

A review of the development of the TED for Indian fisheries

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Introduction

Fishing is one of the largest industries in the country which provides employment or gainful economic activity to nearly 14 million people. Marine fish production in India has reached 3.2 million tonnes in 2008, valued at over USD 2.8 billion and forms about 84% of the potential yield from the Exclusive Economic zone. More than 80% of the current fish production comes from the intensively fished coastal waters. There are over 3300 marine fishing villages in India with a total marine fishermen population of 3.6 million, of which nearly one million are active fishers. There are nearly 59,000 mechanized boats, 76,000 motorized boats and 104,000 traditional non-motorised vessels operating along the 8118 km coastline of India.

Five species of sea turtles viz., *Chelonia mydas*, *Caretta caretta*, *Eretmochelys imbricata*, *Lepidochelys olivacea* and *Dermochelys coriacea* are found in Indian coastal waters. All species except *Caretta caretta* nest on the mainland coast and islands.

Origins of the programme

Trawling provides a major portion of the India's supply of marine fish. Trawling was first attempted in Indian waters during exploratory surveys conducted from *S.T. Premier*, off Bombay coast, in 1902 and by Ceylon Company for Pearl Fishing Survey, during 1906-07. Pair trawling operations were conducted from the Japanese trawler *Taiyo Maru 17*, during 1947-1953. In 1955, shrimp trawling was introduced off Malabar coast, using a Gulf of Mexico type flat trawl of 9.6 m head rope.

The increased demand for shrimps for the processing industry caused rapid development of the otter trawling in Indian waters. Central Institute of Fisheries Technology introduced several designs of mechanised trawlers constructed in wood and fuel efficient combination steel vessels equipped to undertake stern trawling. CIFT also introduced various designs of bottom trawling gear such as two seam and four seam trawls, long wing trawl, bulged belly trawl and six seam trawl, as well as energy saving concepts in trawl design such as rope trawl and large mesh trawl and ancillary equipment such as otter boards for trawling. Trawling targeted mainly at shrimps gained wide popularity in the subsequent years and led to the development of an organized fishing industry.

Even though bottom trawling is an efficient fishing method for demersal fishes, it is a less selective fishing technique. Along with target resources a number of non-target resources, which may include protected and endangered species such as sea turtles, are also caught during trawling. According to a survey conducted by CMFRI, along the coast, barring Gahirmatha coast, during 1997-98 trawls accounted for 13.1% of the incidental catch in fishing gears, gill nets operated from mechanized and traditional fishing vessels 60.0%, seines 4.2% and other gears such as bag net, stake nets, hook and line accounted for 22.6% (Rajagopalan *et al.*, 2001). The incidental catch was comparatively high along the east coast due to congregation and high nesting activity, with maximum intensity occurring during January-March.

Sea turtles are endangered species, which are protected under Schedule I of the Indian Wildlife Protection Act 1972 and its amendment in 1991. They are also protected under international conventions such as Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES 1973) and the Bonn Convention on Migratory Species (CMS 1979) to which India is a signatory. Sea turtles are listed as "critically endangered," "endangered," or "threatened" on the World Conservation Union (IUCN) Red List.

The United Nations Convention on the Law of the Sea (UNCLOS 1982) provides obligations of coastal states with regard to scientific conservation and management of migratory marine species. The Code of Conduct for Responsible Fisheries (FAO, 1995), which gives guidelines for sustainable development of fisheries, prescribes the need for protecting endangered species such as sea turtles. As a signatory to the Code, India is duty-bound to conduct research, develop appropriate devices and practices, and implement regulatory measures for the protection of endangered turtles. The fundamental objective of responsible fishing is to maximise economic returns to the fisherman without affecting the long-term sustainability of the fishery resources and with minimum impact on the ecosystem.

