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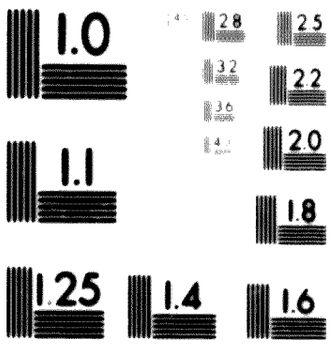

Confidential

UNITED NATIONS INDUSTRIAL SURVEY MISSION

Burma.

FEASIBILITY SUTDY OF FISH MEAL AND FISH OIL PRODUCTION

IN THE

UNION OF BURMA

by

Dr. H. M. Friend

ANNEX IV

TO FINAL REPORT

AUGUST 1963

C O N T E N T S .

1. S U M M A R Y.

1. The United Nations Industrial Survey Mission has been asked to study the Project of a Fish Meal Factory with an intake rate of 50 to 100 tons per day. The feasibility of such a project has been studied and the problems of raw materials, markets, location, technical processes and costs are detailed in the attached report.

2. In conclusion it can be stated that at the moment there is apparently no fishing port in Burma where the raw material required for such a factory, 10,000 tons per year, is easily available at the break-even price of 14 pyas per viss.

3. It is pointed out, however, that there is a large and growing demand for Fish Meal in the world markets and that it is a worthwhile Project to investigate if there are hidden and hitherto unexploited resources of raw material for this product. A scientific maritime survey of potential fishing resources in the open sea is strongly recommended.

4. It is also suggested that better technical fishing methods and the employment of floating factories or factory-trawlers could reduce the manufacturing costs and improve the quality to a point where fish meal can be economically produced for sale in the world markets.

5. In the meantime, the small fish meal factory now being erected by Burma Fisheries Ltd.(BIDC), can be justified as an adjunct to the projected fish canning factory, technically and economically, and can serve as a training centre and pilot plant for future development.

2. INTRODUCTION.

Fish is a popular food in Burma and supplies much of the protein in the national diet.

There is a thriving fishing industry on the rivers and lakes, in the Irrawaddy delta, and along the two thousand miles of coast line.

And yet, strange as it seems, there might be an untapped reservoir of large fishery resources of which very little, or nothing is known as yet.

This is not an unusual occurrance in underdeveloped countries. Only a few years ago nobody thought that Peru would become one of the big fishing nations in the world. In these few years many fish meal factories were built and by happy coincidence a new development in animal husbandry in America and Europe has provided a fast growing market for these products. The supply has just been sufficient to meet the demand.

The natural deep-sea fishing resources off-shore from Burma's continental coast and archipelagos of islands have never been scientifically explored.

According to the latest official figures of the Directory of Fisheries only 0.7% of all the fish caught in the sea are from off-shore or deep sea fishing.

The total amount of fish caught is stated as 174,241 tons, of which 30,619 tons are from inland waters and 143,722 tons from the sea. But only 1,022 tons are listed as the results of off-shore and deep sea fishing.(Appendix 1).

In other words, practically all sea fishing is done near the shore with very small boats, seines, hand netting and similar devices. Three trawlers, chartered from a Japanese firm and mostly manned by Japanese sailors are presently fishing off-shore.

A scientific maritime survey of the potential fishing resources in the open sea is urgently needed.

It should be pointed out that such a study should explore not only the three mile zone along the coast, but also a wider area which could be claimed as Burmese Fishing waters. Many nations have staked out such reservations for years, and Britain has just given notice that she too will no longer abide by the three mile limit.

Only recently there were reports in the Burmese newspapers of foreign trawlers found poaching in the Mergui archipelago and brought into Mergui by the navy.

So far Burma is not even self-sufficient and more than Kyats 207 lakhs worth of fresh, salted, dried and canned fish and shrimp are imported annually.(Appendix 2).

3. STUDY PROJECT PROPOSED BY THE GOVERNMENT (FISH MEAL).

In a Memorandum submitted by Union of Burma Applied Research Institute to the Minister of Industry, dated August 24, 1962, the United Nations Industrial Survey Mission is requested to study the project of the manufacture of Fish Meal as Animal Food.

The specific problem is defined as a Fish Meal Plant with a feeding rate of 50 to 100 tons per day producing Fish Oil as a bye-product.

Raw material for the plant is to be trash fish and offals from fish canning industries.

The investigation is to cover the selection of manufacturing process, equipment and machinery.

The final product is to be Grade C(non-deodorized,non-decolorized) but defatted fish meal.

The study is to include an appraisal of existing project proposals, cost price calculations, capital costs and production costs, and a list of all available reference material, special reports technical studies etc.concerning this project.

A separate project proposal by UBAR concerns Shark Liver Oil of medicinal Grade. As shark would be some of the trash fish supplied for Fish Meal, the extraction of oil from the shark livers can be conveniently done as an additional process in the same factory.

4. PROJECTS OF BURMA FISHERIES AND DIRECTORATE OF FISHERIES.

At present there is no operating Fish Meal factory in Burma. Burma Fisheries Limited (BFDC) have purchased machinery from Daiichi Bussho Co.Ltd., Tokyo, (Appendix 4(iii)) and this is now in Rangoon and will soon be assembled in a new building now under construction.

The plant is described by the manufacturers, Kawashima Iron Works Co.Ltd., Itabashi-Ku, Tokyo, Japan, as a "Continuous Fish Meal Manufacturing Plant with a Production Capacity of 150 to 200 kgs.per hour of fish-meal". This, as the exporter Daiichi Bussho Co.stat , corresponds to an intake of 1,000 to 1,500 pounds of raw fish per hour.

The plant comprises Material Moving Equipment (bucket elevators, belt conveyors); a combined Cooker-Press; Rotary Dryer with all accessories and oil burner; Grinder; Copper Tanks; Bag sewing machine and Boiler with Oil Burner.

There is not included with this plant: Raw fish grinder, Equipment for separation of fish-oil from the liquid running from the Press and packing of fish-oil. Collection of stickwater after separation from the oil, concentration of stickwater for eventual recovery of the solids or mixing-in-treatment of the fish meal.

The total price of the plant and machinery delivered from Japan is quoted as £8,830.0.0 C.I.F. Rangoon (Appendix 4(iii)).

When the plant is assembled there will be required also: Electric wiring work and materials; Steam Piping work and materials; Concrete work for machinery foundations; Heat insulation work and materials; Fire brick and construction etc. This will increase the cost considerably.

This Fish Meal plant is meant to be operated in connection with a Fish Canning Factory in Rangoon.

A detailed Project Proposal for a Fish Canning Factory has been prepared by Burma Fisheries Limited (Application to Union of Burma Investment Committee with no date) for the manufacture of

(1) Sardine in Tomato; (2) Tuna in Tomato; (3) Mackerel in Oil; (4) Fish Balls. Other products are to be added at a later date. The yearly output of the factory is scheduled as 3 million cans in the beginning, to be increased later to 14 million cans which is estimated as Burma's demand of canned fish. In connection with this project Burma Fisheries Ltd. have made an agreement with Taiyo Gyogyo Fishery Ltd. of Tokyo, Japan, to act as consultants and to provide technical assistance and know-how.

The Fish Meal Plant has to be considered as an accessory and complementary installation to the Canning Factory. With this in mind the capacity is sufficient to absorb waste fish and offals from the cannery and there is still a surplus capacity to deal with trash fish landed from the Commercial trawlers, such as shark and other fish not suitable for human consumption or not in demand.

It is estimated that the annual requirements of raw fish for the Canning Factory will be 1,384 tons. Assuming that 10% of it is waste available for fish meal, this would be 138 tons per annum. If the input of the Fish Meal plant is half a ton per hour, the cannery waste could be absorbed in 276 working hours. This raw material would become available only when the cannery is in operation and at the same rate. For example, if fish is canned during 138 working days, this would supply enough waste to make Fish Meal for two hours per day. In addition there may be trash fish from the trawlers, or perhaps from other sources.

Though the new Fish Meal factory has surplus capacity as an accessory to the Cannery, it is still a very small operation. The project proposal recommended for study by Dr. Wallis of USBRI asks for a factory with 50 to 100 tons capacity and this is about eight times larger.

From an economic point of view, the small plant of Burma Fisheries would not be a profitable operation independently from its function within the cannery.

Burma Fisheries can easily dispose of all the fish meal produced, even if it is of low protein value, to Burma Farms Ltd.

Ltd.(BEC) or associated company, who will be glad to have for poultry or sire. If Fish meal had to be made for the world markets, additional protein enrichment from concentrated stick-water would be required. It would be a vacuum concentrating plant and not a paying proposition in a very small factory, but if installed in the factory proposed by FRI could be made profitable. Quotations for such a plant have been obtained from Schlotterbeck & Foss Co., Portland, Oregon, U.S.A. and from The Ferrar Boilermakers Ltd., Aberdeen, Scotland (Appendix 4(i) and (ii)).

We have been informed by U Tin Hlaing, Deputy Director of the Directorate of Fisheries that his department is planning a fish meal factory of about the same size as that of Burma Fisheries. Unless there are special circumstances, as in the case of the fish canning, such a small factory is hardly more than a Pilot plant and cannot be operated as a profitable concern.

6. **R.M [illegible]**.

A fish meal factory of 50 to 100 tons input of raw fish per 24 hours day is large enough to be equipped with all devices necessary for the manufacture of high quality products.

Such a plant would require about 10,000 tons of raw material per year, working 10 hours day for 200 days.

Is such a quantity of fish presently available for this purpose, and at an economic price, in any fishing port in Burma?

The largest catch is made in Mergui, stated by the Directory of Fisheries to be 30,000 tons per year (Appendix 1). It is doubtful if about one third of this could be bought for making fish meal. At the very low prices usually paid for fish waste and trash fish, it is likely that only 10% or about 3,000 tons would be offered, perhaps even less.

On the other hand, the present figure for fish from the Mergui archipelago may have no special significance. It is the result of inshore and coastal fishing with primitive gear, and the actual fishing potential of deep sea fishing in off-shore waters, will only be known when a scientific survey has been made. Such a survey would also reveal resources of fish not usually in demand for human consumption, or outright unsuitable, and yet a good source for fish meal and fish oil. Of course, poisonous fish would not be any good for fish meal either, when this is to be used for animal feed. Such fish have to be sorted out, as they are now, and discarded. But in other countries, for example in the United States, the fast expansion of the industry was based on a variety of fish with no value as human food, namely menhaden. Production of fish meal from menhaden scrap accounts for more than half of the volume and value of all fish meal and oil in the United States. For example, fish meal can be made from shark, and shark liver is a source of valuable oil. There may be other fish plentiful in the Gulf of Bengal which have been overlooked up to now because they are not in demand for human consumption, or they require deep sea fishing equipment not available here at the moment.

All the other fishing centres in Burma have a smaller catch than Tavoy. Myaungmya with fish from fresh water and from the sea is listed as 26,000 tons per year, Thayet and Kyaukpyu are in the 16,500 bracket each, Kyaukpyu 15,000 tons, Akyab and Thaton about 10,200 each; Moulmein with 15,000 tons is a large fresh water centre (Appendix A).

These smaller fishing ports are even less likely to provide 10,000 tons of raw material as the low prices paid for fish meal manufacture unless deep sea fishing techniques are introduced.

This emphasises the urgent need for a Scientific off-shore maritime investigation.

6. [illegible].

A Fish Meal factory with an input of 10,000 tons of raw fish as proposed would have an annual capacity of 2,300 tons of Meal and 2,000 tons of Oil. The yield of dry fish meal and oil is determined by several factors. For example if shark is the principal raw material, the yield of fish oil will be considerably less. But then again, the shark livers could be processed for oil separately and as shark liver oil is rich in vitamins it commands a much higher price per unit.

In America and Europe Fish Meal is valued as an ingredient in formulations for animal food, and presently the entire world production is easily absorbed. Similar as with other constituents of animal foods, the price paid depends directly on the percentage of protein in the product. In fact, it is general practice, to sell these products with Stated Protein Percentage. The percentage of protein in fish meal varies from about 45% to 70% and more. The actual percentage does not so much depend on the original raw material but on the process used in manufacture. For example fish meal made in the plant now being erected by Burma Fisheries with the equipment purchased, will probably result in a meal of 45 to 48% protein. If the stickwater could be concentrated, the protein percentage could be as high as 70%. The following prices of competitive products quoted in Chicago on March 19,1963 and sold on stated percentage of protein will illustrate this:

Soybean Meal, 44% protein	£73.50	per ton.
Cottonseed Meal, 41% ,,	£74.90	,, ,,
Linseed Meal, [illegible] ,,	£69.60	,, ,,
Meat Meal, [illegible] ,,	£8[illegible].00	,, ,,
Gluten [illegible], [illegible] ,,	£4[illegible].00	,, ,,

In Burma there is no Feed Mill nor where poultry-and other animal-food is compounded according to dietetic requirements. This is a pity because there is a large variety of concentrated feeding materials readily available, and in fact surplus. For example molasses from the sugar factories [illegible]

from the Mandalay brewery and oil cakes from various sources, quite apart from Rice bran, broken rice and other by-products. These products and fish meal could become the basis for large scale poultry farms. In U.S. .,Canada and Western Europe,chicken and turkeys are raised by the thousands or single "farms", and then prepared, packed under vacuum in cryovac(plastic)bags,frozen and stored. A stock of such frozen packed poultry can be seen in the Freezer Store of Burma Fisheries, imported from US.for the Inya Lake Hotel.

