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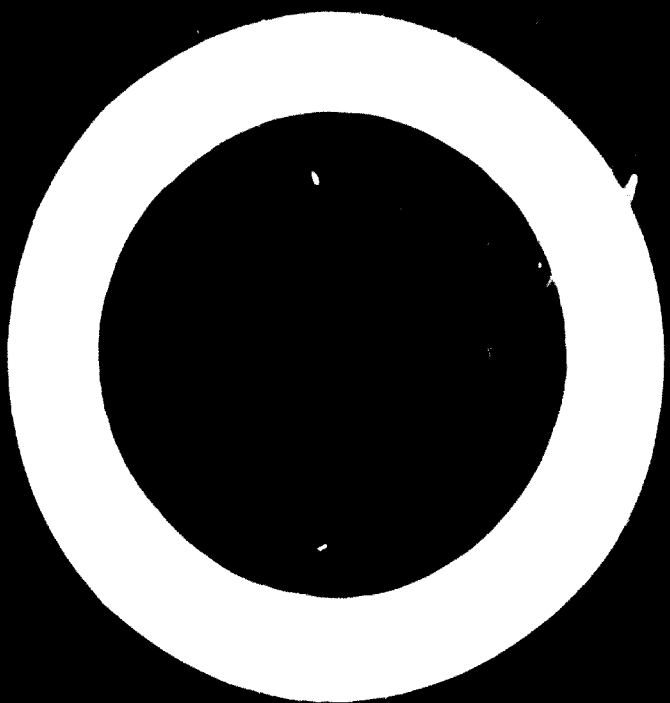
PRODUCTION OF FISH-PROTEIN CONCENTRATE

Report and proceedings of the
Joint UNIDO/FAO Expert Group Meeting
Rabat, Morocco, 8–12 December 1969

Part I REPORT OF THE MEETING

UNITED NATIONS



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
VIENNA

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Explanatory notes

Reference to dollars ($) is to US dollars.

Reference to tons is to metric tons.

FPC = fish-protein concentrate.

Fish-protein concentrate is generally interpreted as an edible product; fish meal or low-fat fish meal refers to animal feed.

SONAFAP = Société Nationale de Farine de Poisson (National Fish-Meal Company).

UNDP = United Nations Development Programme

USAID = United States Agency for International Development.

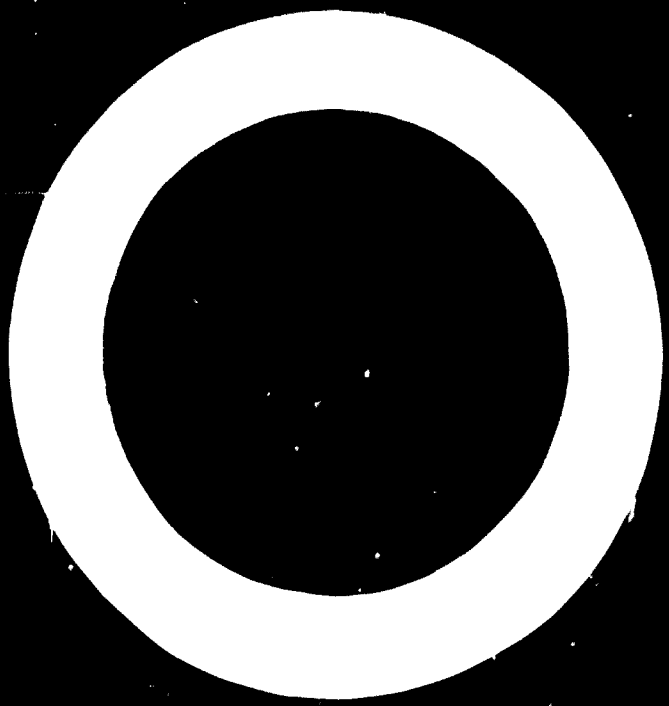
Preface

The joint UNIDO/FAO Expert Group Meeting on the Production of Fish-Protein Concentrate, held in Rabat, Morocco from 8 to 12 December 1969, addressed itself to two principal questions: (a) commercial production of fish-protein-concentrate (FPC) products and their distribution to people having the greatest need for such products; and (b) the development of a commercial enterprise to produce FPC in Morocco, taking into account the efforts made so far.

The present publication (Volume I), the report of the meeting, includes general recommendations on FPC, recommendations for the SONAFAP plant in Morocco, a summary of discussions, and statements describing the situation in Morocco and efforts made elsewhere to produce FPC. The proceedings (Volume II) will include papers presented to the meeting.

