20. CIFT TECHNOLOGIES FOR SUSTAINABLE FISHING

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Introduction

Fishing Technology division of ICAR- Central Institute of Fisheries Technology aimed at conducting research in the fields of fishing craft and gear materials, fishing gear technology, materials protection and pollution in coastal aquaculture environment, upgrade and maintain expertise within these fields and to disseminate proven technologies and expertise through publications, training and consultancy. The Fishing Technology Division strives to address the following major issues facing the fishing industry today:

- Development of boat designs for different fishery
- Long-term sustainability of the fishery resources
- Protection of biodiversity
- Environmental safety
- Energy conservation in fish harvesting
- Fishery legislation
- By-catch, discards and protection of endangered species
- Fishery enhancement

The Division activities are geared to promote the use and development of fishing gear and practices in accordance with the guidelines in the Code of Conduct for Responsible Fisheries, focusing on the following:

- Selective fishing gear and practices
- Bycatch reduction technologies
- Environment-friendly fish harvesting systems
- Energy conservation in fish harvesting systems
- Enhancement of resources and restoration of fishing grounds

This chapter document about technologies that are released by Fishing Technology Division of ICAR-CIFT. The details about the technology is discussed.

1. F.V. Sagar Harita

Fig 1. F.V. Sagar Harita

- The FV Sagar Harita, a 19.75m long fuel efficient multipurpose fishing vessel designed by Fishing Technology Division of CIFT and built by Goa Shipyard Limited (GSL).
- The vessel has met all the requirements of the Indian register of shipping (IRS) and CIFT.
- This new generation energy efficient green fishing vessel is fitted with the latest technology solar panels, aiming to promote green energy and reduce the carbon foot prints. The solar panels fitted on the vessel cater to the energy requirement for navigational lights, cabin lights etc.
- The vessel also incorporates an optimized hull design with a bulbous bow, fuel efficient propeller design and improved sea keeping characteristics.
- Modern tools and techniques including software simulation and model testing have been used for the refinement of the design. The ship's super structure above deck level has been made from FRP using the latest 'resin infusion technology' thereby significantly enhancing the sea keeping performance.
- FV Sagar Harita, conducts trawling, longlining and gillnetting and has an array of novel features.
- The hull is made of marine grade steel and the cabin and wheel house is made of FRP to reduce weight, improve the carrying capacity and speed (Fig 1).
- The main engine power is 400hp which is 20% lower than comparable size vessel. The fishing gear handling equipment such as split trawl winch, long line hauler, setter and gillnet hauler operated by hydraulic power are installed onboard.

- Two RSW tanks (0^0 C to -1^0C) of 1 ton each capacity. 400 watt solar power panel, acoustic Trawl telemetry system with under water sensor, bilge keel, bulbous bow, Kort nozzle propeller, fuel monitoring system are other fuel saving features of the vessel.

2. SAGARKRIPA: A milestone in fishing vessel design and development

Fig 2. SAGARKRIPA

Description of Fishing Vessel Sagar Kripa are:

Year of construction: 1999	Draft (max): 1.50 m	Endurance: 7 days
Length Overall: 15.50 m	Tonnage (GRT): 42	Engine horsepower: 125hp @ 2000 rpm
Breadth (max): 4.60 m	Trawling speed: 4 knots	Insulated fish holds: 30 m3
Depth: 2.30 m	Free running speed: 9.5 knots	Accommodation: 6 crew

- Profitability is the major issue in fishing, particularly in the small-scale sector. Fuel accounts for about 70% of the operational cost of fishing vessels. Design of the vessel and about 50% of the fuel being used in the shipping industry in the country is consumed by the fishing industry.
- The hydrodynamics of the fishing vessel is the critical factor determining fishing efficiency. The Institute has developed different designs and 35,000 fishing vessels operating in the Indian waters follow CIFT design.
- Sagarkripa, a medium class fishing vessel is an improvement over the vessels developed so far, by the Institute. With the help of the Computer-aided Design (CAD) facility at the Institute, Shri M. Nassar, Senior Scientist and his team developed a design with a

narrower hull and an asymmetric nozzle propeller system which evolved into Sagarkripa setting a milestone in fisheries R&D (Fig 2).

