

Processing and Marketing of Fish with Special Reference to Export of Pelagic Fish and Fish Products

By

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Summary

The paper intends to give a description of the world tuna fishery, industry and markets and the trends for its future development. On this background the prospects for developing a tuna export industry in Sri Lanka are discussed. It is suggested that a number of factors favour a quick decision of starting a diversified export scheme of tuna products and that there are the necessary conditions of a successful development. Suggestions are given as to products composition, international co-operation and utilization of available processing facilities. The need for industry and export support is stressed, and it is concluded that preparations for the development should start well in time.

Introduction

The subject that I have been asked to prepare a paper on is a very wide one. The term "pelagic fish" covers a large number of fish species, which have in common that they usually find their food in the surface layers of the sea. The other large group, called "demersal" fish live on or near the bottom of the sea. Small pelagic species, like herring, sardine and mackerel types of fish make up the largest resource of the conventional fish stocks available to increase world fish production for human consumption. Examples of larger pelagic species are tuna-fish, shark and spearfish.

In this paper I have chosen to restrict the subject to cover a commercially very important subgroup of the larger pelagic species, namely the tunas, referring to the following varieties of importance in world trade :

| | |
|-----------|--|
| Bigeye | (<i>Thunnus obesus</i>) |
| Yellowfin | (<i>Thunnus albacares</i>) |
| Skipjack | (<i>Euthynnus pelamis</i>) |
| Albacore | (<i>Thunnus alalunga</i>) |
| Bluefin | (<i>Thunnus maccoyi</i> , <i>Thunnus thynnus</i>). |

The first three of these species are well known in Sri Lanka today and offer very good prospects for the development of a flourishing export trade based on extended off-shore and deep-sea fishing.

General Description of the Tuna Industry

As an introduction to the subject which will focus on Sri Lanka's possibilities of expanding its share of the lucrative export trade of tuna-products, it is felt appropriate to give a general description of today's tuna industry. The purpose is to give some background information on the size and importance of the present tuna fishery, trade, products and processing as well as suggesting trends for the future development.

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Fishery

Total world catches of tuna in 1974 were 1,427,000 tons. During the previous 10-year period landings increased by more than 50%. 41% of the 1974 catch was skipjack which has steadily increased its share of the total landings. 26% of the catch was yellowfin. Altogether the three species skipjack, yellowfin and bigeye, which are the potentials for a tuna export from Sri Lanka, covered more than 75% of 1974 World catches.

It is interesting to note that the only appreciable increases in future catches of tuna will have to come from the yellowfin and especially skipjack fishery. The resources of other species seem to be more or less fully exploited. There are apparently large and still under-developed resources of skipjack in the Indian Ocean.

Fishery for tuna is to a large extent a monopolized business. In 1974 nearly 2/3 of the total catches were taken by Japan (45%) and U. S. A. (18%). Both countries have been dominating for years. Number 3 and 4 countries were Taiwan and the Republic of Korea (South Korea), who together have a share of approximately 15% of world landings with more than 200,000 tons. France and Spain as number 5 and 6 caught nearly 140,000 tons (10%). Altogether nearly 90% of total tuna landings in 1974 came from the above mentioned 6 countries. It is remarkable that Taiwan and Korea have been able to develop their tuna industry within a limited period of 10 years.

Markets

The major markets for tuna are the U. S. A., Japan and Western Europe, where the forecasts for 1977 consumption are 750,000 tons, 390,000 tons and 300,000 tons respectively (all live weight). According to these figures the demand has increased in the last five years by 25%, 15% and 6% respectively. Per capita consumption of tuna per year in the three areas are 3.2 kilo, 3.5 kilo and 0.7 kilo respectively. The demand for tuna is expected to continue upward in all three markets.

With the well established and increasing demand for tuna the scarcity of the fish will determine the further growth of the market. A greater proportion of the future demand will have to be met by skipjack.

The demand/supply situation indicates that prices for tuna will continue to go up. The U. S. A. leads the market and has demonstrated increased demands in spite of steadily increased prices. The background is rising incomes.

International Trade

The international trade deals with two product types : Fresh or frozen tuna and canned tuna. The trading countries can be divided into three groups :

- (1) Countries like Japan, Taiwan and South Korea, where domestic catches leave a surplus for export after meeting the demands of the home market. Sometimes, if the home demand rises or the domestic catch falls, they might have to import in order to meet the demands from well established export markets. This is often the case with Japan.
- (2) Countries like the U. S. A., Canada and most Western European countries (except France and Spain), which need to import to meet the domestic demand.
- (3) Countries like Yugoslavia and Senegal importing frozen tuna with the prime objective of exporting canned tuna.