The meeting was opened with statements by Mr. M. Jaïdi of the Government of Morocco, Mr. M. Mautner of UNIDO and Mr. R. Kreuzer of FAO. Statements were also made by Mr. J. Kerdoudi, Morocco; Mr. G. Parman, United States; and Mr. M. El Bacha, Morocco.

Mr. O. A. Roels was elected Chairman and Mr. J. Blake, Mrs. V. D. Sidwell and Mr. J. B. Cordaro were elected Rapporteurs of the Group. Mr. F. E. Popper of FAO and Mr. M. Mautner of UNIDO were the co-directors of the meeting. Mr. R. Kreuzer of FAO served as Secretary of the meeting and Mr. A. Draneva of UNIDO as Technical Secretary.



Introduction 1/

1. The Group first considered questions of general approach. When questions concerning FPC first aroused world-wide interest a few years ago, there was a great deal of enthusiasm and promotion. Since that time many hopes for FPC have been tempered and many difficulties have put an end to the stage at which FPC was considered as a general remedy for all protein deficiency of the world. Meanwhile, efforts have been made to reach a proper perspective by researching out and testing various sources of protein material and making comparisons to determine which have the greatest potential for development. Some of the sources considered most promising are single-cell protein from hydrocarbons and carbohydrates, protein from rice, protein from soya beans and other vegetables and cakes, protein from protein-rich maize, and protein produced from algae and green leaves.

2. With respect to fish protein it should be emphasized that fish that cannot be otherwise used can and will be caught in the future by countries that have the fleet, the access to the sea, the fishing tradition and the initiative to exploit these immense natural resources. These countries will have the incentive to catch far more fish if they can process their catch and produce FPC for human nutrition.

3. The suggestion that FPC be marketed as such was apparently not a good idea. It was also a mistake to recommend FPC as a means of enriching the intake of protein in daily diet in institutions (army, hospitals, schools) subsidized by a government or by bilateral or international assistance. Protein is a basic component of human nutrition. No country in the world can afford the subsidy for protein for the greater part of their inhabitants. It

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1/ This introduction is based on statements to the meeting by Mr. Mikael Mautner, Chief, Light Industries Section, Industrial Technology Division, UNIDO. Mr. Mautner's brief introductory remarks to the meeting are presented in Annex 2.

certainly cannot be expected that a country in the first stages of development will be able to use part of it's scarce financial resources to invest in testing and experimental development of protein materials or to subsidize protein-processing industries.

4. For developing countries, therefore, it may be wise to adopt the following policy: Only a self-sustaining, profitable food production can expand in a developing country. Only such food production will have the possibility of attracting capital investment opportunities, and only such food production can in the end satisfy the needs for better human nutrition. Such production will create jobs and improve the income and buying power of those involved while at the same time providing goods for developing markets.

5. The Group next addressed itself to the possibilities that would enable FPC to be marketed not only as a protein concentrate but also in more suitable and marketable forms, as for example in the form of textured protein mixed with soy protein as a meat-like product, for example , or as fermented protein; in the form of dry-soup mixtures; as enriched cookies, cookies or cheese spreads; in the form of seasonings; or in any other form that is marketable and has the appeal necessary to gain, after reasonable promotion, substantial demand in the market at home or abroad.

6. The engineering aspects of FPC are also of great interest. The attempt of UNIDO and FAO to discover in a pilot operation the answer to the basic-quality question has been quite successful. By applying the isopropyl-alcohol process released by UNIDO by the United States Department of Interior, Bureau of Commercial Fisheries, the UNIDO team was able, while attempting to avoid substantial investments, to reach a quality level that satisfactorily indicates that the process can be used for sardines and that the material produced can be used for the various marketing purposes.

7. The members of the Expert Group were asked to contribute their know-how and experience to the discussion on the following subjects:

The problem of deboning sardines;

The problem of cooking and pressing;

The exploitation of the effluents after pressing;

The solvent extraction;

The choice of solvents;

The separation of solvent and extracted solids;

The desolventizing operation;

The recovery of the miscella;

The refining of the oil (in the miscella or as crude oil).

8. Finally, the Expert Group turned its attention to helping and advising the host country, Morocco, in its efforts to develop successful protein foods for human consumption.