There is a ready market for all the Fish Meal that can be produced in America and Europe, provided quality and price are competitive.(see letter from International Association of Fishmeal Manufacturers, London, Appendix B(v)). There would also be a market for frozen poultry which could be exported from Burma through the same channels as it is now imported. Burma Fisheries have suitable deep freezing facilities (Immersion Freezers) which could be used during the monsoon period of poultry when the supply of fresh fish is small.

Fish Oil Fish is produced at the same time as fish meal is used in the manufacture of Margarine, Insecticides, Spray, Soap, Fertilizers, Paints, Lubricating Oils, Cooking Fat and Shortening.

Fish Oil from different varieties of fish vary in properties. Some have relatively low iodine values and are classed as semi-drying oil which cannot be used in paints and varnishes since upon drying they do not absorb sufficient oxygen from the air to form hard non-tacky films. Others such as oils from menhaden,sardine, salmon, herring bonito, mackerel and anchovy are classed as drying and can be used in the manufacture of paints and varnishes.

There should be a market in Burma for fish oil in connection with many industrial products. There is also an export market.

7. LOCATION.

The Fish Meal factory of Burma Fisheries will be located next to the Fish Cannery - it is really part of it.

In other cases the question of location is not quite as simple. For example, it may well be that no single fishing centre is presently supplying enough waste and trash fish to warrant the construction of a fish meal factory, big enough to be a sound commercial proposition.

Then again, if the waste occurring in several fishing centres could be worked in the same factory, a bigger plant would be justified.

The difficulty is that the application of preservatives and the costs of transport would increase the price of raw material to a point where it is no longer economical for the purpose. The price of the finished product depends on its quality which is mainly determined by the protein content. Raw fish, particularly in a warm climate, deteriorates fast and the protein is destroyed. Similar problems have been met in other countries, and the answer was the Floating Fish Meal Factory.

There are several types of floating factories, and a very useful one is the factory-trawler, developed in Norway. This combines catching of fish and manufacturing fish meal and oil from the fresh material. The process used aboard ship is in principal similar to that in shore-based factories, but several manufacturers of machinery have constructed compact and simplified units for erection in ships. In Europe, most ships were not especially designed as factory ships, and the plant is adapted to the space available in the particular vessel.

Such a floating factory, even if it is not a fishing vessel, can travel along the coast from port to port, and this is of particular advantage when the season is staggered, or when there is not enough fish in one place to keep the factory busy.

Most larger Fishery ports that have built in recent years employ 200 ships for installation in ships, varying in

capacity from 10 to 400 tons raw material per unit per 24 hour day.(Appendix 3(iv)). Perhaps it should be mentioned that the system has been highly developed in Japan, but they are using very large factory-mother-ships of 10,000 tons or larger with capacities of 500 tons raw fish per day. These are served by fleets of 25 trawlers per factory ship.(Appendix 3(ii),letter from Japan Fish Meal Co.Ltd.).

6. DESCRIPTION OF PROCESSES.

After the fish are weighed they are discharged into a large storage bins or "raw box".

From the "raw box" the fish pass through a crusher and over a conveyor into the continuous cooker, usually fashioned as a screw cooker.

Next the cooked fish pulp enters a continuous screw press and the matted mass, called pressed scrap, is discharged at the opposite end. The intense pressure to which the material is submitted results in an expulsion through the screw openings in the cylinder of the press of most of the water and oil. This liquid material is caught in a receiving pan.

The pressed scrap is conveyed to a grinder where it is broken up into small pieces and passes into the drying equipment.

Fish meal plants are seriously troubled with odours. When the plant is situated in or near a built-up area, provisions should be made to deal with gases from the driers. When the dried meal is discharged from the drier, its temperature varies between 200 to 400°F(93 to 204°C). It contains from 6 to 10 per cent moisture and from 2 to 6 per cent oil, depending on the efficiency and regulation of the plant.

The meal is cooled before sacking and is then filled into 100-pound bags. Sacking the hot meal causes excessive heating due to continued oxidation of the oil contained in the meal. This results in an inferior meal, bringing a lower price. Double-wall paper bags, with an asphalt binder between the walls are recommended for packaging the fish meal.

The plant now purchased by Burma Fisheries Ltd.is not equipped for dealing with the oil and stickwater mixture running from the press.

Additional equipment for this purpose consists of vibrating screens to remove suspended particles which are then put through a small "Centripress" and added to the meal. The liquor is either placed in settling tanks for gravity separation of the

oil and water fractions. In a larger plant, 50 to 100 tons per day capacity, a separator with self-cleaning bowl is used. The oil is then ready for market and packed in oil drums.

The water fraction from this separation is known as "stick water" or fish "solubles" and contains minerals, vitamins, amino-acids (proteins), and many other valuable nutritional ingredients. When dumped into public waters this waste product becomes a nuisance. Because of its nature it putrefies easily and gives off revolting odors. Since it contains protein-like compounds, it is an excellent medium for bacterial growth, and thus may become a public health hazard.

The following process has been developed for the condensation of "stickwater". From the receiving tank it is pumped into an iron storage tank where it is treated with a predetermined quantity of sulfuric acid to adjust the pH to 4.5 from the normal stickwater pH of 6.0 to 7.0

The storage tanks are fitted with steam coils and the temperature is held at 150°F(66°C) for 30 minutes to coagulate some of the protein and to precipitate the bone salts. When the reaction is complete, the stickwater contains approximately 5% protein in solution, which is recovered under concentration.

After the above reaction the stickwater is passed through a clarifying centrifuge to remove the precipitated solids. A small amount of oil entrapped mechanically by the suspended protein, approximately 1.0 per cent, is also recovered.

The concentration of the stickwater is completed in vacuum evaporators. With steam jet ejector and vapour compression a concentrate containing 50% of solids is obtained. During evaporation the original liquor is here reduced in volume by approximately 90 per cent (i.e. 90 pounds of water has been removed from each 100 originally contained in it.) It contains sufficient acid to prevent either bacterial or proteolytic decomposition, and can be stored for a short time.

(Appendix A(1). Schlotterbeck Process of Fish Meal and oil plant with Stickwater Recovery).

9. COSTS AND POSSIBLE PROFITS.

The following Cost Estimate for a Fish Meal Factory of 50 to 100 tons capacity per 24 hour day is an approximation to serve as a very general guide.

The figures are based on raw fish input of 10,000 tons per annum, and this would average to 100 tons per day on 100 days or 50 tons per day on 200 days, within the limits of capacity.

In the model the total annual production costs are just under K.15 lakhs and a profit would be possible if the total production could be sold ex-factory at K.200 per ton (£14). The break-even price under these conditions would be K.141 per ton (£70). If it is further assumed that this is a first class product and that the fish meal has a total protein content, this would be a competitive price on the world market.

It is quite obvious from the Estimate that the project stands and falls with the price paid for Raw Fish. In the estimate, the price paid is K.04 per ton (equal to K.0.10 per viss). From American sources it appears that the price paid in USA for the raw fish material in fish meal production is around £16 or K.76.(equal to about K.0.19 per viss). If the raw material is waste and offals from the canning and general all trash fish a price of K.0.10 to K.0.20 per viss may be justified. Normally, in Burma, there is no fish available at this price anywhere. The lowest price paid in the fishing ports for even mixed fish is about K.0.40. It has been questioned if the landing costs can be lowered under K.0.20 per viss. How is it possible that the fish meal manufacturers can purchase the raw material at K.0.12 per viss? The reason is 50% canning waste and 50% shrimper and similar trash fish caught with cheaper equipment by deep sea fishing.

It is easy to see that a price of only K.0.20 per viss for raw fish would increase the manufacturing costs by K.6,40,000 again and leave no profit, not to mention K.0.40 per viss or more.

The break-even price in the present Estimate is between K.0.12 and K.0.14 per viss. The lowest price Burma Fish Rice Export pay for raw fish used for canning is K.0.20 per viss and it is only suitable for fish balls.

[illegible] be [illegible] . [illegible] is [illegible] th[illegible]

[illegible] tern [illegible] by [illegible].

[illegible] price [illegible] per viss [illegible] .40,000 [illegible] or more.

[illegible] than [illegible].13 and [illegible].14 per viss. [illegible] per viss [illegible] suitable for [illegible].

.... p.13.

Cost Estimate of Fish Meal and Fish Oil Production Requirements.

Annual Production: Meal 2,300 tons.
Oil 2,000 tons.

1. CAPITAL REQUIREMENTS

a. FIXED CAPITAL, say K. 15,00,000
b. WORKING CAPITAL, say K. 45,00,000

Total Capital Requirement. K. 60,00,000

2. MATERIALS & SUPPLIES

	Annual	Annual
a. Direct Materials		
Raw Fish	10,000 tons, K. .10/viss	[illegible],40,000
Salt	10,000(cwt) K. 1/-[illegible]	40,000
Drums	10,[illegible] (40 gal) K.[illegible]/-each	4,6[illegible],000
Total Direct Supplies.	K.	11,48,000
b. Other Supplies (Chemicals, Spare Parts, etc)		44,000

3. ELECTRIC POWER, FUEL

Electric Power,[illegible] K. .10/unit	35-460.
Fuel, 40,000 gall. Oil, K. .5[illegible]/gal.	2[illegible].400

4. DEPRECIATION, 10%	1.50,000
5. MANPOWER	
a. Indirect Labour	47.490
b) Direct Labour	20,000

6. TOTAL ANNUAL COST AND SALES REVENUE

Direct Material	11,48,000	
Direct Labour	20,000	
Manufacturing Overheads,(Supplies,Power, Fuel, Depreciation and Indirect Labour)	[illegible]	
Total Manufacturing Cost.	K.	14,68,350
Total Administration Cost(Insurance, Audit, Legal, Contingencies)		15,000
Sales Expenses		10,000
Total Annual Costs.	K.	14,93,350

Annual Sales Revenue.

2,300 tons Fish Meal, K.400/-ton(£84)	9,20,000
2,000 tons Fish Oil, K.400/-ton(£84)	8,00,000
Total Sales Revenue.	17,20,000

Appendix 1. FISHING STATISTICS OF THE DIRECTORY OF FISHERIES. (1)

List of fish caught annually in Union of Burma. December 1962.

Serial No.	Districts.	Fish Produce Viss	Viss
1.	Rangoon	39700 x 2	79,400.
2.	Pegu	941300 x 2.5	2,823,900.
3.	Irrawaddy	711500	1,600,000.
4.	Hanthawaddy.	650000 x 7	4,550,000.
5.	Tharawaddy.	1040000 x 2.2	1,188,000.
6.	Prome	70000 x 2	140,000.
7.	Toungoo	316800 x 2	633,600.
8.	Bassein	1668400 x 2	8,342,000.
9.	Henzada	1200000 x 2	2,400,000.
10.	Myaungmya	7000000 x 5	35,000,000.
11.	Maubin	1027000 x	18,200,000.
12.	Pyapon	2304200 x	18,700,000.
13.	Thaton	2003600 x 7	14,025,200.
14.	Amherst	2033800 x 10	20,338 000.
15.	Tavoy	480000 x 12	5,760,000.
16.	Mergui	3573500 x	41,000,000.
17.	Thaketmyo	64600 x 2	129,200.
18.	Minbu	40200 x 2	80,800.
19.	Magwe.	71100 x 2	142,200.
20.	Pakokku	14800 x 2	29,600.
21.	Mandalay	520000 x 2	1,040,000.
22.	Kyaukse	179700 x 2	359,400.
23.	Meiktila	6800 x 2	13,600.
24.	Myingyan.	31300 x 2	62,600.
25.	Yamethin.	55500 x 2	111,000.
26.	Shwebo.	199900 x 2	399,800.
27.	Sagaing.	170300 x 2	340,600.
28.	Katha.	342500 x 3	1,027,500.
29.	Upper Chindwin.	155000 x 2	310,000.
30.	Lower Chindwin.	187800 x 2	375,600.
31.	Akyab	1320600 x10	13,206,000.
32.	Kyaukpyu	1710000 x 12	20,520,000.
33.	Sandoway	62200 x 12	746,400.
34.	Bhamo	650000 x 2	1,300,000.
35.	Myitkyina	221000 x 2	663,000.
36.	Southern Shan Sts.	50000 x 2	100,000.
37.	Northern Shan ,,	40000 x 2	80,000.
38.	Off-shore or deep sea.		1,308,798
		Total	217,026,598.

Appendix C.

IMPORT OF FISH PRODUCTS(1951 STATISTICS).

	Units.
Fresh Fish	[illegible]
Hammerstaub	1,[illegible],078
Fish Dried Salt	15,[illegible]
Dried Prawns	[illegible],09,[illegible]
Crustacea	[illegible],[illegible]3
Canned Fish	[illegible],[illegible],010
Canned Crustacea	[illegible],[illegible]5[illegible]
Fish Pasta Paste	[illegible],[illegible]4
Fish Preparations	~~1,8[illegible],[illegible]5~~
	~~[illegible],[illegible],[illegible]~~

Appendix 3(i) (2)

Letter dated 16th January 1962 from Dr.B.Kreuzer of F. .O.

Thank you very much for your letter of 9 January in which you informed me of development concerning fish meal production in Burma. I note from your letter that Burma Fisheries Ltd.have ordered a fish meal plant from Japan. I have not been informed of this project and as the firm you mentioned as suppliers of the equipment, Dai Ichi Busso Co.Ltd., is a trading company and not a firm of plant manufacturers, I regret that I have not the slightest idea what type of equipment and what size of plant was ordered.

In 1961 U Pwint Gaung, Managing partner of the firm in Burma, Pwint Gaung and Bros.,visited me here in Rome. He was interested in the manufacture of fish flour and in establishing a plant for its production for human consumption. However, I have never heard from him since. Is Burma Fisheries Ltd.identical or associated with U Pwint Gaung's firm?

