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Contents

Editorial Committee

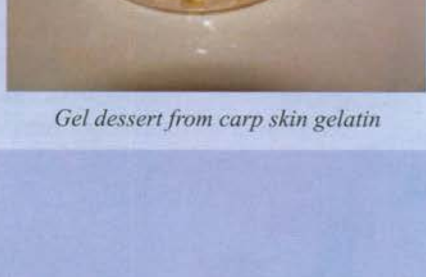
News from the Research Front

Production of Food Grade Gelatin From Fishery Waste

Gelatin is a gelling protein, which has widely been applied in the food and pharmaceutical industries. Commercial gelatins are mostly derived from mammalian sources, mainly pig skin and cow hide but for many socio-cultural reasons alternative sources are increasingly demanded. The amount of gelatin used in the Worldwide food industry is increasing. However, frequent occurrences of Bovine Spongiform Encephalopathy (BSE) and foot/mouth diseases limited the utility of mammalian gelatin in processing of functional foods, cosmetics and pharmaceutical products. Therefore, the studies on the suitability of alternative sources such as fish skin and bone for the extraction of gelatin have gained momentum in recent years.

Utilization of fish processing waste for the production of high value products like gelatin is an active area of research and has high commercial relevance. Considering the quantum of fish processing waste generated in India every year (which is about 50% of the total fish production), it is appropriate to find suitable solutions for fishery waste management and turn this waste in to high value resource. The aquaculture production in the country is estimated to be over 2.5 million tonnes and freshwater fin fish contributed almost 97% of the total freshwater aquaculture. Among the freshwater species Indian major carps contribute 85% of the total landings of freshwater fish in the country. The 12th plan gives priority to value addition in the inland fishery sector in India through network of organized fish processing and marketing units which are being established in the sector. Viable options

Gelatin from carp skin



Gel dessert from carp skin gelatin

केन्द्रीय मात्स्यिकी प्रौद्योगिकी संस्थान

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Juvenile Fish Excluder cum Shrimp Sorting Device for Responsible Trawling

The shrimp trawl is a non-selective gear that commonly has an associated catch of non-targeted organisms such as finfish and miscellaneous invertebrates generally known as bycatch. The importance of reducing bycatch and minimizing ecological impacts of fishing operations has been emphasized by scientists and fishery managers and recognized by fishermen. Trawl fisheries in different parts of the world are now being required to use bycatch reduction devices as a result of pressure from conservation groups and legal regimes introduced by the governments. The Code of Conduct for Responsible Fisheries (FAO, 1995), which gives guidelines for sustainable development of fisheries, stresses the need for developing selective fishing gears in order to conserve resources, protect non-targeted resources and endangered species. Pramod (2010) estimated the bycatch discards from mechanized trawlers operating in Indian EEZ as 1.2 million tonnes. Trawl bycatch in the tropics is known to be constituted by high proportion of juveniles and sub-adults, particularly of commercially important fishes, which needs serious attention in development and adoption of bycatch reduction technologies. Najmudeen and Sathiadhas (2008) have estimated the annual economic loss due to juvenile fishing made by trawlers, along Indian coast as US$ 15,686 million yr^{-1}.

Trawler fishermen in India and other tropical fishing nations depend on both finfish and shrimp catches to keep the commercial operations economically viable. The Juvenile Fish Excluder cum Shrimp Sorting Device (JFE-SSD) is an International Smart Gear Competition-2005 prize winning design (WWF, 2012) developed by CIFT, under an ICAR funded Ad-hoc Research Scheme titled "Bycatch reduction devices for selective shrimp trawling". The JFE-SSD brings down the bycatch of juveniles and small sized non-targeted species in commercial shrimp trawl and at the same time enables fishermen to harvest and retain large commercially valuable finfishes and shrimp species (CIFT, 2007; Boopendranath *et al.*, 2008; WWF, 2012). In addition, the fishermen would benefit economically from higher catch values due to improved catch quality, shorter sorting time, longer tow duration, higher catch and lower fuel costs.

