Vol. 21 No. 1

Central Institute of Fisheries Technology's RECENTLY DEVELOPED COMMERCIALLY VIABLE AND FISHERY-BASED TECHNOLOGIES

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Central Institute of Fisheries Technology (CIFT) is a multidisciplinary research organisation established by the Government of India in 1957. Its administrative control was brought under the Indian Council of Agricultural Research (ICAR) from 1st October 1967. The Institute has been vested with the responsibility of devising suitable technologies for the sustainable exploitation and utilisation of the vast marine fish resources of India. These are to be developed through sustained research in respect of fishing craft and gear suited to regional fishing conditions and also in regard to post-harvest technologies.

Since its inception, the Institute has taken up and successfully completed many studies on various important aspects of fishing and fish processing. As a result of these studies, new technologies have been developed. Existing technologies for the construction and maintenance of fishing craft, and fabrication, operation and maintenance of fishing gear have been improved. Processing and preservation of fish and shellfish, and fabrication of equipment, instruments and accessories for use in fishing and fish processing were the other two areas that received considerable attention. Some of the significant and commercially viable technologies recently developed by the Institute are briefly described here.

FISHING CRAFT

Fuel-efficient fishing vessels: The Institute has developed twelve standard designs of mechanised wooden fishing boats in the size range 7.67 m to 15.24 m during its early days and most of the wooden fishing boats plying in the Indian waters are built to CIFT designs.

A 15.5 m steel fishing vessel, christened 'Sagarkripa', far more fuel efficient than other vessels of its size, has been designed and fabricated by the Institute, and dedicated to the Nation on 17 September, 1999. This vessel has a hydrodynamically efficient hull fitted with advanced propulsion system perfected at CIFT. This vessel has been found to reduce fuel consumption to the extent of 20% compared to similar vessels under identical operational conditions. It is estimated that a vessel of this design will save about 16,000 litres of fuel during one year of operation in comparison to a conventional vessel of the same size. The vessel is fitted with Leyland ALM 412, 125 hp and 2000 rpm engine. The speed of the vessel during free running is 9.5 knots and 4 knots while trawling. For locating fish shoals, the vessel has 50/2000 dual frequency SIMRAD. Fish Finder and GARMIN 128 GPS Navigator. The vessel also features better accommodation standards, higher fish hold volume (30 cu m), increased winch capacity, large fishing deck area and sea-friendly cruising gait. These features help the vessel to achieve higher endurance and to carry out deeper water operations. This vessel is poised to revolutionise the fishing industry by bringing down the operational costs of vessels of this LOA. At present 70% of the operational costs are related to fuel. The present design of CIFT brings down this expense substantially.

FRP Canoes for traditional fishermen: Fiberglass Reinforced Plastic (FRP) is an industrially important construction material. Strength, light weight and long life are the special advantages of this material. As such, it is a convenient and suitable material for building fishing boats, especially those meant for fishing in nearshore waters of the sea and in backwaters. Taking these facts into consideration, CIFT has designed FRP coated fishing canoes for traditional fishermen. Initially four such boats have been built for the Chellanam Village SC/ST Co-operative Society under the Special Component Plan of the Government of India. The CIFT-designed canoe has a length of 5.78 m, breadth of 0.82 m and height of 0.385 m. The cost of construction of each comes to Rs. 22,500/-. It is proposed to construct 17 more such canoes to be handed over to 34 fishermen for fishing operations. Besides, 10 persons have been trained in the construction of such fishing boats.

Aluminium - alloy sheathing for wooden fishing vessels: Most of the coastal fishing vessels constructed and operated in our country are wooden. Unprotected wooden hulls of fishing vessels get damaged by marine borers and fouling organisms. The traditional method of protecting the hull is by providing copper sheathing which is very expensive.

CIFT has recommended cheap aluminium-magnesium alloy for sheathing wooden hulls in the place of costly copper sheathing along with G.I. fastenings, cast iron fittings and aluminium alloy tacks and screws. The alloy is light, resistant to seawater corrosion and cheaper in price. Fouling on metallic surface can be eliminated through the use of a specific painting schedule recommended by the Institute.

