

# Central Institute of Fisheries Technology- In the Service of the Fisheries Sector

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The Central Institute of Fisheries Technology (CIFT) was established in 1957 as a National Institute dedicated to development, refinement and transfer of harvest and post harvest technologies in the fisheries sector. It continues to remain the only technology Institute in India which caters to the entire spectrum of fisheries from harvest to post-harvest operations including harvesting systems, quality assurance, post-harvest handling, preservation, processing and product development, waste utilisation, value addition, packaging and transportation. It has its headquarters in Cochin and research centres function in Veraval in Gujarat, Visakhapatnam in Andhra Pradesh, Mumbai in Maharashtra and Burla in Orissa for solving regional and location specific technological issues in fisheries development. CIFT has had close relations with the fishing and fish processing industries right from its inception.

## **Achievements in the harvest sector**

One of the major areas of research of the Institute is in the fish harvest sector with projects focused on design and development of crafts and gear for marine and inland water systems. Special emphasis has been laid on identification of substitutes for expensive and scarce wood used for construction of boats, fuel saving devices for operation of fishing vessels, eco-friendly technologies for responsible fishing and low-energy fishing technologies for traditional sector.

CIFT also supports the fishing industry by providing the standards for netting, netting yarn and

netting twine used for fishing and standardization of fishing gear accessories.

## ***Modernization of Indian fishing fleet***

Central Institute of Fisheries Technology has contributed to the modernisation of Indian fisheries in a very significant way. CIFT has developed and popularized 12 standard designs of fishing vessels in the size range 7.67-15.24 m, suitable for various types of fishing under the Indian conditions and appropriate gear systems for trawling, seining, gillnetting, lining and trapping. Almost 80% of the nearly 59000 mechanized crafts constituting the small-scale mechanised fleet of India are largely based on 12 standard designs developed by CIFT.

## ***Fuel efficient fishing vessels***

In view of high expenditure incurred in mechanised fishing operations, CIFT has taken initiative to develop fuel efficient fishing vessels. A 15.5 m multi-purpose deep sea fishing vessel



*Fuel-efficient fishing vessel - Sagarkripa*

Sagarkripa with steel hull was designed and developed with energy saving features. These include optimized hull design, optimized installed engine power, fuel efficient propeller and propeller nozzle. The commercial trials by the fishing boat operators have realized about 17% savings in the fuel cost.

***Low-cost and durable substitutes for conventional craft materials***

Traditionally, wood is used for construction of fishing vessels in India which has become scarce and costlier. Focused attention has been given in identifying alternate materials for fishing vessel construction, in order to reduce the dependence on traditional scarce wood species. Cheaper and readily available cultivated wood species with short life cycle such as rubber wood (*Hevea brasiliensis*), fortified with dual preservative treatment using 7.5% Chromated Copper Arsenate (CCA) and creosote, has been identified for construction of canoes operated in backwater and coastal fisheries. A number of preservative treated rubber wood canoes have been distributed for field operations by fishermen groups and cooperatives. The cost of the canoe is 35 – 40% less than a canoe of same size built of ‘anjili’, the usually used wood. This saves the depleting forest wealth, helps the rubber farmer to get a better price for his under utilized wood and gives a durable, maintenance free boat at affordable cost to the poor fisherman especially of the South West and North East where rubber trees are grown.

Designs of fiberglass crafts have been developed for operation in inland waters. Fibreglass sheathing as protection against borer attack and biodeterioration and as preventive against environmental pollution while using preservative



*FRP vessels for inland fishing*

treated wood in boat construction has been popularized, in traditional sector. Use of Aluminium alloy for construction of inland and coastal fishing craft has been demonstrated. A 5.2 m L<sub>OA</sub> aluminium alloy boat has been constructed and put to operation in Malampuzha reservoir. Durability, light weight, corrosion resistance, toughness and resilience, low maintenance and high re-sale value make aluminum alloy a good material for construction of fishing craft.

***Protection of fishing vessels***

The deterioration of crafts as a result of exposure to environmental factors is a major problem faced by fishermen. To mitigate this CIET has developed anti-fouling paint formulations as well as FRP sheathing technologies. Ternary aluminium sacrificial anodes were developed for corrosion of protection of aluminum sheathed vessels. The Institute is also working on the application of nano-technology in corrosion protection of aluminium.

