

# STABLE TROPICAL FISH PRODUCTS

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Report on a workshop held in Bangkok, Thailand,  
8-12 October 1974

Marilyn Campbell



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Report on a Workshop held in Bangkok,  
Thailand, 8-12 October 1974

**Marilyn Campbell**

Sponsored by the  
International Development Research Centre  
in cooperation with the  
Department of Fisheries, Ministry of  
Agriculture and Cooperatives, Thailand

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# Stable Tropical Fish Products

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## Abstract

Representatives from 13 countries met in Bangkok, Thailand, to discuss possibilities of producing low-cost stable tropical fish products from underutilized species. The aim of the workshop was to permit scientists of the region to formulate precise practical programs based on what were considered to be prime needs and major problems in producing, for human consumption, better fish products that will not deteriorate when held in storage for reasonable periods of time. Topics included traditional products, nontraditional and industrial products, consumption patterns, available resources, by-catch utilization, product handling problems, and practical steps for product development. Fisheries technologists, market organizers, credit and bank financiers, and industrial operators discussed both the scientific viewpoint and practical constraints of producing pragmatic programs suited to the needs of developing countries. Two project proposals were formulated, the first dealing with improvement of traditional salted/dried fish products in tropical countries of Southeast Asia, and the second with the development of nontraditional products using minced fish obtained from trawler by-catches.

## Résumé

Des représentants de 13 pays se sont réunis à Bangkok en Thaïlande pour discuter des possibilités d'en arriver à des produits de la pêche qui soient peu coûteux et non périssables à partir d'espèces tropicales sous-exploitées et soumises à divers traitements: salage, séchage, marinage, fumage, fermentation, mise en conserve — en excluant la congélation. C'est dans le but de permettre aux hommes de science de ces régions d'élaborer des programmes précis et applicables qui puissent, d'une part, répondre à l'urgence d'offrir aux consommateurs des produits qui se conserveront durant des périodes suffisamment longues et, d'autre part, apporter des solutions aux problèmes associés à cette production, que s'est tenu cet atelier de travail. Les sujets étudiés au cours de la réunion ont porté sur les produits courants, les nouveaux produits industriels, les modèles de consommation, les ressources disponibles, l'utilisation des prises accidentelles, les problèmes de la manutention et les dispositions nécessaires au développement des produits de la pêche. Ces technologues des pêches, spécialistes du marché, financiers et industriels ont examiné tant l'aspect scientifique de la mise en oeuvre de programmes susceptibles de répondre aux besoins des pays en voie de développement que les problèmes d'ordre pratique qu'ils soulèvent. Ces entretiens ont abouti à deux propositions de programmes, l'une portant sur l'amélioration des méthodes traditionnelles de salage et de séchage du poisson dans les pays tropicaux du Sud-Est asiatique et l'autre intéressant le développement de nouveaux produits à partir des prises accidentelles lors du chalutage.

## Foreword

Fish is one of the most important animal protein foods available for human consumption in many Asian countries. The surrounding vast expanse of seas and the Pacific and Indian oceans have for many years yielded more than a third of the world's fish production for consumption by the most densely populated area of the world. Fish products are, moreover, a relatively cheap source of protein for rural peoples, whose well-being is a matter of particular concern to countries of the region.

However, there is considerable waste in this industry through such practices as discarding the "by-catch" when harvesting more valuable species such as shrimp; spoilage of products because of inadequate storage or handling systems; and processing methods that do not efficiently preserve the protein content for human use. By improving processing practices alone, one-fifth more fish products could be made available to the consumer in a region where there is a continuously increasing demand for such products, as well as a food shortage.

With the purpose of finding ways to eliminate fish losses, including use of the by-catch and other underutilized resources, IDRC sponsored a workshop on stable tropical fish products in Bangkok, Thailand. "Stable" fish products are those that will not spoil at normal temperatures, such as many traditional salted, dried, smoked, or pickled fish products. However, in tropical regions, heat, humidity, reinfestation, and enzyme fermentation contribute to spoilage more rapidly than in cooler regions and the tendency has been to use frozen or chilled storage to delay this spoilage. This is an expensive system and is usually not available to rural communities without a considerable subsidy.

The aim of the workshop was to permit scientists of the region to formulate precise practical programs based on what were considered to be prime needs and major problems in producing for human consumption better fish products that will not deteriorate when held in storage for reasonable periods of time.

The workshop was a direct result of a suggestion discussed at the meeting of the Indo-Pacific Liaison Group on Cooperative Research on Fish Product Development held during the FAO Fish Products Conference in Tokyo in December 1973. At that time, IDRC suggested organizing a workshop/seminar to consider possibilities of producing low-cost products from underutilized tropical fish species. Because of taste preferences, species available, and cultural patterns, it was then suggested that it would be most practical to deal with fish product development problems on a regional basis, starting with the working party established by the IPFC of the FAO for processed fish products. With the collaboration of the IPFC secretariat, IDRC invited the members of this working party and representatives from countries of the region to participate in the Bangkok workshop.

Representatives came from Australia, Bangladesh, Britain, Canada, India, Indonesia, Japan, Korea, Malaysia, the Philippines, Sri Lanka, Thailand, and the USA. The representatives included not only fisheries technologists but also market organizers, credit and bank financiers, and industrial operators. In this way it was hoped that both scientific viewpoints and practical constraints could be fully considered in order to produce pragmatic programs suited to the needs of developing countries.