Cathodic protection of fishing boats: Marine metallic structures are constantly subjected to very severe corrosion resulting in heavy maintenance cost. Properly designed cathodic protection system is not only technically feasible but also economically viable. Presently, zinc and ternary aluminium anodes are used for cathodic protection.

A galvanic anode free from mercury has been developed for use in cathodic protection of fishing boats and metallic marine structures. The life of these anodes is three times to that of zinc anodes. As these anodes are free from mercury unlike its commercial counterparts, pollution of the aquatic environment by mercury does not occur.

Specifications were laid down for cathodic protection of steel and metallic sheathed wooden boats, and standards worked out on the quality, quantity and geometrical disposition of the anodes on the hull.

Chemical wood preservatives: Traditional fishing contributes to the major part of fish landings of India. 'Kattamaram' and built-in canoes or boats (such as *navas*) or dug-out canoes are used for traditional fishing. These wooden crafts deteriorate rapidly due to ravages of weather and also because of continuous contact with seawater containing organisms like wood borers which destroy wood. Fishermen use indigenous preservatives like liquid cashewnut shell extract, fish oils etc., to protect their fishing craft. Studies have shown that these preservatives have very little toxic properties. They merely act as water repellents.

Considering the wasteful expenditure incurred by the traditional sector on wood maintenance, CIFT has developed certain chemical wood preservatives viz., arsenic creosote, copper creosote and creoscor. Creosote is a coal tar distillation product. Fortification of creosote with copper or arsenic makes it more toxic and consequently prolongs the efficiency of the preservatives. Fortified creosote not only imparts toxicity to wood against bacteria, fungi and termites but also retards the formation of cracks on the wood due to weathering.

Creoscor is a highly efficient oil-borne wood preservative which is prepared by heating together heavy creosote oil, copper compound and plant resins. The treatment consists of giving two or three liberal coats of copper creosote on all parts of the boat. The hull portion is then coated with creoscor which not only protects the craft but also provides a smooth surface which helps reduce the frictional resistance to motion of the craft in water.

The new treatment costs much less than the traditional treatment.

Fishing Gear

Specialised Gears: The Institute made notable contribution by developing suitable fishing gear for operation from mechanised fishing boats of varying sizes. Designing of nets for operation from traditional craft was also given equal importance. Some of the important types of gear developed are :

1) Long wing trawl; 2) Double rig shrimp trawl; 3) Shrimp trawl for traditional motorised craft; 4) Bulged belly trawl; 5) High opening trawl; 6) Large mesh trawl; 7) High speed demersal trawl; 8) Midwater trawl; 9) Rope trawl; 10) Purse-seine; 11) Mini purse-seine; 12) Large lines and 13) Troll lines.

Gill nets for marine and reservoir fisheries: Gill nets are selective gear, the efficiency of which depends upon the selection of proper thickness or diameter of twine and mesh size. The twine diameter and mesh size for gill nets and trammel nets have been standardised for common marine species like seer, pomfret, hilsa, lobsters, prawns etc., by the institute.

Likewise, gill nets including trammel net and frame net have also been developed and introduced in reservoirs for the capture of catla, rohu, mrigal, catfish and also for catching several miscellaneous fish.

Combination wire ropes for deepsea trawling: Combination wire ropes are specialised wire ropes used as head and foot ropes of heavy demersal and mid water and pelagic trawls. Materials like steel wire and synthetic fibre having divergent qualities when in isolation are combined together to form the combination rope which acquires strength. The synthetic fibre provides insulation for the highly corrosive steel from the hostile marine conditions. India has been importing combination wire ropes from other countries. The indigenous production of combination ropes will help in not only meeting the country's increasing demand but can also be an item of export in the near future.

