Innovations in Fish Harvest ,Onboard handling , and Post Harvest Operations





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Presentation Overview

- **1. Harvest Technologies for small scale fisheries**
- 2. Post Harvest Technologies for small scale fisheries
- 3. Processing machinery for small scale fisheries
- 4. Incubation support for Fishpreneurs
- 5. Success stories



Responsible trawl systems

- Trawling impacts to the bottom integrity, generation of large quantities of bycatch, which includes large quantities of juveniles of commercially important species, capture of endangered, threatened or protected (ETP) species, high energy input etc. are some of the negative aspects of trawling.
- Though trawling has negative impacts, they contribute significantly to the total landings along the region
- In India, about 50% of the total marine capture landed by trawlers 35, 228 trawlers (CMFRI, 2012)
- Therefore, it is imperative that trawling should be made more responsible by reducing its negative impacts, in addition to other measures like reducing capacity, legal mechanisms etc. to control its impact.
- Trawling systems with effective gear-based restrictions, including size and proper seasonal and or temporal resolutions, can be effectively used to capture shrimps and smaller species which are beyond the catchability of other commercially used gears.



Off-bottom Trawl System (OBTS)

- These four-seam, trawl design, operated along with a suberkrub otterboard, is found to reduce the bottom impacts.
- An effective alternative during shrimp lean seasons, when fishes are targeted.
- This design is also found to be affective in capturing offbottom fast swimming fish species, that are normally not caught by shrimp trawlers.



Short body shrimp trawl (SBST)

• Trawls with a reduced total length, (which in turn reduces drag and fuel consumption), is another simple design that is found to reduce the catches of fish, which form a bycatch in shrimp trawls.



BYCATCH REDUCTION DEVICES (BRDS)

- There are many bycatch reduction devices (BRDs) that have been developed, field tested and optimized in the south Asian waters.
- BRDs like Juvenile fish excluder cum shrimp sorting device (JFE-SSD), big-eye BRD, square meshes, and square mesh panel BRDs, are found to significantly reduce the bycatch generated in trawling systems (Boopendranath, 2010; Madhu, 2018).



Juvenile Fish Excluder- cum-Shrimp Sorting Device (JFE – SSD)

Bycatch reduction: 29-43%;

Shrimp loss: 3-5% (Boopendranath, 2008)



ENERGY EFFICIENT FISHING VESSELS

- Energy spend to capture fish is a very important metric that determines the profitability at the level of the fisher and on a larger scale, it has implications on release of greenhouse gases which adversely contribute to climate related changes.
- Though the production of CO₂ equivalent to capture one unit weight of fish, is much lower than the global standards, the exponential increase in the level of motorization in fisheries, adds up collectively to the CO₂ production, since Asia has almost 68% of the total vessel operating globally (FAO, 2020).
- In most of the south Asian fisheries, the vessel design followed are mostly based on traditional designs in most cases, that lack scientific principles, often leading to wastage of energy and fuel.
- Maintaining the ideal length-speed ratio, use of modern simulation techniques for designing, could be used, so that designs would have lower resistance, better stability, and energy efficient.
- FV Sagar Harita, FV Sagar Kripa are some of the models developed which includes energy saving features and combination of different fishing methods for better profitability.



Sagar Kripa:

A 15.5 m multi-purpose deep sea steel fishing vessel developed with energy saving features.

FV Sagar Haritha:

A 19.75 m standard combination green fishing vessel for the mechanized fishing sector



SOLAR POWERED FISHING BOAT

- The use of renewable energy in the fish harvesting sector is very relevant in the context of environmental protection and reducing the dependency on fossil fuels.
- Though solar powered vessels are not feasible in immediate future for high energy intensive operations like trawling, solar energy based propulsion systems are available for smaller fishing boats for operation in the inland and estuarine waters.
- The utility of solar power has been successfully demonstrated in India, by designing two vessels, meant for the inland waters, that run exclusively on solar energy.
- Fishing operations like gillnetting and lining were successfully conducted onboard these vessels.
- More research into PV cells, that is happening now, can help in higher powered solar boats, that can meet the challenges faced in the sea for successful operation soon.