United States' legislation (Section 609 of Public Law 101-162) introduced in May 1996, restricted the imports of shrimp harvested with fishing equipment such as trawl nets not equipped with Turtle Excluder Devices, which result in incidental mortality of sea turtles. The law ensures that US market demand for imported shrimp does not involve the Endangered Species Act. In October 1996, India, Malaysia, Thailand and Pakistan requested consultation with the United States under WTO dispute settlement procedures regarding US import restrictions. In April 1998, WTO ruled that the trade restrictions were illegal as they violated international trade rules as outlined in the General Agreement on Tariffs and Trade (GATT). However, on a subsequent appeal filed by the United States, the WTO Appellate Body reversed the Dispute Settlement Body (DSB) Panel's findings on the ground that U.S. laws are covered under exceptions to WTO rules for measures relating conservation of exhaustible natural resource, but only failed the way in which the law was administered. In terms of its systemic implications, the decision in the shrimp-turtle case has virtually mainstreamed environmental requirements in the WTO through its interpretation of the relevant WTO articles.

Expert Scientific Panel on TEDs

In the context of the US ban on import of shrimps from countries not having compliance of the use of TEDs in shrimp trawlers, the Marine Products Export Development Authority (MPEDA), Cochin, constituted a Committee of Experts to assess the economic gain or loss from installation of TEDs in shrimp trawl nets. The Committee recommended that an Expert Scientific Panel (ESP) be set up to conduct a detailed study. The Government of India constituted the Expert Scientific Panel (ESP) on 10 July 1998. The Fisheries Development Commissioner functioned as the Member-Convener of the Panel. Other Members included the Heads of Central Marine Fisheries Research Institute (CMFRI), Cochin; the Fisheries Survey of India (FSI), Mumbai; the Central Institute of Fisheries Technology (CIFT), Cochin; the Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Cochin; and a representative of the Wildlife Institute of India (WII), Dehra Dun.

The terms of reference of the panel covered (i) distribution of sea turtle species in Indian waters, (ii) incidental catch of sea turtles by trawl nets, gillnets etc., (iii) study on the mortality of sea turtles due to factors other than fishing, (iv) trials/demonstrations on the efficacy of established TED models, (v) loss of catch through the use of TEDs in trawl nets (cost-benefit analysis), and (vi) management measures for conservation of marine turtle species along the coastline of India.

Central Institute of Fisheries Technology (CIFT) has closely collaborated in this study while pursuing concurrent investigations under two ICAR funded projects entitled, *Performance Evaluation of Suitable Selective Devices for Elimination of Bycatch (BRD) and Turtles (TED) in Shrimp Trawling*, and *Development Studies on Responsible Trawl Systems* with focus on the design, fabrication, field-testing of Turtle Excluder Devices, and training of trawler fishermen and other stake holders in their fabrication and use.

A very important recommendation of the ESP was the mandatory implementation of turtle excluder devices (TEDs) in all mechanised trawlers operating in areas of mass nesting where incidental mortalities have been recorded, in order to bring down incidental catch and mortality of sea turtles. The areas proposed to be brought under control included (i) entire coast of Orissa during the period from November to April, (ii) coast of Midnapore District in West Bengal during December-March, (iii) coast of Srikakulam, Vizianagaram, Viskhapatnam and East Godavari Districts in Andhra Pradesh during November-April, (iv) coast of Nagapattinam, Turticorin, Ramanathapuram and Tirunelveli Districts in Tamil Nadu during December-April, (v) coast of Pondicherry, excluding areas off the coast of Mahe, Karaikal and Yanam, during December-April, and (vi) coast of Quilon and Trivandrum Districts in Kerala, during December-March.

