



# Stakeholder Preference towards Conservation of Marine Mega Fauna: Olive Ridley Turtle (*Lepidochelys olivacea*) (Eschscholtz, 1829) Conservation Dilemma in Odisha

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## Abstract

Conservation of marine megafauna is a complex issue as it is linked to ecological, socio-economic and political dimensions. Olive ridley turtle (*Lepidochelys olivacea*) (Eschscholtz, 1829) conservation along Odisha coast is one of such dilemma which often leads to conflict between different stakeholders. Considering the mass nesting status, incidental mortality and fisheries linkages, several legislations to conserve the turtles were evolved from time to time imposing regulation on fishing activities in Odisha coast. The study reviews the scenario for conservation of the turtles along Odisha coast and fishers' awareness, perception and preferences towards alternate management measures. Study found that 81.58% of the fishermen preferred an alternative conservation scenario either with a reduction in closure time, area closure or both. Even though, they were aware about the need of conservation of marine turtles, it was found to be partial. Adequate research on the ecology, distribution/redistribution and bycatch of olive ridley turtles in Odisha and proper awareness generation with the updated information among the fishers was found to be necessary for ensuring better conservation management. Study on spatial distribution of turtles and its association with the existing fishing grounds in a participatory bottom-up approach can help in making targeted conservation measures more effective. Ecological dimension of conservation may be coupled with socio-

economic dimensions for a sustainable ecosystem management.

**Keywords:** Marine megafauna, olive ridley turtle, conservation

## Introduction

Since the advent of technologically intensive commercial fishing, bycatch has become a major concern in marine fisheries management. Bycatch is considered as the "catch that is either unused or unmanaged" and with this classification, the global bycatch was estimated to the tune of 40.4% (Davies et al., 2009). Bycatch consists of a large variety of marine fauna including the charismatic marine mega fauna like turtles, elasmobranchs, sea birds and other marine mammals (Hall et al., 2000; Komoroske & Lewison, 2015).

When the incidental mortalities of these charismatic species are high, management measures become inevitable from a conservation point of view. Major fisheries based management measures to conserve these charismatic species include use of Bycatch Reduction Technologies (BRTs) such as Turtle Excluder Devices (TEDs) and spatial or temporal closure of fishing activities. Declaration of an area in the form of Marine Protected Areas (MPAs) has also been followed in many cases for protection of these species (Agardy, 1994; Ramesh & Rai, 2017; Salm et al., 2000).

Compared to the commercially important fishes, conservation of marine mega fauna is a complex issue as they do not have any direct market value. As there will be a trade-off between the conservation objective and human well-being, achieving a consensus between different stakeholders is often difficult in such cases (Mcshane et al., 2011). In order to avoid conflicts, open communication and negotiation

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between different stakeholders are vital before reaching to a litigation measure (Tucker et al., 1997). The present study tries to review one of such conservation dilemma of olive ridley turtles in Odisha by considering the perceptions and preferences of different stakeholders.

Olive ridley turtles had been listed as an endangered species by the International Union for Conservation of Nature (IUCN) and according to the Convention on International Trade in Endangered Species of Flora and Fauna (CITES), these turtle species are prohibited from international trade. In India, Odisha is one of the largest rookery of olive ridley turtles, with three major mass nesting areas; Gahirmatha, Devi river mouth and Rushikulya (Pandav et al., 1998). Mass nesting or *arribadas* of olive ridley turtles were reported in Odisha from 1970s itself, with an estimated nesting ranging from 100-8,00,000 turtles (Shankar et al., 2004). Large number of incidental mortality was reported from gillnets and trawl fisheries. A study conducted during 2008-2010 period in Odisha coast showed an average stranding of 3481-14035 adult olive ridley turtles which had a positive correlation with the trawling intensity (Behera et al., 2013). Other studies undertaken along Indian coast during 1985-1998 period reported that gill nets accounted for major proportion of turtles landed or trapped followed by trawl nets (Rajagopalan et al., 1996; 2001). A study conducted by Behera et al. (2016) along the Gahirmatha coast of Odisha showed that highest number of dead turtles were found in February and least in November and the mortality is mainly due to illegal fishing in the near shore waters using trawls and gillnets.