Designed and constructed Solar powered boat for reservoir & aquaculture farms



Utilization of unconventional wood for fishing vessels in small-scale sector

- Material used for construction of the fishing vessel has large negative impact in LCA
- Wood with negative values for many indices that add up to the Green house potential, is the best material for construction
- The rubber wood, which can be cheaply sourced 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 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.
- Coconut wood as material for construction was successfully demonstrated.
- The mechanical properties of the coconut wood canoe are at par with canoes made using traditional wood, but with about 20-30% reduction in the cost.



Coconut wood canoe



Rubber wood canoe



Onboard handling



Clean fishing deck designed for hygienic fish landing by CIFT



Insulated FRP Fish store



Stainless steel insulated Fish store



CIFT - Insulated Fish Bags

A simple intervention for hygienic handling of iced-fish by traditional fishers, fish vendors and fish consumers. Keeps the fish fresh in chilled condition for 6 hours

The bags are made of three layers:

- 1. Outer water proof covering
- 2. Middle insulation layer
- 3. Inner plastic lining













Refrigeration enabled Mobile Fish Vending Kiosk

- No odour, No flies and No Contamination
- Fish display in chilled condition 25-30 Kg (1-5 °C)
- Shelf life extension upto 3-4 days
- Attached with Fish Descaling machine
- Provisions for Cutting, Cleaning and Packing
- Separate provisions for collecting liquid and solid wastes
- Storage facility in Ice-Box (70-75 Kg)
- Mobile unit with wheels
- Plug-in unit with provision for inverter battery/DG set
- Designed considering the maximum weight that a man pulls on a rickshaw
- Can be integrated with Solar power system
- Detachable roof and seat for roadside vending
- Applied for Design Patent
- Consultancy extended for Pondicherry Govt.



Cost of Machine: Rs.60,000/-+ GST No. of units commercialized: 4 No. of Demonstration units : 20 (NFDB)+ 28 (GoK)

NPV (Rs.)	IRR (%)	BC ratio
96978.00	35	1.86

Coated Fish Products

- The most prominent among the group of value-added fishery product is the battered and breaded products.
- Fish is processed to mince and further used for the production fish mince based coated products.
- Fish mince can be used for processing a variety of value-added products.
- Depending on the type of product, a frozen storage life up to 6 months without any appreciable quality deterioration can be expected for these categories of products.
- Value added sea food-based products in ready-to-cook or ready to serve convenient form
- Effective utilization of by-catch fishes
- Enhances the nutritional quality; the coating can be fortified with necessary nutrients.
- Value addition- increases the bulk of the substrate thus reducing the cost element of the finished product.
- The product is protein enriched snack food

The Benefit - Cost Analysis Ratio of a coated fish product manufacturing unit with a capacity to produce 300kg per day works out to be 1.2









Fish Sausage

- Sausages prepared from fish has the advantage of health aspects apart from its unique taste.
- Although fish sausage is highly relished, the availability of sausage on the shelf is limited to chicken, pork or other meat varieties. However, there is a good market for fish sausage if promoted suitably.
- For fish sausage, a wide variety of fishes can be used ranging from lean to fatty variety.
- Sausages are usually prepared from minced meat mixed with ingredients like fat, binders, fillers, spices, salt etc. according to the consumer's preference.
- The advantage of sausage preparation is its adaptability to variety of ingredients resulting in distinctly different taste which increases the variety of sausage products.
- Sausages are ready-to-cook or ready to serve convenient products
- Suitable for wide variety of fishes which increases the variety of products
- Product can be modified using different ingredients depending on the consumers choice
- Provides good quantity of nutrients with calorie value of 250 300 kcal 100 g⁻¹

The Benefit -Cost Analysis Ratio of a fish sausage processing unit with a capacity to produce 200kg per day works out to be 1.48







Fish/Prawn Pickle

- Fish pickle is one of the most prominent and age-old delicacy relished by many communities across the World.
- Most of the sea foods like prawn, tuna, seer fish, etc. are ideally suitable for making pickles.
- Pickles are good appetizers and digestive agents.
- The basic principle of pickling is curing of fish by salting, acidifying by addition of vinegar and/or oil and spices.
- In general, pickling enhances the product shelf life to six months and more.
- These are ready-to-serve convenient form of products used as side dishes in Indian menu
- Effective utilization of by-catch fishes
- A means of value addition- reducing the cost element of the finished product.
 - product. Shelf stable nutritious commodity