***Energy saving concepts in trawling***

Trawling is an active fishing method in which a bag shaped fishing gear is towed from mechanized fishing vessel. It is known to be one of the most energy intensive fishing methods. In excess of 60% of the total trawl resistance is known to be contributed by netting alone. Fuel consumption during trawling is directly related to the drag of the gear system. Substitution of large meshes in the front trawl sections has been reported to reduce the drag of the trawl system by about 7% and hence reduces fuel consumption in trawling. The reduced drag permits greater trawling speed and/or operation of larger trawl with the available installed engine power. Large mesh demersal trawls, have been extensively adopted by mechanized fishermen of north-west coast, Mangalore and Kerala, for resources like ribbonfish, squid, horse mackerel, mackerel and pomfrets, due to its low drag and fuel efficiency.

Otter boards are known to contribute 20-25 % of the total drag of the trawl system. Introducing camber in otter board design is known to reduce resistance

of the boards considerably, by increasing the hydrodynamic efficiency of the boards. CIFT has introduced high aspect ratio, cambered otter boards for semi-pelagic trawling. Introduction of camber in otter boards reduces the drag of the trawl system by 4% with accompanying savings in fuel. This technology is expected to be adopted when the concept of semipelagic trawling become popular among trawler fishermen. The V-form otter boards are hydrodynamically efficient and have very inherent stability. It is made of steel and do not utilize wood in their constructions. These boards do not plough or dig into the bottom and will tide over smaller bottom obstacles, thus becoming suitable for trawling in uneven and rocky grounds. V-form boards are cheaper and safe in shooting and hauling if properly rigged with a longer service life of 5-6 years. V-form type otter boards have become popular among trawler fishermen of southern India and Gujarat, since its introduction.

#### ***Harvest technologies for responsible fishing***

Demersal trawls are generally non-selective and a large number of non-target species and juveniles are landed during trawling, in addition to its impact on benthic communities. Resource specific trawls for semi-pelagic resources have comparatively low impact on the benthic biota. CIFT Semi-pelagic Trawl System (CIFT SPTS-I) has been developed as an alternative to shrimp trawling in the small-scale mechanized trawler sector, after extensive field-testing. The system consists of an 18 m four panel semi-pelagic trawl with double bridles, front weights and vertically cambered high aspect ratio otter boards of 85 kg each. It is capable of attaining catch rates beyond 200 kg.h<sup>-1</sup> in moderately productive grounds and selectively harvest fast swimming demersal and semi-pelagic finfishes and cephalopods, which are mostly beyond the reach of conventional bottom trawls, currently used in commercial trawl fisheries in India. Press releases have been on the advantages of the technology.

#### ***Bycatch Reduction Devices***

Among the different types of fishing, trawling accounts for the highest rate of bycatch along with the target species. Almost 70-90% of the trawl catch is bycatch, among which, about 40% is constituted by juveniles that are invariably discarded resulting in two serious consequences- depletion of the resources and pollution of the marine water and the consequential threat to the ecosystem. Further, higher the quantum of bycatch the less will be the economic benefit accruing from the fishing operation. Bycatch is unavoidable in any fishing operation; only its quantities vary according to the type of the gear and its operation. Therefore, one of the important research focuses of the Fishing Technology Division was development of bycatch reduction devices.

Bycatch reduction device (BRD) is a device aimed at reducing the catch of non-targeted and unwanted species of fish in shrimp trawling. While BRD is a broad term used to describe any device that can be employed to eliminate or reduce the bycatch, turtle excluder device (TED), though in principle a BRD, is a specialized form of BRD designed to eliminate turtles, sharks and rays also from the trawl. These devices have been designed and developed taking into consideration the differential size and behavior pattern of shrimp and fish inside the net. BRDs include Fish Eye which is stainless steel escape chute attached in the codend for the escape of actively



*JFE-SSD ready for installation in trawl net*

swimming finfishes and rigid grid devices; and soft BRDs such as square mesh windows, Radial Escapement Device, Big eye, Sieve net and International Award winning design Juvenile Excluder cum Shrimp Sorting Device (JFE-SSD) are being evaluated for use in Indian waters.