Design, construction, installation and operation of JFE-SSD

Juvenile Fish Excluder cum Shrimp Sorting Device (JFE-SSD) replaces the conventional codend of the trawl net. Schematic diagram of JFE-SSD, design drawing of the grid and method of installation of JFE-SSD in the shrimp trawl, are given in Figure 1. The device consists of an oval grid made of stainless steel rods having bar spacing of 22 mm kept at 45° angle to the horizontal. The grid is provided with a 250 x 680 mm top opening which leads to an upper codend with large square meshes (60 mm). A funnel made of netting (20 mm mesh size) accelerates the flow of water and guides the catch components towards the lower side of the oval grid kept at 45° angle to the horizontal which separates the shrimp from the rest of the catch. Shrimps pass

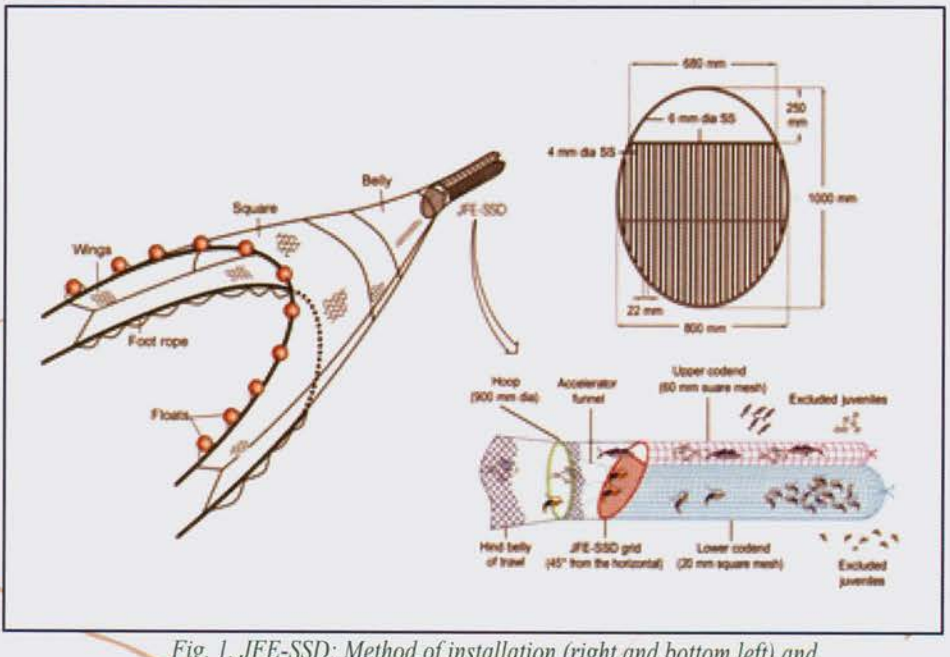

Fig. 1. JFE-SSD: Method of installation (right and bottom left) and design drawing of JFE-SSD grid (top left)

Fig. 2. Views of JFE-SSD under fabrication (upper left), ready for installation (lower left) and its operation (right)

Fig. 3. Views of catch from JFE-SSD operations: Upper codend (left), lower codend (middle) and excluded catch (right)

Fig. 4. Scenes from demonstration of JFE-SSD to stakeholders in Ratnagiri, Maharashtra, during April 2008

through the grid spacing and are retained in the lower codend made up of 20 mm square mesh netting. Juvenile shrimps escape through 20 mm size square meshes of the lower codend. The large fishes and cephalopods are deflected upwards to the 250 x 680 mm wide opening provided at the top of the grid and enter into the upper codend with large square meshes (60 mm). Juveniles of finfishes and cephalopods, and low value small sized finfishes, which have entered the upper codend escape through large square meshes in the upper codend.

Views of JFE-SSD under fabrication, JFE-SSD ready for installation and its operation are given in Figure 2 and views of catch from JFE-SSD operations are given in Figure 3. An Awareness cum Demonstration Campaign on Bycatch Reduction Device was conducted during April 2008 for the benefit of trawler fishermen at fishing villages in Ratnagiri, Maharashtra, India, by CIFT, Cochin, College of Fisheries, Ratnagiri and Cameron International (Mumbai), under a unique collaborative initiative focused on conservation of trawl caught resources and reduction on the negative impact of trawling on juveniles. Scenes from demonstration of JFE-SSD to stakeholders in Ratnagiri are given in Figure 4.

Fishing trials with JFE-SSD installed trawls, off southwest coast of India have indicated that the device has excellent juvenile bycatch reduction and pre-sorting capabilities. The JFE-SSD has the following advantages:

- Conventional codend in a shrimp trawl could be easily replaced by JFE-SSD without any alteration in the net design.
- The device reduces the bycatch of juveniles of finfishes, shrimps, crabs and cephalopods, and small sized fishes of low commercial value, contributing to sustainability of the resources and protection of biodiversity.
- The fishermen are able to retain large fishes of higher market value, which will enhance the overall revenue realized from trawling operations.
- The *in situ* sorting effect and separation of shrimps from finfishes and cephalopods help to reduce the sorting time and increase useful fishing time of the trawler fishermen and thus enhance the profitability of fishing operations.
- Increase in towing time can be expected due to slow filling of the codend as a result of reduction of non target fishes and juveniles.
- It is possible to adapt JFE-SSD to retain the shrimp catch and efficiently exclude jellyfish when they abound in the shrimp fishing grounds, by keeping the upper codend of the device open.
- Training requirements by fishers for fabrication, installation and operation of JFE-SSD is minimal.