Considering the mass nesting status, incidental mortality and fisheries linkages, several legislations to conserve the turtles were evolved from time to time imposing regulation on fishing activities in Odisha coast. The conservation issue had become a multistakeholder concern in the state with the involvement of fisheries department, forest department, civil society organizations, coast guard and the fishers. Increasing restrictions on fishing, in addition to the declining marine resources many times leads to conflicts of interest between fishers and other stakeholders. In this context, we tried to analyze the existing scenario of fisheries regulations in Odisha coast, fishers' awareness and perceptions regarding the importance of turtle conservation and the technology based turtle conservation strategies.

Considering the ecological-economic trade-off, the fishers' preference for alternative turtle conservation scenarios were also explored in the study.

## Materials and Methods

The study was conducted in Paradeep (near Devi river mouth), Odisha during 2015-2016 period. Key informant interviews were conducted among the officials of state fisheries department, state forest department, World Wide Fund for Nature (WWF) and representatives of fishermen associations in Paradeep to review the existing fisheries based regulations for conservation of olive ridley turtles. As trawlers predominates among the mechanized fishing vessels in Paradeep Fishing Harbour and a large number of incidental mortality was reported from trawl fisheries, data was also collected from randomly selected 38 fishermen engaged in trawl fisheries to analyze their awareness and perception related to importance of turtle conservation and technology based turtle conservation measures. A qualitative scenario analysis was conducted among the fishermen to elicit their preference towards alternative conservation scenarios. Different scenarios considered were status quo conservation, alternate conservation and no conservation scenarios.

## Results and Discussion

Considering the mass nesting and incidental mortality of olive ridley turtles through fishing in Odisha coast, several regulations were imposed on fishing from time to time. The detailed list of different measures taken by various departments for turtle conservation are given in Table 1.

Most of the turtle conservation measures are implemented by Odisha State Fisheries Department and Forest Department and for monitoring the compliance status, Indian Coast Guard and marine police also play a major role. Fishers are liable to different sanctions/punishments upon non-compliance to different fishing regulations. Different conservation measures also indicated that relatively unconstrained trawling is permitted only for three months (August, September, October) near the major turtle congregation areas in Odisha coast.

There are around 649 trawlers operating from Paradeep fishing harbour mainly engaged in shrimp trawling. Length of the trawlers vary from 32-52 ft and were fitted with engines of maximum power of

Table 1. Measures of turtle conservation in Odisha

Sl. No.	Conservation measure	Period of implementation	Act/Notification/ Amendment	Concerned department
1.	Declaration of Gahirmatha National Park and Prohibition of fishing within 20 km radius of Gahirmatha beach	Throughout the year	Wild Life Protection Act, 1972	State Forest Department, Odisha
2.	Ban on mechanized fishing near shore up to 5 km	Throughout the year	Orissa Marine Fishing Regulation Act, 1981	State Fisheries Department, Odisha
3.	Prohibition of fishing by trawlers up to a seaward distance of 20 km from the high tide line of Orissa coast from Jatadhar river mouth to Devi river mouth and from Chilika river mouth to Rushikulya river mouth	5 months (1 January-31 May)	Fisheries Department Notification dated 6 June 1997 (amended on 20 May 2000)	State Fisheries Department, Odisha
4.	Prohibition of motorized vessels, trawlers and those using mechanized fishing techniques in 10 km radius from Devi river mouth, Rushikulya river mouth and Dhamara river mouth	7 months (1 November to 31 March)	Fisheries Department Notification dated 4 February 2005	State Fisheries Department, Odisha
5.	Prohibition of multifilament gill nets of a length less than three hundred meters with mesh size below one hundred and forty millimeters and twine diameter of 0.7 millimeters and monofilament gill net of above dimension with twine diameter of 0.5 millimeter within 5 km radius of Devi river mouth, Rushikulya river mouth and Dhamara river mouth	7 months (1 November-31 May)	Fisheries Department Notification dated 21st July 2005	State Fisheries Department, Odisha
6.	Mandatory use of Turtle Excluder Devices (TEDs) in all mechanized fishing vessels	Throughout the year	Orissa Marine Fishing Regulation (Amendment) Rules 2001 dated 17 April 2001	State Fisheries Department, Odisha
7.	Blanket fishing ban of 61 days	61 days (1 June-31 July)	Orissa Marine Fishing Regulation Act, 1981	State Fisheries Department, Odisha