The type of plant which should be chosen depends very much on the fat content of the fish to be used for reduction and it is therefore necessary to get data on the fat content of the main species of fish which are to be used. I hope you will be able to get such data in Burma.

In tropical climates it is necessary to give some attention to the storage of the raw material before reduction in order to avoid too much deterioration. The storage of the raw material will need especially careful planning if the product should be used for human consumption. As I mentioned above, plans existed in Burma earlier on to produce fish meal for human consumption and it may be that these plans will be merged with those of the Burma Fisheries Ltd.

With regard to the Japanese firm, Taiyo Gyogyo Fishery Limited, which you mentioned in your letter, I can assure you that this is the largest fisheries enterprise in Japan and perhaps in the world. They own about 300 fishing vessels, run canning factories, etc. Such a firm is commercially minded and will surely recommend the establishment of a canning factory, and participate in such an enterprise, only if the project is sound. I feel that there would be nothing to worry about if this firm were to plan and install a canning factory in Burma. The fact that they made trials before starting the real planning shows that they base their plans on technological data. This is not very often the case in government-sponsored projects.

In the meantime you probably have realized that there is nobody in Burma who would be able to plan, install and operate a canning plant. It would in fact be very advisable for some Burmese people to be trained in Japan or elsewhere in canning technology and in technical and commercial management of canning plants.

In the last paragraph of your letter you mention the fish flour factory proposed by Dr.Wittforel. I mentioned above that U Pwint Gaung was concerned with this project.

It should be possible to ascertain when you have sent the plans, later on, whether the fish meal plant ordered through Dai Ichi Busso will be suitable also for making products for human consumption. However, in the meantime it would be useful if you could find out whether it is planned to use separate equipment for the manufacture of fish meal for animal feeding and for fish flour (fish protein concentrate) for human consumption, or whether both products are to be manufactured in turn with the same equipment (see my above remarks concerning U Pwint Gaung's intention to produce fish flour for human consumption).

Appendix 3(1)

Letter dated 19th.February 1963 from Dr.R.Kreuzer of F. .O.

This is just to acknowledge your letter of February and to thank you for sending me the plan and specification of the Japanese fish meal factory which has been ordered by Burma Fisheries Ltd. The information you have made available is very interesting, and I am pleased that we are allowed to copy the plan and specifications of the plant. I will not comment on the plant since it is already ordered. I only wonder whether such a small and rather elaborate plant will work economically. I would appreciate it if you could keep me informed about the operation of this plant. After having copied the documents I will send them back to you.

Regarding the utilization of large prawns, I consider freezing of peeled prawns to be more profitable for export than canning, especially if freezing equipment is already in existance at Burma Fisheries. Plate freezers would, of course, be advisable for freezing packed shrimp, but an air blast or shelf freezer could also be used. For export, suitable transport facilities must, of course be available.

If you intend to ask FAO for advice with regard to the design of trawlers, it would be advisable to forward such a request through the proper channels. You might contact Dr.R.B. Griffiths, the FAO Representative in Burma whose address is:

The United Nations Offices,
24, Cheape Road,
Rangoon.
(P.O.Box 650).

Letter dated 6th.March 1963 from Dr.R.Kreuzer of F. .O.

This is to acknowledge with many thanks your letters of 5th.and and 26 February which contained so much interesting information. I will try to comment on some of your points.

1. I understand that U Paint Gaung is no longer interested in establishing a fish-meal or fish flour factory. I am glad that he has given up this idea. When he visited me he wanted to produce fish flour and to mix it with shrimp sauce or shrimp paste to make a dried or semi-dried product. I also had the impression that his chemist, if he really is one, did not have much experience in the manufacture or development of fish flour or other fish products. You may understand that we cannot support the idea of producing fish flour and mixing it with shrimp sauce in order to sell the stuff as a "shrimp" product. I do not know what ideas Dr.Wittfogel had in this respect.

As far as fish meal plants were concerned, Dr.Wittfogel tried to revise the idea of producing 10 to 20 tons of fish meal by using a drying chamber with trays as was suggested by his precedessor, and he was right. Dr.Wittfogel, a capable veterinarian who has specialized in fish hygiene and inspection, went to Burma under terms of reference which were not within his field of specialisation or experience (e.g.canning of various products,etc). As regards his work on fish processing, he had no guidance from this Division. We were not concerned and we did not get his reports. When I saw him in Burma I was sorry for all the effort he expended without getting anything established on a firm basis. It would be wrong to blame him for this. An expert who goes to a developing country, especially for the first time, needs guidance in his work. This is particularly true for an expert who has to carry out practical work using modern methods in such a wide field as food processing.

I told you that I feel that the Burmese urgently need experienced specialists for developments in the field of fish processing and fish products. These specialists need not be FAO experts, and I agree to your proposal that a Japanese fish meal expert should be recruited to set up and operate a fish meal plant. It would also be a good idea to send one or two technicians from Burma to Japan for special training in fish meal manufacture.

2. You mention that U Pwint Gaung is interested in manufacturing dehydrated fish sauce. As far as I know, trials in this field have been made only in Vietnam where a small scale spray dryer provided by U.S. technical aid was used. I saw the dried product, it was just wonderful but I did not see the raw material and I cannot believe that it is possible to make such a dried product from fish sauce prepared in the normal way. On the other hand, these trials showed that it is possible to make a dried fish sauce product of good quality which is water soluble. However, it is necessary to make practical trials since we have no description of a suitable method. The only man who could give us more information, the young Vietnamese chemist who developed the process, is, as far as I know, fighting somewhere in the bush. In any case, I have written to the Director of the Institute in Saigon, whom I know personally, asking him for further information. You will hear from me again concerning this matter.

3. If U Pwint Gaung should seriously consider manufacturing such a product, then I would advise you to suggest that an expert should be recruited for this development work. There is only one problem, namely that it may be very difficult to get a suitable expert. There are one or two Japanese scientists who might be in a position to do the job - Japan is not a fish sauce producing country - but I am not sure whether they would go to Burma. I tried several months ago to find in the IPFC region a suitable man for a fellowship to study the fermentation of fish but there was nobody suitable in the fish sauce producing countries. Therefore, it might be a better idea to send U Pwint Gaung's chemist on a fellowship to study the laboratory and technical aspects of producing fish sauce and to get practical experience in spray drying techniques.

4. Powdered fish, such as dried powdered Hilsa, is, of course, a completely different product from dried fish sauce and a very different process is involved.

To comment on the experiments described in the paper attached to your letter of 5 February, I would not suggest using this process for the manufacture of larger quantities, e.g. more than one ton of raw material per working day. To make a dried product from fish with 11 percent fat content in the flesh the cooked flesh must be pressed in order to reduce the fat content. By pressing the fat content can be reduced to about 6-8 per cent in the final product. For the production of dried powdered fish for human consumption on a commercial scale Schlotterhose type equipment would be recommended. Such equipment is manufactured not only by Schlotterhose but also by firms such as Stord Mhrine, Norway, and Rennebürg, U.S.A. I attach a "Note" on the production of fish protein concentrates which shows the various possibilities of producing such products on a commercial scale. The powdered fish you describe is no other than fish flour for human consumption (fish protein concentrate type C).

It would be a different matter if you intended to produce a powdered fish product made from dried but uncooked fish. Such a product has the disadvantage that it very easily becomes rancid if fatty fish such as Hilsa is used.

5. Regarding a floating fish meal factory, I can understand your interest, especially in view of the conditions prevailing in the delta area but I would be very hesitant to recommend such a floating factory for Burma. From your letter I cannot see what type you have in mind. Are you thinking of a factoryship which would be supplied with fish from catching boats, a fishing vessel on which a fish meal plant is installed or a fish meal plant installed on a pontoon? You mention in your letter of 5 February that you contacted Stord Marine Industry, Bergen and that they referred you to Ocean Products A/S. As regards these firms there are two points which may be of interest to you:

a) Stord Marine (in collaboration with Atlas,Denmark) produces a so-called Rotadisc dryer which dries the fish rapidly and gently on a steam heated screw dryer. The dryer is a cylinder surrounded by a steam jacket divided into several sections, each of which is equipped with an independent regulator for the steam supply. The heating surface is constructed so as to prevent solid deposits and ensures maximum heat transmission. Water is used as heat transmitting material. Normal steam consumption is about 170 kg per ton raw material. Fish meal is advanced through the dryer by means of a large rotary screw conveyor steam heated in shaft and threads. Condensate from rotor and threads is returned to the boiler, a considerable advantage in places where water is scarce. This Stord/Atlas continuous indirect dryer is constructed in 5 different sizes, ranging from process capacities of 0.5 to 18 tons of raw material per hour.

b) I know that Ocean Products are operating one or two fish meal factory ships. One of these ships is called "Havkvern II" and is equipped with a Rotadisc dryer. I think that Stord are referring to this type of vessel. The meal produced is of high quality. This is obviously due not only to the fact that the equipment is better than any other heat jacketed equipment but also to the fact that raw material of freshest quality is used.

By means of such a factory ship fish meal of high quality can be obtained and there are, of course, advantages since the raw material need not be transported or stored for long periods. On the other hand production on factory ships is very expensive. A skilled crew and trained processors, landing and unloading facilities for the vessel, etc. are necessary. It is preferable to process fish ashore and before deciding to use a factory ship the economics of its operation should be carefully investigated.

If I may advise you, I would suggest that a survey should be made by an experienced specialist before any decision is taken on using a factory ship for fish meal production. First of all it would be necessary that you yourself should see the delta region in order to ascertain whether a factory ship could be operated there and, also, how a fish meal factory established ashore could be supplied with raw material.

The Stord Marine fish meal plant can also, of course, be used ashore.

6. You mentioned that you were using fish processing methods which were taken from the "Technical Digest Service". I assume that this is a publication but I had not previously heard of it. I am sure that the methods described are excellent but to apply them may be difficult. The method you used is advisable only for processing lean fish. If fatty fish is processed in this way you get a fat content which is too high and the product cannot be used.

Regarding fish distribution, it is necessary (a) to show what should be done and (b) to show how it should be done. In the case of (a) it is necessary to make surveys and to give advice; in the case of (b) specialists should be employed in order to find out the best techniques according to local conditions and to train the people. The best results will always be achieved if these two tasks are carried out separately.

I have tried to comment comprehensively because I am very interested in fisheries development in Burma and I know that they do not have specialists. I would be glad if you could in your surveys draw attention to the fact that the long term services of specialists are necessary in order to achieve development.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Fisheries Division - Rome - 1962

NOTE ON A PROPOSAL TO MANUFACTURE FISH PROTEIN CONCENTRATES IN PERU

1. Background

The use of fish protein concentrates for human consumption was discussed by the FAO International Meeting on Fish Meal, Rome, March 1961, by the FAO/UNICEF/WHO Protein Advisory Group, June 1961, by the FAO International Conference on Fish in Nutrition, Washington, September 1961 and, in particular, by a Panel of Experts convened by FAO in Washington in September 1961. This Panel made certain recommendations concerning the specifications which should be followed in the manufacture of such products and concerning areas in which campaigns to promote the consumption of such products would be likely to be most effective. Among the latter, priority was given to a campaign in Peru to be associated with the very large-scale production of fish meal which had developed in that country. Recommendations of the Panel were subsequently discussed in FAO and were also referred to the Second Annual Conference of the International Association of Fish Meal Manufacturers, Lisbon, October 1961. A tentative plan of operation for a project in Peru was drafted and thereafter discussed in detail with representatives of the Government, the Fish Meal Industry, and other interested agencies in Peru, by Mr.W.E.Popper of FAO Fisheries Division and other FAO staff members, during a visit to Peru in December 1961. Mr.Popper's discussions revealed a strong interest on the part of the Government of Peru in promoting such a campaign and on the part of the fish meal manufacturers in Peru in acquiring and operating the necessary equipment for the manufacture of fish protein concentrates in sufficient quantity to supply such a campaign and, later, the commercial demand for such products in Peru.

During the foregoing series of discussions FAO received much valuable collaboration from the U S Bureau of Commercial Fisheries, as a result of which arrangements were made for Dr.E.R.Pariser, of the Technological Laboratory, College Park, Maryland, to accompany Mr Popper during his visit to Peru and thereafter to visit Europe in order to inspect various types of equipment and processes used in Europe for the manufacture of fish protein concentrates and to discuss his findings with FAO with a view to advising the Peruvian fish meal manufacturers.

2. Fish Protein Concentrates - Characteristics and Specifications.

In considering the manufacture of fish protein concentrates in powdered form, it is essential to recognize the typical characteristics of these products and what bearing these have on

the equipment and processes established. For the purpose of these and similar projects, where the production of fish protein concentrates, as described in the tentative specifications, is envisaged as supplementary to the manufacture of fish meal, three types of product have been specified.

These tentative specifications for fish protein concentrates as adopted by the Panel of Experts convened by FAO in Washington in September 1961 are appended.

The specifications give the minimum requirements for each type. Type A is completely, or almost completely, deodorized and defatted, Type B is partly deodorized and defatted and Type C is non-deodorized and non-defatted.

3. Existing Equipment and Processes for the Manufacture of Fish Protein Concentrates

The following is a summary of what is known to FAO concerning available equipment and processes used for the manufacture of fish protein concentrates in different countries. In this connection, it must be emphasized that the manufacture of Types A and B products from a Type C product has so far been restricted to batch production on a small scale and that continuous type extraction plants have not yet been tested on fish.

(a) Types A and B Products

Two groups of processes can be distinguished:

(i) Production of Types A and B in one stage, directly from raw fish by azeotropic dehydration and lipid extraction with partial or complete deodorization. Fish protein concentrates of Type C cannot be manufactured by this method. (Examples of this process are: VioBin process, Vogel process, process developed at the Herring Industry Board Reduction Factory in Great Yarmouth, England, process developed at the Fisheries Research Board of Canada, Halifax, process developed at the Norwegian Fisheries Research Institute, Bergen.)