General recommendations for the development of fish-protein products

9. Concerning commercial production of fish-protein products and their distribution, in particular, to people having the greatest need for such products, the Group agreed on the following recommendations:

Engineering and production

(1) To pursue development of fish products other than solvent-extracted whole fish. The Expert Group recognizes the value of autolysates, nuoc mam, proteolysates, fermented products and the products with functional properties. It recommends support in these fields by multilateral and governmental aid programmes and also the encouragement of private industry.

(2) To determine the utility of existing countercurrent extraction equipment in making fish protein from raw fish and press cake. The properties of press cake as they relate to its extraction and transport in slurry form should be investigated.

(3) To provide pilot and production plant experience in making fish protein. Problems affecting the final costs include selection of construction materials, recovery of by-products and use of antioxidants and other additives.

(4) To emphasize hygienic procedures for handling the extracted product.

(5) To devise procedures to make light-coloured FPC. Washing fish with chilled water and extraction with aqueous media are promising means.

Feasibility and marketing

(6) To promote both technological and market development activities, while the technology and investment remains responsive to market and feasibility developments.

(7) To produce for the animal feed market until the FPC business develops, as the most likely route to successful FPC ventures.

(8) For governments to protect investments in FPC if they wish to attract foreign capital into fish-protein production.

(9) To urge all countries to adopt food regulations that encourage the utilization of fish protein and products fortified with fish protein.

(10) To introduce fish protein products into the diets of economically advanced societies in order to help to promote marketing of this product everywhere.

Nutrition

(11) To formulate a series of foods based on fish protein, which should include milk substitutes comparable to milk in appearance, cost and nutritive value. Dried baby foods comparable to dried milk are particularly important. These should be complete foods, providing all the necessary nutrients, particularly adequate supplies of vitamins A and D. Infants are the most important group needing the benefits of fish protein. Bland solvent-extracted fish protein is particularly well suited for infant foods.

(12) To study the possibility that fish protein containing increased amounts of stabilized fat may contribute, along with lipids from other origins, to meet caloric needs.

(13) To integrate fish-protein foods into national economic and health policies aimed specifically at alleviating nutritional deficiencies.

Recommendations for the SONAFAP plant at Agadir, Morocco

10. With respect to the development of a commercial FPC enterprise in Morocco, preferably through SONAFAP, the Group agreed to the following recommendations:

Engineering and production

(1) To expand the fish-meal capacity and to continue efforts to make FPC and low-fat meal, to seek to generate enough income from the animal-feed products to proceed towards the goal of a profitable FPC operation, and to consider recovery of stickwater.

(2) To install a fish unloading device in the port immediately, and to use clean sea-water or air suction to avoid contamination of fish.

(3) To produce FPC from fish other than sardines when expedient.

(4) To assure that immediate improvement in the Agadir plant includes means to feed press cake to extractor and steps to make handling and storing of extracted products more hygienic.

(5) To explore the procurement of a sanitary cooker and press and a more efficient extractor and drier.

(6) That technical assistance be provided to SONAFAP on the following:

(a) Changes needed in the SONAFAP plant to produce a good-quality, low-fat fish meal as well as ordinary fish meal;

(b) Production of FPC (for human consumption) for marketing purposes, and development of FPC food products;

(c) Problems connected with pilot production of FPC foods in Morocco;

(d) Problems of technical and economic management and training of personnel;

(7) That SONAFAP should take steps to secure a more constant supply of fish over a longer season. These steps might include contracts with particular fishing boats or even operation of SONAFAP's own fishing fleet.

Feasibility and marketing

(8) To carry out, in a timely and orderly manner with a series of well planned and realistic steps, market

and feasibility studies as well as the technological development programme necessary to establish an FPC industry in Morocco.

(9) To begin as soon as possible a feasibility study (with co-operative participation from the Government of Morocco, AID, FAO, UNIDO, WHO and other international organizations and interested Moroccan industries) to determine the economic viability of producing FPC and also low-fat fish meal for animal feed. The study should include:

(a) Examination of raw material supplies, including exploratory and experimental fishing in off-shore waters, the assessment of the available pelagic stocks, and necessary technical and institutional measures to assure adequate and regular deliveries of raw material to SONAFAP over an extended season;

(b) The possibilities of product identification, development, acceptance and promotion for determining the range of food products suitable for domestic and export markets;

(c) An analysis of the economics of producing, marketing and distributing SONAFAP products;

(10) To rehabilitate the SONAFAP plant at Agadir consistent with:

(a) The need for an adequate supply of good-quality FPC for market studies and other immediate demands;

(b) Increasing the production of fish meal;

(c) The plan to produce low-fat fish meal.

