea turtle conservation was also attempted at the adjoining villages of Rushikulya sea turtle rookery along the Orissa coast.

40. TRIPATHY, B. (2004). Sea turtles and their habitat protection at Rushikulya rookery of Orissa, India. Report submitted to Wildlife Trust of India, New Delhi, 12 p.

The present study was carried out with the objective of documenting the present practice and principle of community involvement in sea turtle conservation and management along the Rushikulya rookery of Orissa, India, so that a community participatory management plan for sea turtle conservation can be prepared for the region and placed before the Union Government of India for considering Rushikulya Rookery as the country's first COMMUNITY CONSERVED AREA (CCA). Information was collected from the villagers adjoining the rookery through questionnaire survey. Informal meetings were conducted among various community groups in the coastal villages. Films on sea turtle biology and conservation as well as slide shows were organized. Posters, handouts, stickers and T-shirts bearing the message of sea turtle conservation were distributed as part of awareness generation campaign. The community groups were trained on various techniques for sea turtle conservation and management. Based on the observations, specific recommendations were made on the prospects of community based sea turtle conservation along the Rushikulya rookery of Orissa, India.

*** Article not available**

DISSERTATIONS AND THESIS

1. *BEHERA, M. (1989). Ontogenic development with special reference to sex differentiation in the Olive Ridley Sea Turtle *Lepidochelys olivacea* (Eschscholtz). Unpublished Ph.D. Thesis, Utkal University, Bhubaneswar, Orissa, India.

A comprehensive study on the ontogenic development with special reference to sex differentiation in the olive ridley turtles along with other ecological processes involved at the Gahirmatha rookery in Orissa have been reported in the thesis. However, details not available.

Source: Utkal University, Bhubaneswar, Orissa, India.

2. KARNAD, D. (2008). The effect of lighting and temperature on the eggs and hatchlings of olive ridley turtles at Rushikulya, India. Unpublished M.Sc.Thesis. The Manipal University, Manipal, Karnataka, India.

The olive ridley turtle (*Lepidochelys olivacea)* nests both sporadically and *en masse* along the Indian Coast. Of the three mass nesting sites along the East coast of India, the Rushikulya rookery may currently have the most regular nesting population of olive ridley turtles and is therefore likely to play a key role in maintaining the Indian Ocean population of the species. The sporadic nesting site of Chennai is completely altered by human activity and represents a set of conditions completely different from those in Rushikulya. Olive ridley turtles in India are protected and have been studied for several years but detailed studies on factors affecting nesting and hatching have not been conducted. The present study examines the effect of temperature and lighting on egg and hatchling survival of the olive ridley turtle. The response of the hatchlings to different lighting regimes on the beach, as well as to specific combinations of wavelength and intensity of light was studied. Hatchlings responded to both intense point sources of light at Rushikulya as well as glows from hidden point sources. A mixed age plantation of *Casuarina equisetifolia* proved to be an effective light barrier that prevented disorientation of hatchlings. Preference for light of lower wavelength and higher intensity was observed, although hatchlings responded differently to light in the violet band depending on its intensity. Olive ridley hatchlings were indifferent to red light indicating that the use of this wavelength could be recommended as a photo pollution management measure. Incubation temperature and hatching success of selected nests were monitored within hatcheries at both sites. Incubation temperature did not have a significant influence on mortality in nests; however, based on these temperatures, female biased sex ratios of hatchlings at both sites were predicted.

Source: Divya Kanad/ Centre for Wildlife Studies & Post-Graduate Program in Wildlife Biology & Conservation, Centre for Wildlife Studies, & National Centre for Biological Sciences,UAS-GKVK Campus, Bangalore – 500 065. Email: ecodivs@gmail.com.

3. *KAR, C. S. (1988). Ecological studies on the pacific ridley sea turtle, *Lepidochelys olivacea* (Eschscholtz, 1829) in the Orissa coast. Unpublished Ph.D. Thesis, Sambalpur University, Sambalpur, Burla, Orissa, India.

A comprehensive study on ecological aspects of the olive ridley sea turtles have been reported in the thesis. However, details not available.