#### ***Turtle Excluder Device***

Sea turtles are endangered species. Various protection measures have been adopted the world over for its protection. In India, they are declared protected under the Indian Wildlife Protection Act. The importance which the world community gives to the protection of marine turtles can be gauged from the fact that the USA allows import of marine shrimp only if the consignments are accompanied with a certificate from the designated competent authority to the effect that the shrimp is caught in trawls provided with a turtle excluder device. Incidental catches of turtles have been reported in the trawl landings of India particularly from West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and southern parts of Kerala. CIFT has developed an indigenous design of the turtle excluder device which is appropriate for the Indian conditions. CIFT-TED is a single grid hard TED with top opening of 1000x800 mm grid size for use by small and medium mechanized trawlers operating in Indian waters. In the TED developed by CIFT, great care has been taken to ensure 100% escapement of the turtles while escapement of fish and shrimp at the minimum possible level. 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. Demonstration cum training on Fabrication, installation, Operation and Maintenance of CIFT-TED were conducted at several centres in West Bengal, Orissa, Andhra Pradesh and Kerala, in collaboration with MPEDA, Department of Fisheries, Department of Wildlife and NGOs.

#### ***Low energy and eco-friendly harvest technologies for the traditional sector***

Improved and durable lobster traps with escape window for juveniles have been developed as substitute for traditional traps of short life span and low efficiency, for harvesting of spiny lobster. Design features: 700x550x400 mm size; mild steel rod frame mounted with 25 mm square welded mesh, plastic coated for corrosion protection. 120 modern lobster traps made of durable material and escape gaps to effect escapement of juvenile lobsters were got fabricated and distributed to fishermen at Kadiyapatnam (Tamil Nadu), as part of a MPEDA funded project on conservation of lobster resources along the south west coast of India, in collaboration with CMFRI.

The rich tuna resources of the Lakshadweep waters are under-exploited as the fishing operations are still limited to traditional pole and line method. CIFT has introduced large mesh gill nets and monolines (monofilament long lines) in Lakshadweep waters, for targeted fishing of tunas, billfishes, seerfishes, carangids and perches, in an effort to diversify fishing methods and improve catching efficiency. During experimental drift gill netting operations, catch rates up to 198 kg per 1000 m<sup>2</sup> was obtained for large mesh gill nets.



*Modern lobster traps*

### ***Popularization of advanced technology in fisheries***

In association with Space Application Centre (SAC) Ahmedabad, ocean colour as indicators of potential fishing zones, based on IRS P4 OCM Chlorophyll imageries and sea-truth data collected from fishing vessels, operated off of Munambam (Kerala) and Veraval (Gujarat). Better catch of hairtails off Diu and bullseye (*Priacanthus* sp.), off Dwaraka could be correlated with chlorophyll gradients.

Recent advances in technology have provided fishermen with equipment to reach the potential fishing ground accurately (Global Positioning Systems), detect the presence of fish acoustically (echosounder and sonar), thus saving the search time and fishing time and hence saving energy. These advances in technology have been popularized among fishermen, in collaboration with agencies like MPEDA and Department of Fisheries, for bringing down fuel use and environmental impact through fuel use. This, coupled with affordability and subsidy support, has resulted in significant penetration of GPS and Echosounder among small mechanized commercial fishermen, all along the coast.

### ***Achievements in the post harvest sector***

In the post harvest sector, the Institute lays stress on complete utilization of resources and includes in its ambit handling and preservation right from harvesting, value addition, waste management and quality assurance. CIFT had supported the nascent fish processing industry of the country by developing technologies for preservation and processing of almost all commercially important varieties of fish like shrimp, squid, cuttlefish, lobster tails, pomfrets, mackerel, sardines, crab, clam, mussel, oyster and other seafood.

### ***Water usage and effluent treatment in seafood processing***

Processing of every kg of fish requires 10 litres of water and 1 kg of ice, in addition to water required

for general cleaning. Economy in water usage and energy-efficient effluent treatment in seafood processing is highly essential for optimized processing operations. Self closing taps and proper cleaning schedule can reduce the usage of water up to 20%. The Effluent Treatment Plant (ETP) designed by CIFT saves energy in excess of 50% which is ideal for seafood processing units.

### ***Practices for minimization of waste***

About 1% raw material can be saved through prevention of wastage during washing, cleaning and pre-processing. Saving of about 1% processed frozen fish is possible through minimization of extra weight added to compensate for weight loss by better production management.

### ***Quality assurance and food safety***

Quality assurance and food safety in seafood processing are areas where CIFT has imparted significant contributions to the seafood industry. Implementation of HACCP in fish processing units and adoption of cold chain in seafood trade can ensure quality and safety, thereby minimizing wastage. CIFT conducts regular training programmes for professionals from different sectors of food industry in HACCP and quality control.