The workshop was divided into six sessions, each consisting of a summary of the various countries' reports on the particular agenda item, followed by a discussion to determine the major problems of that topic. The seventh and final session was devoted to formulating the "action programs" in order of priority.\*

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\* The reports for each session contained herein provide only a concise summary of the problem areas identified, generally without particular reference to the countries concerned, but with stress on the significance of the problem and the benefit that its solution would provide. For details of the problems described for each country, please refer to the papers appended as microfiche.

Each representative was therefore able to share other participants' experiences and to contribute to project formulation insofar as it was relevant to his own country. In addition to the round-table discussions there were field study visits to fish processing and marketing establishments in Bangkok and Smutsakorn Province, and to the fish technology laboratory in Bangkok. These trips enabled visiting participants to appreciate operational activities and problems of the Thai fish processing industry especially during the monsoon rains.

The assistance of the Department of Fisheries of the Ministry of Agriculture and Cooperatives of Thailand and of the Thai Government in making the arrangements for the workshop is much appreciated. This assistance and gracious hospitality have enabled participants not only to discuss their common problems, but to formulate programs that may help produce more economical, nutritious, and acceptable processed fish products for people at the lower end of the economic scale in Southeast Asia.

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Associate Director (Fisheries)  
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International Development Research Centre



*"By improving processing practices alone, one-fifth more fish products could be made available to the consumer. . ."*



## Introduction

"I am particularly pleased to learn that the objective of the Workshop is to identify, define, and focus attention on research programs which are essential for the accelerated development and improvement of tropical fish products for the lower income groups. I consider this endeavor very important and beneficial since the majority of our people still live in poverty. For them, fish is very important as it is the cheapest source of animal protein available at present.

"... It should be noted that in 1973, the total fish production [in Thailand] exceeded 1.5 million metric tons, of which approximately slightly less than half was trash fish. . . [not] utilized for human consumption or for the production of fish meal, but. . . used widely by our poultry and fish farming industry. Furthermore, due to the prevailing methods of fish handling and processing employed by the fishing industry in general, a considerable quantity of fish has to be disposed of or converted into animal feed annually, because it is not fit for human consumption. It has been roughly estimated that more than 15 percent of the landing annually is spoiled, resulting in a considerable economic loss. If we can develop effective methods for handling and processing fish as cheaply as possible, I am confident that fishermen will eventually have increased earnings, more food will be available to our people, and at the same time the nutritional standard and the general health of the people will be improved considerably.

"... I believe that through the exchange of ideas, the Distinguished Participants will have, at the end of the Workshop, a clear picture of priority research programs which should be carried out in the field of fish processing in our region. I sincerely hope that this workshop will foster closer collaboration among countries in the region in this important area of fisheries development."

Thus H.S.H. Prince Chakrabandhu Pensiri Chakrabandhu, Minister of Agriculture and Cooperatives of Thailand, set the theme for the stable tropical fish products workshop in this keynote address.



*"In Thailand, more than 15 percent of the landing annually is spoiled. . ."*

## Traditional Products

Traditional fish products of southern Asia vary slightly from country to country but usually consist of some form of salted, dried, smoked, fermented, boiled, pickled, or canned fish.

The fish used for producing traditional products are in general those species for which there is little consumer demand; those that are too low priced to support refrigerated storage; those whose quality is too poor for market sales as fresh fish; or those that are rejected in the fresh market because of their size and mixture. In addition, seasonal gluts of fish resulting from monsoon rains and high humidity, which increase the processing and storage problems for such fish, are also used for traditional products.

Therefore, for the small-scale producer in rural areas or for the large-scale industrialized operation in the urban areas, the processing of traditional fish products is more or less a salvage operation of fish otherwise unsalable for human consumption. (If the state of decomposition of the fish is too far gone, it is generally consigned for livestock feed processing.)

The salted, dried, and smoked products present the major problems in preparation, nutritive value, and keeping quality. Lesser problems and waste are associated with products that are pickled, fermented, or boiled, and canned products generally have to comply with international standards.

Certain inherent characteristics seem to be typical of the fish used for processing as traditional products:

- great variety in volume and uncertainty of supply, seasonally as well as within season;
- low initial quality of the raw product and lack of uniformity in the condition of batches;
- low value of both the raw product and the processed end product.

These conditions allow little room for any change that will add to the cost structure.

Related factors also influence the processing of traditional products:

- variable demand and inadequate storage or marketing conditions;
- lack of plant processing standards or controls and thus the variable quality of products coming from small processors.

In addition there are technical areas within the processing that can cause further problems:

- quality and quantity of salt used;
- moisture content of the product and its interaction with the humid or dry weather conditions;
- slower spoilage that may result from moulds or bacteria causing off-flavours;
- storage conditions under which the products are held prior to and during marketing;
- ignorance of the precise nature of the biochemical processes involved.

Conference delegates stressed that because of the seasonal availability of supplies, traditional products are generally intended to have a relatively short shelf life and rarely are packaged adequately against microbial reinfestation or even against insect contamination or rodent attack. However, packaging costs money and anything that tends to increase the cost of the product to the consumer may be unacceptable unless larger units and marketing systems would allow for economies of scale.

On the other hand, high-value products destined for export receive major attention. They are generally well handled from time of capture, through processing systems, to storage and sales either for export or for consumption in urban areas among higher income groups. Such products are generally marketed fresh or frozen.

The improvement of traditional products must start with the handling of the catch aboard and at landing places. However, the improvements possible using traditional processing techniques are distinctly limited, determined as they are by climatic conditions, small dispersed supplies, low capital, inadequate infrastructure, and the impossibility of standardizing





processing conditions. Thus the fundamental problems are social and economic rather than technical. Unless some incentive is provided for industry to produce better quality traditional products, improvements in handling these products will be difficult to achieve. It may be that such incentives will have to be provided by governments.