The international canned tuna industry is illustrated in table 1. Clearly the U. S. A. is the leading producer. Japan is the leading exporter covering in 1974. 81% of the canned tuna export with nearly 46,000 tons, worth U. S. \$. 121 million. More than 40% of her export went to the U. S. A. and a similar quantity to Western Europe and Canada. Recently Taiwan has developed its own export of canned tuna.

TABLE 1
Canned Tuna Production 1969 and 1974

| Country | 1969 | | 1974 | |
|-------------|------------|-------|------------|-------|
| | Production | Share | Production | Share |
| Total world | 385,000 t. | 100% | 571,000 t | 100% |
| U.S.A. | 183,000 t. | 47% | 303,000 t. | 53% |
| Japan | 72,500 t. | 19% | 82,800 t. | 14% |
| Italy | 36,000 t. | 9% | 38,900 t. | 7% |
| France | 26,200 t. | 7% | 32,100 t. | 6% |
| Spain | 21,500 t. | 6% | 28,000 t. | 5% |
| Senegal | 8,500 t. | 2% | 12,600 t.* | 2% |
| Peru | 5,100 t. | 1% | 2,100 t. | 1% |
| Mexico | 3,300 t. | 1% | 14,800 t. | 3% |
| Canada | 2,400 t. | 1% | 4,900 t. | 1% |

*1972—Figures.

TABLE 2
Exporters of Fresh and Frozen Tuna 1974

| Country | Quantity | Share | Main Importers |
|--------------------------------|------------|-------|-----------------------|
| Total world Export (Estimated) | 273,000 t. | 100% | U.S.A. and Italy |
| Japan | 139,400 t. | 51% | U.S.A. and Italy |
| Taiwan (Estimated) | 45,000 t. | 14% | Japan, U.S.A., Italy |
| South Korea | 34,100 t. | 12% | Japan |
| Spain | 29,700 t. | 11% | U.S.A., Italy, France |
| Malaysia | 13,500 t. | 5% | — |
| France | 6,700 t. | 2% | Spain and Italy |

The export of frozen (and a little fresh) tuna is demonstrated in table 2. The leading importer of frozen tuna is definitely the U. S. A. with Italy as number 2. Japanese traders used to deal with most of the export from Taiwan and South Korea, but these countries have now established their own tuna brokerages and shipping agents.

Processing

Tuna as a fish has certain features of importance for its processing. It has a very high protein content of 22–26%, which is one of the main reasons for its highly valued flavour and texture. Also, the content of pure meat is exceptionally high: 60–65% 4–5% of this yield, however, comes from the dark/brown lower valued flesh around the lateral line. The oil content in tuna varies. It is characterized by the fatty acids being highly unsaturated and therefore very exposed to oxidation and development

of rancidity. Tuna is a "warm blooded" fish. Its temperature exceeds that of the surrounding waters by about 8°C. Unless, therefore, rapid and effective chilling is arranged after catching the spoilage processes will proceed very quickly. This is further aggravated by a high content of histidine in tuna which is an excellent substrate for spoilage causing bacteria.

Processing starts on board the vessel as soon as the tuna is caught. It is essential to lower the temperature of the fish more or less immediately. Depending on the distance to the landing port the tuna are either frozen in (brine freezer or air blast) or chilled by means of ice. In both cases a pre-chilling to temperatures below 5—10°C by means of chilled sea water (ice/water mixture with circulation) could safeguard quality retention and also increase freezer capacity/reduce ice melting during subsequent storage.

A proper design of the freezing or chilling system on board a vessel is extremely important if export quality tuna are to be landed. A number of factors have to be considered like the size of the hauls, the size of the fish (larger fish cool down slower), the high temperature of tropical tuna and of the surroundings, reliability of equipment, accessibility for service, cost of installation and maintenance, and compatibility with other space, weight and trim requirements of the vessel. It is essential that chilling/holding or freezing/storing of tuna can be performed securely on board. Otherwise financial losses might be heavy.

Processing at land varies with the circumstances. When most simple frozen tuna is transferred to a cold store for trans-shipment to the markets. There are 32 major trans-shipment points spread over the world. Closest to Sri Lanka are Penang, Malaysia and Port Louis, Mauritius. At the transshipment points there are facilities for cold storage of tuna and for service and repair of vessels. Very often a local tuna industry develops at the trans-shipment points. Examples are found in Senegal, Ghana, Malaysia, Angola and the Ivory Coast.

