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Adoption of square mesh codends for the trawl fishery: A success story along Sindhudurg coast, Maharashtra

Madhu V.R., [1]Vasudevan, N. and Leela Edwin

ICAR-Central Institute of Fisheries Technology, Cochin

[1]Office of the Additional Principal Chief Conservator of Forest and Mangrove, East Mumbai

With over 24,000 tonnes of fish catch, the Sindhudurg coast of Maharashtra is an important fishing ground along the Indian coast. Trawlers (314 Nos. in total) operating from three landing centres *viz.*, Vengurla, Malvan and Devgad, contribute to the bulk of the landings from this region (CMFRI, 2012). The trend of increasing the length of the vessels with concurrent increase in the engine power is not reported in this region. The L_{OA} of the trawlers ranged between 12-15 m and are fitted with 104 HP marine diesel engines. Though, there are no reports of bycatch generated by trawlers at Sindhudurg, Pramod (2010) reported that nine lakh tonnes of discards is generated along Maharashtra coast, which is 12 percent of weight of the total landings. A project funded by United National Development Programme (UNDP), catering to all aspects of the economy of Sindhudurg District was taken up by the Government of Maharashtra and was implemented by the Mangrove Cell of the Forest Department. As part of this project ICAR-CIFT was asked to take up a project to address the problem of high bycatch incidence in trawlers in the region.

The study started with an initial survey covering all the trawl landing centres of the region to collect details regarding the specifications of the most common gears used and other operational parameters in the trawl fishery. It was observed that the trawl nets of this region are smaller in size when compared to the dimensions of trawl nets used along the west coast of India (Saly N. Thomas *et al.*, 2015). The mesh size of the webbing used in the codend ranged from 15 to 25 mm. The composition of bycatch consisted of 70-75 % of juveniles of ribbonfish, sciaenids and squids (Fig. 1), depending on the season of operation. The highest bycatch was noticed during January (56 kg/ haul), followed

Fig. 1. Juveniles of commercially important species in the bycatch

by December with a catch rate of 43 kg/haul.

Apart from the monsoon ban that is religiously followed, no other technical measure was adopted in the fishery. Apart from the demonstration of the Juvenile Fish Excluder Cum Shrimp Sorting Device (JFE-SSD), no other bycatch reduction device was ever tried in this region and there were no reports on the selection properties of trawl codends from this region.

As a prelude to implementing the project, 14 awareness programmes were conducted for the fishermen and the officials from the Department of Fisheries, in which the different responsible fishing techniques developed by ICAR-CIFT were explained using audio-visual aids. Feedback data using structured questionnaires was collected, from the trainees. Many fishers who attended the programme raised their apprehension regarding the escape of commercial catches from the square mesh codend. Based on the feedbacks and the interaction with the fishers, it was finally decided to demonstrate the operation of Square Mesh Codends (SMC) and Semi-Pelagic Trawling System (SPTS) on-board the trawlers of fishers.The trials were conducted on-board three commercial fishing vessels off Malvan, Vengurla and Devgad fishing harbours.

To make the fishers visually aware of the escapement, a small mesh cover was woven over the square mesh codend, to collect the escapees from the codend. The cover also helped to collect the length-frequency and finally to derive the selectivity parameters of some commercially important species. The catches from the codend cover were kept separately and analyzed for its composition to convince the fishers regarding the damage to ecosystem, due to the use of small mesh in the codend.

A total of 38 comparative hauls of 95 hours each, using trawl nets installed with square and diamond mesh codends of 35 mm mesh size were carried out. The average CPUE recorded in the square mesh codend was 19.48 $kg.h^{-1}$ and trawls using diamond mesh had an average CPUE of 18.77 $kg.h^{-1}$. The length-frequency of the species caught in both the codends were also analyzed to show the better selectivity of square mesh codends. The mean lengths of 12 out of the 15 commercial species studied, were higher by a minimum of 7.8% in the square mesh codend compared to the length of the same species caught in diamond mesh (Fig. 2). The results of the study, convinced the fishers that there is no significant revenue loss occuring if square mesh codends are used.

The escapement from the square mesh codends was between 2.5 kg per hour, which was about 3.5 percent of the total catch in the codend. A total of 83.6 kg of juveniles were released by the square mesh codends during the study. The price of the bycatch was ₹ 15 per kilogram, and the value of excluded catch was about ₹ 22.5 per haul.

Arathy Ashok and Madhu (2017) carried out a study to understand the level of adoption of responsible fishing operations along Sindhudurg coast and results showed that 100 percent of the fishers interviewed were aware of the technology and about 40 percent of the fishers had already adopted the new technology. Since the technology involves natural resource conservation in which benefits are often not perceived directly, it is often recommended to have initial support mechanisms for adoption. Taking this into consideration, the UNDP-GEF project, followed by the Government of Maharashtra under the District Development Fund had supplied one square mesh codend each for the 314 trawlers operating along the coast. All the trawlers have since then started using square mesh codends during their operations.

