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POSSIBLE INTRODUCTION OF ALUMINIUM CANS FOR FISH

A report prepared for the
Pelagic Fishery Investigations on the Southwest Coast - Phase II - Project

by

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This is one of a series of reports prepared during the course of the FAO/UNDP project identified on the title page. The conclusions and recommendations given in the report are those considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

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1. INTRODUCTION

1.1 TERMS OF REFERENCE

The Government of India, assisted by the United Nations Development Programme and the Food and Agriculture Organization of the United Nations, have been engaged in the Pelagic Fishery Investigations on the Southwest Coast - Phase II - Project (IND/75/038), whose main purpose has been estimating the characteristics, gear and methods for efficient and economic exploitation, and determining for industrial application the most economic ways of processing and marketing pelagic fish.

The project was operational from 1 January 1976 to 30 March 1979.

As part of the project operation, FAO assigned Mr V. Perovic, Industrial Processing Adviser, from 30 October 1976 to 31 December 1978 with the following general terms of reference:

> "To advise the fish processing industry on fish handling, raw material usage, plant layout, production control and equipment requirements, and to encourage close relationship between technological research and industrial application in fish handling and processing technology, thus contributing to an effective transfer of technology to industry."

1.2 BACKGROUND INFORMATION

A review is made in this report of the resources of India from which national benefits can be derived in terms of employment, nutritional needs and increased fishermen's earnings as well as showing the viability of canning with reasonable returns on investment. The following factors resulted from investigations:

- There is an abundant resource of small pelagic species on the southwest coast of India not now fully exploited. Present catches can also supply raw material in that the present infrastructure is not making proper use of surplus landings.

- There is unemployment and underemployment on the southwest coast. Labour is readily available, and such development would provide employment ashore for nearly 7 000 persons.

- The present fish canning industry, although having idle capacity that theoretically could can up to 250 t of raw material per day, is not capable of producing the type and quality of product that can meet the standards of customer acceptance in foreign countries.

- Tinplate cans presently in use, which are the only supply available for fish canning, are not acceptable on foreign markets, due to a combination of price, gauge and quality.

- Aluminium is the acknowledged material for shallow drawn cans for fish products and is fast supplanting tinplate in most countries.

- India can produce an aluminium alloy sheet that can meet international standards.

- The cost of producing aluminium in India is on a par with other producing countries but the rate of taxation makes the price to the internal market very prohibitive. At present, taxation accounts for about 50 percent of the aluminium manufacturer's selling price.

2. PRESENT SITUATION OF THE FISH CANNING AND CAN-MAKING INDUSTRIES IN INDIA

2.1 INTRODUCTION

The seafood industry in India has recorded a phenomenal growth in the course of the last 15 years, due almost entirely to investment by the shrimp processing sector, most products of which are exported. Export earnings registered an impressive growth from Rs. 37.5 crore[1/] in 1962 to a record of Rs. 1 797.3 crore in 1977. This represents an increase of nearly 50 times the 1962 value in 15 years. Frozen shrimp has been the main contributing factor and in 1977 accounted for 72 percent of the quantity and 87 percent of the value of seafood exports.

Comparing this rapid growth of frozen shrimp to other seafood exports, a reverse trend is noted. Canned products now account for less than 1 percent of the seafood export value, decreasing from Rs. 528 lakhs[2/] in 1973 to Rs. 88 lakhs in 1977. Thus the canned seafood sector is making an insignificant contribution to foreign exchange earnings yet has a considerable investment in plant and machinery, most of which is not being utilized.

The following table indicates the recent trends in export of frozen and canned fish products.

Table 1

VALUE OF SEAFOODS EXPORTED 1973-77
(Lakhs of Rupees[3/])

Canned products	1973	1974	1975	1976	1977
Prawns/Shrimps	523.68	478.42	59.99	39.35	52.21
Sardines	-	-	-	5.34	1.41
Mackerel	-	-	.02	-	-
Tuna	-	-	-	-	3.49
Other fish	.25	.27	-	.26	-
Lobster tails	.28	-	-	-	-
Crabmeat	3.84	5.09	.18	14.50	31.44
Clams	-	-	.04	-	-
Mussels	-	-	.03	-	-
Total canned products	528.05	483.78	60.26	59.45	88.55
(Total frozen products)	714.68	681.29	10.18	17.46	1 722.85

The above table shows that seafood canning relied heavily on export of canned shrimp, and when market preference turned abruptly to frozen shrimp the canning sector almost disappeared. Some little effort was put into producing other canned products, but as is explained below, these have not been developed to meet the rigid demands of importing countries.

1/ 1 crore = 10 000 000
2/ 1 lakh = 100 000
3/ US$ 1.00 = Rs. 8.70 (January 1977)

World production of canned seafoods has shown a slight but steady increase in recent years. The following table shows the trend of utilization of fish used directly for human consumption.

Table 2

WORLD DISPOSITION OF CATCH FOR HUMAN CONSUMPTION

	1970		1975	
	million t	%	million t	%
Fresh	19.5	44.8	20.7	42.5
Frozen	9.7	22.3	12.7	26.1
Cured	8.1	18.6	8.1	16.6
Canned	6.2	14.2	7.2	14.8
Total human consumption	42.5		48.7	

Source: FAO Yearbook of Fishery Statistics, 1975. Vol. 43, Fishery Commodities (1976)

Countries with substantial sardine, mackerel and tuna resources destine large amounts to the canning sectors compared with fish for human consumption. Japan has the greatest volume, 684 000 t of fish canned in 1975, representing 7% of the total supply of fish for human consumption. Other countries with large canning sectors in fisheries include Spain, 302 200 t (24.3%), Morocco, 78 200 t (48.7%) and Portugal, 49 200 t (3.7%) of fish for human consumption in 1975.

Catches for India were as follows:

Table 3

DISPOSITION OF CATCH FOR HUMAN CONSUMPTION - INDIA
(in t)

	1970	1973	1974	1975 %
Fresh	1 170 500	1 278 600	1 616 400	76.1
Frozen	80 200	105 500	65 200	3.0
Cured	354 300	379 700	441 600	20.7
Canned	12 300	15 900	4 800	0.2

In 1975, the 7 200 000 t of raw material processed in canned form equated to 4 470 000 t finished product; the species of major interest being:

Sardines, anchovies and herring-like species	721 000 t
Tunas	512 000 t
Other (including mackerels)	1 302 000 t
Balance of prepared products (not airtight containers)	1 935 000 t

A considerable volume of canned seafood products enters world trade, increasing from 627 000 t in 1971 to 746 000 t in 1975. Japan plays a dominant role in the supply of canned fish to Asia as illustrated by FAO (1975) statistics for Asian countries (Near East to Far East excluding People's Republic of China):

	Imports (t)	Exports (t)
Asia including Japan	134 000	291 000
Asia without Japan	127 000	24 100
Japan only	7 000	166 900

Source: FAO Yearbook of Fishery Statistics, 1975. Vol. 43, Fishery Commodities (1976)

The fish canning industry plays an important part in optimizing utilization of raw materials, by providing a large volume of high protein food. India has the resources and strategic location to become a leader in the canned fish sector of world fisheries.

2.2 CANNING SECTOR

There are 64 seafood canning plants in India registered with the Marine Products Export Development Authority (MPEDA). Processing capacity is reported to be 250 t of raw material per day:

Table 4

SEAFOOD CANNING PLANTS REGISTERED WITH MPEDA

State	No. of plants	Installed capacity (t/day)
Kerala	39	148.7
Karnataka	9	38.0
Maharashtra	1	2.5
Tamil Nadu	4	5.5
Andhra Pradesh	1	0.2
Gujarat	1	6.4
West Bengal	-	-
Goa	6	41.5
Pondicherry	1	1.5
Laccadives	1	1.0
Orissa	1	1.0
Total	64	246.3

It is estimated that the nominal quantities of fish now processed, both for domestic and export markets, are less than 10 percent of the above capacity. As shown in Table 1, canned shrimp exports were considerably more a few years ago. Due to various changing market factors a revival of shrimp canning now seems unlikely.

While existing machinery and equipment are unexploited, canned products such as sardines, tuna, mackerel, Anchoviella, etc. are readily accepted by established markets abroad and, the domestic market, with its insatiable demand for high protein foods, plus the trend toward packaged and convenience foods, is not even fractionally satisfied. Moreover, it is not uncommon that during periods of heavy landings large quantities of fish decay or are converted into fish meal. These factors provide the foundation for the development and modernization of a canning industry based on fish instead of shrimp.

Canning not only ensures the proper utilization of protein-rich food by making it available in remote areas of the country but also renders it non-perishable. Attempts have been made by the canners independently and collectively under the banner of MPEDA to utilize the canning capacity both for the domestic and export markets. For various reasons explained below, little progress has been made by the fish canning industry.

2.3 PACKAGING MATERIAL

Factors hampering the growth of the canning sector have been identified and the most serious problem appears to be the unsuitability of Indian-made cans. Satisfactory cans are not available at reasonable prices. This applies particularly in the case of sardines for export where the MPEDA has attempted large-scale promotion. Export sales failed to materialize due to the poor quality and exhorbitant price of the home-produced cans. Details are outlined below.