Otter boards: The Institute has developed a number of designs of otter boards of different shapes and sizes for operation with different sizes of trawl nets from different sizes of vessels. 'V' Form steel otter boards of the as given in Table 1 at next page sizes are recommended for of different OAL trawlers.

Advantages of 'V' form Otter Boards compared to Rectangular flat Wooden Otter Boards

1. They render service for a longer duration (5-6 yrs), when maintained well.
2. They are hydro-dynamically efficient - Hence they enable utilisation of engine power more effectively.
3. They facilitate tiding over bottom obstacles of smaller magnitude and are thus suitable for bottom trawling on somewhat uneven and rocky grounds.
4. They offer less of resistance (drag), there by augmenting speed of trawling without increase in fuel consumption. In other words they contribute to fuel efficiency.
5. They do not plough or dig into mud. They are thus less risk prone and also improve manoeuvring in deepsea

trawling too.

6. They impart an increased measure of efficiency for demersal finfish trawling.

7. Better bottom/ground contact with least lift effect while dragging and no digging in soft bottom.

8. Interchangeable from starboard side to port side and vice versa by effecting slight changes in the fixing of bracket - thus facilitating the reduction in uneven wear of the keel.

9. Relatively cheap.

10. Safe in shooting and hauling, when properly rigged; and

11. Saves precious wood (good quality prime wood).

Turtle excluder device to prevent incidental mortality of marine turtles, during trawling: Marine turtles are endangered species which are protected under Indian Wildlife Protection Act. Incidental catches of marine turtles are known to occur during commercial trawling operations, particularly along the coasts of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and southern parts of Kerala. Turtle mortality during shrimp trawling is also linked with import embargo on wild-caught shrimp by USA. Turtle Excluder Device (TED) is a special equipment that greatly reduces the incidental death of turtles caught in trawl nets, by facilitating their safe escape during the tow.

Table 1

S.No.	Length (mm)	Breadth (mm)	Weight in air (kg)	Trawlers OAL (m)	B.H.P of engine
1.	a) 1500	890	125	14-15	125-160
	b) 1500	890	125	15-17.5	165-300
2.	1370	820	70-90	12-14	70-120
3.	1050	620	50-55	10-11	50-65

CIFT has developed a CIFT - TED which is a top exiting, single grid, hard TED of 1000 x 800 mm size, for use by small mechanised trawlers which predominate in Indian waters. Field trials of the CIFT - TED have been carried out off Cochin (Kerala), Visakhapatnam (Andhra Pradesh) and Paradeep (Orissa). Demonstration of fabrication and operation of CIFT-TED was carried out in Orissa, during the mass nesting season of Olive ridley turtles (*Lepidochelys olivacea*) in February, 2001. CIFT-TED permitted 100% escapement of turtles while keeping escapement of shrimp as low as 0.62%. CIFT-TED is now being popularised in maritime states in collaboration with MPEDA and respective State Fisheries Departments.

By-catch reduction devices (BRDs): Incidental catches of non-target species and size groups during trawling operations are an important issue which is linked with conservation of resources and biodiversity. Juveniles and sub-adults of commercially important finfishes form a significant proportion of trawl by-catch. CIFT has conducted investigations with several by-catch reduction devices such as Radial Escapement Device, and Fish Eye and Rigid Single Grid Separator devices, which facilitate the escape of non-target species and juveniles from trawls. Square mesh panels have been developed in order to improve the selectivity of trawl codends and to protect the juveniles.

Square mesh panels: Trawling operations with conventional diamond mesh codend result in mortality of juveniles, as the mesh lumen tend to close under tension, preventing their release. CIFT has developed square mesh panels for trawl codends, incorporating square meshes, which do not close under tension, and facilitate escapement of juveniles and sub-adults.