Bycatch exclusion, shrimp retention and sorting effect of JFE-SSD

JFE-SSD operations off southwest coast of India have realized bycatch reduction up to 42.9% with shrimp retention of about 95%. Out of a total retained catch (in the lower and upper codends), about 77% was retained in the lower codend and the balance in the upper codend. Of the retained catch of non-shrimp resources, about 70% was retained in the lower codend and nearly 30% in upper codend. The sorting effect was most pronounced in the shrimp species. Out of the retained shrimp catch, nearly 99% was retained in the lower codend (Boopendranath *et al.*, 2008) (Fig. 5).

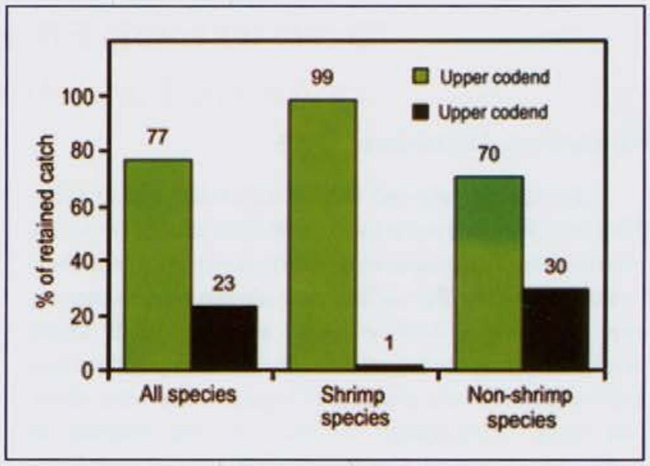

Fig. 5. In situ sorting effect on species groups due to installation of JFE-SSD

Conclusion

The International Smart Gear (WWF) award winning design of JFE-SSD combines the unique capabilities of excluding juveniles and small sized non-targeted species caught in commercial shrimp trawl, retaining large commercially valuable finfishes and shrimp species with an integrated *in situ* shrimp sorting mechanism, and has high potential for adoption among trawler fishermen in Indian and other tropical shrimp fisheries. It is also possible to adapt JFE-SSD to retain the shrimp catch and efficiently exclude jellyfish when they abound in the shrimp fishing grounds and thus reduce the sorting time onboard.

Training requirements by fishers for fabrication, installation and operation of JFE-SSD is minimal. A National Plan of Action for bycatch reduction in fishing gears, particularly targeting trawling sector, is needed for Indian fisheries.

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Thermochromic Effect of Gold Nano Rods: An Atomic Force Microscopic Evaluation

Atomic Force Microscope (AFM)

Binning, Quate and Gerber invented AFM in 1986. The basic principle is the measurement of changes in forces between the nanometer-sized sharp probe tip (cantilever) positioned above the surface and sample while scanning over the sample surface. Short or long range forces dominate during the interaction between the tip and surface and it depends on the distance of separation between them. The force measurement is based on the bending of cantilever by an optical lever technique, where a laser beam is focused on the backside of the cantilever and its reflection is monitored through a photodetector. Smaller the deflection, smaller the force and as the force increases, the deflection also increases. Map of surface topography and other properties of the surface can be generated by raster scanning the tip across the surface and change in force as a function of position. Major advantages of AFM is that it can be used for getting a three dimensional topographical information of conducting and insulating structures with lateral resolution of 1.5 nm and vertical resolution 0.05 nm or even lower. Pyramidal or needle shaped silicon (Si) or silicon nitride (Si_3N_4) are the two main tips used in AFM and in recent years large number of advanced tips are available. The method helps to image sample with minimal preparation. Images of biological samples like DNA, proteins, cells, clusters of atoms and molecules can be generated by using AFM. It is also used to measure the physical properties of materials including elasticity, adhesion, hardness, friction and chemical functionality. There are four modes of operation *viz.* contact, non-contact, lateral force and tapping mode.

Mode of Operation	Force of Interaction
1. Contact mode strong (repulsive)	Constant force or constant distance
2. Non-contact mode weak (attractive)	Vibrating probe
3. Tapping mode strong (repulsive)	Vibrating probe
4. Lateral force mode	Frictional forces exert a torque on the scanning cantilever

Recently Fishing Technology Division of CIFT has procured Park Systems XE100 AFM.