Summary of discussions

11. It was generally agreed that the need exists for a highly sanitary protein supplement for human consumption. FPC properly prepared and incorporated into various food-stuffs, or as a milk substitute, can meet this need. FPC fed directly to humans ensures a more efficient use of protein than by using fish or fish products for animal feed and thence producing meat for human food.

12. It was emphasized that many species of presently unused or under-utilized fish would be suitable and are available for the production of FPC. In some instances, however, new methods of harvesting would have to be developed. One possible approach would be to provide more food for fish (hence more fish for human consumption) by causing deep water, which is cold and rich in nutrients necessary for photosynthesis, to come to the surface. In many countries, development of the fishing industry would be essential to permit more effective harvesting of the marine resources.

13. Various chemical and biological procedures for preparing FPC were reviewed by the Expert Group. The desirability of functional properties, such as solubility and binding capacity, was mentioned in particular.

14. Opinions varied as to whether FPC should be used primarily in institutional programmes and whether it should be distributed by local governments. It was mentioned that a high quality FPC containing a higher level of stabilized fat would be desirable.

15. The SONAFAP FPC process was described to the Group, which subsequently visited the plant and the fishing harbour in Agadir. In ensuing discussions, it was agreed that the technical problems could be solved. The major area of concern centred around the marketing and distribution of the product.

16. Consideration was given to general observations on fish processing. An extensive review was made of processing at sea, fermented fish products, fish sausages, salting, drying and dehydration and smoking. The Group heard suggestions on the use of factory ships. On the basis of observations made off the coast of South Africa, it was generally felt that certain factory ships could be profitable; however, it was pointed out that such ships might antagonize local fishery interests.

17. A discussion was held as to why fish sausage has not spread beyond Japan. It was suggested that the reason for this was that the product had to be identified as "fish sausage" and this limited its appeal.

18. A description was presented on a two-solvent system (Marine Protein Inc.) for the production of FPC: 1,2-dichloroethane followed by isopropyl alcohol. The costs of several plants were discussed; a two-solvent plant of 100-tons-raw-fish input/day would cost approximately $2 million. A 200-ton plant would cost approximately $4 million. The cost of the Agadir plant was set at about $1 million.

19. Brief descriptions were given of the hexane extraction process used by Pescamino Ltd. A/S, Norway, and of the proposed Experiment Demonstration plant being constructed by the United States Bureau of Commercial Fisheries.

20. Technical descriptions were presented on Canadian processes for making FPC using isopropyl alcohol as solvent. The question of FPC colour was again discussed. The suggestion was made that water washing, either before solvent extraction or by the proper ratio of water and solvent, could help overcome this problem. It was stated during the discussions that certain metals used in plant construction can impart colour to the FPC because of catalytic effects and corrosion.

21. The production of other types of FPC, prepared by biological procedures, was discussed, such as FPC from enzyme hydrolysis and products like nuoc mam. There was general agreement that the Group should indeed consider methods of making FPC other than by solvent extraction. Both products show much promise, especially nuoc mam since it is now in commercial production and has been successfully introduced on the Ivory Coast. It was emphasized that FPC of all types, including materials such as nuoc mam, are to be used as protein supplements and are not intended to be used as food in itself.

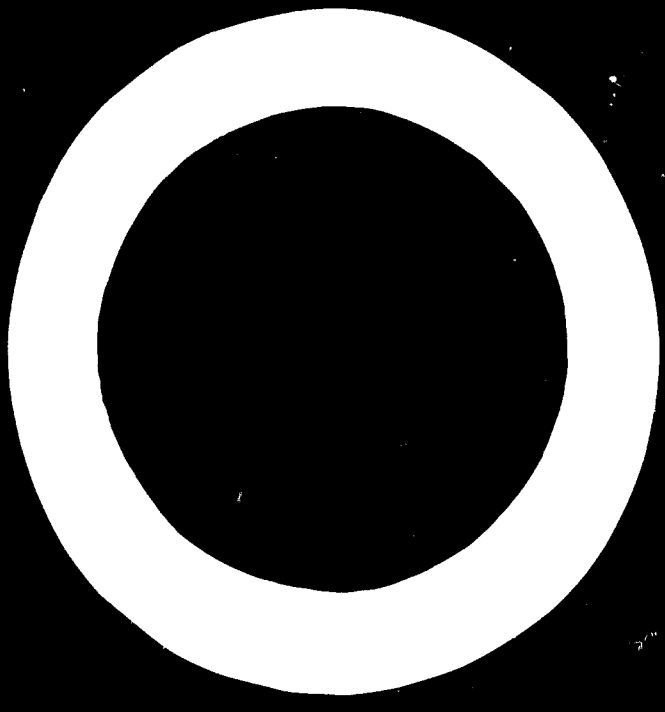
22. The incorporation of solvent-extracted FPC into various foods was described. The product has wide versatility and can be used nearly universally.