Improved lobster trap: Spiny lobsters constitute an important item of marine products exported from India fetching foreign exchange for the country. Thousands of traditional fishermen are dependent on this fishery for their livelihood. The traditional traps used by them for exploiting spiny lobsters are made of easily biodegradable vegetable fibres. These traps are crude in shape, less efficient and last only for 2-3 weeks. CIFT has developed a new trap which is 70 x 55 x 40 cm in size and is fabricated out of M.S. rod frame and mounted with 2.5 cm square welded mesh. Corrosion being the greatest drawback for iron materials in seawater, a complete plastic coating is provided to the trap as a measure of preservation which makes the iron material completely impervious to seawater. The trap lasts for 3-4 seasons and is 2.5 times more efficient than the traditional trap in terms of catch and is economically advantageous in the long run. These traps have become highly popular among traditional lobster fishermen of S.W. coast of India.

Studies on baits for lobsters revealed that diesel oil can be successfully used as bait to attract lobsters to the traps.

Fish Processing

Freezing of fish or shellfish: Freezing is one of the important methods for processing food. Preservation of live aquatic animals by freezing depends upon the inhibitory effect of low temperature upon the rate of growth of microbial organisms and the enzymic and biochemical reactions which normally occur in unfrozen foods. CIFT has developed a number of processes for freezing almost all important varieties of fish both marine and freshwater and also shellfish. These include processes for freezing of prawns, squid and cuttlefish, lobster tails, pomfrets, seer, mackerel, sardines, crab, clam, mussel, oyster meat and freshwater fish like major carps, and euryhaline fishes like milk fish.

Filleting and freezing of fish: Fillets are strips of flesh cut parallel to the backbone of the fish. Seer, tuna, mackerel, milkfish, catfish, perch, mullet, threadfin bream, carps, polynemus, shark, eel, leopard fish, coral trout etc. are suitable for filleting and freezing. Frozen fillets can be either exported or sold in domestic markets.

Filleting can be done by using a filleting machine or by hand. Although filleting machine is preferable for use in a factory, filleting by hand is also economical and can be followed by the industry. The fillets cut from the fish, as per the technique developed, are dipped in 15% brine for 15 to 30 seconds, drained, wrapped individually in polyethylene sheet and frozen at -35 to -40°C. The frozen fillets are packed in cartons and stored at -23°C. Fillets can be frozen as blocks also. Convenient lots are packed in polyethylene lined waxed cartons, sufficient glaze water is added to cover the fillets, frozen and stored.

Canning of fish and Shellfish: Canning is another form of preservation of food materials. Fresh foods normally carry organisms which will cause spoilage if their activity is not either neutralised or contained. The basis of canning process rests on the destruction of these organisms by heat and prevention of the entry of others. Enzymic action will also be restricted by heat treatment. Methods have been developed for canning almost all varieties of fish and shellfish in different forms and media.

Canning of prawn, tuna meat, sardines etc., clam meat, mussel meat, crab meat, edible oyster meat etc., in different media are some of the examples worthy of mention. But due to the prohibitive cost of the cans the canning industry had a major setback and now attempts are being made to introduce alternate methods for the heat processing of fish and fishery products.

Ready to serve fish curry in flexible pouches: Value addition and diversification to satisfy the ever changing and diverse demands from the importing countries as well as urban consumers at home are some of the major challenges faced by the Indian fish processing industry. Value addition is the most talked about word in the fish processing industry these days because of the increased realisation of foreign exchange and high unit value of such products. One such value-added product developed at CIFT is fish curry processed in packed flexible pouches.

The earlier attempts at popularising a ready-to-serve fish curry could not meet with success because of the limitations imposed by the metal containers. Now CIFT has successfully developed a suitable three-layer configuration of flexible pouches which can perform the packaging function equally well as metal cans, and is free from the disadvantages met with them. This is a retortable flexible pouch based on Polyester/Aluminium foil/Cast polypropylene. Now flexible pouches are manufactured in India employing the configuration developed by CIFT and this opened the way for commercialisation of heat processed fish curry packed in flexible pouches. CIFT has standardised the process for the production of fish curry in these pouches using over pressure autoclave and the curry processed in them has remained without any change for over a year at room temperature.