- The vessel which was developed under the ICAR ad-hoc project was launched in September, 1999. The commercial trials by the fishing boat operators have realized the expected outcome, that is, about 17 % savings in the fuel cost.

3. Collapsible Fish Trap

Fig 3. Collapsible Fish Trap

- Two different designs of innovative collapsible fish trap with dimensions of 1 m ×0.6 m ×0.6m &1.5 m x 0.8 m for fishing along the backwaters of Kerala was developed and tested in the field.
- HDPE webbing of 80mm mesh size rigged with iron bar as frame was used and two funnels measuring 35cm Ø were attached both the sides to allow fish to enter.
- These traps were supplied to local fishermen and experimental trials were conducted along backwaters of Vypeen Island. The traps were operated at depths ranging from 1.5-2m and retrieved after a soak time of 16-18h. The catch efficiency for the trap derived as 3crabs/operation and 6fish/operation in terms of number and 1.05kg 1.02 kg respectively for crab and fish in terms of weight (Fig 3).

4. Myctophid trawls (45m and 28.4 m)

Fig 4. Myctophid trawls (45m and 28.4m)

- Two new myctophid trawls (45m and 28.4m) with four equal panels were designed and two prototype trawls were fabricated, for experimental operations from FORV Sagar Sampda.
- The total weight of the four equal panel 45 m myctophid trawl net, excluding buoyancy elements has been estimated as832 kg. The twine surface area (TSA) of the myctophid trawl, which predominantly determines the trawl drag, has been estimated as 412 m^2. Estimated trawl drag in terms of towing speeds of 2 to 3kn range from 4.9 to 7.3 t.
- The new mid-water trawl system designed to attain larger mouth area, smoothly tapering trawl body with small meshes in belly and codend, which can be towed at about 2.5kn is adjudged to be appropriate, taking into consideration available information on biological characteristics and behavior of myctophids, fishing conditions and vessel characteristics.
- The gear will be rigged with 40 floats of 270 mm dia along the headline and about 100 kg of iron link chain along the foot rope. Double sweeps of 98 m, 350kg bunched chain depressors and 5 m 2 Suberkrub otter boards will be used for the operations (Fig 4).

5. CIFT Turtle Excluder Device (TED)

Fig 5. CIFT Turtle Excluder Device (TED)

- Turtle Excluder Devices (TEDs) are recognized internationally as a convenient and effective measure for protecting sea turtles from trawling-related mortality.
- An indigenous design of TED developed at Central Institute of Fisheries Technology, after extensive field trials off southwest coast and east coast, with focus on reducing catch losses, which is a cause of concern for trawler fishermen in adopting the device.

- Field trials with CIFT-TED, so far, has 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 fin fishes and elasmobranchs in the trawl catch.
- However, the 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 (Fig 5).

6. CIFT Semi-Pelagic Trawl System

Fig 6. CIFT Semi-Pelagic Trawl System

- Trawler fishermen in India cannot depend on shrimp and associated species alone for viable commercial operations any more, and there is need to adopt responsible alternate trawl systems for harvesting large demersal and semi-pelagic species.
- CIFT semi-pelagic trawl system, christened as CIFT SPTS was developed as an alternative to shrimp trawling in the small-scale mechanized trawler sector, after extensive field-testing.
- It is capable of attaining catch rates beyond 200kg/hr in moderately productive grounds and selectively harvest fast swimming demersal and semi-pelagic finfishes and cephalopods, which are generally beyond the reach of conventional bottom trawls, currently used in commercial trawl fisheries in India.
- CIFT SPTS has been developed and perfected after extensive field trials and observations, using acoustic gear monitoring instrumentation and inference from statistical evaluation of catch, over an extended period (Fig 6).