Development of TED for Indian Fisheries

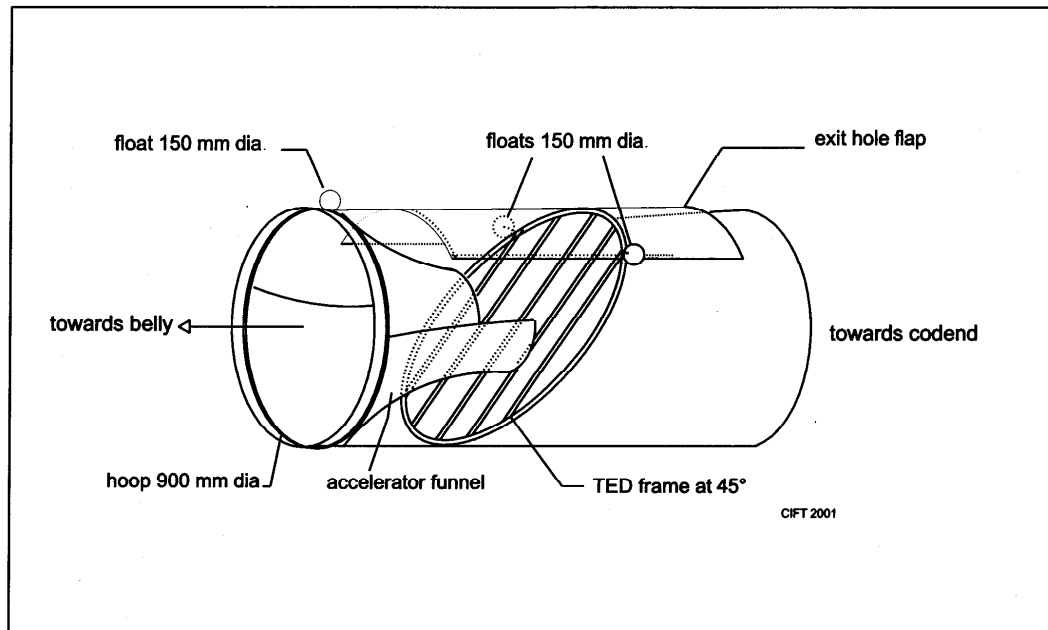
Initial experiments by CIFT to evaluate a Turtle Excluder Device (Super Shooter TED) of 1030 x 850 mm size and deflector bar gap of 90 mm imported from U.S. by MPEDA were conducted onboard the vessel *Matsya Shikari* (39.8 m L_{OA}; 1740 bhp stern trawler) of Fishery Survey of India, Visakhapatnam, during 16-25

August 1995. Fishing operations were conducted off Andhra Pradesh, north of Kalingapatnam, at a depth of 45-55m. Experiments with the imported Super Shooter TED were continued using the same trawl gear and rigging from the FSI vessel *Matsya Shikari* off Andhra Pradesh, between Bhimli and Chilika, during 20-30 September 1995. An exit hole codend was additionally provided in order to retain the catch excluded due to the installation of TED extension in the trawl net. Results indicated an overall escapement of 31% (range: 15 to 50%) of the finfishes which entered the trawl, through exit hole of TED extension. Sea turtles were not seen retained in either the main codend or exit hole cover codend, during the period of observations.

Preliminary observations were carried out using a Super Shooter Type TED fitted to 31.8 m shrimp trawl from *M.V. Skipper* (28.19 m L_{OA} ; 600 bhp) by CIFNET (Cochin), during October 1999-January 2000, off Andhra Pradesh, in the depth range of 36-50 m (Kirubakaran et al, 2002). The TED was of 1040x840 mm size and constructed of 16 mm aluminium rod with 89 mm deflector bar gap. Two turtles were seen excluded during the operations in November 1999. TED operations with an exit hole at the top, resulted in total catch loss of 43% while operations with an exit hole at the bottom resulted catch loss of 14%.

Unlike the fishermen in the United States, Australia and other maritime nations which engage in exclusive shrimp fishing, the fishermen in Indian coasts target both shrimp and non-shrimp resources, for economic trawling operations. If the target were shrimp alone, fishermen could benefit from installation of a TED in the trawl net due to (i) higher catch values due to reduction of large bycatch species which could damage the shrimp, (ii) shorter sorting times (iii) lower fuel costs due to reduced net drag as the codend would fill more slowly, and (v) higher catches of shrimps. For this reason, TEDs are sometimes designated as Trawling Efficiency Devices. Experiments with TED designs which have deflector gap of less than 90 mm in Indian waters, though successful in excluding turtles, showed poor performance in the retention of targeted non-shrimp catch components.