The Benefit -Cost Analysis Ratio of a fish pickle unit with a capacity to produce 50kg per day works out to be 1.69



Fish Wafers / Crackers

- Dried, ready-to-fry-and-serve wafers/crackers, employing carbohydrate as the main base and incorporating salt and several other ingredients with or without spices are very popular in Asian countries.
- The basic principle for the preparation fish wafer involves the addition of starch into the fish mince together with spices and other ingredients which is blended, cooked for gelatinization and further cut and dried to a moisture content less than 10%.
- Being dried products, fish wafers have a shelf life of one to two years.
- By-catches as well as processing frame meat can be very well employed as raw material for the preparation of these dehydrated commodities.
- Ready-to-fry or ready to serve convenient form
- Effective utilization of by-catch fishes as well as processing discards like frame meat.
- Fortification of carbohydrate based commodities.
- Product diversification based on customized demands

The Benefit -Cost Analysis Ratio of a fish wafer unit with a capacity to produce 50kg per day works out to be 1.77





Fish Paste

- Fish paste is a value added product prepared from deboned fish by mixing with condiments, salt and oil.
- Ingredients inclusion could be customized based on the consumer targeted/needs.
- Fatty and non-fatty fishes of marine origin and fresh water fishes can be used for fish paste preparation.
- A variety of fishes with low economic value can also be employed for this value addition. Marine fatty fishes could serve as a rich source of omega-3 fatty acids and impart characteristic taste of fatty fishes.
- Incorporation of ingredients help in concealing the identity of the original raw material and improves the consumer acceptability.
- Fish paste in Ready-to-eat (RTE) form can be stored at ambient temperature with a shelf life of minimum 1 year.
- Very rich in highly digestible protein with well-balanced essential amino acids
- Can be customized to variety of taste
- It finds application in processing several 'convenience foods' like salad dressings, spread (bread spread / spread on roti / chapatti), condiments etc.
- Suitable for all age groups including infants, lactating women and aged community.







Fish Protein Powder

- Fish powder is a product prepared from prime quality edible fish muscle. It is a protein rich (75-85%) shelf stable product intended for human consumption.
- The proteins present in fish powder are highly digestible (90-98%) and can supply all the dietary essential as well as non-essential amino acids and a good source of functional bio-minerals including selenium and zinc.
- Fish powder consists of two variants viz., whole fish protein powder and hydrolysed fish protein powder including muscle protein hydrolysates and collagen peptide.
- The hydrolysed fish protein powder is more suitable for infants, aged population and for the people having difficulties in protein digestion.
- The hydrolysed fish collagen powder is a high value bioactive ingredient having applications in nutraceutical and functional food formulations and essentially recommended for arthritis patients as a supplement for bone regeneration.
- It can be packed in metalized polyester laminated with polyethylene and HDPE containers, glass bottles etc. for 6 to 9 months at ambient temperature.
- Application as Binder, Dispersing agent, Emulsifier, Ingredient in restructured products (gelling agent), Protein fortification, Thickening agent etc.





Ready-to-Serve Fish Curry in Retort Pouches

- The technology provides a method for preparing the ready-to-serve fish curry in retortable pouch with excellent storage stability and quality with a shelf life of more than one year at ambient temperature.
- The preparation of the ready-to-serve fish curry includes processing fresh fish, preparing a curry medium and finally mixing the processed fresh fish and curry medium in an appropriate ratio.
- The processed fish curry medium is mixed in appropriate ratio to obtain the readyto-serve fish curry and packed in the retortable pouch.
- The air inside the retortable pouch is exhausted by steam injection. Subsequently the retortable pouch is heat sealed and subjected to retort sterilization at 121°C for a specified time.
- The ready-to-serve fish curry is thermal processed and do not require any further processing before consumption.
- The thermal processing conditions have been standardized for this product in order to make it safe for consumers
- Fishermen will get better returns and consumers will get ready to serve safe products.