Source: Dr. C. S. Kar, Orissa Forest Department, Prakruti Bhawan, 5th Floor, BDA Building Complex, Neelakantha Nagar, Nayapalli, Bhubaneswar - 751002 (Orissa). Email: drcskar@gmail.com/ Sambalpur University, Burla, Sambalpur, Orissa.

4. PANDAV, B. (2000). Conservation & management of olive ridley sea turtles on the Orissa coast**.** PhD thesis. Utkal University, Bhubaneswar, Orissa, India**.**

Olive ridley sea turtle (*Lepidochelys olivacea*) nests in low densities all along the east-coast of India. However, the most important nesting beaches lie in Orissa where the mass nesting occurs. Three of the world's six known major mass nesting beaches of olive ridley occur in Orissa. The three mass nesting beaches in Orissa at Gahirmatha, Devi River mouth and Rushikulya together support a significant portion of the world's olive ridley population. Although the nesting population at Gahirmatha has been the focus of several studies over the past two decades, little is known about the turtles at the other two rookeries in Orissa. This study aimed at monitoring the turtle population all along the Orissa coast and addressing certain key issues related to their conservation. The off shore aggregations of olive ridleys in the coastal waters off Gahirmatha as well as the nesting populations at the three rookeries were studied during 1995 – 1999. 1,767 olive ridley mating pairs were captured in the coastal waters off Gahirmatha of which 1,657 males and 1,616 females were double tagged using monel metal flipper tags. On the beach, 10,327 nesting females were tagged during the study. This study reveals that straight carapace lengths of males and females at Gahirmatha are 66.2 ± 2.9 cm and 66.7 ± 2.4 cm respectively. When compared with sizes from other populations it seems clear that average lengths of carapaces and range of sizes obtained in this study are larger than other geographical regions. Both male and female olive ridleys showed strong fidelity to breeding ground. Upon remigration ridleys tagged at Rushikulya rookery re-laid their eggs within 100 to 300 m of their previous nests with a range of 0 to 1,000 m. Nesting females also showed some degree of movement between nesting beaches, both within as well as between nesting seasons. The range of such inter-rookery movement of olive ridley in Orissa varied from 35 to 320 km (n = 6). Recovery of 14 tagged turtles from Sri Lanka and three from South Tamil Nadu (Gulf of Mannar) provides a clue about the non breeding areas of olive ridleys nesting in Orissa. One year remigration intervals were the commonest for ridleys of both sexes with the second and third year intervals are correspondingly less common. Tag recovery from dead turtles washed ashore the Orissa coast also showed considerable movement in the coastal waters off Orissa. The location of olive ridley mating pairs, sighted during the study, in the coastal waters off Gahirmatha were recorded and the extent of distribution was obtained by drawing a Minimum Convex Polygon around the turtle locations. Mating pairs were found to be aggregated in an area of 52.58 sq. km (100% MCP) in the coastal waters off Gahirmatha and the area of maximum utilization was 27.52 sq. km (90% Harmonic Mean). All the sightings of mating pairs recorded during the study were within 5 km of the coast line. All the observed mating took place within a depth of 20 meters. Turtles nesting in Orissa showed a distinct temporal pattern of nesting with most of the nesting taking place during neap tidal nights. A drastic change in beach profile was observed at the Nasi rookery, Gahirmatha during the study. In total, 34,469 and 77,208 eggs were examined respectively at Gahirmatha and Rushikulya rookery to determine the incubation success. The mean percentage hatching success and emergence success at Gahirmatha varied from 47.7 to 94.4 and 39.8 to 84.3 respectively. Similarly, the mean percentage hatching success and emergence success at Rushikulya varied from 83.8 to 97.01 and 69.78 to 96.1 respectively. The overall man hatching success of the nests in the whole period of study were 63.5 ± 30.4 (range = 0 to 100, n = 277 nests) and 95.01 ± 7.03 (range = 39.7 to 100, n = 600 nests). A significant difference in hatching success ($F = 304.137$, $df = 1$, $p < 0.001$) as well as emergence success ($F = 282.127$, $df = 1$, $p < 0.001$) was observed between Gahirmatha and Rushikulya. Of the two mass nesting beaches (Gahirmatha and Rushikulya) regularly monitored during the study, extensive beach erosion was observed at the Nasi rookery, Gahirmatha. Beach erosion resulted in loss of almost 59% of the total nesting area at Nasi rookery, Gahirmatha. The disorientation of turtle hatchlings at Rushikulya was prevalent at Rushikulya rookery. During the study, the Orissa coast witnessed an exponential increase in number of dead turtles. In total 46,219 adult olive ridleys were counted washed ashore the Orissa coast during the study. All the dead turtles counted during the study were adults. The number of dead turtles counted in the survey sectors showed a strong correlation with the number of mechanized fishing vessels operating in their respective coastal waters. The findings of this study strengthen the case for establishing a net work of protected areas for sea turtles along the Orissa coast. This study proves the fact that olive ridleys in Orissa use more than one beach for nesting during the same as well as subsequent breeding season. Based on the movement of turtles between nesting beaches and in the coastal waters off Orissa obtained during this study it is proposed that the entire sea turtle population visiting Orissa coast should be considered as a single conservation unit. Therefore protection of all the three mass nesting beaches as well as their coastal waters are extremely crucial for the survival of sea turtles in Orissa which could well be a single population. Further the analysis on incubation success data strengthens the importance of smaller rookeries like Rushikulya. The large-scale mortality of adult turtles in Orissa recorded during the study