### ***Value added fish products, specialty products and byproducts***

Development and standardization of value added products from seafood is a priority area of CIFT. Value added fish products and specialty products include coated products, frozen products, cured products, pickles and ready to serve products. surimi and surimi based products are another important area of value addition of low value fish. The Institute has developed value added products from both marine and fresh water fish and conducted extensive studies on their storage and shelf life under different conditions. Technologies for the production of fishery by products like fish meal, fish body oil and fish liver oil, fish silage, fish protein concentrate, fish



*Fish Fingers*



*Coated shrimp products*

hydrolysate, fish maws and isinglass, shark products and seaweed products developed by CIFT has been transferred to the industry. Technology for the production of chitin, chitosan and Glucosamine hydrochloride developed by the Institute is an important milestone in the commercial utilization of shrimp shell waste.

#### ***Utilization of small sized low value fish and fish processing waste***

Small lean fish with white flesh can be utilized for mince and surimi production. Waste generated from fish processing plants has been a major problem of the seafood industry and CIFT has ensured that its commitment to the environment is reflected in the management and utilisation of seafood processing waste. The motto of CIFT has been 'development sans degradation' and the efforts of the Institute have

resulted in the development of several useful and valuable products from seafood processing waste. Fish processing waste can be transformed to silage for making products like animal feed and pet feed. Fish bones are a good source of Calcium and Phosphorous. De-proteinised and sterilized fish bone powder can be used as nutraceuticals.

#### ***Fish based convenience products***

Convenience products are fast gaining popularity in the country with increasing urbanization and more number of working women. Ready-to-cook and ready-to-eat products from fish and shell fish will thus be of great demand in the future and CIFT has developed many such products. Besides fish curries in retort pouches having long shelf life, battered and breaded product, mince based products, extruded products and analogue products have been standardized and transferred to the industry. Products are today available in the domestic and international market which has been produced by firms under technical consultancy from CIFT.

Canning is another popular form of preservation the world over and the industry is now picking up again after a slump in India. CIFT has been working on preservation of ready-to-eat products in tin free steel cans and this can be popularized as an economically viable alternative to the costly tin cans.

Packaging is an important aspect in product development and marketing. The Institute is involved



*Fish based ready-to-serve convenience products from*

in the development of suitable packaging technologies for different fish products. Different types of packaging materials used in seafood processing such as polyethylene (PE), polypropylene (PP), polyester (PES), polyamide (PA), polystyrene (PS) and their laminates have been standardized according to product and process requirements.

### ***Fish processing equipment***

In the area of processing equipment, energy efficient driers have been developed which use both conventional as well as non-conventional energy sources. Equipment such as fish fryers moulds for analogue products and meat bone separator have also been developed.

### ***Sensors and measurement systems for fisheries and environmental applications***

Various electronic instruments and sensors that have application in the field of fisheries, aquaculture and agriculture have been developed. These include environmental data acquisition systems, automatic weather stations, solar radiation measuring systems, sensors systems with applications in fishing and fish processing technology.

### ***Fish based products of biomedical significance***

CIFT's work also had an impact on the biomedical applications of products developed from fish. These include the surgical sutures from fish gut which can be a substitute to the imported sutures. The collagen-chitin film has been tested for covering wounds and burns and in guided tissue regeneration

in dentistry. Squalene a hydrocarbon found in liver oil of some deep sea sharks has been isolated and the technology has been commercialized. PUFA (poly unsaturated fatty acid) from fish oil has therapeutic value as they lower cholesterol and the technology for extraction and purification of PUFA has been perfected.

### ***Support to the seafood industry***

The Institute plays a vital role in development and implementation of quality and food safety standards in the fishing and fish processing industry. Its efforts are also directed towards development of rapid methods for assessing microbial hazards. The institute is responsible for development and implementation of HACCP in the seafood value chain including HACCP software.

The cleaning schedules for processing industry and chloritest paper for detection of chlorine levels in process water have been developed for the industry. Besides these the Institute has helped the aquaculture industry by developing methods for detection of white spot disease, caused by White Spot Disease Bacculo virus (WSBV) and a Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) technique was developed for detection of yellow-head virus. Various rapid methods for detection of pathogens have also been developed which can benefit the seafood industry. A simple effluent treatment system with standards meeting that of the Pollution Control Board was designed and has been successfully transferred to the industry.

**The Institute has been recognized as a Referral Lab for testing toxic residues in fish and fishery products for both export and import items. The Government of India nominated scientists of CIFT as members of the Inter Departmental Panel (IDP) and Supervisory Audit Team (SAT) constituted for preliminary inspection and final approval of fish processing plants and fishing vessel for export to European Union countries as per international norms**