2.3.1 The high cost of cans

Heavy tinplate and high taxation make the cost of Indian-produced cans prohibitive and non-competitive. The cost of each 1/4 dingley can is Rs. 0.64 plus Rs. 0.08 for the key, i.e., Rs. 0.72. The price of the can alone is nearly 33 percent of the total for the filled can and when labels and cartons are added 50 percent of the total product cost is accounted for. This compares unfavourably with the retail price in the United Kingdom of a filled 1/4 dingley sardine can which is 13 pence or approximately Rs. 2,08 and Norway, with a progressive and thriving seafood canning industry, where the total cost of packaging (tin, label, carton), for a 1/4 dingley can of sardines is a reasonable 16 percent of production costs.

Consequently, the Indian product is uncompetitive on foreign markets and beyond the financial possibility of most domestic consumers.

2.3.2 Unsuitability of the cans used

Another disadvantage is the shortage of good quality tinplate meeting recognized specifications, the local product being of an unnecessarily thick gauge and containing a high percentage of phosphorus unacceptable to foreign buyers. Almost all tinplate presently used for making fish cans is imported, and the gauge is from 0,25 to 0,29 mm, as compared to 0.22 mm and less for the Double Reduced Cold Drawn tinplate used abroad.

The heavy-gauge tinplate results in Indian cans being difficult to open and foreign consumer prefers easy-to-open cans even though their price may be higher. Further, the Indian cans have unprotected lithographed tops and so rust easily, giving a poor external appearance and implying inferior quality.

2.3.3 Failure to promote introduction of Indian canned sardines in present form

Promotional efforts undertaken by MPEDA to introduce canned Indian sardines were not successful, but did reveal considerable demand and shortage of supply of acceptable products in foreign markets. In 1976, the Government of India attempted to establish the Indian canned product on the world market by introducing a scheme for cash compensatory support of 20 percent of f.o.b. value of exports to bridge the gap between unrealistic production costs and international prices. However, this pricing measure did not significantly contribute to export development, largely because Indian producers continued to use the traditional tinplate cans and could not compete with similar products in the easy-opening aluminium cans fast replacing tin cans on the European market. It is clear that unless India is in a position to market canned sardines in the latest type of container, little progress can be expected in the export trade. It should be noted that India is a big producer of aluminium suitable for can-making, and thus has the other major requirement to develop a modern canning industry.

3. DEVELOPMENT CONCEPTS FOR EXPANDING AND IMPROVING THE INDIAN FISH CANNING INDUSTRY

3.1 AVAILABILITY OF FISH

Marine fish landings in India have risen from 832 000 t in 1965 to 1 390 000 t in 1976. In the coming years the annual increase in catch is expected to be in the range of approximately 10 percent (George et al., 1977). There are substantial resources to meet anticipated increased production, and many of the species that can sustain further exploitation are also suitable for canning, e.g., sardine, mackerel, tuna and whitebait. These species form the bulk of marine fish landings of the west coast of India, and the following table compares the present catch to estimated sustainable yield for the southwest and lower east coasts comprising Kerala, Karnataka, Goa and Maharashtra, Lakshadweep and Gulf of Mannar.

Table 5

ANNUAL CATCH FROM 1972 TO 1976 OF SPECIES SUITABLE FOR CANNING COMPARED TO ESTIMATED SUSTAINABLE YIELD IN TONNES FOR THE SOUTHWEST AND LOWER EAST COAST REGIONS OF INDIA

	Peak year	Low year	5 years average	Sustainable yield	Available surplus over average catch
Oil Sardines (Sardinella longiceps only)	1976:169 300	1976:126 700	132 000	180 000	48 000
Mackerel	1972:108 000	1974:37 000	65 000	95 000	30 000
Tunas[1/]	1976:19 300	-	10 000	120 000	110 000
Whitebait	1974:41 500	1972:18 700	36 000	240 000	204 000

1/ includes Laccadive Islands

Source: George et al. (1977)

3.1.1 Sardine

Several species of sardines are fished in Indian waters but the most abundant and best suited for canning is the oil sardine, Sardinella longiceps, which is distributed mostly along the southwest coast, the bulk of the fishery being concentrated between 9°N and 17°N Lat, (i.e., between Quilon in the south to Ratnagiri in the north). However, due to variations in annual recruitment rates, this fishery shows wide fluctuations. The average annual stock of oil sardines for the period 1960-71 has been estimated at 400 000 t for the present fishing grounds (Silas et al., 1976). It is estimated that the average annual yield could reach 200 000 t (George et al., 1977). Of this total about 50 000 t/year from the Cochin-Goa area could be directed to the canning industry (see the available surplus figures given in Table 5).

3.1.2 Mackerel

The Indian mackerel forms one of the important pelagic fisheries along the west coast of India and is comprised mainly of Rastrelliger kanagurta. Mackerel is caught mostly on the west coast between Ratnagiri and Cape Comorin. The average annual stock of Indian mackerel was estimated as 57 000 t for 1960-71 (Silas et al., 1976), but the trend in catch shows

erratic fluctuations. An annual yield of 100 000 t for mackerel is estimated (George et al., 1977) of which about 10 000 t of the surplus of 30 000 t could be available to the canning industry.

The possibility of developing the fisheries for Carangidae, notably Decapterus (round scad) and Megalaspis (torpedo trevally) could also be examined. These species might prove suitable for canning as they have a flesh and texture similar to mackerel.

3.1.3 Tuna

There are larger resources of tuna and tuna-like species in waters around Lakshadweep Islands and Andaman and Nicobar Islands than are presently exploited. The projected figures are about 100 000 t for skipjack and 50 000 t for other tunas (George et al., 1977). As the tuna resources are not yet exploited to any major extent, there should be scope for further development and tuna canning could become an important part of the Indian fishing industry.

3.1.4 Whitebait

The whitebait (Anchoviella sp.) resources are found off the southwest coast and the lower east coast of India. The resource concentrates in the Gulf of Mannar during the southwest monsoon and heavy fishing and substantial landings occur from July to October. At other times of the year, they spread along the southwest coast. The current catch of about 36 000 t/year appears very low compared to the annual stock abundance of 500 000 t in the present fishing grounds. A modest estimate rates the annual sustainable yield of this resource at about 250 000 t (George et al., 1977).

3.1.5 Others

There are other species with excellent canning properties such as clams, mussels, crabs, etc. These resources should also be utilized by the canning industry, being highly valued on foreign markets.

3.2 MARKETING

The basic goal in developing a canning industry should be its contribution to national socio-economic and nutrition needs or improvements. The development of an internal market should be the prime marketing strategy, and added to this should be the production for export. As export trade should give a greater unit return besides earning foreign currency, export production could bear a greater portion of the costs and minimize the cost of production for internal sales.

3.2.1 Internal marketing

India is a country of great contrasts, not only in size and population, but also in culture, diet and living conditions. One such difference is the consumption of fish which can be directly related to daily protein intake per caput. Table 6 below shows the availability of fish by states and by population. This is an exaggerated picture in that there is some movement of fish products from high producing areas to areas of low production and low supply, but it clearly illustrates the disparity of distribution of a perishable food product.

Table 6 shows the availability of fish expressed as kilogrammes per caput by States, the last column being adjusted, taking out 30 percent of the population considered to be vegetarian. Thus for the non-vegetarians availability in 1973 ranged from 21.58 kg per caput in Kerala to less than 1.0 kg per caput in 12 States and Union Territories, with the average being 5.1 kg per caput. A figure of 10 kg per caput of fish has been projected as being necessary to a balanced protein diet for India's non-vegetarian population.

Table 6

PER CAPUT AVAILABILITY OF FISH IN DIFFERENT STATES

Territory	Population 1971 ('000)	Fish production in 1973 ('000 t)			Annual per caput availability of fish (kg)			
		Marine	Inland	Total	Marine	Inland	Total	Adjustment 1/
Andhra Pradesh	43 503	116.73	89.61	206.34	2.68	2.06	4.74	5.93
Assam	14 958		30.00	30.00		2.01	2.01	2.11
Bihar	56 353		67.12	67.12		1.19	1.19	1.49
Gujarat	26 697	151.20	14.56	165.76	5.66	0.55	6.21	17.74
Haryana	10 037		1.00	1.00		0.10	0.10	0.20
Himachal Pradesh	3 460		0.73	0.73		0.21	0.21	
Jammu and Kashmir	4 617		7.59	7.59		1.64	1.64	2.05
Karnataka	29 299	55.11	60.00	115.11	1.89	2.04	3.93	4.91
Kerala	21 347	350.76	17.84	368.60	16.44	0.83	17.27	21.58
Madhya Pradesh	41 654		9.00	9.00		0.22	0.22	0.44
Maharashtra	50 412	292.32	15.50	307.82	5.80	0.31	6.11	8.72
Manipur	1 073		1.20	1.20		1.12	1.12	
Meghalaya	1 012		0.80	0.80		0.79	0.79	
Nagaland	516		0.12	0.12		0.23	0.23	
Orissa	21 945	17.00	23.00	40.00	0.77	1.05	1.82	2.27
Pumjab	13 551		1.71	1.71		0.13	0.13	0.26
Rajasthan	25 766		7.98	7.98		0.31	0.31	0.77
Tamil Nadu	41 199	182.53	135.00	317.53	4.43	3.28	7.71	9.63
Tripura	1 556		4.15	4.15		2.67	2.67	
Uttar Pradesh	88 341		23.40	23.40		0.26	0.26	0.47
West Bengal	44 312	8.85	235.15	244.00	0.20	5.31	5.51	5.82
Andaman and Nicobar Islands	115	0.85		0.85	7.39		7.39	
Arunachal Pradesh	468		0.18	0.18		0.38	0.38	
Chandigarh	257							
Dadra and Nagar Haveli	74							
Delhi	4 066		0.22			0.05	0.05	
Goa, Daman and Diu	858	15.74	1.21	16.95	18.34	1.42	19.76	
Lakshadweep	32	1.85		1.85	57.81		57.81	
Mizoram								
Pondicherry	472	17.51	0.48	17.99	37.10	1.01	38.11	
All India	547 950	1 210.45	747.55	1 958.00	2.21	1.36	3.57	