Actual processing at land has to take place, when tuna are landed non-frozen. The raw material will then be processed into frozen or canned products. The procedures for frozen products might be restricted to a de-icing, cleaning, freezing and packing. Or it might lead to more refined and less bulky semi-products of gutted, headed and trimmed tuna or even pure tuna meat (loins).

Raw materials for canned tuna are chilled as well as frozen fish. The tuna canning industry varies from country to country. The big tuna canners in the industrialized countries, for instance the U. S. A. run large-scale processing plants with very sophisticated equipment. Where manpower is abundant and cheap more traditional canneries are set up. A "standard" size cannery process approximately 2 tons of tuna (live weight) per hour giving an output of 850 kilo solid packs + 210 kilo flakes or chunks, and provides employment for 50-85 persons. The operations involved in tuna canning are illustrated in Appendix I. The offal from the processing can be turned into various by-products like fish meal or hydrolysates, pet food and oil (with a high vitamin A-content).

In the future today's canned tuna could for price reasons become a luxury product and new tuna-based food products like pastes, mousses and jellies might develop, supplemented by already known tuna-products like goulash, salad, sausage and baby food. New types of packaging materials made out of aluminium and plastic will most likely gradually supplement, may be even substitute cans made out of tin.

Prospects for Tuna Export Industry in Sri Lanka

How are then the prospects for Sri Lanka to develop an export industry based on off-shore and deep-sea tuna fishery? Let us try to consider it from various angles.

Fishery

A tuna fishery is already established in Sri Lanka in the coastal areas with catches of skipjack amounting about 12,000 tons in 1976. To this could be added the so far not very successful experiment with 2 deep-sea tuna longliners. The lack of success with these longliners, however, does not necessarily indicate bad prospects for the development of an off-shore/deep-sea tuna fishery. But it stresses the importance, even necessity of a proper support, service and management, if a new kind of fishery development has to be implemented successfully. The experience gained with the longliners should be analysed and used in the preparation and execution of a new fisheries project.

The necessary condition of an increased tuna fishery, namely the resources give good reasons for optimism as far as skipjack is concerned. With the extension of the national fishing jurisdiction to cover a 200 miles zone, Sri Lanka has also the possibilities of getting her fair share of yellowfin and bigeye. With catch regulations and more detailed fishing control to come it may well be important for Sri Lanka to establish her rights by expanding the tuna fishery as fast as possible.

Markets

The market situation, in general, is ideal from a sellers point of view. Demand is high, supplies are scarce and prices good. And there is no reason to anticipate that the picture should change in the years to come. It should not be difficult to enter the export market. To remain there, however, will claim a big effort to establish Sri Lanka as a reliable supplier of high quality fish products. While building up the necessary experience in fishery, processing and marketing it might be advisable for Sri Lanka to establish close connections with one or a few larger trading companies. The advice, help and training gained from such a co-operation will help the country to overcome most easily the many initial problems, which will no doubt have to be met.

Products

The spectrum of products is not very big, but big enough to leave a choice for the design of a new tuna industry. Let us try to identify the prospect contrasts before choosing.

Looking into *frozen tuna* the Galle Fisheries Harbour Complex is established but no use has been made of the investment. The size and technical standard of the complex offers obvious possibilities of starting a project on export of frozen tuna with short notice. Galle might even become a transshipment point for international tuna trade. A production could initially be restricted to the most simple products : Round frozen tuna. Gradually, as landings increase and know-how develops, a production of more refined semi-products like loins could be started. This would add value to the export and create more occupation. The low labour costs in Sri Lanka should enable a highly competitive export production.

Canned tuna is not a semi—but an end-product. Canned tuna production would therefore reserve the major part of the added value from such a product to Sri Lanka and give the highest export earnings. Furthermore such production needs more manpower and would thus contribute by reducing the unemployment. On the other hand production and marketing of canned tuna is more complicated and costly and would initially depend on imported packaging materials. At a later stage with a demonstrated demand for cans investors might be attracted to start can production (for fish and fruit products) in Sri Lanka.

Looking into the long-term objectives of maximising export earnings and creating employment it seems to me that establishing of a local tuna canning industry is worth considering. At a start frozen (or fresh) raw material could be supplied to the already established small-scale canning plant in Pesalai, which could make a nice profit by utilizing its capacity to produce approximately 300 tons of canned tuna + 32 tons of fish meal a year. Meanwhile a frozen tuna export could be established as outlined above.