Instances were cited of consumer preferences changing from the traditional dried, salted, or pickled products to frozen products, but it was agreed that this was generally associated with the availability of refrigeration and with increased purchasing power. This was not applicable to the rural areas of most of the tropical countries represented.

Solutions to the problems listed above will involve improved handling practices from the time of capture of the fish until its processing and consumption in order that good quality initial raw material can give a good quality end product. However, the possibilities of improving processing techniques on a small scale are distinctly limited. Minimum economical units would be required for raw product storage, mechanical drying, improved smoking kilns, fermentation techniques, packaging, and the storage of finished products. It was agreed that any new methods will only be acceptable provided they do not greatly alter the appearance of the finished product. If, however, innovative processes result in products that are unfamiliar to the consumer, resistance will

be greatest at the lowest income levels and it will require much effort to secure consumer acceptance.

*"...the processing of traditional fish products is more or less a salvage operation of fish otherwise unsalable for human consumption. . ."*

*"...products resulting from new processing methods will only be acceptable provided they do not greatly alter the appearance of the finished product. . ."*

## Nontraditional and Industrial Products

Manufacture of frozen fish products on an industrial basis has evolved in all of the participating countries, with the main emphasis on shrimp, squid, and fish fillets, all of which are exported. Constant world prices and adequate resources have helped to make this an expanding industry and a safe one for investment. Improvements are still needed in quality control and storage facilities, but generally the demands of importers in developed countries have helped to ensure such measures, and the extra profit margin that higher quality brings provides the industry with added incentive for improvement. The improved standards demanded by the export market are now influencing consumer demand for better quality and better hygienic standards in products manufactured for local consumption. Such plants also have an interest in new products if they are economically attractive. Products that may be developed from the by-catch of shrimp trawling may be particularly interesting.

Canned products are produced throughout the region. Concern was expressed at the relatively high cost of cans in the small sizes preferred by the lower income group and the difficulty of ensuring standard quality when there were seasonal supplies of fish from various sources. Local canning of fish products offers an uneconomical alternative to some accepted traditional products and cannot compete in price with imports. In addition, capital requirements, limited bulk supplies, and the need for training in new technology have evidently made local canneries a lower priority in many countries, despite the fact that canned fish products are admittedly among the most widespread stable products available.

Minced fish products prepared from underutilized species were of particular interest to most countries. Some countries were already using the system to make fish balls and other products. The new technology of flesh and bone separators permits the preparation of fish flesh products that can be formulated along traditional lines, modifying the procedure to prepare a good quality standard of versatile products that can be dried or frozen. There

was also the possibility of dehydrated sterilized packs in flexible pouches rather than cans.

This approach to nontraditional products probably offers the greatest potential for a wide variety of stable "convenience" fish products for both rural and urban consumers. The development of minced fish as a basic raw material would enable "total catch utilization," thereby doubling earnings. There are possibilities of doing this afloat larger vessels but also at centrally located shore plants. This system can thus offer an opportunity for a wider utilization of species presented in minced blocks of varied texture or flavours. The flexibility of the process offers great potential for the use of a variety of species, either singly or mixed, in a wide range of products that may be cooked, salted, smoked, dried, or semidried with the addition of spices or flavours required by market preferences.

It was agreed that this is an area for priority action, and that it will also involve some attention to suitable packaging and the need for adequate quality control standards of products for domestic, regional, and international markets.

Dehydrated and fermented products were also discussed. It was agreed that they are largely speciality products and they may be less widely accepted than minced products.

*"... Capital requirements, limited bulk supplies, and the need for training in new technology have made local canneries a lower priority. . ."*

## Consumption Patterns

Fresh fish, whether marine or freshwater, are preferred by consumers of the region, whenever and wherever available. This includes to a lesser extent frozen rather than iced fish. In most countries the bulk of processed products is consumed in inland areas, where fish farms have increased the availability of such products. Consumption of dried, salted, pickled, and fermented fish was significantly high in all countries. Because of existing unsatisfied demand, the amount of processed products — variably estimated at 40–50% of total fish consumption — could perhaps be substantially increased if problems of spoilage, distribution, supply, and storage were resolved.

Good quality raw material must be available for processing at a price low enough to produce quality end products for consumer acceptance at a reasonable price. Slow freezing or freezing of poor quality fish often result in a frozen product that is not acceptable to consumers particularly where a cold storage distribution chain has not been effectively developed.

The clear preference for fresh fish apparently does not preclude acceptance of new products provided they are available at a reasonable price and are conveniently supplied. To assure consumer interest, new products should resemble traditionally acceptable ones in appearance and taste if possible, because low income consumers resist changes in food habits, and to promote new products would be costly and time-consuming.



*"...Fresh fish, whether marine or freshwater, are preferred by consumers of the region, whenever and wherever available. . ."*

## Available Resources

Various fish species, either because of their small size or because consumers dislike them, are underutilized. Many of these occur in coastal waters as a by-catch in shrimp trawling; others, like skipjacks, saury, and needlefish, are the by-catch of purse-seine fishing; others, such as various types of sharks, occur in almost all harvesting systems. Although over 231 species are caught in the coastal waters of the Gulf of Thailand, only five are in high demand for human consumption, the rest being converted to fermented products when caught. Some attention was given to the resources of squid, cuttlefish, and jellyfish, which are seasonably abundant, and to delicacies prepared on a limited scale from the evidently large resource of sea cucumbers and sea urchins.