1/ Adjusted for 30 percent vegetarian population

Source: Report of the National Commission on Agriculture. Part 8. Fisheries (1976)

This indicates the shortage of protein in the diet of much of the Indian population, since other protein sources are inadequate to minimum nutrition standards. Even if fish production expands, supply will increase in its disparity and consumption will probably increase inversely as distance from supply increases, as the infrastructure for the distribution of fresh and frozen fish is yet to be developed on a national scale. Thus, conversion by canning of a highly perishable product to a long shelf-life commodity, with the resultant wider geographical distribution and availability during times of fresh fish scarcity should take priority in the Government's fishery development plans.

Development of the marketing strategy for internal consumption should be based on the following criteria:

1. Prices which permit purchase by the middle and lower income groups. Some distribution could be through subsidized food programmes or social assistance schemes for the under-privileged
2. Maximum value to be given to the edible contents as compared to non-edible components
3. Quality consistency and at acceptable levels
4. Development of products to suit the tastes of consumers
5. Packing should be simple and at reasonable cost
   - in sizes suited to consumer's needs
   - durable but reasonably easy to open

Basic nutritional needs and areas of low protein supply should be the prime consideration. In the developing stages the products should not be classified "gourmet" or "luxury".

The need for a fish supply which requires a doubling of present production cannot be met by canning development only. The disparity in consumption should be eliminated and development of other non-perishable products, improved infrastructure and distribution facilities must also be considered.

3.2.2 Export marketing potential

With the build-up of the shrimp canning industry and its rapid decline in the early seventies, several attempts were made to develop a market for canned fish products from India, notably oil sardines. These attempts have been unsuccessful as the following data show (MPEDA export statistics, quantities in tonnes):

	1973	1974	1975	1976	1977
Sardines	-	-	-	40.9	10.6
Other fish	2.8	1.5	-	1.8	-
Mackerel	-	-	77	-	-
Tuna	-	-	-	-	22.2

World production of canned fish products increased slightly in recent years compared with fish used directly for human consumption (from 6 200 000 t in 1970 to 7 200 000 t in 1975, an increase in percentage from 14.2 percent to 14.8 percent, see Table 2). This equated to 4 470 000 t in 1975.

Species of interest to India include:

Sardines, anchovies and herring-like species	721 000 t
Tunas	512 000 t
Mackerels and similar species	1 302 000 t

Total world exports rose from 627 000 t in 1971 to 746 000 t in 1975. Exports are dominated by Japan and it is interesting to note that in 1975, the exports from Asian countries totalled 291 000 t as against 134 000 t of imports. Japan imported only 7 000 t but exported 166 900 t, indicating a huge volume within the Asian region.

3.2.2.1 Europe

Europe is a net importer of canned/prepared fish products, with an imbalance averaging close to 100 000 t/year in recent years; for example, in 1975, imports totalled 307 000 t against 211 000 t of exports. The excess imports of 100 000 t or more can be considered as trade from outside the European Community needed to supplement production from dwindling local catches.

MPEDA organized sales promotion missions to Europe in 1976 and 1977. Through a consortium of canners, the common brand name "S E S" Malabar sardines was promoted, and in 1976 a subsidy of 20 percent of the f.o.b. value was given by the Government of India on sardines exported in the hope that a favourable price would establish the Indian product on foreign markets. The missions found a wide demand and short supply but only for a product and type of pack that would meet the strict specifications of European buyers. Although the content of the Indian product was usually of an acceptable quality, the packaging was inferior and outdated. Tinplate was of an unacceptable quality and gauge, and no provision was made for easy opening.

3.2.2.2 Southeast Asia and Middle East

Southeast Asian trade in canned fish products is dominated by Japan while for the Middle East, Morocco, Spain and Portugal are major producers. The recent strengthening of the Japanese Yen, a considerable increase in both the standard and cost of living in Japan, and exclusion of Japanese fishing fleets from recently declared extended economic zones which used to be traditional fishing grounds, are factors which place Japanese exports beyond the financial capacity of some importing countries. These factors may have a direct bearing on the exportation of canned fish from Japan and offer the opportunity to other countries with suitable resources to develop or expand their fish canning industries.

India, served by frequent ocean transport and strategically located, is ideally situated to cater to both these markets, where there is, moreover, a substantial population of Indian origin who could form a nucleus for consumer acceptance of new Indian products.

The following table shows the volume imported in tonnes and the supplying country (1975 and 1976), as reported in the FAO Yearbook of Fishery Statistics, Vol. 43, Fishery Commodities (1976).

Importer	Exporter	Volume of canned sardines, mackerel and other similar fishes (t)	
		1975	1976
SOUTHEAST ASIA			
Philippines	Japan	49 700	36 800
	Morocco	3 800	-
Singapore	Japan	25 000	17 400
Malaysia	Japan	9 100	8 300
Indonesia	Japan	1 000	11 900
Thailand	Japan	1 300	1 800
	Morocco	300	-
Total		90 200	76 300

(cont.)

Importer	Exporter	Volume of canned sardines, mackerel and other similar fishes (t)	
		1975	1976
MIDDLE EAST			
Egypt	Japan	5 900	9 000
United Arab Emirates	Japan	700	3 200
Saudi Arabia	Japan	5 200	6 700
Yemen Arab Republic	Japan	500	3 800
Kuwait	Japan	800	1 700
Total		13 100	24 400

Although most of these importing countries have had reasonable expansion in their national fisheries, supply has yet to catch up with demand and the market is open for increased production. (Further details of export price and volume information are given in Appendixes 1 to 8.)

3.3 DEVELOPMENT CONCEPT

Based on current estimates of the potential resources of pelagic species and market conditions outlined above, the southwest coast of India is a promising area in which to develop a canning industry. Development should be based on the following criteria:

- availability of raw material
- erection of modern fish canning plants and modernization or revival of some of the existing fish canning plants
- operation of canning plants at least 220 days in a year by procuring raw materials from a wider area and providing adequate cold storage facilities
- use of latest technology, design and materials for packaging to be produced in India
- products should respond to market requirements, respecting consumer acceptability and the specific demand of both domestic and export markets. Experimental and research institutions engaged in fish processing should play a major role in the diversification of products and development necessary to meet the changing circumstances and varied preferences of consumers in potential export areas.

3.3.1 Capacity, location and structure

The most promising area for a fish canning industry is the west coast of India and it is estimated that some 60 000 t can easily be diverted to a canning industry from the surplus between present average catch and estimated substainable yields (see Table 5). Preliminary calculations have been based on 50 000 t of sardines and 10 000 t from mackerels, tunas and whitebait. However, these proportions of product mix could easily be changed with substantial increase in mackerel, tuna and whitebait products according to the supply of raw material and market demand for product mix. This will require the equivalent of 330 million 1/4 dingley cans. This could represent the first phase in developing the fish canning industry in India with increased exploitation of tuna and whitebait resources opening up new possibilities for further volume and product development.

The development of the fish canning industry will be based on modernizing and revival of existing fish canning factories and construction of new canning plants. The existing plants, lacking in modern technology and equipment, cannot ensure production of high commercial and hygienic standards but 7-10 existing fish canning plants in the area between Goa and Quilon could be modernized. Cold stores with freezing units equipped to maintain raw material for longer periods could be constructed and modern canning machinery, such as automatic seaming machines and over-pressure autoclaves, could be installed.

These modernized canning plants will have the production capacity of about 80 million cans per year, or a quarter of the total increased production planned.

The main effort should be directed to the erection of new fish canning plants which should be located in landing centres provided with technical facilities for landing fish from the more sophisticated vessels planned for exploitation of resources out to the 200-mile exclusive economic zone. The newly erected canning plants will produce about 250 million cans per year. The yearly capacity of each plant should range between 5 000 to 10 000 t of raw material, i.e., 27 to 55 million cans. Each of the new canning plants will have the following facilities:

- Cold store with freezing equipment
- Ice-making plant and ice storage
- Continuous canning lines for small pelagic fish and for processing small species such as whitebait
- Empty can making line
- Fish meal and oil plant for production of fish meal and oil from offal of canning plant
- Adequate infrastructure and transport facilities
- The new canning plants will supply empty aluminium cans to the modernized existing canning plants

Experience from the fish canning industry in many developed countries as well as in some developing countries has shown that a volume of at least 25 million cans per year is necessary to reach optimum performance and sale of products on international markets with favourable economic results.