7. Large Mesh Purse Seine

Fig 7. Large Mesh Purse Seine

- Purse seining is one of the most efficient and advanced commercial fishing methods. It is aimed mainly at catching dense, mobile school of pelagic fish and includes all elements of searching, hunting and capture.
- Purse seine nets was using mesh sizes ranging from 10 to 22 mm in the main body of the netting and was mainly for targeting anchovies, sardines and mackerels in the coastal waters. With the objective of targeting the under exploited large pelagic fishes in deeper waters, a purse seine net was designed with large mesh size (45 mm),so as to reduce fishing pressure in the coastal waters (Fig 7).
- Introduction of large mesh purse seines facilitated by CIFT has led to the revival of small mechanized purse seine fishery in Kerala. The traditional fishermen and the purse seiners were targeting small pelagic like anchovies, sardines and small mackerels in the costal waters.The purse seiners were also targeting the same resource in the coastal waters.
- There was severe competition and rifts between the tradition and mechanized purse seiners. With the introduction of large mesh purse seine, the fishermen could go to deeper and farther waters targeting large pelagic like tunas, seer fish, pomfrets and large mackerels thus reducing the competition and fishing pressure in the coastal waters.

8. Treated Rubber Wood Canoe

Fig 8. Treated Rubber Wood Canoe

- Central Institute of Fisheries Technology has evolved a simple technology for development of traditional fishing canoe from the rubber wood, which comes as a waste from rubber plantations (Fig 8).
- Though rubber wood is comparable to many structural timbers in terms of mechanical properties and working qualities, it is highly perishable under marine conditions. The study proved rubber wood as suitable for construction of canoe after upgrading by chemical preservative treatment. The conventional prime quality boat building timbers are very scarce and have become very costly.
- Traditional fishermen using wooden canoe find it extremely difficult to afford the cost. The new technology can reduce construction cost of small canoes by 35-40%.

9. FRP-Coated Rubber Wood Canoe

Fig 9. FRP-Coated Rubber Wood Canoe

- Central Institute of Fisheries Technology has developed a fibre glass reinforced plastic (FRP) coated rubber wood canoe for operation in marine and inland waters (Fig 9).
- The rubber wood, which comes as a waste from rubber plantations is upgraded through chemical preservative treatment and the canoe made using the treated wood is further given a sheathing of FRP.
- The technology has made possible the utilization of rubber wood and also provided additional dimensional stability through sheathing.
- The FRP sheathing provides water proofing, reduces maintenance, resistance to impact and abrasion and prevents attack of marine borers and other decay causing organisms besides giving an extended service life and better appearance for the wooden canoe.

- Canoe made of treated rubber wood and sheathed with FRP will give a maintenance free service life of 15-20 years.