The Benefit -Cost Analysis Ratio of a ready to serve fish product manufacturing unit with a capacity to produce 750kg per day works out to be 1.37



Fish Incorporated Extruded Snack Products

- Extruded snacks are gaining importance now-a-days due to their peculiar taste, texture and convenience. They are rich in calories and contain low levels of protein, which makes it necessary to fortify them with protein-rich diets.
- Utilizing fish meat and fish portions and its derivatives like fish protein hydrolysate powder, dry fish powder etc. for extruded products will add value to the low-cost and underutilized fish and shellfish, thus promoting their utilization.
- Food extrusion using fish provides a great versatility for the development of low-cost, high-nutritive protein rich and convenient food products.
- Metalized laminated pouches with nitrogen gas are used for the packaging of extruded products and can be stored at room temperature for 4 months.
- Versatility wide variety of products are possible by changing the ingredients, varying the operating conditions & and shape of the dies
- Low operational costs
- High production rate operate continuously and have high throughputs
- Good quality products involves high temperatures applied for a short time and the limited heat treatment therefore retains many heat sensitive components
- No effluents is a low-moisture process, eliminates water treatment costs and does not create problems of environmental pollution

The Benefit -Cost Analysis Ratio of a fish based extruded snack unit with a batch production capacity of 50Kg per day works out to be 1.52







Silage from Fish Processing Discards

- Fish silage can be defined as a product made from whole fish or parts of the fish to which no other material has been added other than an acid and in which liquefaction of the fish is brought about by enzymes already present in the fish.
- Normally formic acid at the rate 3.5% of the weight of waste is added to the minced waste and stirred well intermittently.
- The product is a stable liquid with a malty odour which has very good storage characteristics and contains all the water present in the original material.
- After liquefaction, it is mixed with rice bran and dried. This is a base material in place of fish meal for making feed for various animals and fish.
- It is a simple process and it requires little capital equipment particularly if non-oily fish are used.
- The minced fish is mixed with the and liquefaction takes place depending upon the temperature of the mixture, size of the offal, freshness etc. The warmer the fish and acid mixture, the faster is the process.
- There are no problems in storage of fish silage if the correct acidity is maintained.
- Total utilization of available fish waste
- Can eliminate the environmental hazard and valuable protein source can be protected.
- Generate employment opportunities for unemployed youth
- Scaled up production for commercial application for poultry feed and other feeds

Foliar Spray from fish processing discards

- The fish waste cooked for half an hour with required quantity of fermentable carbohydrate. It is then cooled and added with starter culture of lactic acid bacteria.
- The product is then kept under covered condition for a period of 20-3- days and the supernatant is collected and packed in bottles as foliar spray. It is supplemented with potassium and magnesium in the required level.
- Tests have shown that foliar feeding can be 8 to 10 times more effective than soil feeding and up to 9(% of foliar fed nutrients.
- The application of foliar spray has been advocated in spices like cardamom, black pepper, tea etc. and encouraging results have been reported.
- The entre bulk waste generated in the domestic fish markets will be cleared within the market hour itself.
- Conversion of fish waste to high value end products is a wiser option for the industry as they can
 potentially generate additional revenue as well as reduce the cost of disposal of these process discards.
- The high end products such as foliar spray rich in nitrogen and minerals can be preferred inputs for the agricultural field and help in replenishing the soil health.
- The trend of terrace culture of vegetables and organic farming has taken a fast momentum among the city dwellers as it permits agriculture activities in limited space

The Benefit -Cost Analysis Ratio of a foliar spray unit with a batch production capacity of 75 litres works

out to be 1 Q1



Livestock and Aqua Feed from Fish Processing Discards

- In Asia, the fish farming activity is expanding exponentially leading to high demand for quality feed.
- The waste generated from fish processing sector can be used for making good quality fish feeds. This in fact helps the processing industries to control pollution of the environment
- Bulk waste generate in domestic fish markets and fish processing facilities is collected in wet form.
- Further, the waste is crushed to fine paste and cooked along with other necessary ingredients to form a dough mass. The dough is further passed through a pelletizer and dried to a moisture content of less than 10%.
- The present technology introduces a process addressing a value-chain approach for the management of bulk-waste generated in the seafood sector, especially in domestic fish markets, by directly converting to a high-in-demand commodity such as aqua and livestock feed, which at present is at its infant stage.
- The entre bulk waste generated in the domestic fish markets will be cleared within the market hours itself.
- Conversion of fish waste to high value end products is a wiser option for the industry as they can potentially generate additional revenue as well as reduce the cost of disposal of these process discards.