Source: Key informant interviews; reports of Directorate of Fisheries, Government of Odisha

120 hp. Trawlers are engaged in multi-day fishing with voyage duration of 7-12 days and trawling is done at depth range of 30 – 60 m. The socio-economic profile of the respondents showed that the average age of fishers engaged in trawl fisheries as 49.95 years with an average experience of 19.41 years in fishing. Average operational expenditure on fishing of 7-12 days voyage was around Rs.1.15 lakhs. Increasing operational expenditure of fishing combined with poor catches sometimes results in financial losses for the trawler fishermen. Large

variation was observed in the average operational profit of the fishermen and in the present study it was found to be Rs. 26,101 per trip (Table 2).

Compliance to different regulations often depends on individual's socio-cultural and psychological attributes such as perception about the authenticity and benefits of conservation, attitude, norms and beliefs (Nielsen & Mathiesen, 2003; Piovano et al., 2012; Bennett & Dearden, 2014). From the primary survey conducted among the fishers engaged in

Table 2. Socio-economic profile of the respondents (n=38)

Sl. No.	Variable	Mean $\pm$ SD
1.	Age (Years)	49.95 $\pm$ 9.41
2.	Experience in fishing (years)	19.41 $\pm$ 9.10
3.	Operational cost of fishing per trip (Rs.)	114667.95 $\pm$ 20398
4.	Operational profit of fishing per trip (Rs.)	26101.3 $\pm$ 28798.6

trawl fisheries, it was found that all the fishermen were partially aware about the importance of conservation of olive ridley turtle in Odisha coast even though some skepticism exist on the present abundance of the species. Considering the longer life span, occurrence of *arribadas* and high fecundity of turtles, fishermen perceived that the population might have increased. Regarding incidental mortality of olive ridley turtles, they perceived that in addition to trawlers, incidental mortality also occurs through gill nets and marine pollution can also lead to the death of turtles. Only partial awareness was found in case of critical turtle congregation areas in Odisha and according to fishermen, there are redistributions in breeding and mass nesting sites from year to year. As there were several interventions conducted on use of Turtle Excluder Devices (TEDs) in trawls, majority of the fishers were aware about the technology, but they perceived that there will be a catch loss (10-25%) by using TED. As there were other regulatory measures such as area and seasonal ban on fishing, fishers perceived that use of TED is an additional burden.

Fishers perception on catch loss by using TED was not found to be in tune with the research trials. Even though the earlier studies using Super Shooter TED along Andhra-Odisha coast had shown 30.8% escapement of finfishes (Ramalingam & Pandian, 2002), later advancement and modification in TEDs such as the development of CIFT-TED for small mechanized trawlers showed relatively insignificant catch loss of 1.2% and 100% escapement of turtles off Agaranasi and Paradeep (Boopendranath et al., 2003) and in case of another study conducted off Dhamra the catch loss of fishes was found to be between 2-3% (Raghu Prakash et al., 2016).

Three qualitative scenarios were considered for eliciting the trawl fishers' preference towards

conservation of olive ridley turtles in Odisha. The scenarios were developed based on the observations evolved from the key informant interviews. Among the three scenarios, status quo conservation scenario indicates the present regulations for the trawlers whereas the alternate conservation scenario indicated a reduction in the existing ban area or ban period or both. No conservation scenario indicates the blanket fishing ban of two months existing across east coast and restriction of mechanized up to 5 km from the coast across the entire east coast, but no additional conservation measures for turtles.

Results of the study indicated that 15.79% of the respondents were not having problem with the status quo conservation scenario when there will be a compensation for the loss of fishing days. 81.58% of the fishermen preferred an alternative conservation scenario either with a reduction in closure time (18.42%), closure area (18.42%) or both (44.73%) (Fig. 1). The preferred reduction in closure area was up to 10 km from the coast in case of turtle congregation area and the closure time reduction indicated a three months ban rather than seven months. Only negligible proportion of the surveyed fishermen opted no conservation scenario.