CIFT has a research/pilot model of autoclave with full provisions for monitoring all functions associated with thermal processing of flexible pouches and allied infrastructural facilities.

CIFT can offer state-of-the-art technical consultancy services on heat processing of food products in flexible condition.

Improved method of fish curing: The present method of fish curing is somewhat crude and unhygienic. The fish, after salting, is sun-dried on the open beach or ground by which process it gets contaminated with a lot of sand and mud. Fish cured in this way often shows contamination with red halophilic bacteria and fungus and these products cannot be stored for more than two months.

A method has been standardised for preparing good quality cured fish. In this improved method, the fish, after proper evisceration and cleaning, is salted in a specified way and kept in clean cement containers for about 24 hrs. The salted fish is dipped in saturated brine containing 5% calcium propionate for 2-5 minutes followed by drying. The dried fish is then packed in polyethylene bags for retail marketing and in synthetic woven sacks for bulk marketing. The dried fish so preserved and packed has a shelf life of more than 6 months.

Rack drying of fish: Sun drying is a traditional method of drying fish, either salted or unsalted, depending upon their use. The traditional method of drying is very crude and unhygienic causing quick spoilage of the dried product. CIFT has developed racks for drying fish in a hygienic way. Contamination of fish with sand and other dirt and fish being snatched away by dogs and cats is prevented by drying them on racks.

Any locally available material like bamboo, casuarina, etc., can be used for making the racks. Nylon webbing is used as base of the rack. A rack of two decks can be conveniently used for drying fish. As the fish is dried by strong wind and high temperature in the beach area, the material put on the lower deck also gets dried properly, although drying rate is lower in the initial stage.

Freeze-dried fish products: Freeze-drying has become an accepted method of food preservation and is gaining more of popularity because of its several advantages. In this technique, the material is frozen and the ice is directly converted to vapour (by sublimation) which is removed. The dried, porous material can be well re-hydrated when required. As the moisture content of the freeze dried product is 1-3%, the material has to be packed in air tight containers and stored at ambient temperature. CIFT has developed techniques for processing several freeze-dried fish products including ready-to-serve soup mixes, salads etc.

Dehydrated jelly fish: Jelly fish is a marine species abundant on east and west coasts of India. It has hitherto been unutilised although some of the species are said to be edible. CIFT has now worked out a suitable method for processing jelly fish. As it is highly susceptible to spoilage under tropical conditions, it has to be processed immediately after catch or kept for a short period in iced condition.

In the process developed, the umbrella portion alone is taken, trimmed, cleaned, washed well and then treated in four solutions of salt and alum of different concentrations and drained till the moisture content is reduced to less than 60%. It is then graded, packed and stored in chilled condition at around 0°C.

Beche-de-mer: *Beche-de-mer* is the commercial name for cured holothurians, commonly known as sea cucumbers. This is a high unit value dry item almost entirely exported. *Beche-de-mer* is known to have an unique place in Chinese diet probably due to its reputation as an aphrodisiac and for treatment of high blood pressure. An improved technique has been evolved for processing *beche-de-mer*. The process involves evisceration of fresh sea cucumbers, cooking in boiling water, drying and packing in gunny bags.

Improved method of preparation of 'masmin/masmin flakes': 'Masmin' is a traditional fish product of Lakshadweep prepared from tuna fish which is an abundant catch of the island. Traditional 'masmin' is crude and poor in quality fetching a very low price. Improvement in quality is sure to fetch the product a better price leading to the betterment of the island's economy.

An improved method has been developed for preparing 'masmin'. The fillets from tuna are cut into steaks, brined, steamed, partially dried, smoked and finally dried followed by packing.

'Masmin' is usually made into shavings or flakes before preparing food dishes. The hardness of the dried product makes the preparation of flakes very difficult. Hence, process has now been developed to convert the cooked product into flakes before smoking and drying.