is a matter of utmost concern and need to be addressed immediately. The need for strengthening the patrolling in offshore waters where turtle congregation occur and the use of Turtle Excluder Device are some of the steps suggested that needs to be taken up immediately. Turtle congregations like that in the coastal waters off Gahirmatha need to be located along rest part of the Orissa coast so that adequate protection can be provided to the turtles in the offshore waters. Keeping in view the intensity of artificial illumination at Rushikulya rookery, the use of low intensity lights is suggested to mitigate the problem. Finally this study recommends a continuous monitoring of the turtle population in Orissa which is undoubtedly under great threat.

Source: Dr. Bivash Pandav, Wildlife Institute of India, post Box # 18, Chandrabani, Dehradun – 248 001, Uttaranchal, India. Email: pandavb@yahoo.com.

5. TRIPATHY, B. (1996). Mass hatching of olive ridley sea turtles (*Lepidochelys olivacea*) at the Rushikulya muhana, East coast of India. Unpublished M.Sc. Thesis, Berhampur University, Bhanja Vihar, Orissa, India.

Some aspects on the behavioral ecology of the olive ridley sea turtle (*Lepidochelys olivacea*) hatchlings were studied during a post *arribada* season (March 1996-May 1996) at Rushikulya Rookery, Orissa Coast, India. 50 nests were excavated and 40 nests were monitored to study the hatching time lag, emergence success, hatching success and orientations of the hatchlings. The mean percent hatching success observed during the study was 98 $\pm$ 18.86. Average clutch size of the nest was 126 $\pm$ 19.20 eggs. Except for few nests, hatchling emergence was 100%. Hatchlings showed strong photo-tactic orientation. Predation on the hatchlings was found less during night hours.

Source: Dr. Basudev Tripathy, Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun – 248 001, Uttaranchal, India. Email: tripathyb@yahoo.co.uk.

6. *TRIPATHY, B. (2000). Behavioural ecology of olive ridley sea turtle *Lepidochelys olivacea* (Eschscholtz, 1829) hatchlings at Rushikulya Rookery, Orissa. Unpublished M.Phil Thesis, Berhampur University, Bhanja Vihar, Orissa, India.

A behavioural study on the olive ridley turtle hatchlings along at the Rushikulya rookery in Orissa have been reported in the thesis. However, details not available.

7. TRIPATHY, B. (2005). A study on the ecology and conservation of the olive ridley sea turtle *Lepidochelys olivacea* at the Rushikulya rookery of Orissa coast, India. Unpublished Ph.D. Thesis. Andhra University, Vishakapatnam, India, 162 pp.