Throughout the region the potential of aquaculture resources is considerable. In most cases the products of culturing practices are sold fresh or live but when there is need for extensive cropping before typhoons, processing becomes a problem. The potential production from fish culture ponds can increase the yields of fish twofold and then processing problems would be accentuated. Future developments of the extensive brackish water ponds systems of the region may accelerate improved processing of such fish. However, the efficient processing of some freshwater species such as "sepat siam" presents technical problems.

Various problems are encountered in processing this mixed catch of hundreds of species of fish with varied fat content, flesh colour, and taste. Some fishes may also be noxious and others, like sharks, require special processing techniques to remove the urea. Such problems can only be solved by developing appropriate processing technology.

The main underutilized resource seems to be the by-catch from shrimp trawling, the processing of which may be performed either by floating factory ships or ashore at fish plants. The factory ships are considered more feasible

because of the variable catch, low value, great bulk, and high handling costs of such fish if it had to be landed for processing.

All participants agreed that efficient utilization of marine fishes that are now harvested as by-catch and discarded or processed for animal feed, could increase the amount of food available without increasing the exploitation of resources if converted into products for human consumption. Additional resources from inland fisheries, canals, and aquaculture systems can increase supplies but will also require technological innovations.

*"...Although over 231 species are caught in the coastal waters of the Gulf of Thailand, only five are in high demand for human consumption. . ."*

*"...The main underutilized resource seems to be the by-catch from shrimp trawling. . ."*

## By-Catch Utilization

Four of the countries present — India, Malaysia, Indonesia, and Thailand — indicated that there has been a considerable increase in the quantity of underutilized trawling by-catch. The quantities varied but the annual estimates in Thailand and India were 400,000 and 200,000 tons respectively. The Philippines, Bangladesh, Sri Lanka, and South Korea indicated that there was either no by-catch or the quantities involved so far were relatively small.

The major problems with handling the by-catch are: (1) variable mixture of species (sharks, rays, and small bony species not usually consumed by humans); (2) widely variable quantities; and (3) boats not designed to handle the by-catch economically. Any solution to the problem of utilizing the by-catch will be dependent upon the different situations in each country. The relative merits of processing on board the boat versus processing on shore were discussed. High temperatures of sea water and on-deck plus bulk handling problems make processing at sea difficult, but the consensus was that processing at sea is the method with the best potential, particularly in view of increased size of vessels.

Discussions involved possible use of the by-catch and research on salting products at sea, preparing minced products, and preparing slurry or hydrolysates for use as animal feed.

### Shrimp trawler by-catch

Because of the interest of all countries of the region in total utilization of the catch, and since it was indicated that four of the participating countries obtain considerable quantities of fish from shrimp trawling operations, a special session was devoted to this topic. In exceptional cases trawling yields about half fish and half shrimp, but more often at least three-quarters of the catch is fish. Delegates were concerned about how best to utilize this low-value fish, which trawlers customarily discard to make room for the maximum cargo of shrimp.

The problem was illustrated with reference to areas such as the Gulf of Mexico and the Guiana shrimping grounds. It was recognized as an almost universal problem of shrimp fisheries for which no solution has been found in the last 15 years, even though this is clearly a valuable potential source of accessible food.

Various aspects of the problem were discussed. Shrimp trawlers contend that there is no clear biological data indicating that over the years of shrimp trawling the discarding of the by-catch affects the size and availability of shrimp or the fish species composition, although there are some unsubstantiated indications of an increase in sharks and a decline in shrimp size.

The present size, design, and limited crews of vessels prevent convenient handling and return to shore of all the fish and shrimp caught, or easy sorting and stowage. Processing or partial treatment of the fish catch at sea will only be feasible with the introduction of larger vessels specially designed for the purpose. The possibility of processing in bulk by salting, silage, minced flesh separation, dried products, or frozen stowage will depend upon the value of the end product. All indications suggest that it will be more practical to process at least partially to a bulk-stowable product aboard vessels, either on the catcher vessel itself or on a mother ship-type operation, rather than returning the catch to shore for total processing. The economic feasibility of such operations may only be justifiable if high-value products as well as low-cost products result. These can be both for human consumption and for hydrolysates and meal for animal feed.

The new technology of flesh-bone separators has added an additional dimension to the utilization of the by-catch. These separators would require sizeable capital inputs and modification, but are capable of wide application.

*"...In exceptional cases, trawling yields about half fish and half shrimp, but more often at least three-quarters of the catch is fish..."*

## Product Handling Problems

The problems involved begin with the handling of the fish from the time of capture and holding and transferring them prior to processing. The difficulties include some that are associated with the harvesting systems — types of fishing methods, facilities aboard the vessel or small craft for stowage, and transport to landing points for bulk sale. They also include the cost, supply, and even quality of the ice that is available and whether it is even used to delay spoilage. Often adequate quantities of hygienic water for washing fish are lacking at landing sites and rural processing centres. The subsequent chain of problems involves supplies for processing, including cost, supply, and notably quality of salt; containers for handling fish when transferring it with minimum loss or damage; and the packaging of the processed products.

Although it was agreed that the poor quality and high cost of both salt and ice are often major limiting factors, it was nevertheless conceded that these were indeed part of a much more complex problem, and that the removal of these constraints were beyond the competence of, and could not be tackled by, the workshop. However, there were various suggestions put forward to deal with other handling problems that seem more controllable. Those that fall in this category are: (1) the availability of suitable inexpensive containers (boxes, baskets, tubs, etc.) for handling the raw material; (2) the packaging of the finished product after processing for storage and marketing; (3) the improved storage of fish or products before or during distribution and the minimizing of other practices that are harmful to products.

