SOUVENIR

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FISHERY TECHNOLOGICAL RESEARCH AND EXTENSION IN INDIA

M. R. NAIR
Director, Central Institute of Fisheries Technology, Cochin 682029.

The Central Institute of Fisheries Technology was set up by the Government of India according to the recommendations of a high power Fisheries Research Committee headed by Dr. B. N. Chopra so as to undertake research on Craft and Gear, and Byproducts technology. The Institute had started with Fishing Craft and Gear wing in 1957 and in the following year Processing Wing was added to carry out research on handling preservation, Quality Control and Inspection and to conduct fishery technology extension services. Since then the country has achieved commendable progress in her fishing and fish processing industries. Ranking sixth in the world in magnitude of production, landiing 2.4 million metric tonnes of fish, India's export of processed marine products reached an all time record of Rs. 3850 million per annum.

Some of the important achievements of the fishery technological research and extension work carried out in the country so far are briefly enumerated in the following paragraphs.

FISHING CRAFTS

The crafts most widely employed for fishing in the early years when mechanisation was thought of in the country were wooden dug-out canoes. The first mechanised boat to be introduced in the country by the Indo-Norwegian Project was of 7.5 m OAL Pablo type. The problem of designing of mechanised fishing boats suitable for the Indian coast was taken up by the Central Institute of Fisheries Technology even from its early years of existence. Twelve standard designs varying in OAL between 7.67 m (25 ft) and 15.35 m (50 ft) perfected by the Institute were readily adopted by the State Fishery Departments and private fishery interests and a majority of the 19,000 and odd machanised boats operating in the country at present are of CIFT design. Designs for boats for fishing in rivers and reservoirs varying in length from 6.14 m (20 ft) to 9.21 m (30 ft), an 11.66 m (38 ft) boat for pole and line fishing, an 18.42 m (60 ft) trawler-cum-carrier vessel and a 17.5 m (57.4 ft) steel trawler-cum-purse seiner were also developed.

Seasoned and preservative-treated secondary species of timber like haldu (*Adina cardifolia*) and mango (*Mangifera indica*) wood were proved to be

cheaper but efficient substitutes for the conventionally used costlier timbers like teak (*Tectona grandis*) and aini (*Artocarpus hirsuta*) for construction of wooden boats. Toxin-incorporated wood plastic composites were developed by treating secondary species of timber with monomers such as acrylonitrile, polyester etc. together with toxicants such as tributyl tin oxide and creosote followed by irradiation.

Arsenical and copper creosotes were developed and standardised for treatment of wood intended for marine applications. Spheroidal grain austenitic cast iron was proved to be highly suitable for marine propellers instead of costlier bronze, resulting in 25 to 30% savings in their costs. Marine antifouling paints incorporating tributyl tin oxide and cuprous oxide were developed and produced on pilot plant scale for protection of wooden boat hulls. Anticorrosive paints using zinc dust, sodium silicate and modified cashewnut shell liquid developed by the Institute were found effective in providing cathodic protection to steel and aluminium. A method for sheathing wooden hulls of fishing boats with fibreglass reinforced plastic was developed with a view to protecting them against fouling.

Fishing Gear

During the early years of the fishing industry in India, the materials that went into the production of gear and accessories were of natural origin like cotton yarns, imported hemp yarns, ropes like coir and manila and indigenous floating materials. The Institute standardised construction of ropes and twines for different gears, developed methods for their preservation to get better service life and efficiency and found out indigenous substitutes for Italian sun hemp used for ghol-dara gill nets along the northwest coast. With the introduction of synthetic floats and sophisticated sinkers in the early sixties and their accpetance by both the artisanal and mechanised sectors, these were standardised and knotless webbings fabricated and popularised. The Institute also actively associated with the Indian Standards Institution in formulating national standards for the above materials. Suitable gear and accessories were designed for the mechanised fishing sector, particularly different concepts of trawl designs for shrimping in various areas of the Indian coastline. Several new designs of gears were developed both for the marine and inland areas like different types of high opening trawls, midwater|pelagic trawls, purse seines, trolling for seer, tunny etc., long lines for sharks and traps for lobster and fishes. Methods for shrimping from medium and large vessels were worked out. Double rig trawls, bulged belly trawls, separator trawls for the separation of shrimp and fish and six-seam four panel large-mesh high opening trawls for the capture of bottom and column fishes were some of the sophisticated types of gear evolved. Bottom trawling and long lining for eradication of predatory and uneconomic varieties of fishes from reservoirs, standardisation of

a tickler chain for more efficient shrimping resulting in 35% increase in catches and development of different types of otter boards like rectangular flat, horizontal curved, oval and 'V' shaped for bottom trawling and vertical curved, hydrofoil and four board system for midwater trawling were some of the other fields of investigations taken up by the Gear Division of the Institute.