Processing

The importance of establishing the highest quality standard from the start of an export cannot be over-emphasized. No compromises should be permitted. If a product is once downgraded the reputation of the whole country's industry is damaged. The Government has, therefore, to take a leading role in product inspection and should intervene forcefully to prevent secondary grade products from leaving the country. The legislation for a fish plant and product inspection service is of course necessary, but not sufficient. Inspectors should be properly trained, and the industry should be advised on how to establish their own quality control scheme. Authorities should support the export trade by issuing Health Certificates when claimed by the importers.

Information on suitable handling and processing technique can often be obtained from countries and companies involved in similar activities. But any country, also Sri Lanka, has its own special background and conditions. So attempts to merely copy from other's experience are normally bound to fail. There is a need for Sri Lanka to built up own know-how suited to fit exactly her conditions.

Examples :

- Do we have to preserve the catch on board by freezing or can we apply the cheaper methods of chilling ?
- For how long can we keep the chilled tuna and still maintain an export quality ?
- Should we land gutted or ungutted fish ?
- Which are the relatively simple physical and organoleptical changes that we can use to form the basis of a fish inspection service ?
- How will we in practice chill and store the fish on board the vessels ?

It is my belief that the Institute of Fish Technology, Sri Lanka could make a significant contribution in supporting a potentially big tuna export industry. But it has to start its work well in time.

Literature

HARMAN, G. M. AND M. J. J. MACMILLEN

The market for tuna. Tropical Prooducts Institute G 80 London (1973)

Yearbook of Fishery Statistics 1974, Vol. 38 and 39. FAO (1975).

PECKHAM, C. F.

International Trade—Tuna. In "Indian Ocean Fishery Commission Publication IOFC/DEV/74/40." FAO (1974).

ZAITSEV, V. ET ALL.

Fish Curing and Processing. Moscow (1969).

SIVASUBRAMANIAM, K.

Small-Boat Tuna Longline Fishing Feasibility. Indian Ocean Fishery Commission publication IOFC/DEV 75/26. FAO (1975).

BROMILEY, PETER S., J. ENGSTROM AND S. THOMSON

A Study of the Feasibility of the Canning of Fish and Shellfish in Indonesia. Indian Ocean Fishery Commission Publication IOFC/DEV/73/30. FAO (1973).

DISNEY, J. G., R. C. COLE AND N. R. JONES

Considerations in the Use of Tropical Fish Species. In "Fishery Products" (Ed. R. Kreutzer). Surrey, U. K. (1974).

KRONE, M. AND W. RUCKES

Export Markets for Fishery Products from Developing Countries. Ibid.

SALVIN, J. W. AND R. FINCH

Design of Systems for Freezing Tuna at Sea. In "Freezing and Irradiation of Fish" (Ed. R. Kreutzer) London (1969).

PEROVIC, V.

The Canning of Fish in the Tropics. Paper from Conference on Handling, Processing and Marketing of Tropical Fish. London (1976).

APPENDIX I

SEQUENCE OF OPERATIONS IN A TUNA CANNERY

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|-------------------------------|---|
| 1. Defrosting | In water, at ambient temperatures or in specially designed equipment. |
| 2. Initial Dressing | Strip side fins off, eviscerate, wash belly cavity. |
| 3. Cooking | 1-8 hours depending on size. <i>N.B.</i> Meat may also be packed raw. |
| 4. Cooling | 10-20 hours in cold air. Makes flesh resistant to mechanical damage. |
| 5. Dressing. | Skin, head, fins cut off. Flesh carved in slabs, freed of subcutaneous fat and skin. Brown meat cut off, bones removed, Portioned out Yield 60-65% light and 4% brown meat. |
| 6. Packing | In tins with for instance 18-28% oil (cottonseed, groundnut, soya), 2% salt, 0.2 MSG. Also packs with pure brine. |
| 7. Vacuum-sealing | |
| 8. Sterilizing | At 116°C. |
| 9. Drying, labelling, packing | |

DISCUSSION

Mr. Andriezz

I want to know the procedure regarding the issue of certificates for export of fish and fish products and details of infrastructure facilities available to set up a fish canning industry?

Mr. A. S. Mendis

Government is very responsive about export of frozen fish and fish products and decided to set up a quality control laboratory for checking purposes. During the past there had been certain instances of export of low quality fish. It is essential that exporters should maintain proper standards. There is legislation to cover conservation of lobster resources. Still baby lobsters are caught by our fishermen. If this situation continues lobster resources will diminish and there will be no lobsters available in the near future. Co-operation of purchasers, processors and exporters, moment, and freezing is not possible on board 38' boats.