(ii) Production of fish protein concentrates in two stages, the first of which consists in producing a concentrate of Type C. The second stage is a solvent extraction of Type C leading to a concentrate of Type A and B. (Examples of this process are: that developed by Societe Azote Unic, Safi, Morocco, South African Fish Meal Producers' Association, Capetown, and Astra International, Soderstalje, Sweden)

The solvents used in the various processes for making fish protein concentrate of Types A and B are: ethanol, isopropanol, hexane, ethylacetate, acetone and ethylene dichloride.

The solvents used may affect the wholesomeness of the product. They must be eliminated from the final product because of undesirable effects on taste and flavour. No toxic residues must be allowed to remain in the final product.

Good experiences are reported with ethanol and isopropanol.

In most of the equipment to be used for manufacturing concentrates of Types A and B, various solvents can be utilized but trials have to be carried out before switching from one solvent to another.

The apparent merits and disadvantages of the various processes in relation to requirements for [illegible] discussed below. The conclusion is that the [illegible]

available is sufficient for the Peruvian Government and industry to come to a decision about the manufacture of Types A and B in Peru now, but that the selection of a specific process might be made dependent on further investigations and trials. If the decision is positive, these investigations and trials could take place concurrently with the first phase of the campaign for the introduction of fish protein concentrates into the diet of protein-deficient people in Peru, namely the development of suitable vehicles including testing for palatability. Meanwhile, FAO is now conducting wide-spread enquiries in order to supplement the analytical and operational information available at present.

(b) Type C Products

Subject to certain precautions and control with regard to the quality of the raw material and standards of hygiene during processing, these products can be manufactured in conventional fish meal equipment. The methods can again be divided into two groups:

(i) Those where the raw material is dehydrated by direct heat (flame driers);

(ii) those where the raw material is dehydrated by indirect heat (indirect steam driers).

It is fully realized that satisfactory products might be produced by all these methods involved. In order to decide what type of process should be selected for Peru, it appears that the following points ought to be taken into account:

(i) The process should be easily controllable and not need highly skilled operation.

(ii) The equipment should be easily serviced and cleaned in order to meet the requirements necessary for food processing equipment.

4. Investigations Concerning the Manufacture of Fish Protein Concentrates.

There is widespread interest on the part of the fishery industry, food technologists and nutritionists in the development of equipment and processes for the manufacture of fish protein concentrates suitable for human consumption, and certain investigations now proceeding offer hope of success at a fairly early date. From these, FAO has assembled information from the following:

Schlotterhose and Company
Maschinenfabrik, Postfach 329,
Bremerhaven-Fischereihafen 4,
Western Germany.

Stord Marin Industry A.S.
Stord, Norway.

Rose, Downs and Thompson Ltd.
Old Foundry, Hull, England.

Edw. Renneburg and Sons Co.,
2639 Boston Street, Baltimore 24
Md., U.S.A.

De Smet
38 Avenue de France,
Anvers, Belgium.

Lurgi Gesellschaft fur Warmetechnik mbH
Frankfurt-am-Main, Western Germany.

Fisheries Research Board of Canada
5 Terminal Road, Halifax, N.S., Canada.

Herring Industry Board Reduction Factory.
Yarmouth, United Kingdom.

Norwegian Fisheries Research Institute
Fisheries Department
Lars Hillesgate 26, Bergen, Norway.

Bureau of Commercial Fisheries
U.S. Fish and Wildlife Service,
College Park, Maryland, U.S.A.

Societe Azote Union
Safi, Morocco

South African Fish Meal Producers' Association
Capetown, South Africa.

VioBin Corporation,
Monticello, Illinois, U.S.A.

UNICEF Fish Flour Plant
C/O ISAS.,
Quirtare, Chile

Astra International
Sodertalje, Sweden.

5. Considerations affecting the Proposed Project in Peru.

During discussions between FAO and the fish meal manufacturers in Peru, the latter indicated their interest in an installation capable of producing 1,500 tons annually of fish protein concentrates of Types A, B and C, without restriction below this limit of the capacity to produce any one of these types. It will be evident that in the circumstances described above, the manufacturers are faced with a number of alternatives which must be evaluated in terms of the commercial risks involved and the prospects for a profitable return on investments. These alternatives are described below, together with FAO's comments on the apparent advantages and disadvantages from the standpoint of technical, economic and organizational considerations:

(a) It is recognized that an annual production of 1,500 tons, such as is visualized by the fish meal manufacturers in Peru, is considerably in excess of the requirements of the projected campaign and that the surplus will be marketed together with fish meal for animal feeding. In view of this, and also since some Type C product will probably be required in any case (for the purpose of the campaign), it is assumed that the project in Peru will be based on the manufacture of a Type C product. The manufacture of Types A and B products will be based on processes involving the manufacture of a Type C product as a first stage (production in two stages).

(b) With regard to the manufacture of a Type C product, it has been mentioned above that conventional fishmeal equipment can be used for this purpose. It is a matter for the manufacturers to decide whether to install a new plant or to make available an existing plant for this purpose. In this connection, it is strongly recommended that whatever equipment is used, whether new or existing, the installation should be used exclusively for the manufacture of a Type C product and

should be operated quite separately from other installations manufacturing products below the standards required for human consumption, with due regard for the control of raw material and standards of hygiene as mentioned above. The manufacturers of the fish protein concentrate should be carried out in a closed building.

(c) With regard to the manufacture of fish protein concentrates of Types A and B, continuous production processes have been used so far only for products other than fish, and on a scale much larger than that envisaged in Peru.

(d) For the manufacture of Types A and B products, therefore, the manufacturers could adopt one of the following alternatives:

(i) A rotary drum batch process using a plant to be purchased and installed by the fish meal manufacturers.

Comment:

The advantage would be that a Type B and perhaps a product could quickly be produced in sufficient quantities for the promotion campaign. During this period, it would be hoped that the results of various experiments and pilot operations would be available, on the basis of which the manufacturers could then be further advised. If, at a later stage, the manufacturers decided to replace the rotary drum process by a continuous process, this might be done without changing the solvent recovery unit which accounts for the greater part of the cost of the equipment.

(ii) A pilot plant for continuous extraction set up and operated by interested manufacturers of equipment.

Comment:

Manufacturers of equipment have already indicated interest in making pilot plants available in Peru or to make trials with products in their own countries. Production would be on a small scale, but would be adequate for gaining experience with the process and for supplying material for the early stages of the promotion campaign.

(iii) An existing continuous extraction plant now being used in Peru for products other than fish.

Comment:

The capacity would undoubtedly be much greater than that required for the manufacture of fish protein concentrates in Peru. The arrangement would depend on the willingness of a firm in Peru already operating a continuous extraction plant to make the plant available and to operate it under appropriate conditions, including the use of specified solvents and the exclusive use of the plant at given periods for the manufacture of fish protein concentrates.

(iv) A full-scale continuous extraction plant purchased and installed to the specifications of the fish meal manufacturers.

Comments:

FAO could not recommend the outright purchase of any particular full-scale continuous extraction plant

essential. However, interested suppliers of equipment may be willing to make such a plant available on attractive terms. This would be subject to negotiation once it has been decided to proceed with the project.

(e) In general, for a plant in which fish protein concentrates of Types A, B and C should be manufactured, the following characteristics should be given:

(i) Operate only with fresh, wet fish of good quality.

(ii) Be equipped in a fully sanitary manner, so as to qualify as a food processing installation.

(iii) Store the fish protein concentrates in such a way that no spontaneous heating can occur (storage of the concentrates in bags of suitable material).

6. Conclusions.

It is necessary first to decide, in principle, whether in the light of the information now available, the campaign outlined in the draft plan of operation should be undertaken. If this decision is positive, the fish meal manufacturers could go ahead with setting up a new, or using an available, plant for the production of fish protein concentrate of Type C.

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APPENDIX

Tentative Specifications for Fish Protein Concentrates.

(Edible Fish Flour and Fish Meal).

The following criteria are considered important to guarantee the quality of fish protein concentrates (edible fish flour and fish meal) for human consumption.

1. Raw Materials: The various types of fish protein concentrates (A, B and C) may be prepared from the same material. This material need not be confined to fish flesh, but could include whole fish, de-headed and degutted fish, or trimmings of suitable type. In all cases, it should be in a condition fit for human consumption.

2. Processing: The processing methods which could be used to produce types A, B and C of fish protein concentrates need not be specified in detail. However, sanitary precautions ordinarily applied in producing human food must be observed in the handling of the fish from catch to end of processing.

3. Production Specifications:

	Type A	Type B	Type C
a) Protein Nx6.25			
Protein content(at minimum 10% moisture content)	minimum 67.5%	minimum 65%	minimum 60%

	Type A	Type B	Type C
Pepsin digestibility	minimum 90%	minimum 92%	minimum 92%
Available lysine	minimum 6.5 g of the protein	minimum 6.5% of the protein	minimum 6.5% of the protein
b) Moisture	maximum 10%	maximum 10%	maximum 10%
c) Fat content	maximum 0.75%	maximum 2%	maximum 10%
d) Chloride	maximum 1.5%	maximum 1.5%	maximum 2%
e) Silica	maximum 0.5%	maximum 0.5%	maximum 0.5%

4. Odor and Taste: Type A should have no more than a faint odor and taste when wetted with boiling water in a closed container.

No specifications can be made for types B and C since they will show a wide range of odors and flavors.

5. Storage Stability: Type A, after six months storage at 80°F(27°C); and when packed in a hermetically-sealed container, should exhibit no significant deterioration as judged by the development of off-flavors or by loss in protein quality as shown by digestibility and available lysine values appreciably below the specific minima.

In types B and C the requirements are the same for protein quality, but no specification is possible for the development of off-flavors.

6. Bacteriology: Type A should be free from Enterococci, Salmonella/Shigella, Coagulase-positive Staphylococci and clostridia and have a total bacterial plate count at 37°C of not more than 10,000 per gram.

For types B and C the same requirements would apply for Enterococci, Salmonella/Shigella, Coagulase-positive Staphylococci and pathogenic anaerobes.

7. Safety: No additives, preservatives or harmful solvent residues should be present in type A. Safety tests on at least one species of animal should be done according to the requirements of the appropriate official agency of the country where the product is to be used.

Types B and C should contain no solvent residues and no substances such as anti-oxidants, or flavorings should be added unless permitted by the consuming country. Safety tests with animals are required as with product A.

8. Methods of Analysis.

a) The fat content of Types A and B should be determined by extraction for six hours with boiling ethanol or chloroform-methanol (2:1). The fat content of Type C should be determined by extraction with ethyl ether for six hours in a Soxhlet apparatus.

b) Available lysine should be determined by the method of Carpenter.

c) Prior to large scale testing and, if accepted for mass feeding trials, at reasonable intervals thereafter, biological evaluation of protein quality would be required. The level should be specified.

Other problems remain to be dealt with when the necessary information is available. Thus there are problems of dispersability, grittiness and volatility, particularly for products of Type A. There are problems of packaging. The suggestions above have been made in an effort to combine technological feasibility with adequate nutritional and palatability requirements.

It is recognized that the existing methods of analysis are, in many cases, inadequate and diverse procedures are employed in different countries for products of these types. It is to be hoped that studies currently underway on methods of analysis will soon be completed in order that they may be used for the necessary determinations as outlined in these specifications.

The first draft of the above specifications was prepared by a Working Party at the FAO International Meeting on Fish Meal, Rome, March 1961. In June 1961, the specifications were reviewed and slightly amended by the WHO/FAO/UNICEF Protein Advisory Group. The specifications were further discussed by the Interim Panel of Experts on Fish Meal and Fish Flour for Human Consumption which was convened by the Director-General of FAO at the end of the FAO Conference on Fish in Nutrition, Washington, September 1961.

The tentative specifications given above are a composite of the views expressed at the above meetings.

Appendix 3(ii)

JAPAN FISH MEAL COMPANY, LTD.,

No.3. 3-CHOME, GINZA-NISHI, CHUO-KU, TOKYO.

Mar. 7, 1963.

To,
United Nations Industrial Survey Mission,
C/O Technical Assistance Board,
No.12, Newlyn Road, Rangoon,
BURMA.

Dear Sir,

We have duly received your letter of 28th. February, (FI/MF/1-42).

As our affiliated fishing companies have been operating fish meal factory ships from 1958, we are naturally in a position to assist you in fish meal production. However, we call your attention to the fact that the Japanese factory ships are operated on a bigger scale than you may suppose.

Any mother ship is registered as 10,000 tonnage or bigger class and accompanied by a fleet of more than 25 trawlers. The plant in a ship has the capacity of processing more than 500 tons of raw fish per day. If it is impossible to secure the supply of the above quantity, production of fish meal is unprofitable under the present world market.

Such being the case, we are afraid that it may be difficult to operate such a factory ship as the Japanese system in consideration of the fish resources in the Burmese coast, and the sales in your market. A factory ship on a small scale, of which capacity of processing raw fish is 100 tons, is impossible from the points of economical and technical views.

The other method is the production by a factory of comparatively small scale at landing places. Even if the supply of raw fish is less than 100 tons per day, this method is economically and technically possible. In this case, it is needless to say that the fishing ground is restricted to the small part of the coast waters.

It is naturally at your choice which you take up, a ship factory or a land factory. We beg you to let us know your opinions about the above matters after your careful study.

In any case, we are sure that we are able to assist you in this matter.

Yours faithfully,

Sd/- S.Kabeya,

President.