Instrumentation in Fishing

Several instruments for fishery hydrographical investigations like Bathy Thermometer, Salinity-Temperature-Depth meter, direct reading digital current meter and ocean tele lab were developed. Electronic instruments for behaviour studies of marine animals like fish activity recorder, barnacle cirri beatings counter and oyster shell movement counter were fabricated.

Deck equipments such as collapsible gallows and pulley systems for using in purse seining, hydraulic winch for hauling up trawl nets, equipments for fishing squids with the aid of light attraction and a totally enclosed power take-off clutch suitable for small fishing boats were some of the accessories developed by the Institute for efficient fishing operations.

Portable electronic warp load meter, ship-installed warp load meter, trawl depth meter, speed and distance log and catch indicator were some of the important gadgets developed for use in fishing. Electronic instruments for fishing gear testing like Bollard pull monitor, Mesh distorsion meter, Net flow meter, Under water tension meter, Board tilt meter, Angle of attack meter, Marine temperature alarm, Rudder angle indicator, Bilge water alarm and Multi signal data acquisition system were also developed successfully.

Biochemistry

Knowledge of the fundamental biochemical compositions of fresh fish muscle and the changes they undergo during handling and processing is very essential for evolving methods for their long term preservation. In this context, fatty acid compositions of oil sardine, mackerel, seer, pomfret, lactarius, anchovy, prawns, tilapia, barbus, ophicephalus, caranx, sole, tuna, mullet etc., and a comparative study of the lipids of skin, muscle and viscera of our important food fishes and their seasonal changes were studied in detail. A systematic study of the changes in 5'-nucleotides, the important flavour-bearing constituents in fresh fish and the changes they undergo during iced and frozen storage in prawns and oil sardines was made. Changes in the major protein fractions of all commercially important fishes during storage in ice and in frozen condition and during thermal denaturation were studied in detail.

Detailed studies of the proteolytic enzymes in fish and shell fish like prawns, sardines, mackerel, perch, jew fish, sole, ribbon fish, catla, tilapia and

ophicephalus were made. Hepato-pancreas of oil sardine had high concentrations of lipase enzymes. Phosphorylase enzymes were isolated from tilapia, lactarius and jew fish and their activities studied.

Animal feeding experiments showed that fish oils rich in poly-unsaturated fatty acids could bring down blood cholesterol levels considerably.

Fish Microbiology

Seasonal variations in the qualitative and quantitative distribution of the bacterial flora of commercially important marine fishes like oil sardine, mackerel etc. and changes occurring in them during ice storage, freezing and frozen storage were studied extensively. During ice storage, the heterogeneous flora underwent significant changes giving place to one or two genera at advanced stages of spoilage viz. *Pseudomonas* in the case of fish and *Pseudomonas-Acinetobacter-Moraxella* in the case of prawns. During freezing there was a reduction of 40 to 90% in the number of bacteria and after 3 to 6 months of frozen storage, the residual flora consisted mainly of *Micrococcus* and *Bacillus* genera. There was complete arrest of bacterial activity during frozen storage at −18 to −20°C.

Detailed investigations were carried out on the bacterial profile of brackish water fishes like pearl spot and milk fish, fresh water fishes like tilapia and shell fishes like clams, mussels and oysters.

Chlorotetracyline dips and CTC-incorporated ice considerably suppressed bacterial spoilage in sardine and mackerel; but chemical spoilage progressed unhindered.

A systematic study of the occurrence of *Clostridium* group of bacteria in fish, fishery products and fish processing environs on the west coast upto Mangalore showed the presence of *C. perfringens* in one of the factory environs and guts of some prawns. Investigations on other food poisoning organisms like *Salmonella, Vibrio parahaemolyticus, V. cholerae* and *Staphylococcus areus* were also carried out.

Processing and Packaging

Marine, brackish water and fresh water fishes could be successfully transported in iced as well as frozen condition by rail in plywood boxes insulated with expanded polystryene slabs over distances involving journeys of 3 to 4 days. A chemical sanitizer was developed for cleaning, deodorisation and disinfection of fish boxes, railway wagons and trucks used for transporting iced fish.

Quick frozen tuna and seer in the form of chunks kept in better condition in frozen storage than in the form of fillets. Wrapping in polythene film increased their storage life. Oil sardine with fat contents of 10 to 25% (DWB)

kept well for 12 to 16 weeks at —18°C, while those with 25 to 40% fat had a shelf life of only 10 weeks when frozen individually. Absolutely fresh oil sardine having a fat content of 20% (DWB), when block frozen with heavy glaze, remained in good condition for 6 to 8 months at —18°C. Sardine and jew fish could be frozen in 30 to 40 minutes by immersion in 15% brine containing 20% glucose at —9 to —10°C. Cat fish, kalawa and jew fish could be filleted manually, frozen and stored for long periods.