The modern canning industry, although equipped with sophisticated machinery, is still labour-intensive and could provide employment for well over 5 000 people. Although much of the work is for unskilled or semi-skilled operators, intensive training will be required for specialized mechanics and processing technologists. These specialists will work in a plant only if management can guarantee year-round employment. Thus, a minimum 220 continuous working days is proposed for the new canning factories as well as for modernized existing plants. They must be organized and equipped to provide raw material when fresh supplies are out of season

3.3.2 Packaging material

India does not produce tin sheets for can-making. All sectors of the canning industry - fruit, vegetables, fish and meat - use imported tinplate.

This situation should be reviewed since the Indian aluminium industry has the capacity and expertise to meet all demands from the canning industry for packaging material of international quality; and aluminium is supplanting tinplate as a container for many products.

The future development of the Indian canning industry should be based on using aluminium produced in India as the prime packaging material. Tin should be used only for containers which cannot easily be made from aluminium, for example, large cans (1-5 kg).

3.3.3 Investment requirements

It is proposed to produce 330 million cans of fish per year from 60 000 t of raw fish. Of this, ten existing but modernized plants, will produce 80 million cans, and the balance of 250 000 000 will be produced in four plants of 55 000 000-unit and one of 27 000 000-unit capacity.

To produce this volume the following investments in plant and machinery will be required:

	Unit cost	Imported equipment costs US$	Local costs Rs.
4 plants: 10 000 t fish, 55 000 000 cans each	US$ 4 883 000	19 432 000	
	Rs. 33 898 500		135 594 000
1 plant: 5 000 t fish, 27 000 000 cans		1 700 000	26 730 000
10 plants: modernize existing plants,	US$ 145 000	1 450 000	
1 500 t fish, 8 000 000 cans each	Rs. 4 455 000		44 450 000
1 plant: aluminium surface protection		2 500 000	10 125 000
		25 182 000	216 999 000

Total imported equipment and local costs Rs. 420 973 000

The US dollar costs for equipment were prepared from actual equipment costs c and f calculations India plus 30 percent allowance for duty if applicable. Buildings, infrastructure and costs shown in Indian rupees are based on locally obtained estimates. It should be noted that the foreign purchases could probably be cut by half, as most of the canning equipment could be manufactured in India after 2 or 3 prototypes were imported from which copies could be made.

3.3.3.1 New canneries

Proforma capital cost schedule for modern fish canning plant for small pelagic fish with 10 000 t capacity of raw material or about 55 million 1/4 dingley cans per year (US$ 1.00 = Rs. 810)

1.	Cold store capacity 1 000 t at -25°C, freezing capacity 40 t/24 h, ice production 40 t/24 h and storage for ice of 100 t, including building	Rs. 10 125 000
2.	Canning plant with 3 lines for small pelagic fish	US$ 3 841 000
3.	Empty can making line including line for can body, lids with tongue and key	US$ 1 042 000
4.	Fish meal and oil plant 50 t capacity of raw material per day	Rs. 2 025 000
5.	Building for items under 2, 3, 4, stores, administrative building and hygienic premises for workmen including water supply, electricity for lighting, drainage system (including cold storage)	Rs. 11 623 500
6.	Steam boiler, steam supply, transformer station, power supply system, telephone and telex system	Rs. 2 835 000
7.	Transport facilities for internal and external transport	Rs. 3 240 000
8.	Not specified	Rs. 4 050 000
	Total investment	US$ 4 883 000 Rs. 33 898 500

From the above estimate, a plant of 5 000 t raw fish or 27 000 000 cans per annum is estimated to cost US$ 1 700 000 and Rs. 26 730 000.

3.3.3.2 Modernization of present canneries

Proforma capital cost schedule for modernization of a typical canning plant on west coast of India for canning small pelagic fishes with 1 500 t capacity of raw material or about 8 million 1/4 dingley cans per year

1.	Cold store capacity 200 t at -25°C, freezing capacity 10 t/24 h, 10 t/24 h ice production and storage for ice	Rs.	2 430 000
2.	Two automatic seaming machines with 4 different tools	US$	70 000
3.	Over-pressure autoclave with 2 retorts for sterilization	US$	40 000
4.	Can-washing machine	US$	35 000
5.	Building adaptation	Rs.	405 000
6.	Steam boiler	Rs.	405 000
7.	Transport facilities	Rs.	810 000
8.	Not specified	Rs.	405 000
	Total investment	US$	145 000
		Rs.	4 455 000

3.3.3.3 Investment for providing facilities for packaging material protection

Cost of anodizing and lacquering machinery with capacity of 8 000 t of aluminium alloy was estimated by the Indian Aluminium Company as follows:

Machinery and equipment	US$	2 500 000
Buildings and infrastructure	Rs.	10 125 000

3.3.4 Justification for development

3.3.4.1 Return on investment

Assuming a product mix of approximately 80-85 percent sardines, and 15-20 percent mackerel, tuna and fish spreads, the return on investment, based on the product costs given in Appendixes 12 and 13, and current export market values for category 2 sardines, is as follows:

Table 7

RETURN ON INVESTMENT

Example 1: ALUMINIUM CAN COST WITH METAL ASSESSED AT CURRENT TAX RATE OF 42% AD VALOREM, Rs. 840 LEVY AND 4% MMCT

	Sardine in oil	Other	Total
Volume - 1/4 dingley cans	45 600 000	10 000 000	55 600 000
Sales revenue per can ex-plant	Rs. 2.18	Rs. 3.00	
Cost of production (Appendix 15)	Rs. 2.17	Rs. 2.33	
Return on investment per can	Rs. 0.01	Rs. 0.67	
Return on investment - total per annum	Rs. 456 000	Rs. 6 700 000	Rs. 7 156 000
Return on investment of Rs. 73 450 800			9.7%

Example 2: ALUMINIUM CAN COST WITH METAL ASSESSED AT 7% AD VALOREM, Rs. 840 LEVY, and 4% MMCT

	Sardine in oil	Other	Total
Sales revenue per can ex-plant	Rs. 2.18	Rs. 3.00	
Cost of production (Appendix 14)	Rs. 1.94	Rs. 2.10	
Return on investment per can	Rs. 0.24	Rs. 0.90	
Return on investment total per annum	Rs. 10 944 000	Rs. 9 000 000	Rs. 19 944 000
Return on investment of Rs. 73 450 800			27%

Table 7 shows that the viability is marginal if the can costs Rs. 0.70 due to taxation remaining at current level. On the other hand, by reducing the ad valorem duty on the metal cost from 42 percent to 7 percent, the can cost decreases to Rs. 0.53 and the overall cost of production decreases by Rs. 0.23 (from Rs. 2.17 to Rs. 1.94 per can). Thus, the costing of aluminium for the manufacture of cans is a crucial factor in the viability of a large capacity canning plant.

3.3.4.2 Benefits to fishermen

Availability of small pelagic species varies considerably according to season and year and the market is often subject to surpluses in excess of human consumption demand. Thus, the price paid to the fisherman for sardines can fall to around Rs. 0.30/kg. If only half of the requirements of the cannery concept are purchased at a Rs. 1.00/kg floor price, the fishermen will benefit from such a minimum price structure to the extent of Rs. 17 500 000 (25 000 t at Rs. 0.70/kg).

3.3.4.3 Employment

New employment potential can be calculated as follows:

A plant consuming 10 000 t raw material requires: 720 employees working 220 x 8 hour-days for direct labour, or 1 267 000 h (see Appendix 14) plus 100 fixed labour categories, for a total of 820 new posts in one plant. Therefore, for plants consuming a total of 45 000 t raw material, the labour force required is 4 1/2 times or almost 4 000 new posts, plus requirements of the modernized existing plants which will be less automated and will use more labour, bringing the total new workforce to 6 800 persons. In addition, direct labour is estimated at a rate of Rs. 2.0 per hour, which is much higher than prevailing rates in the fish processing sector at the present time.

4. PACKAGING MATERIALS

Packaging material for canned foods, including fish products, must have the following characteristics and properties:

- It should protect the product from spoilage during transport and long (one year and more) periods of storage.
- It should be thermally conductive.
- It should not cause any impairment of taste.
- It should not affect the food value of the product.
- It should be light.
- It should be strong enough to be self-supporting.
- It should be heat-resistant.
- It should not be affected by varying ambient mediums.
- It should be reasonably priced in comparison with the contents.
- It should have shape, colour and appearance to attract the buyer and make it more easily marketable.
- It should have easy-opening properties.

Different types of packaging materials are commonly used in the canning industry: tin-plated sheet steel, aluminium sheet, laminated aluminium foil (semi-rigid material) and glass. None of these four types of material satisfy all of the aforementioned characteristics and properties. Characteristics of the two most widely used packaging material for canning food products are compared below:

4.1 TINPLATED STEEL

The most common material used by canning industry is tinplated steel commonly referred to as "tinplate". It is particularly suitable because of its strength, toughness and malleability and because it can be soldered to make very strong side seams for cylindrical containers (FAO Fisheries Circular No. 315, (1973)).