Fish wafers and soup powder: This is a protein-rich food product prepared from miscellaneous fish. It is prepared out of fish meat, starch powder, salt etc. The cooked meat is first homogenised with water. To this, corn flour, tapioca, starch and salt are added and the whole mass blended for about an hour. The homogenised slurry is then spread uniformly in trays in layers of 3-4 mm thickness and cooked in steam. The cooked material is then cooled and the layers cut into desired shapes and dried. For consumption, it is fried in oil and used as a side dish. Soup powder is another type of protein-rich food formulated by CIFT. Cooked fish meat is mixed with fried onion and other ingredients and ground thoroughly till it becomes a fine paste. The pasty mass is spread in trays, dried and powdered. This powder, in fine form, is mixed thoroughly with the required quantity of milk powder and stored in bottles or in laminated paper bags. The product is a rich source of animal protein and other nutrients and stores well for 16-18 months at room temperature. For consumption, one part of the powder is boiled in 20 parts of water for five minutes.

Battered and breaded products: These items form an important class of value-added fish products. The battering and breading process increases the bulk of the product, thus reducing the cost element. The basic fish products prepared after preliminary processing are battered and breaded to obtain the final products which can be stored in frozen condition for future use. CIFT has developed methods for preparation of several types of battered and breaded fish/shellfish products. Important ones among them are fish fingers, fish sticks, fish cutlets, fish patties (burgers), prawn products like peeled and deveined, cooked and peeled, pan tail (butterfly) and round tail-on, squid rings, stuffed squids, mussel, clam and oyster, cuttlefish fillets, fish fillets etc.

Pickles from fish and shellfish: Fish pickles have got wide acceptance in the internal markets. They are likely to have regular foreign markets particularly in Gulf countries.

The meat from fish/shellfish is prepared as per specific methods, mixed with salt, kept aside for some time, fried and mixed with lightly fried chilli powder, turmeric, mustard seed, garlic and ginger. Afte cooling, vinegar is added and the product is stored in clean bottles. Pickle prepared by this method keeps well for 8-10 months. Pickles can be prepared from fish, prawns, mussel meat, clam meat, oyster meat etc.

Industrial Products

Chitin and Chitosan from prawn shell waste: More than 1,00,000 t of prawn and other crustacean shell waste is available annually from prawn processing centres in India. This is not properly utilised at present. CIFT has developed a process for preparation of chitin from prawn shell waste. Chitin can be incorporated in the diet for broiler chicks. The diet with chitin was found to improve the feed efficiency, resulting in about 10-12% weight gain in the birds compared to a chitin-free diet. Use of chitin for the production of glucosamine hydrochloride which finds application in antibiotics and baby food formulations is already known. Chitin is also a raw material for preparation of chitosan. Chitosan is a valuable chemical substance finding use in several fields. Process has been developed for preparing chitosan from crustacean shell wastes.

Chitosan can be used as sizing material for textiles. It can be used as a water/wine clarifying agent and also in the preparation of cosmetics, pharmaceuticals etc. Recent studies have shown the effectiveness of chitosan in the form of microfined powder, impregnated gauze and film for treatment of chronic wounds and external ulcers and to arrest/minimise bleeding in neurosurgery. Chitosan film can also be used as artificial skin and kidney membrane, and as contact lens. Incorporation of chitosan during mixing and homogenisation of shrimp and fish feeds for pelletisation and granulation of the feed imparts very good water stability to the feed without the use of sophisticated machinery.

Fish feed: With the advancement of scientific fish/prawn farming in India, need for good quality feed is felt. The indigenous feed used by farmers does not meet the nutritional requirements of the fish. Other types of feed available in the market are very costly. Therefore, formulations have been worked out at CIFT for preparation of fish/prawn feed at reasonable cost by incorporating miscellaneous fish and fishery wastes like prawn shell and squilla, groundnut cake, groundnut oil, starch and salt mixture in specified proportion. This feed can be prepared by the skilled farmers with simple facilities.