23. The United States AID involvement in FPC was reviewed. It was stated that AID had terminated its contract with Alpine Marine Protein Industries, Inc. for failure to deliver. AID is working with Alpine, however, to overcome the difficulties. The present and proposed future role of AID in Morocco was also described.

24. The possibilities of collaboration between UNIDO, FAO and AID were discussed, and each of the agencies agreed that inter-agency co-operation was desirable and essential.

25. The need for protein was clearly established since infant mortality in Morocco is high. It was the consensus that action to alleviate this situation must be taken immediately.

26. Interest was expressed by a private Norwegian firm, in co-operating with and investing capital in Morocco for FPC production, providing that adequate guarantees for foreign capital exist.



Annex 1

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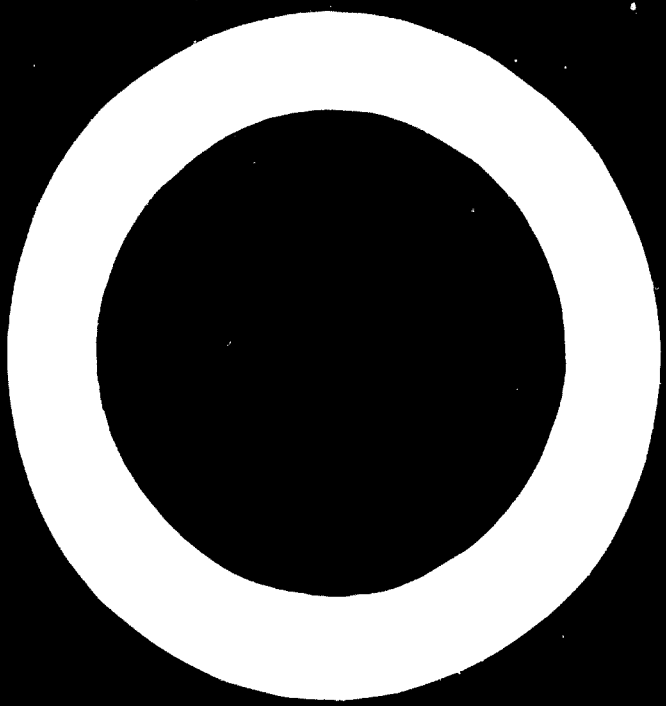

Annex 2

STATEMENTS TO THE MEETING

Welcoming address of Mr. Mohammed Jaïdi, Minister of Commerce, Industry, Mining and Shipping, Government of Morocco

Introductory statement by Mr. Mihajlo Mautner, Chief, Light Industries Section, Industrial Technology Division, UNIDO, on behalf of the Executive Director of UNIDO, Mr. Ibrahim Helmi Abdel-Rahman[1/]

Statement by Mr. Rudolf Kreuzer, Chief, Fishery Products and Marketing Branch, Department of Fisheries, FAO, on behalf of the Director-General, Mr. Addeke H. Boerma

Statement by Mr. Jawad Kerdoudi, Director, Fish-Canning and Fish-Meal Section, Bureau of Marketing and Export, Morocco

Statement of Mr. George Parman, United States Department of State, Agency for International Development, Washington, D.C.

Statement by Mr. Mohammed El Bacha, Assistant Director, Office of Fisheries, Government of Morocco

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1/ The major substance of the statements by Mr. Mihajlo Mautner is presented in the introduction to this report.

Welcoming address of Mr. Mohammed Jaïdi, Minister of Commerce, Industry, Mining and Shipping, Government of Morocco

Morocco is in the forefront of progress in the industrial production of fish-protein concentrate, thanks to the National-Fish-Meal-Company (SONAFAP) factory at Agadir, which you will have an opportunity to visit within the next few days.