Although plastic fish boxes had been considered as a solution as containers because of durability and easy cleaning, their currently increasing costs, as petroleum-based products, place their use beyond the price structure capability of small-scale operations, particularly for traditional products. Locally made baskets or boxes lined with banana leaves and sheet plastic seem to be the temporary and

expedient alternative, and have returned to popular use. The possibility of bulk handling of by-catch aboard trawlers may also preclude use of containers until the finally processed form is produced.

The difficulties of modernizing the packaging of traditional products include considerations of cost; bacterial spoilage of some products of high moisture content; possibilities of pasteurization or sterilization; and the effectiveness of the packaging material against insect infestation. Consumer as well as bulk or institutional packs for dried, smoked, or salted products of suitably low moisture and fat content are used currently in some countries. Their wider use for different products requires specific investigation. Again, the economies of scale that can result by processing operations of sufficient bulk with adequate cool, dry, and effective storage, whether as cooperative or other groupings, can contribute to cost reductions both from the organizational and technical production aspects.

Because dried products constitute a major portion of the products consumed in this region, investigation of effective quality control and protective packaging systems may provide useful results for extending shelf life. Ventilated storage and weather protection are indicated as necessary.

Finally, the rigid hygienic standards and modern packaging required for nontraditional products, such as frozen shrimp, etc., for export markets, have influenced considerably the upgrading of standards and methods in handling traditional products. However, it is recognized that there is still a clear need in most countries for definite improvements in the areas cited above.

*“...The problems begin with the handling of the fish from the time of capture and holding and transferring them prior to processing...”*



## Practical Steps for Product Development

The current programs that are being undertaken in institutes and industrial centres in the region were summarized in a paper prepared by Dr R. Kreuzer (Appendix II). In it are indicated the capabilities as well as some of the limitations of the technological laboratories in the region. It was agreed that additional personnel and facilities will be required for any particular action programs that may be formulated by the workshop. Certain technological laboratories had some programs underway and others were planning to undertake such programs.

Laboratories based in the developed countries that were participating in the workshop seem to be appropriate places for training and the assurance was generally given that such collaboration as was needed would be provided by them by specific arrangements. It was also indicated that in some instances relevant industrial experience and advice may be furnished when requested.

The coordination and exchange of information and experience in product development activities seem to be particularly essential between government laboratories and industry as well as between countries of the region. This was particularly important in optimizing traditional fish products. With respect to minced fish products the collaboration between laboratories or industry from the developed countries and the technological institutes of the developing countries seems highly desirable from the experimental through the pilot stage to industrialized operations.



*"... Coordination and exchange of information and experience in product development are essential between government laboratories and industry as well as between countries of the region. . ."*

## Action Programs and Priorities

The aim of the workshop was to formulate precise practical programs of significance for the developing countries of the region. These programs would be based on what the participants from the region considered to be the major problems to be overcome in producing better fish products for human consumption. With this objective in mind, the participants were divided into two groups and produced the following two project proposals, based on the evident priorities of the region.

### Program 1

Improvement of Traditional Salted/Dried Fish Products in Tropical Countries of Southeast Asia

Estimates of up to 25% have been quoted for losses due to microbial spoilage, insect infestation, and breakage in salted/dried fish products in Southeast Asia. This represents a significant waste of protein needed particularly by the rural sections of the community.

There is an urgent need to develop improved processes to prevent these losses. Because of economic and acceptability considerations, it is felt that improvement of traditional processing and packaging is the best means of increasing the supply and quality of fish products.

The objectives of this program are: (1) to prevent the existing losses of traditional salted/dried fish products by improving the methods of handling and processing and the use of preservatives against insect or microbial spoilage; (2) to encourage innovations in packaging or storage systems and the establishment of a standard quality of traditional products; and (3) to ensure that results of this program are communicated to, and adopted by, industry within the region.

The project, with minor modifications, should preferably be conducted in several countries within the region, but different countries could investigate different species of fish as applicable. The overall program should be monitored as closely as possible to obtain the

maximum amount of information for the region as a whole.

While the technological feasibility of product improvement is being established, an assessment of the profitability of any improvements or innovations should be undertaken.

This program was of particular interest to the Philippines, Malaysia, Sri Lanka, India, and Bangladesh.

### Program 2

Development of Nontraditional Products using Minced Fish obtained from Trawler By-Catch

The principal objective of this proposal would be to increase the availability of fishery products to low-income groups in countries of Southeast Asia, using as raw materials those resources now reduced for industrial purposes or presently discarded at sea. Specifically, products would be developed from minced fish, with collaborating research programs being done by several countries. The procedures would be nontraditional in form and the product would resemble closely existing traditional products such as boiled fish balls, dehydrated fish, and deep-fried fish patties. Products would be designed to meet consumer requirements in flavour, appearance, and customary preparation, and to be compatible with existing methods for distribution and retail sale. Profitability assessments would continuously determine production cost, and packaging, storage, and shelf life under varied conditions would be fully tested.

The project would be divided into two pilot plant procedures, one for community production of dehydrated fish and the other for commercial production of fish balls, using three or four species that comprise the bulk of the by-catch. The variety of products will include those of high market value as well as cheaper products.

This program was of particular interest to India, Indonesia, Thailand, the Philippines, Sri Lanka, and Bangladesh.

## Implementation of Results

Several countries indicated their particular interest in these projects and their possible implementation in any given country as a model for regional application will depend upon the facilities available in their fish technology laboratories. The workshop moderator explained that project proposals for funding should be submitted through the formal government channels to IDRC to initiate procedures for implementation of the projects.

A representative of IDRC will be made available to discuss such procedures and any government or research institution wishing to consult IDRC should contact:

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## Appendix II

Evaluation of Research Capabilities for Product Development at Technological Institutes in Asia and the Far East

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The following is information on technological institutes and laboratories in Asia and the Far East in regard to their work programs and research capabilities for carrying out product development.