10. CIFT Sun boat

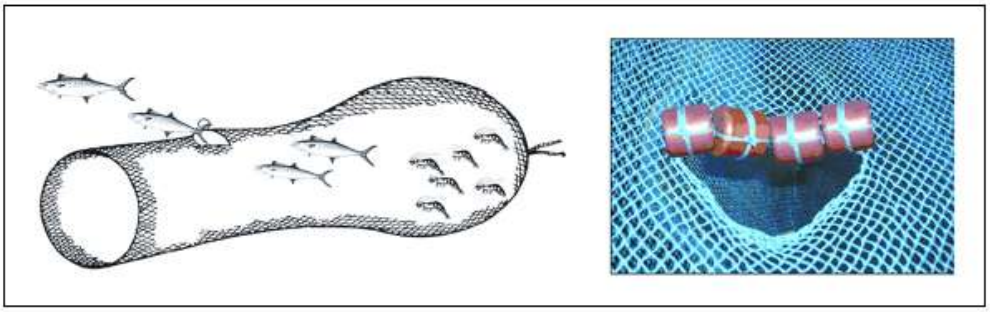
Fig 10 CIFT Sun Boat

- The Central Institute of Fisheries Technology (CIFT), Cochin has developed a solar powered boat which can be operated in reservoirs, small rivers, and aquaculture ponds. This boat also can be used for recreational fishing activities (Fig 10).
- The boat is capable of running for 2.5 to 3.0 hours after complete charging and attains a speed of nearly 4.0 knots in calm water. Considering the 240 days of fishing in a year the fuel saved compared to an equivalent diesel powered boat is Rs. 48,000/=.
- According to studies, one percent of the total fuel consumed in India, is utilized in fishing industry. The exhaust gas produced from the burning of fuel pollutes the atmosphere and leads to global warming.
- This boat runs without any fuel cost and pollution. It has clean FRP surface with wider space and low rolling during fishing and a canopy for protection from rain and sun. The boat has navigational lights which facilitate fishing in early morning and also in the night. The traditional small fishing boats are not fitted with navigational lights.

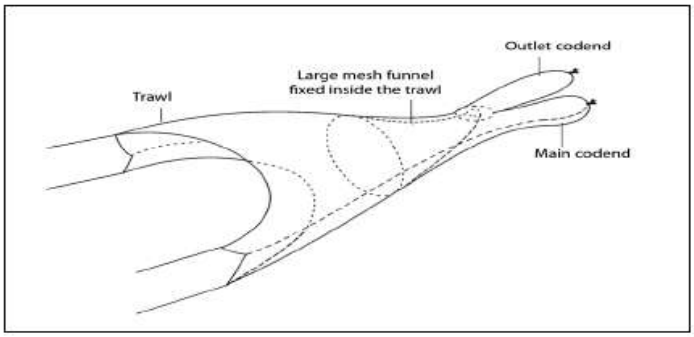
11. By catch reduction devices

Separator panel BRDs

Square and diamond shaped HDPE webbing



. View of the Bigeye BRD attached to the trawl codend. The opening of the BRD is kept open using floats.



Perspective view of Sieve net BRD installed in trawlnet

Plate 1 By catch reduction devices

Devices developed to reduce the capture of non-targeted species during trawling are collectively known as Bycatch Reduction Devices (BRDs). These devices have been developed taking into consideration variation in the size, and differential behaviour pattern of shrimp and other animals inside the net. Different types of bycatch reduction technologies have been developed in the fishing industry around the worldBoopendranath*et al.*, 2010.

BRDs can be broadly classified into three categories based on the type of materials used for their construction, viz., Soft BRDs, Hard BRDs, and Combination BRDs. Soft BRDs make use of soft materials like netting and rope frames for separating and excluding by catch. Hard BRDs are those, which use hard or semi-flexible grids and structures for separating and excluding by catch. Combination BRDs use more than one BRD, usually hard BRD in combination with soft BRD, integrated into a single system. Designs that reduce the non-

targeted catch either by taking into account the behavioural difference of the species or by excluding the catch entered also can be considered as BRDs, though the term is commonly used for devices that are attached to trawls to reduce non-targeted catch (Madhu 2019).

Use of BRDs is one of the widely used approaches to reduce by catch in shrimp trawls. Some of the advantages in reducing the amount of unwanted by catch caught in shrimp trawls by using BRDs are (i) Reduction in impact of trawling on non-targeted marine resources, (ii) Reduction in damage to shrimps due to absence of large animals in cod end, (iii) Shorter sorting times, (iv) Longer tow times, and (v) Lower fuel costs due to reduced net drag (Boopendranath*et al.*,2010). The effects of BRD installation on total drag of the trawl system and hence on fuel consumption has been reported to be negligible (Boopendranath*et al.*, 2010) (Pate 1).

Conclusion

Fishing Technology Division has provided technologies and consultancy on development of boat designs for different fishery, focussed on long-term sustainability of the fishery resources and environment-friendly fish harvesting systems by developing Large Mesh Purse seine and collapsible traps. Bycatch reduction devices was developed to reduce discards and bycatch. Considering energy conservation point of view in fish harvesting and environmental safety, protection of biodiversity and environmental safety CIFT Sun Boat and TED was developed.

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