The establishment of this industrial enterprise, which was made possible by the support and recommendations of FAO, goes back to 1962. The process used is a novel one and has proved particularly advantageous from three points of view: chemical composition, biological value and profitability. For this reason, the Moroccan Government has followed with keen interest the various stages of the gradual launching of this enterprise, which has achieved, especially since 1965, the desired level of efficiency and output. SONAFAP concentrate is now extensively used in hospitals, maternity homes and school canteens.

In the light of these encouraging results, the Ministry of Industry and the management of SONAFAP have asked UNIDO for technical and financial assistance in order to secure the most profitable utilization possible of the very large investment (over $1 million) made in the enterprise.

The excellent results obtained in this first phase of improvement work have induced the Moroccan Government to request the assistance of international agencies, including UNDP, the Special Industrial Services of UNIDO and USAID, in order to improve still further SONAFAP's production and above all to promote more extensive use of its products for nutritional purposes of the population in developing countries.

There are vast fish resources along the Moroccan coast. This is a good reason for Morocco to make a special effort in this field

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1/ The statement was delivered by Mr. Belkhayat.

and it gives Morocco a leading role in the campaign against protein deficiency.

It is important that SONAFAP be enabled in the very near future to occupy its proper place in the struggle to achieve this objective. The high quality of the protein concentrate produced in this factory has been acknowledged by FAO experts; the success already achieved is a good omen for the results of the work to be undertaken by the international agencies that have agreed to help the Moroccan Government to bring SONAFAP conclusively into the phase of production on an industrial scale.

I am convinced that the SONAFAP experiment, which is unique in Africa, will induce other developing countries to follow Morocco's example.

Because of the favourable distribution of their vital amino acids, fish-protein concentrates must form one of the foundations of future human diet wherever there is a shortage of animal-derived food-stuffs. Their special field of application in child feeding makes them particularly important.

Introductory statement by Mr. Mihajlo Mautner, Chief, Light Industries Section, Industrial Technology Division, UNIDO

On behalf of Mr. Ibrahim H. Abdel-Rahman, Executive Director of UNIDO, I have the honour to open this meeting, which was convened by UNIDO and FAO in order to explore the technical, economic and marketing possibilities of fish-protein concentrate within the framework of economies prevailing in developing countries.

We should try to assess here the feasibility of FPC production; we should try to answer the question of how FPC should be marketed, how it can become a major source of proteinaceous enrichment and how the industrial enterprise producing FPC can become self-sustaining and capable of providing means for its own further development. We have convened this meeting also to give

an opportunity for public discussion on how the public funds were used that were entrusted to us to assist the Moroccan Government in its endeavour to produce more and better FPC; and we should like to make use of your presence here to request, in our name and on behalf of the Moroccan Government, your professional advice on how to proceed further in this project for which not only this country but many other countries have vital interest.

We would be very grateful for all contributions made already at this stage, bringing out problems of further processing and use of FPC. We would like to gather more information on your experience in the use and commercialization of FPC and in various processes used to incorporate FPC in conventional, national or international dishes and foods. We will use this information for the benefit of the plant here in Morocco and for other projects in developing countries we will assist in.

Representatives of the most advanced countries have been brought to this meeting and we are anxious to receive their help and assistance. There is no reason to perpetuate the idea that a developing country, producing its own food is in competition with an advanced country. We should not follow the old fallacious idea that a basic food should be produced in an advanced country and then sold to a developing one. This can be done for a certain period but it is not the solution for either party concerned. A developing economy of a new consumer country is a better partner for an advanced country than a country depending on imports for its basic needs. We expect a generous discussion with no hiding of the "secrets" that should be discussed in meetings such as this in order to find the best solutions to problems for the benefit of developing countries.

At the close of this meeting we would like to be able to present to the Government of Morocco our conclusions and recommendations on how to bring successful results to the entire undertaking.

Statement by Mr. Rudolf Kreuzer, Chief of Fishery Products and Marketing Branch, Department of Fisheries, FAO

FAO's interest in the production of FPC for human consumption was first aroused twenty years ago because of the great need for more animal protein in the diet of a large part of the world's population. FAO and UNICEF have jointly focused attention on the development of FPC and by June 1961 both organizations had already elaborated tentative specifications for solvent-extracted FPC. A Joint FAO/WHO/UNICEF Protein Advisory Group (PAG) was established in 1960 to advise the three agencies on their protein-rich-food programmes.

At the FAO International Meeting on Fish Meal (held in Rome in March 1961), the use of FPC for human consumption was discussed and the tentative specifications were raised. The meeting received much information from member countries of FAO, WHO and UNICEF on the basis of their activities over recent years.