An indigenous design of TED was developed at Central Institute of Fisheries Technology with focus on reducing catch losses, which is a cause of concern for trawler fishermen in adopting the device (Dawson, 2001; Dawson and Boopendranath, 2001a; Dawson. and Boopendranath (2001b); Dawson. and Boopendranath (2002b); Dawson. and Boopendranath (2002b); Dawson. and Boopendranath (2003) Boopendranath et al., 2003; CIFT, 2003; CIFT, 2004a; CIFT, 2004b; CIFT, 2004c; CIFT, 2005) The device, christened as CIFT-TED, is a simple single grid, hard TED design with top opening. It consists of an oval frame measuring 1000x800 mm and is constructed with 10 mm \varnothing stainless steel rod. Five vertical grid bars of 8 mm \varnothing stainless steel rod are welded to the inside of the oval frame. The spacing between the deflector bars is 142 mm and the maximum spacing between the frame and the adjacent deflector bar is 90 mm. The frame was fixed in the TED extension at 45° angle. The device could be fabricated and installed with minimum training using locally available workshop and net making skills, at a cost of about Rs. 4000 (equivalent to about USD 90).



Perspective view of CIFT-TED

Field trials with CIFT-TED along the east coast of India so far have shown a mean catch loss in the range of 0.52-0.97% for shrimp and 2.44-3.27% for non-shrimp resources, which is considerably less than the loss incurred during the operations with imported TED designs. The loss of finfish catch is expected to vary from zone to zone and from season to season, depending on the percentage representation of large finfishes and elasmobranchs in the trawl catch. As turtle exclusion in TED is dependent on a physical separation process based primarily on size differences, there is no way available to retain finfishes larger than that could be let in through deflector bar spacing. It is to be noted, however, that large species that are excluded due to installation of TED are not lost to the fishery as a whole, as they can be caught by other fishing techniques in vogue in the fishing area.

Studies conducted under a WII project during November 2001 – March 2002, off Gahirmatha, Paradip and Debi (Orissa) between 11 to 24 m depth have further substantiated the efficacy of the CIFT-TED in saving sea turtles with minimal catch loss (Gopi *et al.*, 2002). Results of 51 hauls showed 100% escapement of 21 sea turtles that entered the trawl, and catch loss ranging from 2.3 to 10.3%. Demonstrations conducted by SIFT, Kakinada, from commercial trawlers in 25–40 m depth have shown that the reduction in catch due to installation of TED is minimal. The percentage loss of catch of finfish and shellfish during the 15 demonstrations off Andhra Pradesh ranged from 0.5 to 3.6% (Sankar and Raju, 2003).

Demonstration and training on fabrication, installation and operation of the CIFT-TED

About 40 demonstration-cum-training programmes have been conducted and facilitated by CIFT on fabrication, installation and operation of the CIFT-TED, in collaboration with Marine Products Export Development Authority (MPEDA, Cochin), Departments of Fisheries, Department of Wildlife and NGOs in the maritime states of

West Bengal, Andhra Pradesh, Orissa, Tamil Nadu and Kerala, where turtle mortality occurs during trawling operations. Over 1300 stakeholders including mechanized boat owners and operators; net makers; representatives of Fisheries Departments, Forest Department, Fishermen Cooperatives, netting material manufacturing industries and NGOs, have been imparted training on fabrication, installation and operation of the CIFT-TED. Publications in English and vernacular languages (Telugu, Tamil and Malayalam) on fabrication, installation and operation of the CIFT-TED have been released for the benefit of fishermen and net makers (CIFT, 2003; CIFT, 2004a; CIFT, 2004b; CIFT, 2004c; CIFT, 2005). MPEDA,

Cochin has adopted the technology and distributed about 2900 CIFT-TEDs to trawler fishermen and operators in states affected by sea turtle mortality, viz., West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Kerala.

Challenges and prospects

Use of the TED among trawler fishermen has been constrained by a lack of incentive-disincentive scheme to facilitate its adoption. Though several maritime states such as West Bengal, Orissa, Andhra Pradesh and Kerala have TED regulations under the Marine Fisheries Regulation Acts, its implementation has not been sufficiently effective so far. This points to the need for a sufficiently attractive incentive scheme for encouraging the use of TEDs. This may take the form of better price realisation for the produce derived from TED-installed operations or TED-use linked subsidy scheme for fuel, as well as effective changes in the enforcement, preferably under a co-management regime, involving all concerned stakeholders.

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