Regular training programmes for conversion of diamond mesh to square mesh codends were imparted to the net makers and fishers in which 347 fishers were trained in 27 programmes. Based on the outcome of the study, the Government of Maharashtra vide its notification dated the 10th January, 2017, has amended the Maharashtra Marine Fisheries Act, 1981, directing that no trawl gear having less than 40 mm square

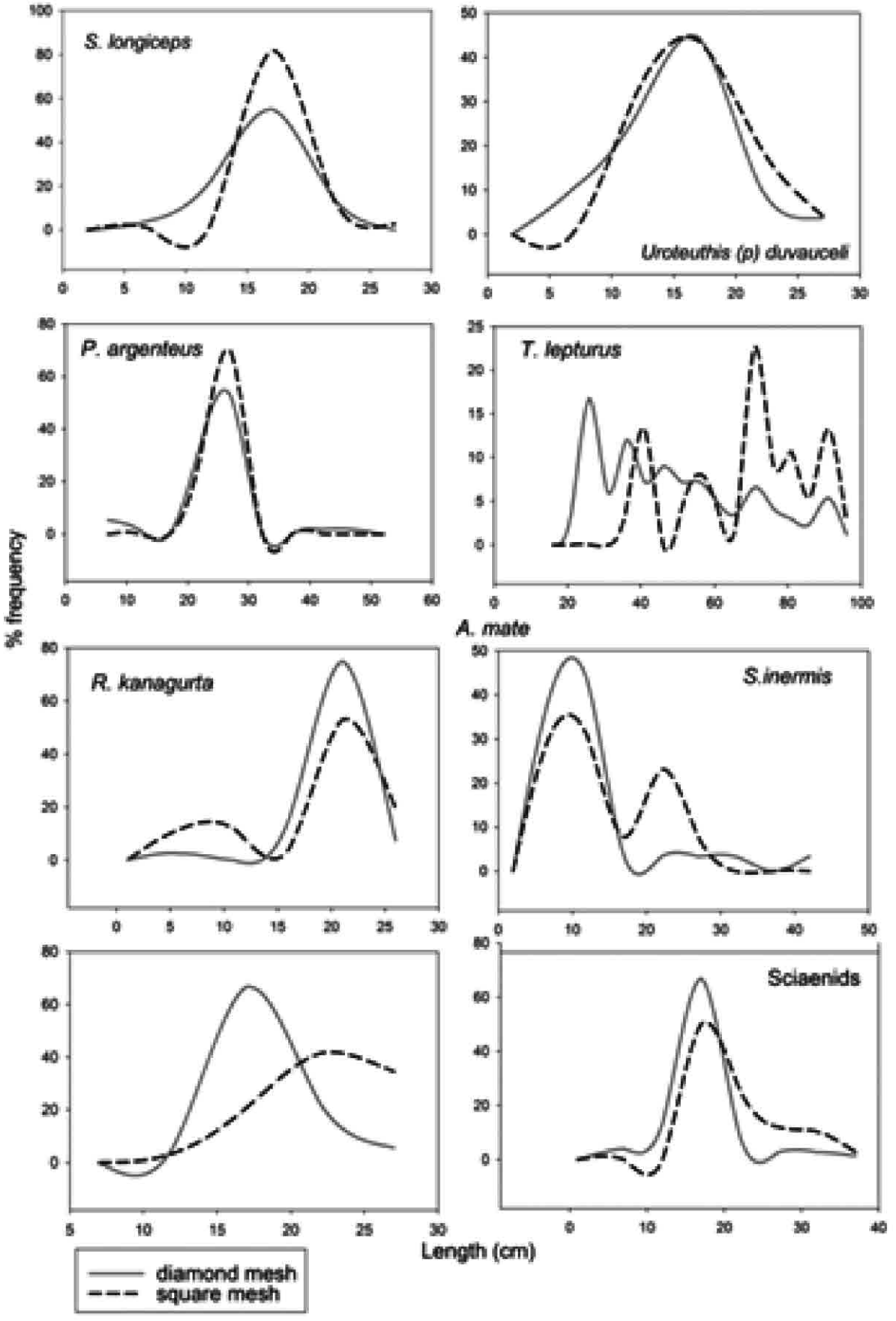

Fig. 2. Size frequency distribution of major species in the diamond and square mesh codends

mesh nets at codends shall be operated by any mechanized fishing vessel.The government of Maharashtra has decided to supply square mesh codends on a buy-back scheme to all the 5613 trawlers operating along Maharashtra coast.

The stipulated mesh size for the codend is 40 mm, which, when used during the shrimp season may lead to escapement of small quantities of shrimp. So optimization studies would be required to finalize the legal mesh size of codends for use during shrimp season.

This approach, for implementation of gear-based technical measure, was very successful, since it actively involved the Department of Fisheries, Department of Forests and support of the Fishermen Societies and can be taken as a model for implementation of Bycatch Reduction Devices elsewhere.

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Development of antioxidant packaging film using Rosemary Essentail Oil (REO) and chitosan

Mohan C.O., Remya S., Bindu J. and Ravishankar C.N.

ICAR-Central Institute of Fisheries Technology, Cochin

Active packaging is a type of packaging which changes the condition of the packed food to extend shelf-life or to improve safety or sensory properties, while maintaining the quality of packaged food. Typically, this refers to the incorporation of certain additives into the packaging systems with the aim of maintaining or extending product quality and shelf-life. Packaging can be termed active when it performs some desired role in food preservation other than providing an inert barrier to external conditions. Most important active packaging concepts include O_2 and ethylene scavenging, CO_2-scavengers and -emitters, moisture regulators, antimicrobial packaging concepts, antioxidant release, release or absorption of flavours and odours etc. Recently, with increasing health concerns of consumers, current packaging research is mainly focusing on the use of natural compounds such as chitosan, essential oil etc. either as edible coating or active agents in packaging material to preserve and prolong the shelf life of food. Among the essential oils, rosemary oil has proven antioxidant as well as antimicrobial properties