At the FAO International Conference on Fish in Nutrition (held in Washington, from 19 to 27 September 1961) an Ad Hoc Working Party on FPC was set up to consider the draft specifications for this product, originally drawn up at earlier meetings.

Following this conference, an Expert Panel on Fish Meal and Fish Protein Concentrate for human consumption was convened (on 28-29 September 1961) to review the prospective supply of FPC in the light of these tentative specifications.

The Panel further considered whether action programmes could be initiated and felt that the successful introduction of FPC into the dietary pattern of one or two countries in different regions of the world would have a stimulating effect in other territories.

Among other items, the Panel considered the possibility of immediate action programmes for various countries. These countries were, in the order of priority, Chile and Peru, Morocco, Senegal, Ghana and Pakistan. The Panel also reviewed the possibility of action programmes in Burma, Congo (Democratic Republic

of), Mexico, Somalia, Thailand and Uganda, but felt that these countries should have less priority than the above mentioned.

The recommendations of the Panel indicating where action programmes may best be initiated were subsequently discussed in Rome with a view to organising a campaign to introduce FPC in Peru. Unfortunately this project, which involved the Government of Peru, UNDP and FAO, did not materialize.

At the FAO Symposium on the Significance of Fundamental Research in the Utilization of Fish (Husum, Federal Republic of Germany, 1964), technological and biochemical problems relating to FPC development were surveyed and an Ad Hoc Working Group was convened to discuss certain aspects of the use of non-extracted FPC for human consumption in FAO action programmes.

The FAO Conference, at its 12th and 13th Sessions held in November 1963 and November 1965 respectively, also stressed the importance of FPC and emphasized the need to stimulate its production and use.

Furthermore, FAO has maintained close liaison with the United States Bureau of Commercial Fisheries and with the Advisory Committee on Marine Resources Development of the Food and Nutrition Board of the United States Academy of Science. In particular, FAO has participated in meetings of the Committee until 1968. These meetings led to the approval by the United States Food and Drug Administration (on 2 February 1967) of FPC made from whole fish.

In the course of the first and second Ad Hoc Consultation on Codes of Practice for Fish and Fishery Products (held at the FAO Headquarters, Rome, from 17 to 21 April 1967, and 1969 respectively) the need to draw guidelines for the production of FPC and a request by the Protein Advisory Group for such guidelines, were elaborated by the Department of Fisheries and the Nutrition Division of FAO and were submitted to the PAG meeting held in Geneva, Switzerland in September 1969. The guidelines were accepted in principle, and Mr. Kapsiotis will give you more details about these guidelines.

FAO has always been aware of the potential need for FPC and has played an important role in stimulating the development of FPC to date, in co-ordinating efforts to produce FPC and in emphasizing the nutritional aspects of FPC, especially in combatting malnutrition. FAO, however, did not have the opportunity to undertake extensive, large-scale product development and marketing programmes. Such programmes have never been carried out except by private enterprises on a much less substantial scale; the manufacture of FPC on a commercial scale is at present handicapped mainly by the lack of outlets for the product. Market development has been hampered by two factors: the lack of sufficient quantities of a suitable product and the lack of adequate funds for initiating effective acceptability and marketing programmes. FAO, therefore, welcomes the participation of USAID in developing ways and means for implementing marketing studies, acceptability tests and introductory programmes. They are confident that well planned approaches on an appropriate scale will furnish conclusive results, which may lead to a breakthrough in the commercial use of FPC. I should like to express FAO's appreciation to the Government of Morocco for assisting the international organizations and USAID in their work on FPC. We hope that as a result of this new concentrated effort we will find a way out of the present impasse.

Statement by Mr. Jawad Kerdoudi, Director,
Fish-Canning and Fish-Meal Section,
Bureau of Marketing and Export, Morocco

As you are meeting here in Rabat to study, in particular, the case of the National Fish-Meal Company (SONAFAP), I will leave this subject to the specialists to deal with in detail.

For my part, I propose to give you an over-all picture of the Moroccan fish-meal industry, since it seems to me that the problems of SONAFAP cannot be isolated from those of the fish-meal industry as a whole. I hope that the following details will be of use to you in your work.