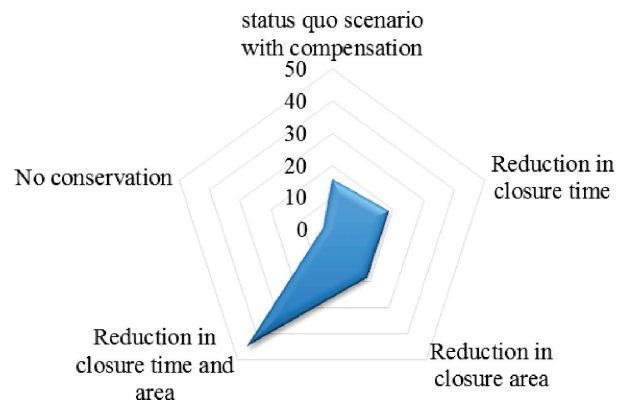


Fig. 1. Fishers' preference towards turtle conservation scenarios in Odisha

Few scientific studies also suggested the variation in the area and season of mass nesting which can support the fishers' arguments. Recent studies had indicated that in case of Gahirmatha, the turtle congregation occurs within 5 km distance from the shore at around 20-30 m depth and the major seasons of congregation was observed between November to February (Behera, 2016; Ramesh & Rai, 2017).

More scientific approaches are needed to fix the reference points or thresholds to the population of the protected species while prioritizing management measures (Curtis et al, 2015). Even though gear modifications were found to be a successful management scenario across globe, its success is many times conditional on the stage of fisheries management, type of fishery and the distribution of bycatch species. It was found to be successful in cases where the fishermen try to avoid costlier decisions such as fishery closures (Campbell & Cornwell, 2008). When the bycatch is dispersed and when a single type of fishery results in more bycatch, then gear modifications or use of BRTs were found to be more effective (Senko et al., 2014).

Conservation of marine megafauna is a complex task as it is linked to the ecological, socio-economic and political functions and involves multiple stakeholders. Conservation of olive ridley turtles along the Odisha coast and associated regulations on fishing often leads to conflicts between fishers and other stakeholders. Adequate research on the ecology, distribution/redistribution and bycatch of olive ridley turtles in Odisha and proper awareness generation with the updated information among the fishers is a necessary pre-requisite for facilitating policy reformulations as well as better compliance to any conservation measure. Study on spatial distribution of turtles (especially during breeding and nesting time) and its association with the existing fishing grounds in a participatory bottom-up manner can help in making targeted conservation measures more effective. Ecological dimension of conservation may be coupled with socio-economic dimensions for a sustainable ecosystem management.