Appendix 3(iii)

Letter dated 11th.February 1963 from Ocean Products A-S,Bergen, Norway, to W.M.Friend,Esq.,Adviser on Food Processing and Canning, Ministry of Industry, United Nations Industrial Survey Mission, New Secretariat, Rangoon.

Through our sister company, Stord Marin Industri A/S, we have received your letter dated 15th.January 1963 regarding a Floating Fish Meal Factory.

We can inform you that we do have a floating fish meal factory and that we for some time have been operating such fish meal factories and we are at present negotiating about the sale of our factory trawler "Havkvern II". There are, however, quite many floating fish meal factories in Europe of a very good quality and we shall be pleased to find out if any of these should be for sale, and we will then come back upon the matter.

We want to draw your attention to the fact that we have acted as advisers in connection with construction and operation of such floating fish-meal factories. In case you should want to establish additional fish meal factories either ashore or floating fish meal factories, we should be pleased to assist you.

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letter dated 25th.January 1963, from Stord Marin Industri,Bergen to W.M.Friend,Esq.,Adviser on Food Processing and Canning, Ministry of Industry,United Nations Industrial Survey Mission, New Secretariat, Rangoon.

We acknowledge with thanks receipt of your letter of 15th. January, which we have taken the liberty to send on to Ocean Products A/S, here. This company is operating floating fish meal factories and we have asked them to reply to your inquiry.

Appendix 3(iv)

Translation from German.

Letter dated 8th. March 1963 from Schlotterhose & Co, Bremerhaven, Germany to United Nations Industrial Survey Mission, New Secretariat, Rangoon.

We confirm the receipt of your letter of March 1, 1963 and we thank you for your inquiry. We can make propositions for Fish Meal factories of both types, those which are based on land and those which can be erected aboard of ships and are not restricted to one location. This latter one can be transferred to the other fishing centres at any time.

As it is intended to use also sharks and similar large fish it is necessary to provide fully mechanised grinders. The big fish have to be cut into small pieces in order to make the cooking process efficient.

First the fish are boiled or cooked for a short time to create a condition where most of the fat can be extracted by pressing.

As a basis for the development of your plans, we enclose a quotation No. 11 612 covering an oily fish sterilising, pressing and drying plant capable of dealing with approx. 100 tons of raw material within 24 hours.

There we have not only described the equipment which we can supply but we have also mentioned the working of the installation and the capacity.

We enclose diagram No. 11 032/6. There is shown an erection plan and the approximate measurements of each part of the equipment and also the connections between them.

You will know already that in the course of processing the fish in the screw conveyer press most of the oil and also a large amount of stickwater is separated from the solids. When the oil is separated there remains the stickwater which is very rich in proteins as well as in vitamins. The profit of Fish Meal Factory is very much increased if these liquids can be used. Generally speaking the yield of fish meal is increased from 18-20% to 23-24% in terms of raw material. The costs of processing the stickwater are very small in comparison.

The stickwater is concentrated in a special vacuum concentrating plant and the resulting concentrate is then dried together with the fish solids. The product which is so obtained is known as "whole meal".

We are sending quotation No. 11 613 covering a vacuum evaporator plant for stickwater recovery, with steam jet air ejection and vapour compression, to produce a concentrate containing 50% of solids. Water evaporation capacity approximate 2.000kg/h which corresponds to a stickwater quantity of 2.400 kg/h for continuous operation, (drawing No. 1000/907).

Similar installations can be erected aboard ships and operated there. We mentioned that we have supplied during the last few years more than one hundred such installations for operation aboard fishing vessels and since our company was founded we have constructed more than two hundred plants for installation on ships. We mentioned this figure to explain to you that we have wide experience in this field. The space available aboard ship is different on each vessel: always it is very restricted. Therefore, we have been asked again and again to adjust the installation to the [illegible]

continuously many new order's from former customers.

If you want to follow up the idea of a small floating fish meal factory and if you have already a certain vessel in mind, in particular, if you know the space available for the erection of the fish meal factory, then with our great experience we shall be pleased to make special propositions to meet your requirements. Such equipment can be made by us for different quantities from 10 tons to 400 tons of raw fish per unit for a 24 hour working day.

We can also assist you with other problems which you may encounter. Dried and salted fish with a moisture content of 25% is easily spoilt because this amount of moisture is high. The easiest way to improve the quality is to grind it and to dry it for the second time. We assume that this fish will not be used for animal feed but for human nutrition. In this case the loss of the original shape by grinding may be objected to by the consumer to begin with, but they might learn eventually to use this product in the form of powder or of larger pieces.

We are also selling equipment for the manufacture of shark liver oil. These are made for various processes. The oil can be extracted from the livers in heated cooking vessels and if desired these can be constructed with a vacuum, for a better preservation of vitamins. We have just developed a new proprietory process for extraction of oil from livers in a very careful manner and at very low temperatures giving a high yield. If you will be kind enough to let us have some figures about the quantity of livers to be extracted per hour, or the quantity per day with an indication of the number of working hours, we shall be glad to send you special quotations.

x x x x x
x x x x

Annex ix 8(v).

Letter dated 1st. April 1963 from International Association of Fish Meal Manufacturers, London to Dr.V...Friend, Adviser on Food Processing and Canning, United Nations Technical Assistance Board, United Nations Industrial Survey Mission, New Secretariat, Rangoon, Burma.

I must apologise for not replying previously in detail to your letter of 1st.March, but unfortunately Dr.Lowrn from whom I wished to obtain certain information had only recently returned from the U.S.A. and was rather tied up, and I have since been engaged on a Conference. I will, however, try to give you detailed information on the points which you have raised.

So far as present price of Fish Meal on the World Market is concerned, I would not like to try to summarize the position except in very general terms. My Association as such does not in any way deal with matters relating to price. Therefore I have no statistical information on price. Prices vary very much from time to time and from country to country. All I can say is that since the advent of Peru as a major Producer, much larger quantities of Fish Meal have been available on the World Market. Broadly, during the last two or three years, production and consumption have kept in line, but all Fish Meal Producers recognise that the price of Fish Meal must at all times be severely realistic, bearing in mind estimated world consumption and the prices of competing products such as Soya.

Some three years ago Fish Meal prices dropped very considerably because it was feared that the advent of Peru as a big Producer would lead to over-production. In spite of ever increasing production by Peru this fear was not realised due to the developments of further markets and increased consumption in existing markets. Therefore, although price fell badly in 1960, there was a marked improvement in 1961 leading to a considerable measure of stability throughout the latter part of 1961 and 1962. Generally, it is recognised that Fish Meal should sell at a good price so long as the price is realistic.

So far as quality Standards are concerned, there are no International Standards or National Standards very generally, and in some cases are worked out by agreement between Producers and Users. This is the case, for instance, in the U.S.A., but essential requirements are limits for moisture, salt, impurities (e.g.sand) and oil, together with a declared level of crude protein (say 60%). In the United Kingdom, for instance, Standards are laid down in the Fertiliser and Feedingstuff Act 1926 and Regulations made thereunder. These provide for two definitions of Fish Meal, firstly Fish Meal as such and secondly, White Fish Meal, which is of course included in the former definition. The two definitions are as follows:

Fish Meal: fish residue meal ...	A product obtained by drying and grinding or otherwise treating fish or waste of fish, to which no other matter has been added.
White Fish Meal	A product (containing not more than 6% of oil and not more than 4% of salt) obtained by drying and grinding or otherwise treating white fish or waste of white fish, to which no other matter has been added.

In selling any form of Fish Meal in the United Kingdom a statutory statement has to be provided which contains particulars of the amount of oil, protein, phosphoric acid and salt respectively

In addition, methods used in analysis are sometimes defined and this Association is particularly concerned with standardisation of methods of analysis for digestibility and fat determination and much work is being done.

Furthermore, some users specify a limit for otherwise permissible free fatty acids in the oil of the meal, but this Association considers this unnecessary and unrealistic. In some countries the repair digestibility of the protein is guaranteed, but the significance of this is very doubtful, although the latest work on repair digestibility using very much less pepsin in many cases than in the past has proved more encouraging. Moisture limits often include a lower level, e.g. 5% as well as an upper one, say 11%. Both limits are imposed on safety grounds during storage, bringing to overheating and mould growth respectively. Limits for oil are also set when a product is recognised as typically low in oil: for instance, in the case of White Fish Meal. In other cases the oil content merely has to be declared.

Some leaflets which were given at my Association's Third Annual Conference last autumn sum up the position in different countries and I am asking you for your confidential use copies of those papers which were available at the Conference. These must be returned as restricted, however.

With regard to your request for plant for stationary floating fish meal factories, I enclose names and particulars of a number of well-known machinery manufacturers taken from the Fisheries Year Book and Directory, published in this country. I might particularly mention the Farrar Boilerworks Limited, if only because they seem to have agents throughout the World and I have listed the agents in East and South-East Asia.

You also asked for statistical material and other information concerning the Fish Meal Industry. I enclose some statistics from the FAO Year Book of Fisheries Statistics, especially reprinted for the Association's Third Annual Conference.

I also enclose a draft of a brochure which was produced by the International Association with the specific object of introducing Fish Meal in under-developed countries. The idea of this Brochure is that the main text can be adapted to suit the understanding of people likely to use Fish Meal in the countries concerned and that it should be preceded by an introductory chapter directed particularly to the people principally concerned. In some countries it might be farmers, in others agricultural officers and so on. It is also suggested that there could be a final chapter giving specific formulae suitable for use in mixed rations in the countries concerned. It is the intention that FAO shall issue this Brochure to its Field Officers, but this has not yet been done.

I also enclose, although it is of more limited interest, a copy of a brochure issued by the United Kingdom Association, of which I am Secretary, and which is revised every two or three years. This is the latest edition which has only been issued within the last month.

As these enclosures are in fact somewhat weighty, I am sending by surface mail with a further copy of this letter, but I am sending with this letter the information relating to machinery manufacturers. I think that they are the people best qualified to answer any queries on the question of machinery.

LIST OF FISH MEAL MACHINERY MANUFACTURERS.

DENMARK.
ATLAS, A/S, 3 Baldersgade, Copenhagen,N. T: Atlas, Copenhagen.
Telex I 5077. T: Estb 1864. MD: S. Tarstad. : In nearly 80
countries. Refrigerating plants, Fishmeal and fishoil plants,
accelerated-freeze-driers, Freshwater generators, etc.(See
advertisement.)

GERMANY
SCHLOTTERHOSE & CO., Bremerhaven-G. Manufacturers of machinery &
equipment for fish by-products, esp.fish oil production,(See
advertisement.)

U.K.
IRR R BOILERWORKS LTD., "Farrematic" Department,Newark-on-
Trent. T:Newark 1143-4-5. T: "Farrematic,Newark." D:G.R.Ellis,
B.Sc., .I. .E., . .E.S., Enst.,John F.Palmer,M.I.B.E.,
R.S.Hepworth. (See advertisement).
Branches and Agents: Hong Kong - Messrs.David Bong & Co.Limited,
Union Building, Hong Kong. Home Correspondence - Messrs.Thomas
& Co.Ltd.,Greenock, Scotland. India(South) Messrs.Binny & Co-
(Madras) Limited, Engineering Department, P.O.Box No.66,Madras 1.
London Office - Messrs.Binny & Co.Limited, 122, Leadenhall Street,
London, E.C.3. India(North) - Messrs. Balmer Lawrie & Co.Limited,
21, Netaji Road, Surhee Road, Calcutta, 1, also at 5, Graham Road,
Ballard Estate, Bombay. London Office - ,Lawrie & Co.Limited,
Dunster House, 37, Lane,London,E.C.3. Malaya - Messrs.
Paterson, Simons & Co.Ltd.,London House,Crutched Friars,London,
E.C.3. Thailand - Messrs.Gerson & Sons Limited,Silom Road,Bangkok.

ROSE, DOWNS & THOMPSON,LTD.,Old Foundry,Hull. T:29864. T.: Rose-
downs, Hull. London Office: 15 Portland Place,London,W.1.T:Langham
5588. MD: C.Robson.Ch:I.H-Downs,C.B.E.,M.I.,Mech.E. : In
many countries. Fish meal and oil machinery including the "Turba-
meal" pack and plants for the production of meals and oil from
fish, and fish offal.

NORWAY.
MYREN D(BERGEN), . T: 1035,1098, : land.D: John Hetland.
Machinery for By-Products and Fish Oil Products.Manufacture of
machinery for the fish meal and fish oil industry.(See advertise-
ment.)

MYRENS VAERKSTED, A/S.P.O.Box 5000-N. Oslo. T: Myren.Telex 1038,
Oslo. Manufacturers and suppliers of complete fish meal and
fish oil factories, including cookers, presses, disintegrators,
driers, evaporators, centrifuges, hammer mills.(See advertisement).

STORD MARIN INDUSTRI, A/S, Bergen S. Norte.-Johannessen,Norway,
Manufacturers of modern processing equipment, Consulting
engineers.

Appendix 3(vi)

Extract from letter dated 28th.February 1962 from the Institute of Food Technologists, Vancouver, Canada, to Dr. [illegible] Friend, United Nations Industrial Survey Mission, New Secretariat, Rangoon, Burma.

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My experience in Ceylon in regard to Fish Meal was rather a frustrating one. The plant was equipped with a batch type cooker and Filter Press at great expense. We found that in the two years I was in Ceylon there was no fish to put through such a plant. The need for fresh and fresher fish was so great that nothing was left for Fish Meal. They eat the entire fish from head to tail and they eat all types from sharks to minnows.

Project 9 - Shark Liver Oil Medicinal Grade.

If you have a reasonable volume of livers from sharks or for that matter any fish, then this project can be relatively simple.

Here again the volume of livers will determine the extent to which you should expand this project.