Surgical sutures: Absorbable surgical sutures are an essential requirement for wound healing after a surgery. Of the various materials tried, catgut is found most acceptable and is the most popular material now used all over the world. But it has its own drawbacks and is also very costly.

CIFT has been examining the possibility of using processed fish guts as surgical sutures for providing a relatively cheaper suture material and at the same time ensuring utilisation of the presently wasted fish guts. The absorbable extra fine sutures are prepared from the fish gut collagen by cross linking and polymer coating and has been found suitable for eye and other microsurgery. It is comparable to the commercial product in its physical properties like thickness, uniformity, breaking strength etc., and is free from abnormal toxicity and tissue reactions.

Collagen-chitin film: This film is prepared from collagen and chitosan obtained from fishery wastes and can be used as artificial skin. It is used for covering wounds/burns to prevent moisture loss and microbial invasion.

Purified air bladder is partially solublised in hydrophilic solvent. Viscous suspension obtained is spread on clean glass surface and evaporated to give thin film of collagen. Reformed chitin matrix is deposited on this exposed surface to give strengthened collagen film.

Shark cartilage: The skeleton of shark is made of cartilaginous bones, which is about 10-15% of the body weight. Until recently, only very small quantity of these bones was made use of, that too from small sharks, for making buttons and necklaces. This cartilage is rich in chondriotin sulphate which has got application in medicine for treatment of arterosclerosis, blood vessel thrombosis and also to prevent infections. Now there is very good demand from Europe, USA and Australia for processed shark bones.

The head and vertebral column of the sharks collected are to be processed to a presentable and stable form before export. A procedure has been developed for the processing of the cartilage into a clean, dry, white, attractive material without any characteristic smell. The products are well accepted by the overseas buyers.

Squalene from shark liver oil: Squalene is a hydrocarbon extracted from the liver oil of shark by fractional distillation under vacuum. An improved method has been developed to extract squalene from shark live oil.

Squalene is used in the preparation of seroid hormones, treatment of wounds and liver diseases and as anti-cancer agent and bactericide.

Hydogenated squalene (squalane) is used in the preparation of cosmetics, perfumes and aromatics and as anti-aging agent and lubricant in finishing silk and wool.

Shark fin rays: Shark fin rays are valuable products of export from India. Formerly, only shark fins were being exported. But now, even fin rays are exported. CIFT has developed a technique for extracting rays from shark fins.

Thr dried fins are soaked in dilute acetic acid for sufficient time to get the muscle and skin softened. The skin is then scraped off and the fins further treated with dilute acetic acid when separation of the rays in clusters becomes easy. The rays are then dried and packed in polyethylene bags.

The rays are utilised in the preparation of soup in many foreign countries. There is good internal demand also for shark fin rays especially in major hotels.

Isinglass: Fish maws are carefully washed and dried air bladder of fish. Air bladders are taken mainly from dara fish, jew fish, cat fish, eels etc. Fish maws are mainly used for making isinglass. Fresh air bladder is taken out, the internal membrane is removed, and the bladder is well cleaned and dried. Fish maws have got great demand in several foreign markets.

Concentrated PUFA from fish oil: Polyunsaturated fatty acids (PUFA) have therapeutic value as they have the power to lower the cholesterol level. A method has been worked out and perfected by the Institute to increase the PUFA content in the oil by suitable methods of concentration. The technology is ready for transfer.

Agar and agarose from seaweed: Sea weeds are important organic renewable resources of the sea, used for a variety of purposes like preparation of agar, agarose, carrageenin etc.

CIFT has developed a process for producing good quality agar with high gel strength by alkali treatment instead of the conventional acid treatment method. Dried sea weeds are soaked in water, agitated to remove foreign particles, drained, treated with sodium carbonate solution and heated. It is then washed repeatedly to free it of the alkali and the agar extracted by boiling with dilute hydrochloric acid. The extracted gel is frozen and then thawed and the thaw water drained off. The gel obtained is bleached, washed with water, drained and dried. It is then powdered and stored in plastic bags.