The Benefit -Cost Analysis Ratio of a pelletised feed unit with a batch production capacity of 500Kg per day of feed works out to be 1.30



Solar Fish Dryers

- Solar drying is an alternative which offers numerous advantages over the traditional method, apart from being environmentally friendly and economically viable.
- Compared to the sun drying, solar dryers can generate higher air temperatures and consequential lower relative humidity, which are conducive to improved drying rates and hence lower moisture content of the final products.
- In order to overcome the heat energy supply during off sunshine hours, backup heating source is provided like LPG, Electrical and biomass.
- Various types of solar dryers with different backup systems suiting different product and client demands are available
- ICAR-CIFT designed solar fish dryers are designed to supply maximum heat energy for drying from incident solar radiation.
- Ideal for drying of fish, fruits, vegetables, spices and agro products
- Hygienically prepared premium quality uniformly dried product
- Economically viable and eco-friendly maximum use of solar energy
- The drying time is reduced considerably with improved product quality.
- Lesser operating expenses
- Labour requirement is considerably reduced

The Benefit -Cost Analysis Ratio of a solar dryer unit with a batch production capacity of 20Kg per day works out to be 1.34









FISH DE-SCALING MACHINES



FISH DE-SCALING MACHINE WITH VARIABLE DRUM SPEED



FISH DE-SCALING MACHINE HAND OPERATED



To remove the scales of fishes easily All types/sizes/ species of fishes 10 kg/ batch 230V AC to drive 1.5 HP VFD motor 350 X 650 mm

₹1,00,000

Use :

Suitable for :

Capacity : Material used for making : Drum Dimension : (Diameler XLength) Cost:

To remove the scales of fishes easily All types/sizes/ species of fishes 5 kg/ batch SS 304

> 255.5 X 270 mm ₹15,000



FISH DE-SCALING MACHINE WITH FIXED DRUM SPEED-TABLE TOP

Use:

Suitable for :
Capacity : Power requirement :
iaterial used for making :
Drum Dimension : (Diameter X Length) Speed range :
Cost:

To remove the scales of fishes easily All types/sizes/ species of fishes 5 kg/ batch 230V AC single phase for 0.5 HP SS 304 345 X 430 mm 20 - 30 rpm ₹50,000



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FISH MEAT BONE SEPARATOR

MINI FISH MEAL UNIT





Use : Suitable for : Capacity : Power requirement : Materials used for making : Meat collecting drum diameter : Meat yield : Speed range : Cost : To separate fish meat from bones A∎ fish species 100 kg/ h 440V AC 3 Phase for driving 3.0 HP motor SS 304 204 mm 60% 5 - 100 rpm ₹5,00,000

Use :

Capacity : Power requirement : Materials used for making : Cost : To prepare value added products like Fish meal and fish oil from fish waste 10 kg/ h 230V AC for driving 1.0 HP motor SS 302 ₹6,00,000



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How ICAR-CIFT ABI Centre handholds a startup

- Provides a well tested technology basket to choose from
- Provides access to a friendly eco-system to start the business
- Act as a constant mentor
 - Technology optimization
 - Upscaling
 - Branding and labeling
 - IP protection
 - Approaching financial institutions
 - Certifications / approvals / registrations
 - Test marketing
- Provides linkages to other business mentors
- Establish a network
- Motivation from experience sharing of other incubatees



Incubation Facilities under one roof



Facility for Direct Incubation

- On site technical guidance from expert R&D personnel
- 5000 sq.ft. furnished office space
- Secretarial assistance
- Conference facility including video conferencing
- Internet and communication facility