### Research Activities

The 12 institutes surveyed were as follows:

**Australia:** CSIRO, Tasmanian Food Research Unit, Division of Food Research, Hobart; **Hong Kong:** Fisheries Research Station, Hong Kong; **India:** Central Institute of Fisheries Technology, Cochin; CFTRI, Central Food Technological Research Institute, Mysore/Mangalore; **Indonesia:** Institute of Fisheries Technology, Jakarta; **Japan:** Tokai Regional Fisheries Research Laboratory, Tokyo; **Korea:** National Fisheries Research and Development Agency, Pusan; **Malaysia:** Technology Research and Development Centre, Serdang/Kuala Trengganu; **New Zealand:** Technology Research Centre, Massey; **Philippines:** Bureau of Fisheries, Technology Laboratory, Manila; **Sri Lanka:** Fisheries Research Station, Sri Lanka; **Thailand:** Fishery Technology Laboratory, Bangkok.

The various activities as mentioned by the institutes were classified under 12 topics:

- (1) Fish handling and preservation
- (2) Fish storage and distribution
- (3) Traditional processing techniques and product improvement
- (4) Industrial processing techniques and product improvement
- (5) Development of new products and of processing methods; development of speciality products
- (6) Utilization of species of low market value; waste utilization
- (7) Development of processing, distribution, and marketing equipment

- (8) Quality assessment, quality and process control, standards, fish inspection
- (9) Assistance to industry (extension)
- (10) Analytical and scientific research related to fish utilization
- (11) Environment and pollution
- (12) Development of fish feed

Activities included in the present work program of the institutes and activities that are planned for future work programs are shown in Fig. 1. Institutes are indicated by country name and when required, the name of the location of the institute. (Hong Kong and New Caledonia are included in Fig. 1 but are not discussed in the evaluation of research activities and capacities as they are not concerned with technological work.) Eleven institutes have been taken into consideration.

Of special interest to this workshop are topics 3, 4, 5, 6, and 8.

Product development is presently carried out in eight institutes and three more are planning to carry out such activities in their future work programs. Thus all 11 institutes under consideration are engaged in product development or will be engaged in it soon. Two institutes only, India (Mysore) and New Zealand, are dealing with the utilization of fish of low market value and of factory waste. Work on improvement of traditional products was indicated by eight institutes but only one (Indonesia) emphasized the importance of such work in future programs. Aspects of quality control, fish inspection, and standards are dealt with in six institutes and two more are planning to work in this field.

### Research Capacities

Table 1 shows staff, facilities, and requirements in relation to activities in technological fields, in particular in product development. From these data an estimation of the potential of the institutes to carry out research in the above fields can be made. (Further details can be obtained from the institutes.)