In Japan, tin cans are still widely used since Japan's steel industry can produce low-cost tinplate and has a large market for cans; on the other hand, aluminium is a very expensive material to manufacture due to non-availability of cheap electrical power.

4.2 ALUMINIUM

Although tin cans have enjoyed a good reputation in industry for many years, packaging material such as aluminium alloys and laminated aluminium foils have been introduced in recent times. The latter are becoming more popular than tin cans in many countries for packaging canned fish, particularly in Europe where the cost of aluminium compares favourably with tinplate.

Apart from the fishing trade, other sectors are choosing aluminium containers in preference to tinplate: the canned drinks industry increasing from 44 percent to 54 percent and the meat packing industry from 35 percent to 49 percent during the period 1976-78.

As far back as the early fifties, aluminium was introduced into the fishing industry and since then has been extensively used for structural members and linings of fish-holds, storage space, deck and trawl gear, fish boxes and crates, processing equipment such as filleting and skinning table, smoking screens and racks, sorting and packing tables, freezing trays, etc. Its main advantages over steel are: it is non-corrosive, light-weight and easy to fabricate. Fish canning in aluminium containers was the next stage of development and it has been established to full technical and economic satisfaction for over 20 years.

Some of the most popular and widely used types of aluminium cans and their dimensions are listed in Appendix 9. Aluminium or aluminium alloys used for packing canned food have the following advantages as packaging material:

4.2.1 Resistance to corrosion

Aluminium has a thin oxide coating which is inert to foodstuff. Even if this extremely hard oxide coating breaks it quickly reforms if exposed to air. Further, aluminium is non-toxic and aluminium sulphide (a possible by-product of the reaction of fish with the metal) is colourless and odourless (unlike ironsulphate); hence, its widespread use for cooking utensils and by food-processing industries.

Aluminium is totally unaffected by the fish and it is only the salt content which may cause the metal to react. In the case of fish cans, however, aluminium's natural corrosion resistance is strengthened by a special surface treatment, i.e., anodizing and/or lacquering. Pretreated cans, therefore, have no effect on the flavour or odour of the fish product, do not blacken or discolour the product even in packaging mediums that are slightly acidic or otherwise hostile to tinplate.

4.2.2. Light weight

Aluminium is one third as light as tinplate, volume for volume. In practice, with tinplate's higher strength this rate is reduced slightly to about 2.8. Taking into account that 1/4 dingley cans weigh 58 g in tinplate and 20.5 g in aluminium, this affords substantial savings in transportation costs which become significant when shipping to distant markets.

Taking an inland transportation cost of empty cans as Rs. 400/t and a freight charge of US$ 60/t for the filled cans, savings could be Rs. 20 lakhs for the cannery producing 55 million cans/year (or a saving of Rs. 0.04 per can).

4.2.3 Easy-opening properties

Canned fish is a convenience food. Ease of opening without injuring fingers, spilling contents or using tools is essential. Only aluminium cans, with tab and key or the ring-pull design offer this advantage.

4.2.4 High thermal conductivity

Aluminium conducts heat 3.5 times as fast as tin and 3 times as fast as steel. Food packed in aluminium cans can therefore be easily heated in the can before serving without the danger of any tin or solder melting. Products in aluminium cans can also be frozen, if necessary, with very little refrigeration load.

4.2.5 Attractive appearance

The pleasing appearance of cans made from anodized and lacquered aluminium is an important factor in retail sales. This is particularly evident on the more affluent European and North American markets where tinplate sardine cans are no longer favoured by the domestic user. Tinplate cans in which Indian sardines have been exported corrode after six months and lose sales appeal. Aluminium is more resistant to corrosion in marine atmosphere than the other materials and can withstand extreme humidity and corrosion conditions in transit and storage.

4.2.6 High thermal and optical reflectivity

Lithography is one way of labelling/decorating rigid cans, although rotogravure is also being considered. Aluminium's high reflectivity promotes wide use of clear or translucent coloured base coatings for decorative purposes. Aluminium's shiny surface also reflects most of the heat rays thus keeping the contents cooler.

4.2.7 High recycling value and recovery

The scrap value of aluminium varies between 15 to 20 times that of tinplate. In India, the price is Rs. 0.70/kg for tinplate and Rs. 14.00/kg for aluminium. Aluminium oxides very slowly whereas tinplate will corrode quite rapidly in humid conditions. Consequently, in addition to the value of the aluminium, the salvageable quantity is more stable, yielding a much greater recovery of recyclable material. In some regions and circumstances aluminium may be more economical than tinplate (FAO Fisheries Circular No. 315, (1973)).

4.2.8 Other positive properties

- Easy to open
- Easy to form
- Impervious to light, air oxygen and vapour
- Impervious to micro-organisms
- Resistant to high temperature and corrosion
- Unaffected by varying ambient conditions

4.2.9 Limiting factors

Alloys of aluminium do have two main disadvantages for certain uses. They are not as strong as tinplate and are not easily soldered, thus being less suitable for 3-piece cylindrical containers. However, most aluminium containers used in fish canning industry are of the shallow drawn type which are strong enough to prevent damage during sterilization.

Taking into consideration the positive and negative characteristics of aluminium as a packaging material for canned fish and the fact that India is importing tinplate, but has a local aluminium industry which is able to supply suitable aluminium alloys for can-making, Indian-produced aluminium alloys should become the main type of packaging material for the fish canning industry in India.

5. PRESENT AND FUTURE AVAILABILITY OF INDIAN-PRODUCED ALUMINIUM

India has an abundant supply of quality bauxite and, with the recent discovery of bauxite reserves along the east coast, ranks among the top ten world producers. Although there is at present a temporary scarcity of aluminium due to hydropower shortage, aluminium smelting capacity will exceed demand for the next few years if sufficient electric power can be provided to the industry.

More than 20 alloys of aluminium are being produced in India; and hundreds of tonnes of aluminium products meeting rigid international specifications have been exported. Moreover the production costs are lower than those of many foreign producers, when compared on a tax-free basis.

Presently, the four producers of primary aluminium (Indian Aluminium Co., Hindustan Aluminium Co., Bharat Aluminium Co. and Madras Aluminium Co.) have together an installed capacity of about 300 000 t of aluminium per annum as against a demand of about 250 000 t. Due to the power shortage the production has only averaged about 180 000 t in the past few years and supply has not been able to meet demand. However, the long-term prospects are encouraging as several of the power generation projects are scheduled for completion in the early eighties (including Madhya Pradesh Electricity Board's Sathpura power generation project and the super thermal power station at Korba both of which should be completed in the next five years).

The production capacity of the existing four aluminium producers is expected to be about 550 000 t. In addition a feasibility study is being completed for a 180 000 t aluminium smelter to be located in Orissa.

Thus, in the near future, there should be a considerable increase in aluminium production, which based on present consumption will exceed national demand. Due to the anticipated output, the cost of production is expected to remain reasonable and competitive if operated at or near peak-capacity as the industry is capital-intensive and has a high fixed-cost ratio.

5.1 REQUIREMENTS FOR SURFACE TREATMENT

The specification for aluminium sheet recommended for sardine cans has recently been developed in India and has obtained approval from can manufacturers both in India and abroad. The other alloys specified for miscellaneous fish cans are already being produced although minor modifications may be necessary to strictly conform to internationally-used specifications (specification details for Norwegian and international standards are shown in Appendixes 10 and 11). The main problem regarding use of Indian-produced aluminium sheet is the installation of suitable surface-treatment facilities.

In industrially advanced countries the practice has been either to anodize or treat chemically the aluminium before lacquering and backing. These are costly processes calling for substantial investment that may be justified only if the demand for such pre-treated sheet is great, at least 2 500 t/year, corresponding to 100 million cans.

Recent advances in lacquering technology claim to make anodizing unnecessary and the lacquering of bare aluminium is considered adequate. This is being investigated with lacquer manufacturers abroad, while local lacquer manufacturers are being contacted to find out if the lacquer formulation is freely available in the country.

6. GOVERNMENT PRICING AND TAXATION POLICIES AFFECTING ALUMINIUM AS A PACKAGING MATERIAL FOR FISH

Considering the future availability of the metal the applications for the use of aluminium should be enlarged and new outlets investigated. Production costs are not an obstacle, but present prices are artificially high due to unrealistic taxation and government pricing restrictions. For example, the excise duty on aluminium metal has risen from a mere Rs. 300/t in 1960 to about Rs. 4 200/t in 1978, i.e., 1 400 percent.