Pilot Plant





Pilot Plant Facility includes production lines for

- pre-processing
- freezing and chilling
- value added product
- utilization of by products from fish
- retort pouch processing
- sausage and extruded products
- breading and battering
- cooking and canning
- chitin and chitosan
- packaging



Incubatee Product brands









AL-BADR SEAFOODS PVT LTD Amini Island, Lakshadweep

PLANTZAA - Ready-to-eat jackfruit product – retort pouch technology HI-Q Agro Foods, Nadapuram, Kozhikode





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K136 FISH TEST – Rapid Detection Kit for Adulterants in Fresh Fish HIMEDIA Laboratories Pvt. Limited, Mumbai



Processing of frozen stuffed mussel MEJILLON FOODS Calicut, Kerala





MeMe Natural - Organic Fertilizer from Fish Waste San Isidro, Kochi

B-Lite - Organic Spirulina Cookies Zaara Biotech, Kochi

Smile n Take Zcorp Pvt. Ltd, Kochi







Exclusive Dry Fish Store opened in Kochi AABBAA Fish Products



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Fish Pickle (9 incubatees)

- Vypeen Seafood wonders
- Vanitha Enterprises
 - Amma Kaipunya
 - Herbs n Spices
 - Shahina's
 - **Travancore Pickles**
 - Ponnoos Fish Pickle
 - Vedika Food Industries
 - Sahalas Pickles





Refrigeration enabled fish vending kiosk (4 units)

- Sha Cold Storage and Fish Centre, Cochin
- Santhom Mart and Food Court, Cochin
- Paradise Resorts, Kumarakom
- Mr.Anwar P.S., Cochin









Extruded snack food from fish Or N App Crunchies, Coimbatore

Hand operated de-scaling machine

- Town Harbour, Kochi
- Parayil Foods Pvt. Ltd., Alleppey
- FreshPack, Kochi





Fresh fish retail stores (6 Clients)

- Dharmoos Fish Hub (3 outlets)
- Town Harbour, Edapally
- Vypeen Seafood Wonders, Malipuram
- Santhom Fish Mart, Kochi
- Shah cold storage, Kochi
- Nallakarshakan, Kochi
- Green Marine, Thevara, Kochi









A MoU was signed between ICAR-CIFT and Society for Assistance to Fisherwomen (SAF), Dept. of Fisheries, Govt. of Kerala on 30th September, 2019 for fabrication and installation of 20 numbers of CIFT developed **Refrigerated mobile fish vending Kiosks** for the benefit of women SHGs under **Theeramaithri project**.

The Kiosks will be provided to fisherwomen SHGs who have been involved in fish selling business, on subsidised rate.



Value added products from fish

- Baby Marine Pvt. Ltd
- JMJ Exports, Chennai
- Coral Exports, Kochi
- Chaithanya Foods
- Foo Foods
- Mejilon Foods







Foo Foods India Private Limited was started by Mr. Mohammed Fawas T.C., who wanted to venture a business in seafood sector. He registered as an incubatee at ABI Centre, ICAR-CIFT and an agreement was signed during May 2019. The Institute provided the technical know-how and training for the production of Ready-To-Eat (RTE) mussel products using retort pouch packaging technology. After successful trials from the pilot plant facility of ICAR-CIFT, Mr. Fawas launched his products under the brand name 'Foo foods', developed using classic Malabar snack recipes. The products were highly appreciated by the consumers and found good demand in the retail market. A production unit was soon established at Kozhikode under the technical guidance of ICAR-CIFT. The unit has been successfully operational since then, and now **the firm has been recognized as a Startup by DPIIT, Govt. of India.**









Dr. Saji Pothen Thomas started **One India Farms and Plantations Pvt. Ltd**, as an incubatee firm at ABI Centre, ICAR-CIFT, during July 2021, with the mission to provide chemical-free, unadulterated fresh fishes to consumers. The institute provided technical know-how and training in hygienic fish handling, quality management, processing and packaging. They have established a fishing farm too, to source fish and ensure good quality products. They are setting up a state-of-the art processing facility at Edavanakkad, Ernakulam under the guidance of ICAR-CIFT. Within few months of registration at ICAR-CIFT, they have received recognition from Ministry of Commerce and Industry under #startupIndia.