If it is a small volume operation at several points along the coast, we would suggest that merely chopping or grinding the livers and cooking with live steam will be sufficient. After the livers are well cooked the oil can be floated off the top by introducing water at the bottom of the cooker. The oil so obtained will be suitable for human consumption.

The value of such oils as Medicinal Oils will be determined by the Vitamin A content. This level of Vitamin A fluctuates here in B.C. from practically nil to as high as 30,000 I.U. of Vitamin A per gram of oil for shark livers.

In Ceylon we found that the Vitamin A content was around 3,000 - 5,000 I.U. per gram of oil. This type of oil is of course valuable but the user must take quite a lot at a time to be effective. This would be about the same quantity as taken by users of Cod Liver Oil.

The livers could also vary in quantities of Vitamin D but we have found that in Shark Oil this is very small and of little use to consider as part of the Medicinal Value of the oil.

Now if you plan to collect the livers in large quantities and transport to a central processing plant you might wish to consider a more elaborate set-up. This would involve the use of a centrifuge to extract the oil from the cooked livers. This would result in a better quality oil and less waste on processing.

In Ceylon we used the simple process and produced large quantities of oil. This we put up in 32 oz. bottles using a simple bottle filler. The bottles or cans could even be filled by gravity.

x x x x x
x x x x

Schlotterhose & Co.
Maschinenfabrik,

Bremerhaven 8th March 1963.
Dr. L./gh
Dr. L/Zu

United Nations Industrial Survey Mission.
New Secretariat,
Rangoon.

Q U O T A T I O N

No. 11 612

covering an oily fish sterilising, processing and drying plant capable of dealing with approx.100 t of raw material within 24 hours.

(similar to drawing No.11 032/6)

A) STERILISING, PRESSING AND DRYING MACHINERY

1) 1 automatic duo fe screw conveyor
with filling funnel, for steady feeding of the plant.
Drive is made by adjustable ratchet and pawl by means of an electric reduction gear of 2 HP

2) 1 screw conveyor
to forward the raw material to the cooker.
Drive is made by several wheel gearing by means of an electric reduction gear of ¾ HP

3) 1 screw cooker
In our special design, with heatable steel jacket and rotating water extraction device. The cooker provided with heatable jacket to be heated by indirect steam, with pipe-lines for steam and water of condensation, with automatic discharging devices and all fittings required. Sight glasses and inspection flaps make it possible to steadily control the cooking process and, consequently, to produce a fish pulp well suitable for being pressed.
At the end of the cooker there is a rotating water extraction device, which takes care for extraction of a great deal of water and oil from the fish pulp; thus the task of the press will become somewhat facilitated and the efficiency of pressing will be increased accordingly.
Drive of the screw shaft and of the water extraction device will be made by chain drive by means of a variable speed gear with directly flanged electric motor. The gear is of infinitely variable type, thus making it possible to vary the number of revolutions of the driven parts during operation.
Motor power 5 HP

4) 1 <u>screw press</u>
is of special design, with axially adjustable press screws; consequently, filling and pressure can be changed whilst the press is in operation and can be accommodated to the quantity of raw material and to the condition of the fish pulp.
Further accommodation can be obtained by varying the quantity of material passing the press and the time of staying in the press of the material, which will also be secured by changing the revolutions of the press screw during operation. This will be effected by the drive, which is made by the chain drive by means of a special worm-gear with directly flanged electric motor of 15 HP

5) 1 <u>breaker</u>
with strong type beaters, to crush the press cake obtained from the press.
Drive is made by V-belt drive by means of an electric motor of 8 HP

6) 1 <u>screw conveyor</u>
to mix the crushed presscake and the fish solubles concentrate obtained from a special plant.
Drive will be made by an electric reduction gear of 2 HP

7) 1 <u>screw conveyor</u>
to forward the press-cake/solubles mixture to the dryer.
Drive is made by an electric reduction gear of 2 HP

8) 1 <u>combined steam/warm-air dryer</u>
consisting of
2 upper cylinders with agitating and transporting and shovelling device installed; and
1 cylinder below, fitted with efficient heating system which is also provided with transporting, agitating and shovelling device.
Between upper and lower cylinders there is a coarse mill to avoid any clogging of the dried material. Drive of the same is made by V-belts and electric motor of 6 HP
Supply of heat will be effected by indirect steam originating from steam jackets covering the cylinders and from the heating system fitted into the lower cylinder.
Moreover the dryer is provided with steam-heated air heaters to reduce the warm air required, which is steadily playing around the material to be dried and takes care for quick off-take of the water vapours at low temperatures.
The offer covers a complete drier with all accessories required and pipe-lines for steam and condensate inside the dryer.

The offer covers a complete dryer with all accessories required and pipe-lines for steam and condensate inside the dryer.
Drive is made by chains by means of an electric reduction gear of 20 HP

9) 1 material discharging screw conveyor
for continuous discharging of the dryer.
Drive is made by an electric reduction gear of 1,5 HP

10) 1 dust catcher
for separation of the meal dust carried with by the water vapours leaving the dryer. Provided the discharging connection and discharging gate, the drive of which will be made by an electric reduction gear of 0,5 HP

11) 1 exhaustor
of especially strong type, to suck off the air and the water vapours from the dryer.
Drive is made by V-belts by means of an electric motor of 10 HP

12) 1 the pipe-lines required for water vapours
for connection of dryer, dust catcher, exhaustor and condenser, including all flanges, packings and bolts

13) condenser
with spray nozzles and cataract system installed, to condense and to wash the water vapours resulting from the drying process

14) 1 elevator
made of wrought iron, with buckets moving on sprocket chains of steel; with

screw conveyor annexed
to forward the dry material to the mill.

Drive of the elevator and screw conveyor will be made by chains by means of an electric reduction gear of 3 HP

15) 1 electric magnet
complete with rectifier, of especially strong type, to retain the iron particles possibly being in the dried material

16) 1 mill
to grind the dried material. Provided with mechanical feed device for steady feeding.
Drive is made by V-belts by means of an electric motor of 45 HP

17) 1 iron platform
for mill and motor, with bag filling collection and dust collecting device including dust tube

18) 1 electric vibrator sieve
of closed type, to separate the solids from the press liquid. The wire gauze made of stainless steel. The sieve will be suppliedcomplete with support, V-belt drive and electric motor of 2 HP

19) 1 receiver
to collect the press liquid coming from the sieve, with electric pump annexed,

20) 1 screw conveyor
to return the solids separated from the press liquid and to add same to the fish pulp before the latter is entering the press.
Drive of the conveyor worm is made by an electric reduction gear of 1,5 HP

D) OIL PRODUCTION UNIT

pre-heater with
21) automatic pre-purification
to be heated by indirect steam, with settling device. During passing these pre-purifiers, the press liquid will be brought to the most favourable temperature for separation, and the coarse sludge will become separated ! Sight glasses, fittings, pipings for steam and condensate and other accessories belong to the complete outfit.

22) 1 special separator
of closed type, with self-cleaning bowl, for separation of water and sludge from the fish oil and for separate discharge of same. De-sludging will be effected automatically by operating a pressure valve. The disc set is made of stainless steel.
Drive is made by special flange motor of 15 HP

23) 1 tank
to take up the separated oil, with special electric pump annexed, motor power 1,5 HP

24) 1 tank
to take up the glue water and the sludge, with special electric pump annexed, motor power 1,5 HP

25) the pipe-lines required
for connection of the equipment of the oil production line with vibrator-receiver item 18 and 19

G E S A M T P R E I S . . . . . DM 405.200,--

Total motor power:

item 1 - 20 :)- 146 HP
item 21 - 25 :)

All the electric motors are planned for three phase current of 220/380 Volt working voltage, 50 Hz.

Total net weight:

item 1 - 20:) - 57.600 kg
item 21 - 25:)

without drying of solubles-concentrate:

1.200 + 500 kg/h, having 2 atu + 4 atu working pressure

180 kg/h, having 8 atu working pressure

including drying of solubles-concentrate:

1.300 + 600 kg/h, having 2 atu + 4 atu working pressure

180 kg/h, having 8 atu working pressure

The condensate of the steam employed will be recovered nearly entirely and can be used again as feed water for the steam generating unit.

Cooling water required approx.

Each type of well-water, spring-water or surface water (that means also sea-water and river-water) can be used for cooling purposes.

The prices mentioned are to be understood on a freight basis fob German North Sea Port, including seaproof packing
They do not include import duty, erection, insulation, electrical installations, masonery and foundations, supply of steam, power and cooling water, and all parts not especially mentioned in this quotation.

Time of delivery: at present approx. 8 - 9 months

Delivery: according to enclosed terms of delivery

Payment: according to special agreement

Note: We reserve the right of constructional alterations and improvements of our machinery.

Maschinenfabrik

Bremerhaven 8. March 1963.

United Nations
Industrial Survey Mission,
New Secretariat,

RANGOON.

QUOTATION

No.: 11.613

covering vacuum evaporator plant for Stickwater recovery, with steam air jet air injection and vapour compression, to produce a concentrate containing 30% of solids.
Water evaporation capacity approx. 2.000 kg/h
which corresponds to a Stickwater quantity of approx. 2.400 kg/h ; for continuous operation.
(drawing No. 1000/907)

- -

consisting of

4 heating bodies
with lateral separator. The heating bodies made of ingot steel, with tube heating system welded in. The heating tubes made of ingot steel, too On the top and at the foot, the heating bodies are provided with collapsible covers, which facilitate the cleaning procedure

1 counter-flow mixing condenser
with after-cooling, all accessories required and connections

2 steam jet air ejector sets
made of cast iron, with live steam nozzle of bronze, including intermediate cooler, to deaerate the plant

1 starting ejector
made of cast iron, with live steam nozzle of bronze, to quickly evacuate the plant

1 special centrifugal pump
made of cast iron, with impeller of bronze. to suck off the water of condensation from the condenser and the heating bodies, directly coupled with electric motor.
Pump and motor mounted on common base plate

1 product suction pump
of special design, complete with electric motor.
Pump and motor mounted on common base plate

the pipe-lines required
for connection of the before-mentioned equipment, including all fittings required, valves, cocks, pressure gauges, vacuum gauges, and thermometers

1 operating gallery
made of iron, complete with staircase and guard-rail

Total motor power: approx 5 HP

Total net weight: approx. 9.500 kg/h

Steam consumption:
for the heating process approx. 680 kg/h
at 2 atü working pressure

for the operation of the steam jet air ejector sets approx. 50 kg/h
at 6 atü working pressure

The steam employed for the heating process will be recovered as condensate and can be used again for feeding the boiler.
However, it will not be possible to recover the steam required for operation of the steam jet air ejector sets.

Cooling water required: approx. 16 m^3/h
temperature + 20° Celsius

For cooling purposes, water of the sea, of rivers or of wells will be sufficient.

The Accessory Parts Required
consisting of

1 receiver /tank
to take up the liquid to be treated, arranged for being heated, with all connecting branches required, contents approx. $2m^3$

1 store tank
to take up the concentrate obtained, made of iron, contents approx. 1 m^3, complete with all connecting branches and fittings required. The tank arranged for being heated by indirect steam

1 air-cooled piston compressor
to forward the concentrate from the store tank to the drying plant, complete with electric motor of 2 HP

the pipe-line required
for connection of the before-mentioned equipment

T O T A L p r i c e . . . . . DM 13.200,--

Total motor power: approx. 2 HP

Total net weight: approx. 1.8000 kg

All the electric motors are planned for three phase current of 220/380 Volt working voltage, 50 Hz.

The prices mentioned are to be understood on a freight basis fot German North Sea Port, including seaproof packing.
They do not include import duty, erection, insulation, electrical installations, masonery and foundations, supply of steam, power and cooling water, and all parts not especially mentioned in this question.

-

Time of delivery:	together with the fish meal plant
Delivery:	according to enclosed terms of delivery
Payment:	according to special agreement

Note: We reserve the right of constructional alterations and improvements of our machinery.

Appendix 1(ii)

The Farmer Boilerworks Limited,
Newmarket-on-Tweed, NE36 7ND.

20th. March 1963.

The United Nations Industrial Survey Mission,
New Secretariat,
RIVOCCA.

Dear Sirs,

In reply to your recent letter (undated) we would confirm that we are manufacturers of equipment for converting waste fish and fish offals into animal feeding meals, fertilisers, and oils, and we could well supply the necessary plant to carry out the work envisaged by you.

We do not, however, recommend the use of large single plants and if you fully expect to have some 100 tons of raw fish available per day of 24 hours we would suggest that the installation should consist of:-

1) Two Farmatic Fish Oil Pressing and Meal Drying Plants, each having a capacity of approximately 60 tons of raw fish per 24 hours and each comprising:-

   a) One Packing Machine
   b) One Feed Regulator
   c) One Feed Conveyor or Elevator
   d) One Pre-cooker
   e) One Stone Catcher
   f) One Press
   g) One set "press-cake" conveying equipment
   h) One "press-cake" Fluffer
   j) One Drying Unit
   k) One set of Condensing Equipment

2) One set of Grinding Equipment to work in conjunction with the above two plants, consisting of.

   a) Dry Meal Conveying Equipment
   b) Grinder with cooling cyclone.

3) One set of Oil Recovery Equipment to work in conjunction with the above two plants, consisting of:-

   a) Liquor, Oil and Solids pump
   b) Rotary De-sludger
   c) Boats collecting tanks for the liquor
   d) Liquor pre-heater
   e) Sludge type Separator
   f) Buffer Tank
   g) Oil Centrifuge

4) One Stickwater Recovery Plant to handle all liquors from the Oil Recovery Equipment.

5) Battery of "Farmatic" liver boilers to handle shark livers.