Table 8

RISE OF EXCISE DUTY ON ALUMINIUM METAL, 1960-78

Date	Excise duty on commercial grade aluminium	Total excise duty (Rs./t)	Price without excise duty (Rs./t)	Price with duty (Rs./t)	Duty tax as percent of total
1.3.60	Rs. 300/t	300	3 170	3 470	8.6
26.5.67	Rs. 1 140/t	1 140	3 970	5 110	22.3
1.3.70	30% ad valorem	1 192	3 970	5 162	23.0
16.3.70	40% ad valorem	2 024	5 060	7 084	28.5
1.3.74	40% ad valorem + Rs. 2 000/t	4 024	5 060	9 084	44.3
16.3.76	40% ad valorem + Rs. 800/t	4 040	8 100	12 140	33.3
1.3.78	42% ad valorem + Rs. 840/t	4 578	8 900	13 478	34

Source: India, Central Board of Revenue, Financial Bill, Article 27

It will be noted that while the producer's price has risen less than threefold, excise duty has increased more than fifteenfold. This high excise duty has limited the general use of aluminium particularly in packaging and structural application, and contrasts sharply with the low excise duty of 15 to 20 percent applicable for steel and tinplate.

6.1 TAXATION CHANGES PROPOSED

The following proposals should be examined to make aluminium a realistically-priced packaging material for a food product destined for consumption by a protein-deficient sector of the population, and as an export product earning foreign exchange in a highly competitive but lucrative market.

6.1.1 Reduce excise duty

During recent years excise duty has increased from 10 percent to over 50 percent of the basic metal value or in monetary terms, from Rs. 300/t in 1960 to Rs. 4 200/t in 1978. By reducing the excise duty the price would substantially increase demand, and if volume increased in proportion to the decrease in the rate of excise duty this price/demand elasticity would result in no loss of excise revenue.

A reduction to 7 percent, compared with 42 percent for aluminium products in general, has already been accepted by the Government for aluminium irrigation tubing since this is allied to the agricultural sector. It would seem appropriate and consistent that the duty applicable for aluminium fish cans used on the domestic market should also be reduced to 7 percent or at least to 15.75 percent, the rate applicable for tinplate cans.

6.1.2 The dual pricing policy

Prior to October 1978, producers were obliged to sell 50 percent of their production as "levy metal" for electrical transmission cables at cash cost, i.e., excluding depreciation and return on shareholders' investment. The Government's decision to abolish this dual pricing policy (which previously forced producers to charge full depreciation and full return on investment) to only 50 percent of production, will make aluminium available at more realistic prices based on actual costs and return on investment.

6.1.3 Grant full excise relief on exports

Excise relief should be granted or imposed at a rate which ensures that all aluminium products exported can be priced competitively. Any loss of revenue to the Government would be very small compared to the substantial amounts of foreign exchange earned through exports of high unit value canned fish products.

6.2 EFFECT ON PRODUCT COSTING OF PRESENT AND PROPOSED TAXATION

The following table summarizes actual or proforma product costs for a 1/4 dingley can of sardines in oil. Prices given were quoted in June 1978 (US$ 1.00 = Rs. 850).

Table 9

COMPARISON OF COSTS OF TINPLATE AND ALUMINIUM, 1/4 DINGLEY CANS

Tinplate	Rs.	Aluminium	At present tax rate (Rs.)	At proposed tax rate (Rs.)
1 t c and f Indian port gauge 0.25 mm, imported	3 336	1 t No. C35 coil, 0.28 mm gauge (including anodizing and lacquering)	20 000	20 000
- import duty 100%	3 336	- 42% ad valorem duty	8 400	
		7% ad valorem duty		1 400
- Min. & Metal Tr. Corpn. (M.M.C.) levy	267	- levy per tonne	840	840
- Countervailing duty	200	- C.S. tax 4%	1 170	890
Total cost per tonne	7 139	Total cost per tonne	30 410	23 130
		Scrap value 150 kg at Rs. 14/kg	2 100	2 100
		Net material cost	28 310	21 030
Cans per tonne	15 900	Cans per tonne	41 320	
Material cost per can and lid	Rs. 0.45	Material cost per can and lid	Rs. 0.68	Rs. 0.51

Based on the above, the following is the estimated cost per 1/4 dingley can produced in a can-making plant integrated with a canning plant. This is considered the most viable arrangement since overheads are shared. The can is part of the finished product without being subject to the ensuing taxation and profits if manufactured by a separate company, and transport and other cost-saving benefits also result.

Interest, depreciation, maintenance and fixed overheads have not been charged directly to the cost of can-making, but are included in the overhead costs of canning and therefore as part of the cost of the finished product.

Table 10

COST ESTIMATE FOR 1/4 DINGLEY ALUMINIUM CAN AND LID
(Plant capacity - 70 000 000 cans per annum on a 2-shift basis;
Can type - 1/4 dingley, 112 g with tongue and key-type lid)

		Present rate with 42% ad valorem, Rs. 840 levy and C.S. tax Rs. 3 041/kg	Proposed rate with 7% ad valorem, Rs. 840 levy and C.S. tax Rs. 2 313/kg
Metal cost for 70 000 000 cans:	(kg)		
body - 0.0150 kg each	1 050 000		
lid - 0.0092 kg each	644 000		
less scrap - 0.0037 kg each	259 000		
Net metal cost for	1 435 000	= 47 888 540	35 556 220
Lid compound		630 000	630 000
Labour		258 000	258 000
Energy		859 980	859 980
Total for 70 000 000 cans		Rs. 49 636 520	Rs. 37 304 200
Cost per can		Rs. 0.70	Rs. 0.53

Projecting the analysis of production costs, Appendixes 12, 13, 14 and 15 give details of direct, fixed and overhead costs for a proposed production capacity of 10 000 t or 55 600 000 aluminium cans per annum and production costs of two plants using tinplate cans. Table 11 summarizes the cost of packaging material (can and lid) in relation to the total product cost.

Table 11

COMPARATIVE ANALYSIS OF THE COST OF EMPTY CANS RELATED TO
THE COST OF THE FINISHED PRODUCT, 1/4 DINGLEY SARDINES IN OIL

Appendix	Can type	Can metal taxation	Empty can cost (Rs.)	Product cost ex-plant (Rs.)	Percentage relation: can/ product cost
12	Aluminium	7% + 840 + 4%	0.53	1.94	27.3
13	Aluminium	42% + 840 + 4%	0.70	2.17	32.2
14	Tinplate	100% + 4% + 200	0.80	1.99	40.2
15	Tinplate	100% + 4% + 200	0.85	2.25	37.8

In light of the above considerations, the following recommendations are made.

7. RECOMMENDATIONS

(1) Government taxation and pricing policies for aluminium should be reviewed, and a reasonable level of taxes/duty assessed on aluminium used for fish cans by:

(a) reducing the ad valorem duty from 42 percent to the 7 percent level applied to agricultural products.

(b) abolish the dual pricing policy.

(c) permit complete duty drawback on imported cans or aluminium until local production is available.

(2) Financing should be made available for the development concept in two phases, the first to be completed in a 5-year period:

(a) First phase: 5 years

	Rs.
modernize 10 existing factories	56 295 000
4 new plants of 55 000 000 can capacity	293 803 200
1 new plant of 27 000 000 can capacity	40 500 000
1 new surface treatment plant	30 375 000
	420 973 200

(b) Second phase: assess additional production capacity of 200 000 000 cans on the basis of resources and results of first phase.

(3) Promotional work should commence immediately to develop the domestic market so that the product is distributed to population needing it for basic nutritional reasons. The Government should play an active part in market assessment and later give direct assistance in developing internal markets.

(4) Develop export markets with high quality and higher value products. Introduction of Indian brands should be delayed until such time that the "product of India" concept is firmly established.

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Appendix 1

IMPORT OF CANNED SARDINE, MACKEREL, HORSE MACKEREL AND SIMILAR FISH
BY SELECTED ASIAN AND OCEANIC COUNTRIES

Country	Supplier	Quantity in tonnes		
		1974	1975	1976
Philippines	Japan	43 400	49 700	36 800
	Morocco	1 100	3 800	-
(Total - Philippines)		44 500	53 500	36 800
Singapore	Japan	13 600	25 100	17 400
Malaysia	Japan	5 200	9 100	8 300
Indonesia	Japan	1 000	1 000	11 900
Thailand	Japan	800	1 300	1 800
	Morocco	500	300	-
(Total - Thailand)		1 300	1 600	1 800
Fiji	Japan	4 900	1 900	3 600
Samoa	Japan	1 700	1 700	1 700
Solomon	Japan	300	100	200
Papua New Guinea	Japan	9 800	15 500	16 200
	TOTAL	82 300	109 500	97 800
Quantity in cases (112g x 100 cans)		7 348 200	9 776 800	8 732 100

Source: FAO yearbook of fishery statistics, 1975, Fishery commodities. Vol. 43 (1976)

Appendix 2

IMPORT OF CANNED SARDINE, MACKEREL, HORSE MACKEREL AND SIMILAR FISH BY SELECTED MIDDLE EAST COUNTRIES

Country	Supplier	Quantity in tonnes		
		1974	1975	1976
Egypt	Japan	400	5 900	9 000
Libya	Japan	2 000	2 300	400
U.A.E.	Japan	400	700	3 200
Saudi Arabia	Japan	3 200	5 200	6 700
Yeman Arab Rep.	Japan	1 600	500	3 800
Kuwait	Japan	700	800	1 700
	TOTAL	8 300	15 400	24 800
Quantity in cases (112g x 100 cans)		741 000	1 375 000	2 214 300