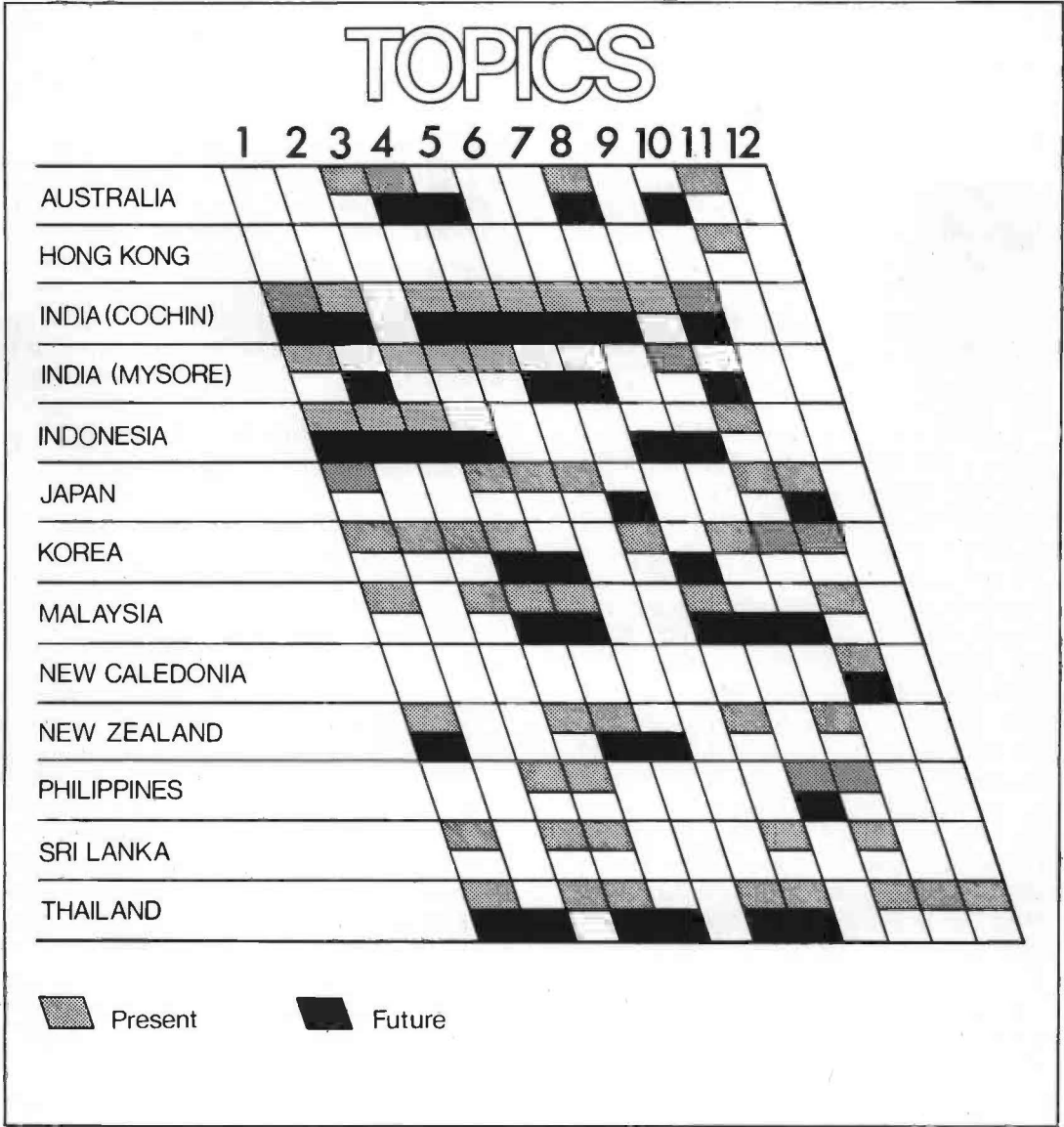


Fig. 1 Present and Future Research on Fish Technology

Only four of the institutes are completely equipped and staffed: India (Cochin and Mysore), Korea (Pusan), and Japan (Tokyo). New Zealand is using the facilities of the Massey University, and has a limited program in fish product technology, but there appears to be sufficient flexibility to cope with new tasks. The remaining institutes have limited facilities and some of them are short of staff. Most of them would, however, be able to carry out a larger product development project on a joint basis with other institutes if government agreement can be achieved. For some specific new developments additional equipment might be required.

#### Development Work

The types of products developed in the various institutes are briefly mentioned in Table 2.

Although there are differences from country to country with regard to product types as well as consumer demand and acceptance, there are common interests in particular types of products and there are certain trends that can be recognized in each country. Only two examples are mentioned here.

Minced fish is under investigation at present in three institutes (India (Cochin and Mysore) and Korea (Pusan)) and at least four to five institutes are interested in working in this field. More will likely follow.

Traditional products are currently being investigated and improved or further developed in eight institutes, namely: Australia, India (Mysore), Indonesia, Korea, Malaysia, the Philippines, Sri Lanka, and Thailand. The interest in these products seems, however, to be declining since only one institute has indicated interest in work in this field in future programs.

A significant shift of interest appears to have taken place in the technological institutes of Asia and the Far East. The interest of the technologists in traditional products seems to be decreasing whereas the interest in particular types of nontraditional products, mainly minced, canned, and frozen products, is increasing.

The available information is, however, not sufficient to enable us to relate this trend in emphasis to a similar trend in the small-scale processing industry and in consumer demand and preference.

Table 1 Research capacity of technological institutes

	Staff	Staff with special training	Facilities	Requirements	Product development
Cochin	Total 188; special training: 4	1 Processing Technologists 1 Biochemist 1 Bacteriologist 1 Quality Control	Completely equipped laboratories for: Processing by-product development; Biochemistry; Bacteriology; Processing equipment & machines; Pilot processing plant	No immediate requirements	Frozen and canned products; Minced and other products from fish of low market value and processing waste; Fish sausage; Speciality products
Mysore/Mangalore	10 Scientists with academic qualifications	6 Fish Technologists 1 Fish Preservationist 1 Meat Technologist 1 Fish Flavour Researcher 1 Animal Physiologist	Completely equipped Fish Technology & Experimental Station in Mangalore; separate disciplines of meat, fish, and poultry; technology pilot plant suitable for experiments on a semi-commercial scale	No immediate requirements	FPC & similar products
Pusan	68 Scientists		Laboratories and pilot plants belonging to 6 sections; Fish utilization and processing section; Fisheries resources section	No immediate requirements	1) Seasoned squids 2) Minced fish flesh using fish of low market value
Kuala Trengganu/Serdang	3 Scientists in Kuala Trengganu (33 total)	<i>Kuala Trengganu</i> 1 Biochemist/ Food Scientist 1 Chemist 1 Food Scientist/ Agriculture	<i>Kuala Trengganu</i> Pilot Station equipped for studies on fish product development, in particular canned, frozen, smoked, and minced products; Quality control laboratory; Analytical laboratory	1) Additional facilities for technological research 2) Training in technology 3) Marketing research 4) Extension service	Canned fishery products
Massey University	2 Scientists	2 Food Technologists with different qualifications	Use of laboratory and pilot plant processing equipment of the Food Technological Department, Massey University; Mobile laboratory	No requirements for carrying out investigations at present	
Bangkok	4 Scientists	1 Food/Fish Technologists 1 Fish Technologist and Engineer 1 Chemist & Fish Technologist 1 Fish Technologist, specialized in Quality Control	Chemical laboratory and Bacteriological laboratory (these laboratories are incompletely equipped); Pilot plant facilities	1) Some laboratory equipment 2) Assistance in specialized technical fields 3) Cooperation with well-established technological institutes	Planned for future programs 1) Utilization of trash fish and other fish of low market value 2) Product development for the freezing and canning industry