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## References

- Agardy, M. T. (1994) Advances in marine conservation: The role of marine protected areas. *Trends Ecol. Evol.* 9: 267-270
- Behera, S., Tripathy, B., Shivakumar, K., Choudhury, B.C. and Pandav, B. (2016) Fisheries impact on breeding of olive ridley turtles (*Lepidochelys olivacea*) along the Gahirmatha coast, Bay of Bengal, Odisha, India. *Herpetol. J.* 26: 93-98
- Behera, S., Kar, C. S., Behera, S. and John, S. (2013) Abundance of olive ridleys along Odisha coast: sources of mortality and relative importance of fisheries impacts. In: *Ecology and Conservation of Tropical Marine Faunal Communities* (Venkataraman, K., Sivaperuman, C. and Raghunathan, C., Eds), pp 311-321, Springer, Berlin
- Bennett, N. J. and Dearden, P. (2014) Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. *Mar. Policy.* 44: 107-116
- Boopendranath, M. R., Dawson, P., Pravin, P., Ramesan, M. P., Prakash, R. R., Vijayan, V., Mathai, P. G., Pillai, N. S., Varghese, M. D. and Rama Rao, S. V. S. (2003) Design and development of turtle excluder devices for Indian fisheries. In: *Marine turtles of Indian Sub-continent* (Shanker, K. and Choudhury, B. C., Eds), pp 244-261, Universities Press (India) Pvt. Ltd., Hyderabad
- Campbell, L. M., and Cornwell, M. L. (2008) Human dimensions of bycatch reduction technology: Current assumptions and directions for future research. *Endanger. Species Res.* 5: 325-334
- Curtis, K. A., Moore, J., Boyd, C., Dillingham, P., Lewison, R., Taylor, L. B. and Kelsey, J. (2015) Managing catch of marine megafauna: Guidelines for setting limit reference points. *Mar. Policy.* 61: 249-263
- Davies, R.W.D., Cripps, S. J., Nickson, A. and Porter, G. (2009) Defining and estimating global marine fisheries bycatch. *Mar. Policy.* 33: 661-672
- Hall, M. A., Alverson, D. L. and Metuzals, K. I. (2000) By-catch: Problems and solutions. *Mar. Pollut. Bull.* 41: 204-219
- Komoroske, L. M. and Lewison, R. L. (2015) Addressing fisheries bycatch in a changing world. *Front. Mar. Sci.* 2(83): 1-11
- Mcshane, T., Hirsch, P., Tran, T., Songorwa, A.N., Kinzig, A., Monteferri, B., Mutekanga, D., Van Thang, H., Luis D.J., Pulgar-Vidal, M., Welch-Devine, M., Peter, B.J., Coppolillo, P. and O'Connor, S. (2011) Hard choices: Making trade-offs between biodiversity conservation and human well-being. *Biol. Conserv.* 144(3): 966-972
- Nielsen, J. R., Mathiesen, C. (2003) Important factors influencing rule compliance in fisheries lessons from Denmark. *Mar. Policy.* 27: 409-416
- Pandav, B., Choudhury, B.C. and Shanker, K. (1998) The Olive Ridley sea turtle (*Lepidochelys olivacea*) in Orissa: an urgent call for an intensive and integrated conservation programme. *Curr. Sci.* 75: 1323-1328

- Piovano, S., Basciano, G., Swimmer, Y., Giacomini, C. (2012) Evaluation of a bycatch reduction technology by fishermen: a case study from Sicily. *Mar. Policy*. 36: 272-277
- Raghu Prakash, R., Boopendranath, M. R. and Vinod M. (2016) Performance Evaluation of Turtle Excluder Device off Dhamra in Bay of Bengal. *Fish. Technol.* 53: 183-189
- Rajagopalan, M., Vivekanandan, E., Balan, K., Kurup, K. N. (2001) Threats to Sea turtles in India through incidental catch, In: Proceedings of National Workshop for the Development of a National Sea Turtle Conservation Action Plan, Bhubaneswar, Orissa (Shanker, K. and Choudhury, B. C., Eds), pp 12-14, Wildlife Institute of India, Dehradun, India
- Rajagopalan, M., Vivekanandan, E., Krishna Pillai, S., Srinath, M. and Fernando, A.B. (1996) Incidental catches of sea turtles in India. *Mar. Fish. Infor. Serv. T. & E. Ser.* 143: 8-16
- Ramalingam, L. and Pandian, P. P. (2002) A note on the results of operation of TED by exploratory survey vessels. Paper presented at the Workshop on the Operation of TED, WLI Dehradun and Department of Fisheries, Kakinada, Andhra Pradesh, 24-25 January 2002
- Ramesh, M. and Rai, N. D. (2017) Trading on conservation: A marine Protected area as an ecological fix. *Mar. Policy*. 82: 25-31
- Salm, R.V., Clark, J. and Siirila, E. (2000) Marine and Coastal Protected Areas: A guide for planners and managers. 371 p, IUCN, Washington DC
- Senko, J., White, E. R., Heppell, S. S. and Gerber, L. R. (2014) Mitigating marine megafauna bycatch. *Anim. Conserv.* 17: 5-18
- Shankar, K. Pandav, B. and Choudhury, B.C. (2004) An assessment of Olive Ridley turtle (*Lepidochelys olivacea*) nesting population in Orissa, India. *Biol. Conserv.* 115: 149-160
- Tucker, A.D., Robins, J. B. and Mcphee, D. P. (1997) Adopting turtle excluder devices in Australia and the United States: What are the differences in technology transfer, promotion, and acceptance? *Coast. Manage.* 25(4): 405-421