Source: FAO yearbook of fishery statistics, 1975, Fishery commodities. Vol. 43 (1976)

Appendix 3

IMPORT OF CANNED SARDINE, MACKEREL, HORSE MACKEREL AND SIMILAR FISH BY SELECTED AFRICAN COUNTRIES

Country	Supplier	Quantity in tonnes		
		1974	1975	1976
Ghana	Japan	7 300	11 600	13 200
	Morocco	100	200	-
(Total - Ghana)		7 400	11 800	13 200
Nigeria	Japan	4 900	11 500	12 800
Ivory Coast	Morocco	700	100	-
Liberia	Japan	600	700	1 200
Zaire	Morocco	5 200	2 000	-
	Japan	1 800	1 200	800
(Total - Zaire)		7 000	3 200	800
Madagascar	Morocco	700	400	-
Zambia	Japan	2 400	600	-
Gabon	Japan	900	600	500
	TOTAL	24 600	28 900	28 500
Quantity in cases (112 g x 100 cans)		2 196 400	2 580 350	2 544 600

Source: FAO yearbook of fishery statistics, 1975, Fishery commodities, Vol.43 (1976)

Appendix 4

IMPORT OF CANNED SARDINE, MACKEREL AND SIMILAR FISH
BY SELECTED EUROPEAN COUNTRIES

Country	Supplier	Quantity in tonnes		
		1974	1975	1976
France	Morocco	15 500	7 900	-
	Germany (Fed. Rep.)	600	600	700
	Netherlands	1 500	1 300	1 200
	Portugal	1 900	-	-
(Total - France)		19 400	9 800	1 900
Germany (Fed.Rep.)	Morocco	6 200	2 500	-
	Denmark	1 400	2 300	2 700
	Netherlands	4 200	5 000	4 700
	Netherlands	500	100	100
	Portugal	6 000	-	-
	Spain	3 700	3 000	-
	Japan	600	1 700	900
(Total - Germany (Fed. Rep.)		22 400	14 600	8 400
Italy	Morocco	3 000	1 400	-
	Portugal	3 200	-	-
	Spain	1 900	1 100	-
	Japan	1 100	200	200
(Total - Italy)		9 100	2 700	200
U.K.	Canada	400	100	100
	Germany (Fed. Rep.)	100	100	100
	Netherlands	500	200	300
	Norway	400	300	300
	Portugal	2 400	-	-
	Spain	1 800	2 600	-
	Japan	2 500	3 400	3 700
(Total - U.K.)		8 100	6 700	4 500
Belgium	Netherlands	300	300	400
	Portugal	900	-	-
	Japan	1 400	1 000	1 000
	Germany (Fed. Rep.)	2 700	1 700	2 000
	Norway	600	500	600
(Total - Belgium)		5 900	3 500	4 000
	TOTAL	64 900	37 300	19 000
Quantity in cases (112 g x 100 cans)		5 794 600	3 330 400	1 696 400

Source: FAO yearbook of fishery statistics 1975, Fishery commodities, Vol.43 (1976)

Appendix 5

IMPORT OF CANNED SARDINE, MACKEREL AND SIMILAR FISH
BY U.S.A. AND AUSTRALIA

Country	Supplier	Quantity in tonnes		
		1974	1975	1976
U.S.A.	Canada	3 200	2 600	3 500
	Denmark	900	500	1 700
	Norway	7 500	4 400	7 400
	Norway	500	300	-
	Portugal	1 700	-	-
	Spain	1 300	900	-
	U.K.	600	200	600
	Japan	19 300	11 000	9 700
	Norway	300	200	200
	Spain	200	200	-
(Total - U.S.A.)		35 500	20 300	23 100
Quantity in cases (112 g x 100 cans)		3 169 600	1 812 500	2 062 500
Australia	Japan	1 800	400	400
	U.K.	200	400	400
	Norway	300	100	200
	Denmark	700	200	500
	Canada	400	400	400
(Total - Australia)		3 400	2 100	1 900
Quantity in cases (112 g x 100 cans)		303 570	187 500	169 650

Source: FAO yearbook of fishery statistics, 1975, Fishery commodities, Vol.43 (1976)

LEADING EXPORT COUNTRIES OF SARDINE, MACKEREL AND SIMILAR FISH

	Quantity in tonnes		
	1974	1975	1976
Japan	165 400	200 100	199 500
Morocco	58 300	39 600	52 600
Spain	40 500	36 600	-
Portugal	27 700	27 900	30 000
Germany (Fed. Rep.)	24 000	22 400	27 400
Norway	22 000	14 800	18 300
Yugoslavia	12 400	10 600	15 900
Denmark	10 600	10 300	13 200
Canada	10 400	11 200	11 600

Source: FAO yearbook of fishery statistics 1975, Fishery commodities, Vol.43 (1976)

Appendix 7

IMPORT OF CANNED TUNA IN BRINE OR VEGETABLE OIL
(ALBACORE, YELLOWFIN, BIGEYE AND SKIPJACK)

Country	Supplier	Quantity in tonnes		
		1974	1975	1976
U.S.A.	Japan (brine)	12 100	14 100	15 000
	Japan (oil)	7 300	5 700	5 000
Canada	Japan	6 600	6 600	7 000
Germany (Fed.Rep.)	Japan	3 000	5 800	2 800
Belgium	Japan	1 500	1 800	1 700
Switzerland	Japan	2 000	2 800	2 300
Australia	Japan	900	500	1 000
U.K.	Japan	4 100	3 900	5 800
Italy	Portugal	1 900	-	-
Australia	Japan	1 300	100	200
Lebanon	Japan	500	400	-
Syria	Japan	800	100	700
Saudi Arabia	Japan	100	200	100
	TOTAL	42 100	41 100	41 600
Quantity in cases (210 g x 48 cans)		4 176 600	4 077 380	4 127 000

Source: FAO yearbook of fishery statistics, 1975, Fishery commodities, Vol.43 (1976)

Appendix 8

MARKET PRICES FOR CANNED SARDINE, MACKEREL AND SAURY IN HODEIDAH YEMEN ARAB REPUBLIC

Type of canned fish	Net weight (g)	Supplier	Price			
			1976		1977	
			Riyals[1/]	Rupees[2/]	Riyals[1/]	Rupees[3/]
Sardine in oil	106	France	7.00	12.95	8.00	14.80
	125	Morocco	2.00	3.70	2.50	4.63
	125	Morocco	1.50	2.78	1.80	3.33
	125	Spain	2.25	4.16	2.75	5.09
	250	U.S.S.R.	2.50	4.63	3.00	5.55
Sardine in tomato sauce	106	Denmark	2.50	4.63	3.10	5.74
	198	U.K.	3.00	5.55	3.50	6.48
	398	U.K.	4.00	7.40	4.20	7.77
Mackerel in tomato sauce	210	Japan	1.75	3.24	2.25	4.16
Mackerel fillets	200	Japan	2.50	4.63	3.00	5.55
Saury in oil	200	U.S.S.R	2.50	4.63	-	-
	250	U.S.S.R.	2.75	5.09	-	-

1/ US$ 1.00 = Riyals 4.55 (1976, 1977)
2/ US$ 1.00 = Rupees 8.90 (May 1976)
3/ US$ 1.00 = Rupees 8.70 (January 1977)

Source: Campleman et al. (1977)
FAO, FAO/TF/YEM 11 (NET) (1978)

Appendix 9

THE MOST POPULAR TYPE OF ALUMINIUM CANS AND THEIR DIMENSIONS

Round cans	Diameter (mm)	Height (mm)	Contents (cm^3)	Common use for packing
1/10	73	28	85	Spread
1/8	73	33.7	106	Spread
1/5	86	37	170	Spread
1/4	86	45.1	212	Tuna, shrimp, fish, vegetable
Rectangular cans	**Dimensions (mm)**	**Contents (cm^3)**		**Common use for packing**
1/4 dingley	105 x 16 x 21.3	112		Sardine, sprat
1/4 club	104 x 59.8 x 29.2	125		Sardine, sprat, tuna, mackerel
Hansa	148 x 81 x 25	200		Herring, mackerel

Appendix 10

NORWEGIAN STANDARD: SPECIFICATION FOR ALUMINIUM ALLOY FOR FISH CAN

1. Alloy

   Norwegian specification sheet CM2

   Alloy NA - C3S

2. Chemical Composition (% max. unless shown as a range)

   Fe: 0.40

   Si: 0.20-0.30

   Mg: trace

   Mn: 0.5-0.7

   Al: remainder

3. Mechanical Properties

   UTS: 19-22 kg/mm^2

   0.2% Proof Stress: 16-20 kg/mm^2

   % E: 2-5

   Earning: C. 12 %

4. Dimensions and Tolerances

   Thickness (excluding lacquer): 0.20-0.245 mm: $\pm$ 0.020
   0.25-0.40 mm: $\pm$ 0.025