This study was carried out at the Rushikulya rookery of Orissa, which critically analyzed the offshore and onshore biology and behaviour of olive ridley sea turtles at the rookery. The at-sea distribution of olive ridley sea turtles off the coast of the Rushikulya rookery, Orissa, was studied during the breeding season. Solitary nesting, arribada estimate with reproductive parameters such as clutch size, hatching success, and hatchling survival was documented. Data were collected on abiotic and biotic factors influencing adult turtles and hatchlings. Factors such as impact of non-human predation, beach erosion and egg loss, artificial illumination, *Casuarina* plantation and other anthropogenic activities were also critically analyzed. The estimated surface density of olive ridleys in the water was 35.067 per sq. km and the encounter rate was 3.68 per km. The reproductive patch was found to be dynamic. The area of maximum utilization for mating pairs was 57.92 sq. km. Sea turtle mating pairs were found patchily distributed in the offshore area at depth between 16 and 28 m. Maximum sea turtle congregation found occurring between 2 to 5 km from the shore. Highest mating pairs were sighted between 11.00hr to 13.00hr and when sea surface temperature between 25^0C and 26^0 C. Sporadic nesting was documented throughout season. Arribada was observed for two nights during February, five nights during March 2004 and for four nights during February 2005. The mass nesting estimate was found much lower than that projected by the Orissa forest department. The period between arribadas (inter-arribada period) was 21 days. Nesting females at the Rushikulya rookery had an average length (CCL) of 67.16 cm. A total of 1070 turtles were recaptured between 2003 and 2005 season. For nesting

females, a remigration interval of 1 to 8 years was recorded. This study found the mean IP (inter-nesting period) to be ~19 days. Emergence success of hatchlings was recorded higher than that of Gahirmatha rookery. There was considerable variation observed on the hatchlings orientation in the new and old nesting beach. The dominated beach vegetation were *Ipomoea pes-caprae* and *Spinifex littorena.* Feral dogs (*Canis familiaris*) were frequently observed canids and Jackals (*Canis lupus*) and stripped hyena (*Hyaena hyaena*) often encountered during the night and found predating on eggs. Erosion was recorded on some part of the beach resulting in egg loss due to it. Dead turtles washed ashore along the Ganjam coast were not much compare to rest of the Orissa coast. However, there are other anthropogenic pressures that are mounting at this rookery and its offshore waters and which may prove to be detrimental for olive ridleys of Orissa in the near future. Problems like *Casuarina* plantation close to the high water level, artificial illumination due to coastal developments and sand mining are the important threats to the olive ridleys and its habitat at the Rushikulya rookery of Orissa coast. An effective protection of reproductive patch would be the best solution for protecting the breeding turtles in the offshore waters of the Rushikulya rookery. Continuous beach monitoring, accurate counting of nesting turtles for population estimation, protection of nests from mammalian predators and checking the artificial illumination on the beach are urgently necessary for the rookery. Along with this, strict implementation of the Wildlife (Protection) Act, the Marine Fisheries Act of Orissa and the Coastal Regulation Zone Management Act will be affective measures for the conservation and management of the olive ridley sea turtles of the Rushikulya rookery of Orissa coast.

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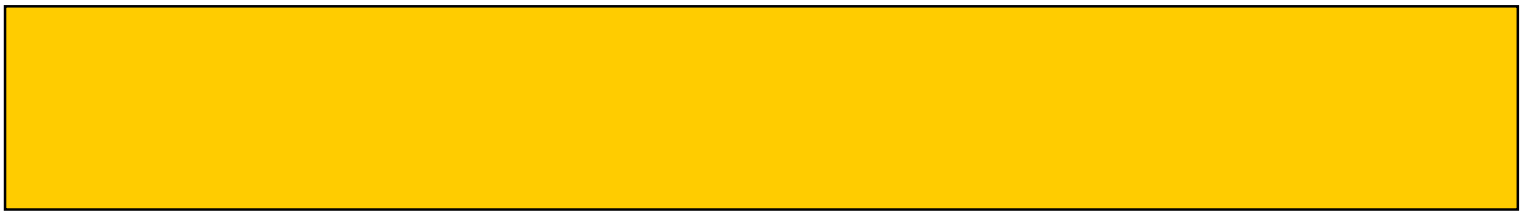

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