6) A suitable steam boiler installation to supply steam for the whole of the processing.

Without going deeply into the matter and preparing layout drawings etc., we estimate that the approximate F.O.B.U.K.Port cost of the foregoing equipment would be in the neighbourhood of £70,000. C. O. D. Nett Sterling, this figure being exclusive of sea freight and duties, erection, foundations, builders work, protective structure, electric wiring, insulation and paint.

Grain elevator, rail facilities 200'0" long x 50'0" wide x 20'0" high would be needed to house the installation if in a shed at high cost. Certain economies in this space could be made for a shipboard installation, but even a very large vessel would be needed. If, indeed, a floating factory has to be considered then it would be well to integrate with the stickwater recovery section of the project.

The attached chart will give you some idea of the "returns" which could be expected from processing 100 tons of raw fish having an initial fat content of 10%, and not taking into account stickwater recovery: viz:-

Meal - 17.6 tons
Oil - 2.5 tons

With stickwater recovery a further 1.5 tons of meal could be expected, the oil yield remaining unchanged.

It is very difficult to give a true assessment of operating costs on the rather vague details given in your letter, we must know the true amount of raw material available each day, the cost of such material to the processing factory, the type of labour available, electricity and fuel suppliers with costs etc. We can only comment at this stage that a proposition of this nature cannot fail to show a high profitability return. When you reach the stage of being able to issue a firm enquiry for a plant to meet your actual needs you will then perhaps be able to include the foregoing information and we will then gladly prepare the necessary operating cost calculations.

Parramatic Plant is not, unfortunately, suitable for the final drying of sun-dried fish, such material would be broken up into a meal-like formation in our unit and it is presumed that you need to keep such dried fish in a whole state.

We hope that we have given you sufficient information for your immediate requirements, but should there be any point upon which you are in doubt please to contact us again and we will help in any way we can. You will, no doubt, be interested to learn that Parramatic Plant is operating, and giving every satisfaction in many overseas countries, see the final pages of our summary catalogue - a copy of which is enclosed herewith.

Once again assuring you of our fullest possible co-operation and awaiting to hear from you in due course.

We remain,

Yours faithfully,
[illegible] OIL WORKS LTD.,

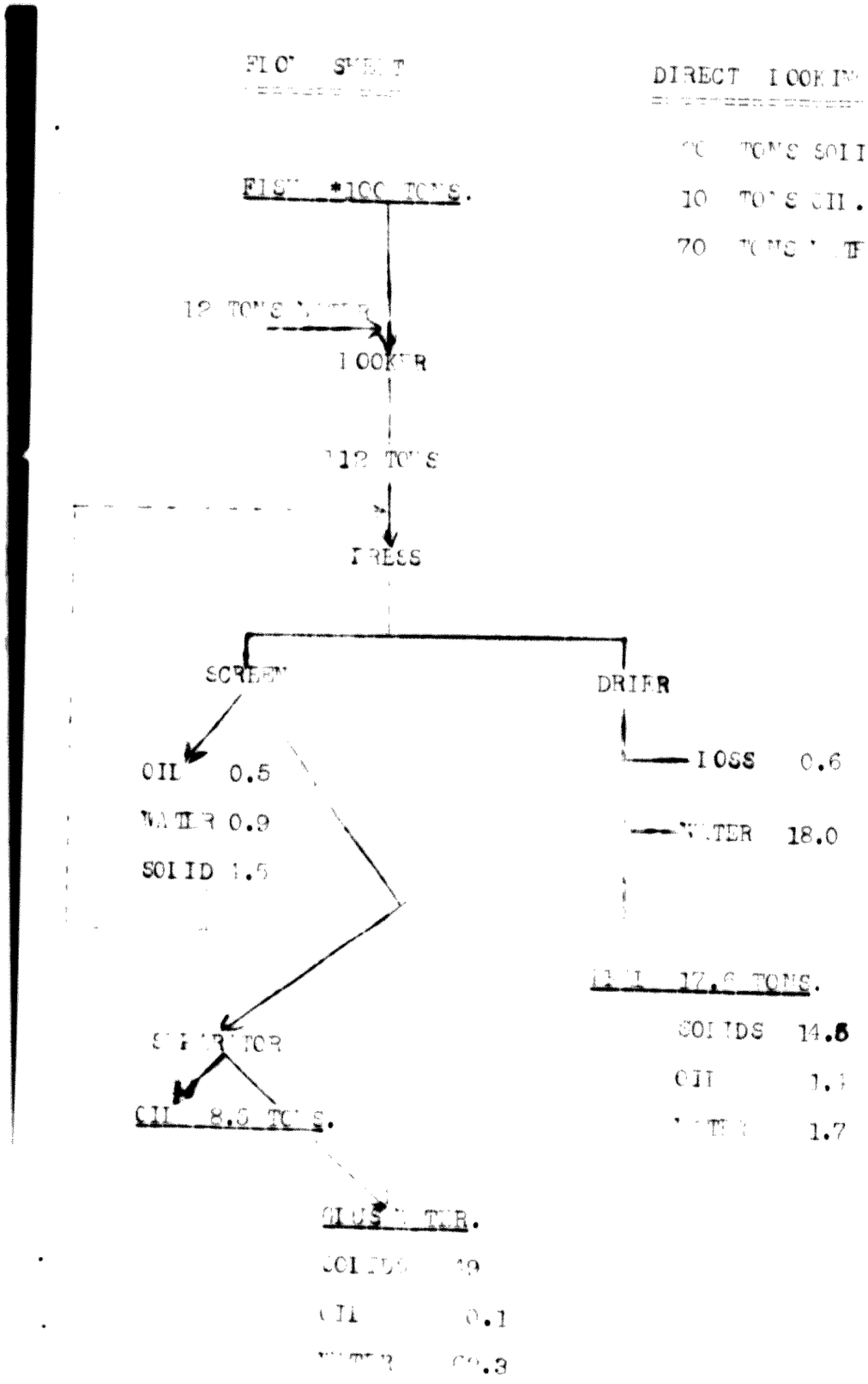
Encl.
Flow Chart
Summary Catalogue.

Sd/- [illegible]
Deputy Managing Director
and General Manager.

CONTINUOUS PRESSURE SYSTEM FOR OIL MILL.

FLOW SHEET

DIRECT COOKING



70 TONS SOLIDS
10 TONS OIL.
70 TONS WATER.

112 TONS 17.6 TONS.

DRG.NO.4696

THE FARROW IRONWORKS LTD.

WOOD GREEN, LONDON.

Appendix 1(iii)

Fish Meal Plant purchased by Burma Fisheries from Daiichi Bussho Co.,Ltd.,Tokyo,Japan.

DAIICHI BUSSHO CO., LTD.

IMPORTERS & EXPORTERS
BUSSHO BLDG.
2,2- Chome,Ginza-Nishi,Chuo-ku,
Tokyo,Japan.

Ref: No.B1-58(A)

SALES CONFIRMED. Tokyo,4th.Nov.1961.

Messrs.Burma Fisheries Ltd.

Dear Sirs,

We have pleasure in confirming our sales of the following articles, on the under terms and conditions.

COMMODITY: Fish Meal Plant.

SPECIFICATION: As per attached proforma Invoice.

QUANTITY: One set.

PRICE: TOTAL AMOUNT £8,000-0-0 C.I.F./Rangoon.
£,801/- C&F/Rangoon.
£,310/- FOb/Yokohama

DELIVERY: FOB: CIF Rangoon.
TIME: Shipment within 6 months after receipt of L/C

PACKING: Export standard iron kind SHIPPING MARK

PAYMENT: T/T, Bremen Net Risk.

INSPECTION: Makers inspection to be final.

PAYMENT BY: The Bank of Tokyo Ltd.,Ginza Branch.

REMARKS:
Details as per attached.

Kindly confirm the above by signing and returning to us the enclosed duplicate copy of this contract.

Confirmed with the additional provises mentioned in my letter No. BFL-O/Ka-8,dated 18th.November 1961.

Yours truly,
DAIICHI BUSSHO CO.,LTD.

Sd/- x x x
General Manager,
Burma Fisheries Limited,
Koralay Bazaar Building,Rangoon.

Sd/- x x x
Managing Director.

... Co., Ltd.
No.1, 3 Chome, Ginza-Nishi, Chuo-ku,
Tokyo, Japan.

Osaka Branch: No.505,
Tenroku-Horkyo,
Bldg.,
6, Chome, Tenjinbashi-Suji, Oyodo-ku,
Osaka.

Messrs. Burma Fisheries Ltd., PROFORMA-INVOICE Date, Tokyo, 4th. Nov, '61.
Rangoon.

Re: Fish Meal Plant.

Dear Sirs,

We are pleased to quote you as follows:-

1. Place of Delivery: C.I.F. Rangoon.

2. Time of Delivery: Within 6 months after receipt of L/C or Order.

3. Terms of Payment: Irrevocable Letter of Credit.

4. Offer kept open until or subject to: Our confirmation.

Yours Faithfully,

DAIICHI BUSSAN CO., LTD.,

Sd/- x x x
Directing Manager.

Item.	Description	Quantity	Unit Price.	Total Amount
Full Automatic Fish Meal Manufacturing Plant.				CIF Rangoon.
Capacity: Final products. 200-300 lbs/hr. One complete Raw Fish treating, 1,000-1,500 lbs/hr.		set.		£8,830/-
				C&F/Rangoon.
Details of this plant as per attached.				£8,801/-
				FOB/Yokohama
				£8,310/

Remarks:-

Under mentioned items are not included in this estimate.

(1) All machineries & equipments installation fee at destination.
(2) Electric wiring work & their materials.
(3) Steam piping work & their materials.
(4) Machineries & equipments foundation work (concrete work)
(5) Assembling & test operating supervision engineer despatching fee.
(6) Heat insulating work & materials.
(7) Fire brick & their construction fee.
(8) Stick water tank (concrete made) & raw fish cutting table.
(9) Finish painting work.

Item.	Description.	Quantity.	Unit price.	Total amount.
	Bucket Elevator.	1 set		C&F Rangoon
	Conveying fresh raw fish to precooker cut to smaller pieces.			
	Capacity: Max. 2,000 lbs/hr. 5 H.P. motor driven reduction gear 50 cycle.			
	Cooker & Press.	1 set.		
	Raw fish cooking by s.t.100 C. of steam and stick water (oil carrier) extracted by pressing in this press.			
	Capacity: Max 2,000 lbs/hr. 5 H.P. motor drive (400/440V, 3 phase,50 cycle).			
	(Details as per attached drawing).			
	Belt Conveyer	1 set.		
	Fish cake conveying to dryer.			
	Capacity: Max 2000 lbs/hr.Motor 1 H.P.(400/440V, 3 phase,50 cycle)			
	Bucket Elevator.	1 set.		
	Fish cake conveying to dryer complete with conveying chute & lid. Motor (400/440 V,3 phase,50 cycle)			
	Capacity: Max. 700 lbs/hr.			
	Rotary Dryer.	1 set.		
	Drying of fish cake.			
	Komachi's Rotary Type No.35.			
	Capacity: Wet materials (fish cake) 500 lbs.(average) Max. 700 lbs.			
	Drying Temperature: 95 - 130° C Drying time: One hour. Heating source: Heavy oils (35 Liter/hr) Dryer drum, dia 1,160 mm Length 6,360 mm. Driving: 5 H.P. motor (400/440 V,3 phase, 50 cycle) with reduction gear.			
	Accessories as follows:-			
	1 set - Heating room (insulated) (dryer kiln cover) 1 set - Exhaust fan Limit - Iron type No.3 75 cm dia x 30 cm W.G. with 2 H.P (400/440 V, 3 phase,50 cycles motor, V.belt,pulley etc.			

Items.	Description.	Quantity.	Unit Price.	Total Amount.

1 set - Hot air duct.
1 set - Hot air chamber.
1 set - Exhaust chamber.
1 set - Exhaust duct.
1 set - Connection chamber (exhause)
1 set - Exhaust Tube.
1 set - Rotary feeder with ¼ HP motor
(200/220 V, single phase, 50 cycle)
1 set - Oil burner, capacity 15 liter/hr.
with 1/6 HP motor 200/220 V.
single phase, 50 cycle).
1 set - 2nd. air hole & manhole.
1 set - Remote thermometer.

Conveyor. 1 set.

For conveying to hopper for grinding of dried fish cake.

Capacity: max. 300 lbs/hr.
complete with 1 HP motor (400/440V,
50 cycle, 3 phase).

Bucket Elevator. 1 set.

For conveying to hopper.
Connecting from above conveyor.

Capacity: Max. 300 lbs/hr.
complete with 1 HP motor (400/440 V,
50 cycle, 3 phase).

Hopper Tank. 1 set.

[illegible] fish meal (Semi-products) storage [illegible].

[illegible] capacity: about [illegible],000 [illegible] with shutter.

Grinder. 1 set.

For grinding of semi-products fish meal.
Capacity: Max. 600 lbs/hr.
ordinary use, 300 lbs/hr.
Complete with 5 HP motor (400/440 V, 3 phase)
50 cycle).

Accessories:

1 set - Starter
1 set - Chute
1 set - Dust collector
1 set - Spare screen

Bucket Elevator. 1 set.

For conveying to finish products hopper.

Capacity: max. 600 lbs/hr.

Complete with 1 HP motor (400/440 V,
3 phase, 50 cycle)

Items.	Description.	Quantity.	Unit Price.	Total Amount.

Mixer Tank. 1 set.

For storing of finished fish meal.

Holding capacity: about 8,000 lbs.

Bag Sewing Machine 1 set.

For filled fish meal in paper bags.
Sewing up capacity 150-250 bags/hr.
(per bag weight abt.100 lbs)

Attached motor: 1/4 H.P.(200/220V, single phase, 50 cycle).