   Width: 100-330 mm: $\pm$ 0.6 mm
   - 0

   Above: 330-610 mm + 1.0 mm
   - 0

Appendix 11

INTERNATIONAL STANDARDS: SPECIFICATION FOR ALUMINIUM ALLOYS FOR FISH CANS

1. Equivalent International Specification

	8011	8011	3105	5052	5081/86
Si	0.40-0.70	0.50-0.80	0.60	0.40	0.40
Fe	0.50-0.80	0.70-1.00	0.70	0.45	0.40
Cu	0.10	0.10	0.30	0.05	0.05
Mn	0.10	0.10	0.30-0.80	0.20-0.50	0.2-0.5
Mg	0.06	0.06	0.20-0.80	2.6-3.0	3.7-4.5
Cr	0.06	0.06	0.20	0.35	0.30

2. Dimensions and Tolerances (mm)

Thickness range	Tolerance
0.15-0.300	± 0.010
above 0.300-0.500	± 0.015

Width:

Type	Coil (mm)	Sheet
Plain	20-1 500	100-1 250
Lacquered	20-1 070	100-1 070

Coil width (mm)	Tolerance
up to 100	+0.2-nil
above 100-500	+0.3-nil
above 500-1 250	+0.6-nil
above 1 250-1 500	+1.0-nil

Tools on sheet width and length

i) Width: up to 500 mm: +0.3-0
above 500-1 250: +0.6-0

ii) Length: 470-100: 1.0-0
1 000-1 500: 3.0-0

Appendix 12

COST ESTIMATES FOR CANNED SARDINE PACKED IN VEGETABLE OIL IN 1/4 DINGLEY ALUMINIUM CAN WITH LID WITH TONGUE MADE IN INDIA
(7% ad valorem, levy Rs. 840, M.M.C. levy 4%)

(Yearly production 10 000 t raw fish = approx. 55 600 000 cans)

Materials and ingredients	Quantity for yearly production	Price per unit (Rs.)	Total cost (Rs.)
Fish (80 g/can)	9 900 000 kg	1.00/kg	9 900 000
Salt (10% of fish wt.)	990 000 kg	0.25/kg	247 500
Oil + 3% (27 g/can)	1 501 200 kg	9.00/kg	12 009 600
Can and lid + 1%	56 156 000 cans	0.53/can and lid	29 762 700
Labels + 1%	56 156 000 labels	0.10/label	5 615 600
Master cartons + 1%	561 560	4.00/carton	2 246 200
Other packaging material	56 156 000	0.05/can	2 807 800
Water	520 520 m^3	0.06/m^3	31 200
Electricity	2 000 000 kWh	0.18/kWh	360 000
Fuel for boiler	1 400 000 kg	2.00/kg	2 800 000
			65 780 600
Deduct cost of fish offal	2 000 000 kg	0.20/kg	400 000
Cost of material			65 380 600
Staff salaries			
Direct labour	1 267 000 man-hours	2.00/h	2 534 000
Management and technical staff	100 staff x Rs. 1 500 x 11 months		1 650 000
Leave, salary and pension benefits at 11%			461 000
Interest on capital cost financing 80% of Rs. 73 450 800 at 10% for 10 years average Rs. 29 380 000 at 10%			2 938 000
Interest on working capital Rs. 24 000 000 at 17%			4 080 000
Depreciation on equipment Rs. 57 777 300 at 10%			5 777 700
Depreciation on building Rs. 15 673 500 at 5%			783 700
Repair and maintenance of equipment at 3%			1 733 300
Repair and maintenance of building at 2.5%			391 800
			20 349 500
Total cost of production (for 55 600 000 cans/year)			85 730 100
Cost of production per can			1.54
Profit 10%			0.15
Taxes for domestic market			
Excise duty at 10%			0.17
Sales tax at 4.4%			0.08
Cost per can for domestic market			Rs. 1.94

Appendix 13

COST ESTIMATES FOR CANNED SARDINE PACKED IN VEGETABLE OIL IN 1/4 DINGLEY ALUMINIUM CAN WITH LID WITH TONGUE MADE IN INDIA
(Metal tax 42% ad valorem, levy Rs. 840, M.M.C. levy 4%)

(Yearly production 10 000 t raw fish = approx. 55 600 000 cans)

Materials and ingredients	Quantity for yearly production	Price per unit (Rs.)	Total cost (Rs.)
Fish (80 g/can)	9 900 000 kg	1.00/kg	9 900 000
Salt (10% of fish wt.)	990 000 kg	0.25/kg	247 500
Oil + 3% (27 g/can)	1 501 200 kg	8.00/kg	12 009 600
Can and lid + 1%	56 156 000 cans	0.70/can and lid	39 309 200
Labels + 1%	56 156 000 labels	0.10/label	5 615 600
Master cartons + 1%	562 560	4.00/carton	2 246 200
Other packaging material	56 156 000	0.05/can	2 807 800
Water	520 520 m^3	0.06/m^3	31 200
Electricity	2 000 000 kWh	0.18/kWh	360 000
Fuel for boiler	1 400 000 kg	2.00/kg	2 800 000
			75 327 100
Deduct cost of fish offal	2 000 000 kg	0.20/kg	400 000
Cost of material			74 927 100
Staff salaries			
Direct labour	1 267 000 man-hours	2.00/h	2 534 000
Management and technical staff	100 staff x Rs. 1 500 x 11 months		1 650 000
Leave, salary and pension benefits at 11%			461 000
Interest on capital cost financing 80% of Rs. 73 450 800 at 10% for 10 years average Rs. 29 380 000 at 10%			2 938 000
Interest on working capital Rs. 30 000 000 at 17%			5 100 000
Depreciation on equipment Rs. 57 777 300 at 10%			5 777 700
Depreciation on building Rs. 15 673 500 at 5%			783 700
Repair and maintenance of equipment at 3%			1 733 300
Repair and maintenance of building at 2.5%			391 800
			21 369 500
Total cost of production (for 55 600 000 cans/year)			96 296 600
Cost of production per can			1.73
Profit 10%			0.17
Taxes for domestic market			
Excise duty at 10%			0.19
Sales tax at 4.4%			0.08
Cost per can for domestic market			2.17

Appendix 14

COST CALCULATION FOR CANNED SARDINE IN OIL PACKED IN LOCALLY MADE 1/4 DINGLEY TIN CANS - CANNERY "A", MAY 1978

Materials and ingredients	Quantity for 100 cans	Price per unit (Rs.)	Price per 100 cans (Rs.)
Sardines (raw material)	25 kg	1.00	25.00
Salt	1 kg	0.20	0.20
Oil	2 kg	8.00	16.00
Cans and lids	100 pieces	0.84	84.00
Master carton	1 piece	4.00	4.00
Fuel	-	-	0.20
Water	-	-	0.20
Electricity	-	-	0.20
Other material	-	-	0.50
Expenses for material			130.30
Depreciation			
Equipment			5.00
Building			5.00
Cost of work			
Direct work			8.00
Management			5.00
Interest on capital			5.00
Cost of production			158.30
Cost of production per can			1.58
Profit 10%			0.16
Taxes for domestic market			
Excise duty at 10%			0.17
Sales tax at 4.4%			0.08
Cost per can for domestic market			1.99

Appendix 15

COST CALCULATION FOR CANNED SARDINE IN OIL PACKED
IN LOCALLY-MADE 1/4 DINGLEY TIN CAN - CANNERY "B", MAY 1978

Materials and ingredients	Quantity for 100 cans	Price per unit (Rs.)	Price per 100 cans (Rs.)
Sardine (raw material)	22 kg	1.25	27.50
Salt	2.91 kg	0.20	0.58
Oil	2.34 kg	7.69	18.00
Cans and lids	100 pieces	0.85	85.00
Master carton	1 piece	3.50	3.50
Fuel (steam)	-	-	0.20
Water	-	-	0.25
Electricity	-	-	0.20
Other material	-	-	0.05
Expenses for material			135.28
Depreciation			
Equipment, Building			12.50
Cost of work			
Direct work			10.00
Management			7.00
Interest on capital			15.00
Cost of production			179.78
Cost of production per can			1.79
Profit 10%			0.18
Taxes for domestic market			
Excise duty at 10%			0.20
Sales tax at 4.4%			0.08
Cost per can for domestic market			2.25

Appendix 16

SALES REVENUE ESTIMATES

1. Sardines in oil per case of 100 cans

Current quote for Morocco category 2 quality c.i.f. Europe	US$ 26.00
deduct ocean freight	2.00
add premium - alumimium cans	3.00
Selling price ex-plant, India	US$ 27.00
Selling price ex-plant, India - per can at Rs. 8.10/US$ 1.00	Rs. 2.18

2. Mackerel fillets in oil per case of 100 cans

Usual spread between sardines and mackerel fillets in oil is US$ 10.00 per case, therefore - selling price ex-plant, India	US$ 37.00
Selling price ex-plant, India - per can at Rs. 8.10/US$ 1.00	Rs. 3.00

	Rs.
Cost of production in excess of cost of sardines in oil	
raw fish - 80 g at 35% yield at Rs. 1.50/kg	0.34
sardines - 80 g at 45% yield at Rs. 1.00/kg	0.18
difference	0.16
plus total cost sardines	1.94
Total cost of production for mackerel in oil	2.10