	Staff	Staff with special training	Facilities	Requirements	Product development
Jakarta	28 Scientists	12 Fish Technologists 5 Micro-biologists 7 Chemists 4 Mechanics	Analytical laboratory; Microbiological lab; Home Economics lab; (all laboratories are well equipped); Pilot plants	1) Cooperation with well-established technological institute 2) Training in modern technology for some staff 3) Facilities for handling & distribution of fish	1) Jelly fish products 2) Minced fish products (planned)
Sri Lanka	6 Scientists	3 Zoology / marine biology 1 Zoology / micro-biology, bio-chemistry 1 Food engineering / fish technology 1 Food technology	Chemical laboratory; Bacteriological laboratory	1) Fish technological station 2) Training in fish technology	Planned for future programs 1) Traditional products 2) Convenience products
Hobart	3 Scientists	1 Bio-chemistry, Nutrition, Processing 1 Fish technologist 1 Plant physiology and shellfish pollution	Biochemical laboratory; Analytical laboratory; Technical laboratory (chilling, freezing); Pilot plant for freezing, canning, and drying; Cold stores	According to activities	Abalone products
Tokyo	107 Scientists	Various qualifications	Completely equipped laboratories for: Product utilization; Product preservation; Biochemistry; Bacteriology; Cold storage	No immediate requirements as concerns product development	Comminuted products

**Table 2** Products developed in institutes included in the survey

Country	Products	Present studies
India (Mysore)	FPC Minced fish flesh	Utilization of low-market value fish; fish sausages, fish flakes
India (Cochin)	Minced fish; products from minced fish; concentrated fish hydrolysate; fish soup powder; fish silage; bacteriological peptone from fish meal	Mackerel canning
Australia (Hobart)	Abalone resource utilization	
Korea (Pusan)	Seasoned squid	Minced fish
Malaysia (Kuala Trengganu)	Dried boiled anchovy; canning	
Indonesia (Jakarta)	Jelly fish	Minced fish

## Appendix III

### List of Papers Presented

(Microfiche included in pocket on page 3 of cover)

The following papers were written according to the agenda and purpose of the workshop. The authors did not seek to provide a comprehensive narrative account of the fish-processing industry in their countries. There are many

other publications that deal with different aspects of fish processing and marketing in the Indo-Pacific area and these should preferably be referred to if such background information is sought. No changes have been made in spelling and grammar and the papers are unedited.

1. Stable Tropical Fish Products for Human Consumption (Bangladesh) by M. Youssof Ali
2. Stable Tropical Fish Products for Human Consumption (India) by M. Jayaraj
3. Utilisation of Trash Fish — Incidental Catch of Shrimp Trawlers (India) by R. K. Rastogi
4. Stable Tropical Fish Products for Human Consumption (Indonesia) by Nizam Zachman
5. Stable Tropical Fish Products for Human Consumption (Indonesia) by Sofyan Ilyas
6. The Status of Fish Processing and Distribution in Korea (Korea) by Sykha Park
7. Preliminary Report on the Processed Fish Products Industry in Malaysia (Part I) (Malaysia) by Sabri Ahmad
8. Stable Tropical Fish Products for Human Consumption under Philippine Situation (Philippines) by Felix R. Gonzales
9. Relevant Problems on Stable Tropical Fish Products in the Philippines (Philippines) by Eduardo C. Sison
10. Stable Tropical Fish Products for Human Consumption (Sri Lanka) by E. G. Goonewardene
11. Stable Tropical Fish Products for Human Consumption (Thailand) by Bung-Orn Saisithi

Contributed reference material (not included on microfiche)

1. *Report of the first ad hoc meeting of the IPFC Liaison Group on Cooperative Research on Fish Product Development*, Tokyo, Japan, 8 December 1973.
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4. *Fish Processing Industry in West Malaysia (Technical Study)* by E. P. Sidaway and M. Balasingam. Food Technology Research and Development Centre of Malaysia, Division of Food Technology, Publication #42, FAO, Ministry of Agriculture and Lands, Malaysia.
5. *Fish Canning in Malaysia* by E. P. Sidaway. Food Technology Research and Development Centre of Malaysia, Division of Food Technology, Publication #43, FAO, Ministry of Agriculture and Lands, Malaysia.



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27. Manas Kasemsap
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29. Al Siegel

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## Recent IDRC Monographs

- IDRC - 020e Cassava utilization and potential markets, Truman P. Phillips, 182 p., 1974.
- IDRC - 021e Nutritive value of triticale protein, Joseph H. Hulse and Evangeline M. Laing, 183 p., 1974.
- IDRC - 022e Consumer preference study in grain utilization, Maiduguri, Nigeria, Jean Steckle and Linda Ewanyk, 47 p., 1974.
- IDRC - 023e Directory of food science and technology in Southeast Asia, E. V. Araullo (compiler), 194 p., 1974.
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- IDRC - 025e,f,s AGRIS and the developing countries: recommendations of the FAO/IDRC meeting held in Rome, 26-28 September 1973; AGRIS et les pays en voie de développement: recommandations de la réunion FAO/CRDI qui s'est tenue à Rome du 26 au 28 septembre 1973; AGRIS y los países en desarrollo: recomendaciones de la reunión del FAO/CIID celebrada en Roma del 26 al 28 de Setiembre de 1973, 35 p., 1974.
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- IDRC - 027e Technology policy study centres in Africa: report on the IDRC/ECA meeting on the creation of centres for technology policy studies in Africa, Ile-Ife, Nigeria, 5-10 December 1973, 35 p., 1974.
- IDRC - 027f Centres d'étude des politiques technologiques en Afrique: rapport de la réunion CRDI/CEA sur la création de centres d'étude des politiques technologiques en Afrique, Ile-Ife, Nigeria, 5 au 10 Décembre 1973, 42 p., 1974.
- IDRC - 028e Rural water supply and sanitation in less-developed countries: a selected annotated bibliography, Anne U. White and Chris Seviour, 84 p., 1974.
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- IDRC - 031e Cassava processing and storage: proceedings of an interdisciplinary workshop, Pattaya, Thailand, 17-19 April 1974, E. V. Araullo, Barry Nestel, and Marilyn Campbell, ed., 125 p., 1974.
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