Processes were standardised for canning of oil sardine and mackerel in oil, brine, tomato sauce etc. Methods were also perfected for canning of smoked oil sardine and froglegs in brine and tomato sauce, crab meat in brine, tuna in oil and brine, mussel and clam meat in oil, brine and tomato sauce and edible oyster meat and anchovies in brine.

Methods were worked out for preparing several diversified products like soup powder, flakes, hydrolysates, fish protein concentrate, bacteriological peptone, pet food, fish fingers, poultry feed, fish ensilage etc. from cheap varieties of fish. Acceptable products like fish curry, fish pickles and smoked fish shavings were developed from trash fish. Nonpenaeid prawn powder from Jawla prawns and salted, smoked and dried doma were some of the other products developed.

Instruments developed for use in quality control and automation in processing factories included Brine concentration meter, Freezer temperature monitor and alarm, Automatic brine dispenser and Moisture meter. Several mechanical devices for fish processing were developed, some of the more important ones being a Rotary drum dryer for fish meal and prawns, single and multi deck tunnel dryers for salted fish, an Electrothermal smoke kiln, Pilot plants for fish protein concentrate and chitosan, a Solar dryer for salted fish and a Refrigerated sea water plant for preserving fresh fish.

A survey of the packaging materials used in the fish processing industry showed that the packagings require considerable improvements in their properties. Hygienic packaging materials were developed for cured fishery products.

Considerable work has been done towards improvements in quality of exportable products. Blackening|blueing of canned prawn|crab meat was prevented by maintaining the titratable acidity in the fill brine at or above 0.06% and addition of disodium salt of EDTA.

A method worked out to prevent drip loss from frozen prawns was commercially applied on 50,000 tonnes of prawns in 1970-75, effecting a saving of raw material to the tune of 5000 tonnes valued at Rs. 7.5 crores. A method was successfully worked out for preparing frozen froglegs completely free from *Salmonella*. Separation of frogleg processing from prawn processing units, stoppage of hut peeling and avoidance of backwater and fresh water prawns for

freezing in raw condition have been recommended for exclusion of *Salmonella* from frozen prawn products. A method for assessing the hygienic conditions in processing plants for introducing inprocess quality control and the requirements for a laboratory for implementing the same were drawn up for assisting the industry. A reagent-impregnated filter paper was developed for determining chlorine levels upto 500 ppm in water used in processing plants, the chemicals employed being potassium iodide, acetic acid and starch.

Methods were worked out for preparing several industrial products from sardine oil. Some of the important products developed were factice (artificial rubber), printing ink and lubricating oil. Procedures were also developed for extracting rays from shark fins and chitosan from prawn shell waste.

National standards were worked out for all important fishes and processed fishery products in association with the Indian Standards Institution.

EXTENSION

Considerable amount of work has been done for popularising the research results for the overall development of fishery industry in the country, gathering feed back information from fishermen, fisheries departments and fishery industry as a whole, organising short term refresher training courses for the benefit of technical personnel from fisheries departments and industry, studying the extent of adoption of new and improved technologies already worked out and conducting statistical investigations on the technological problems involved in fishery technology.

These were achieved through promptly aswering all technical queries received from fishing and fish processing units all over the country, State Fisheries Departments, other fishery organisations as well as new entrepreneurs in the field.

Refresher training courses were conducted for giving advanced training to fishermen, fisherwomen, fish processors and new entrepreneurs in the fields of gear fabrication, fishing, fish processing, production of diversified products and byproducts, quality control and bacteriologicial analysis of seafoods.

Testing of different kinds of samples, products, water and raw materials received from numerous processors and different types of marine engines manufactured in the country was undertaken and reports furnished. Exhibitions and open houses were conducted in order to create awareness and interest in fisheries development among the public. Frequent film shows were conducted in several fishing villages and fish processing factories which helped immensely in imparting general education to the fishermen community and processors on the modern ways of harvest and post-harvest technology.

Radio talks made by the scientists of the Institute over the AIR were of great help in creating awareness of the new developments in fishery technology among fishermen, fish processors and others engaged in or associated with fisheries. Several booklets, folders, pamphlets and leaflets (nearly 120 in number) published by the Institute contributed significantly to its activities. The Institute receives foreign trainees sponsored by FAO and International Agencies and Government of India from several countries like Philippines, Burma, Sudan, Tanzania, Guyana, Yemen, and Nigeria in the disciplines of both harvest and post harvest technology of fish for durations varying from one week to 12 months.

Conclusion

India has made rapid strides in the field of Fishery Technological Research and Extension in the past two and a half decades. In terms of quality and quantity, the contributions made by the country so far in this area are second to none in the world. The country can legitimately feel proud that in the matter of research and extension in harvest and post harvest technologies of fish, she is now on a par with any of the developed countries of the world.