Bag height range: 150-950 mm.

Boiler, with Oil Burner. 1 set.

Vertical Multi-tube type,
Heating surface abt.7 m²
Steam pressure: Max. 6 kg/cm²
Dia 900 x H. 1,800 (mm) abt.
Complete with oil burner
fish brick included.

(But, Red brick not included)
Accessories:
Safety valve, pressure gauge,
Thermometer etc.

I-ICHI BUSSAN CO.,LTD.
[illegible],Ginza,Nishi,Chuo-ku,Tokyo,Japan.
[illegible]: No.505,Tanaka-Yakyu,Bldg.,
-Chome,Tenjinbashi-Suji,Oyodo-ku,
Osaka.

No.-2-115. L/C No. [illegible] Dated ,Tokyo,Dec.21,1962.

Messrs.Burma Fisheries Ltd.,
Rangoon,Burma.

Re: Spare parts for Fish meal Plant.

Dear Sirs,

We are pleased to quote you as follows:-

1. Place of Delivery: C & F Rangoon.
2. Time of Delivery: Shipment within 3 months after receipt of L/C.
3. Terms of Payment. Irrevocable Letter of Credit.
4. Offer kept open until or subject to: 60 days.

Yours faithfully
DAI-ICHI BUSSAN CO.LTD.

C/- x x x
Directing Manager.

Items.	Description.	Quantity.	Unit Price.	Total Amount.
	Spare parts for Fish meal plant, having capacity of 200-300 lbs/hr in final products.			Price in Sterling Pound. C & F Rangoon.
	For Cooker Section.			
(1)	[illegible] type B	8 sets.	£ -18-0	£39- 4-0.
(2)	[illegible]	[illegible].	£5-12-0	£22- 4-0.
	,, B	[illegible].	-14-0	27- 0-0.
	,, C	[illegible].	4- 1-0.	8- 2-0.
(3)	Pilot burner	[illegible]	6- 9-0	18-18-0.
(4)	Roller-chain	10 m.	3-12-0	38- 0-0.
(5)	De-tachable-chain(for bucket elevator)	10 m.	1- 8-0	2- 0-0.
(6)	Bucket.	50 nos.	0-12-0	30- 0-0.
(7)	Stop-valve (1")	3 sets.	3-16-0	11- 8-0.
	,, ,, (¼")	10 sets.	2-10-0	25-00-0.
	,, ,, (½")	5 sets.	3- 0-0	15- 0-0
(8)	[illegible] pressure-gauge	2 nos.	3-10-0	7- 0-0
		Sub Total:		284- 0-0

Item.	Description.	Quantity.	Unit Price.	Total Amount.
B. For Bucket Elevators.				
(1)	**For Rotary Dryer.** Detachable ≠88 x Pitch 66.[illegible] Meter.			
	≠≠88	[illegible] pcs.	£0- 3-0	£24- 0-0.
	≠≠88-K-1	[illegible] ,,	0- 5-0	5- 0-0.
	Bucket	[illegible] ,,	0-12-0	12- 0-0.
(2)	**For No.1 Hopper Tank.** Detachable ≠≠80 x Pitch 66.2 x 1[illegible].5 Meter			
	≠≠88	200 pcs.	0- 3-0	30- 0-0.
	≠≠88-K-1	20 ,,	0- 5-0	5- 0-0.
	Bucket	20 ,,	0-12-0	12- 0-0.
(3)	**For No.2 Hopper Tank.** Detachable ≠≠88 x Pitch 66.3 x 12.5 Meter.			
	≠≠ 88	170 pcs.	0- 3-0	25-10-0.
	≠≠ 88-K-1	20 pcs	0- 5-0	5- 0-0
	Bucket	20 ,,	0-12-0	12- 0-0.
		Sub-Total:		£ 130-10-0
C. For Rotary Dryer.				
(1)	Shaft for support roller	4 pcs.	1-10-0	6- 0-0.
	Metal for shaft	8 ,,	[illegible]	3[illegible]-12-0.
(2)	**For Driving Gears.**			
(a)	**For Kiln**			
	Speed change pulley (UC-260)	1 set		52-10-0.
	Speed reduction gear (TS-[illegible]-3 [illegible] x1/[illegible]0)	1 set		63-16-0
	Roller Chain (RS-[illegible] x [illegible] Meter) with half joint 2 pcs.	1 set		32-16-0.
(b)	For Rotary Feeder.			
	Speed reduction gear (T[illegible] x1/[illegible]0)	1 set		[illegible]
	Roller Chain (RS-[illegible]0 x[illegible] Meter) with flat & half joints each [illegible] pcs	1 set		3-13-0
(3)	**For Rotary Feeder.**			
(a)	Rotor blade, made of heat-resisting (80°[illegible]) synthetic rubber.	1[illegible] pcs.	1-[illegible]	16- [illegible]-0
(b)	Brass screw with nuts([illegible]/16")x16[illegible]	[illegible]		0-13-[illegible]
		Sub-Total.		£ [illegible]23- 0-0
D. For Screw Conveyors.				
(1)	Roller chain(RS-[illegible]8-2 Meter x 3 sets(1 set for [illegible]) with flat & half joints(each [illegible] pcs x [illegible] Meter for 3 sets) - 12 pcs.			12- 0-0
E. For Grinder(Pulverizer)				
(1)	Pulverizing rotor	[illegible] pcs.	£11- 0-0	Stg.33- 0-0
(2)	Exterior hook with rivet for pulverizing rotor	72 ,,	0- [illegible]-0	32- 8-0
(3)	Interior hook with rivet for pulverizing rotor	72 ,,	0- 9-0	32- 8-0
(4)	Screen frame	8 sets.	5- 5-0	15-15-0
(5)	Belts for screen frame	20 pcs.	0- 9-0	9- 0-0
(6)	Bearing (6309)	[illegible] pcs	1-19-0	7-16-0
(7)	Screen	150 sheets.	0-12-0	90- 0-0
(8)	Pulverising stator	15 pcs.	5- 0-0	75- 0-0
		Sub-Total:		295- 7-0

Item.	Description.	Quantity.	Unit Price.	Total Amount.
F.	For Back Gear Main.			
	Part No. Part Name.			
10	Screw	10 pcs.	0- 0-6 Str.£	0- 5-0.
11	,,	10 ,,	0- 0-6	0- 5-0.
14	,,	,,	0- 0-6	0- 2-0
17	,,	1 ,,	0- 0-6	0- 5-0.
31	Nut	5 ,,	0- 0-6	0- 2-6.
34	Tension spring nut	10 ,,	0- 0-10	0- 8-4.
56	Thumb screw	5 ,,	0- 1-2	0- 6-8.
88	Small steel nut	1 ,,	0- 5-0	1- 5-0.
89	Tension screw(small) Stud	6 ,,	0- 3-0	0-15-0.
91	Tension disc(small)	60 ,,	0- 0-9	0-15-0.
92	Tension spring (small)	6 ,,	0- 0-8	0- 3-4.
108	Lever	5 ,,	0-18-0	1-10-0.
112	Back gear	2 ,,	1-10-0	1-10-0.
127-130	Tension regulator	5 sets.	0-11-0	2-15-0.
125-128	Tension foot	2 ,,	1-10-0	3- 0-0
166	Tension screw(stud) (large)	6 pcs.	0- 5-0	1-10-0.
168	Tension disc(large)	10 ,,	0- 2-0	1- 0-0.
169	Tension spring(large)	5 ,,	0- 1-2	0- 5-10.
172-179	Tension regulator.	1 set	1- 8-0	1- 8-0.
196	Cutter blade	5 sets.	0-12-0	3- 0-0.
201	Cutter screw(large)	5 pcs.	0- 1-6	0- 7-6.
202	Cutter screw(small)	5 pcs.	0- 1-0	0- 5-0.
203	Cutter spring	5 pcs	0- 0-10	0- 4-2.
209	Cutter lever spring	5 ,,	0- 1-10	0- 9-2.
211	Stop screw	2 ,,	0- 5-0	0-10-0
220	Cover plate screw	5 ,,	0- 1-10	0- 9-2.
Nor	Machine rollers	100 ,,	0- 1-10	9- 3-4.
	Machine bolt	10 ,,	0- 8-0.	4- 0-0.
			Sub-Total:	42- 0-0
			Grand Total:	Str.£986-17-0.

Letter dated 7th May 1958 from Head, Evaluation Group, Research Evaluation Section, Centre for Industrial Development, United Nations Industrial Survey Mission, New Delhi, India.

We have been asked to reply to your queries about fishmeal, fish oil and whale products, as the Heavy Industries Department are interested.

According to the current prices given in "Oil, Paint and Drug Reporter" there is not very much difference between East and West coast prices for fish meals. They are quoted according to protein content with a usual minimum of 50%. Atlantic prices vary from £ 110 to £ 112 per ton, whilst Pacific coast prices run from £ 128 to £ 130. Below are the available figures for the varieties over the last few years.

FISHMEAL

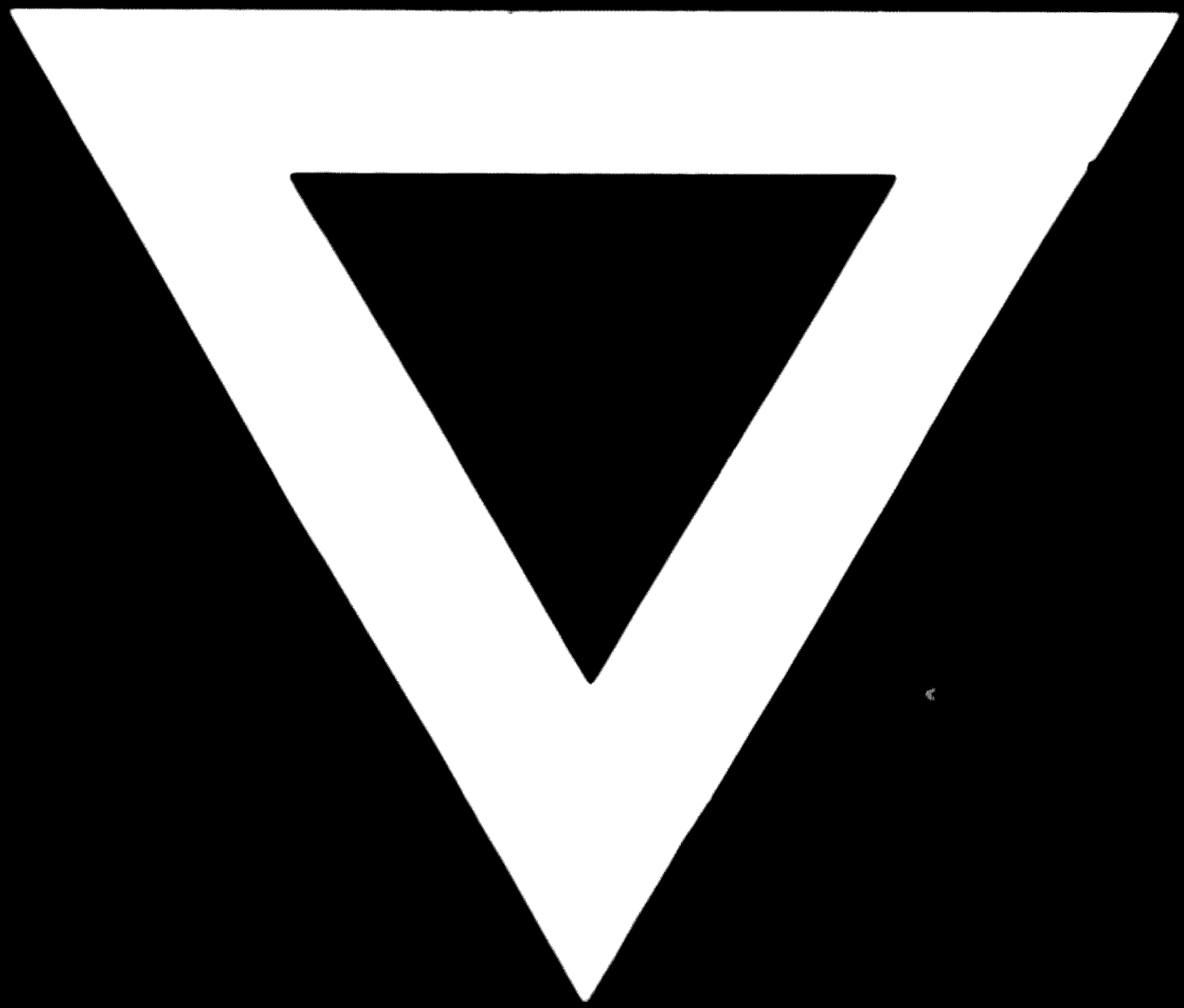
		High.	Low.
Dom., menhaden, 65% protein min., f.a.s., Atlantic coast			
1959	ton	160.00	112.00
1958	ton	152.00	125.00
1957	ton	140.00	126.00
1956	ton	153.00	123.00
1955	ton	150.00	127.00
1954	ton	150.00	130.00
1953	ton	150.00	132.00
1952	ton	135.00	135.00

FISHSCRAP

Dom., menhaden, dried, 60% protein min., f.a.s., Atlantic coast			
1959	ton	150.00	120.00
1958	ton	154.00	121.00
1957	ton	130.00	120.00
1956	ton	140.00	124.00
1955	ton	150.00	126.00
1954	ton	145.00	135.00
1953	ton	150.00	127.00
1952	ton	130.00	123.00

With regard to oil from this source it is not fish liver oil which sells at high vitamin content) the price appears to have varied from just under 4 cents to 10 cents per lb. in drums.

J-731



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