The Moroccan fish-meal industry consists of seventeen factories: seven at Agadir, six at Safi, three at Essaouira and one at Casablanca. Although the total produce capacity of the Moroccan fish-meal industry is estimated at 50,000 tons per year, which represents an over-all processing capacity of 250,000 tons of fish, the production capacity in 1967 was only 14,000 tons.

The raw material for the factories consists almost exclusively of sardines and is made up of fresh fish and fish waste from canneries. The fish are caught by sardine boats, which also supply the canneries and freezing plants. The cost of the raw material is fixed by the Government, after consultation with representatives of shipowners, sailors, fishermen and industrialists, on the basis of the fish prices on foreign markets.

Total production of the fish-meal industry is influenced mainly by the amount of fish available for processing and to a lesser extent by fish prices on the world market. Recent production figures were as follows:

Season	Tons
1966/1967	40,241
1967/1968	34,571
1968/1969	22,880

Catches were very small in the 1967/1968 and 1968/1969 seasons.

Fish meal is classified in three categories according to its percentage of proteins, namely, 55, 65 and 70 per cent. Generally speaking, Moroccan fish meal is in the 65 per cent category, except in the case of a few factories that produce 55 per cent fish meal, others that produce fish meal with a protein content of between 65 and 70 per cent, and the SONAFAP factory that produces 70-per-cent fish meal.

Fish-meal production in 1968/1969 was as follows:

Percentages	Tons
55	4,900
65	13,315
65 - 70	3,000
70	1,665
Total	22,880

Most of the fish meal produced is exported as the local market absorbs only about 1,000 tons.

Fish meal is exported through the Bureau of Marketing and Export (OCE), whose function is to bring sales into line with the over-all production and with the rates obtained on various markets.

Export earnings for the last three seasons were as follows:

	Dirhams 3/
1966/1967	30,892,000
1967/1968	22,677,265
1968/1969	13,807,776

The principal buyers were Cuba, Czechoslovakia, the Federal Republic of Germany, France and Hungary.

The prices obtained on export markets depend essentially on the amount of fish meal placed on the market by the producing countries. Chile, Norway, Peru, South Africa, and the United States are the main producers of fish meal; however, the market is dominated by Peru, which alone produces 2 million tons per year.

Prospects for the sale of fish meal are good from all indications since its world consumption increased from 3 million tons in 1963 to 4 million tons in 1968 and will probably continue to increase.

3/ US$1.00 = 5.02 dirhams.

There is room for extensive development of fish-meal production in Morocco, since the total volume of world exports of fish meal in 1968 amounted to 3.5 million tons and the Moroccan share of this was very small. The main problem confronting the Moroccan fish-meal industry is that of securing adequate supplies of fish. In order to solve this problem a fleet of large fishing vessels should be built up operating solely for the purpose of supplying the fish-meal factories and using the latest methods of fish shoal detection and fish unloading. This would enable the present factories to operate at full capacity and would facilitate the establishment of new factories.

Statement of Mr. George Farman, United States Department of State, Agency for International Development, Washington, D.C. 4/

Our group within AID has been closely concerned with the development of FPC as a weapon in the War on Hunger over the past three years. The experience we have gained reinforces our original premise that marketing is the key factor in a successful FPC development.

By marketing we do not mean simply commercial sales, but rather all the factors involved in getting FPC to the consumer, whether through commercial sale of foods containing FPC or fortification of staple foods through some compulsory basis with the government subsidizing or enforcing the fortification.

In every case acceptability is a key factor. Acceptability is not only a matter of taste; the acceptability of the economics of the concept is equally important. Even where fortification is done by compulsory means, the resulting fortified food must be

4/ The statement was delivered by Mr. J. B. Cordaro.

acceptable to the consumer if the fortification is to be successful. It will be important to determine how the cost of fortification will be borne to make certain that the economics are acceptable to the consumer, and to the government, in the case of subsidies. Any attempt to gloss over the importance of acceptability must inevitably lead to difficulties and will certainly incur questions as to the long-term viability of the programme.

The studies made by our agency have been closely concerned with questions of acceptability, with the economics of producing FPC in a given country and with the impact of FPC production upon the supply of fish. We consider all of these to be important elements of the FPC system.

It is important, for example, to determine what is the minimum production scale for a plant that is needed to produce FPC at an acceptable price. In turn there must be a sufficient market to take the full output of the plant so that the full economy of scale can be realized.

Finally, there must be assurance that the supply of raw materials is available at a price and during a sufficient part of the year to keep the plant running at an economical rate. Great importance is attached to these factors because a plant producing at an uneconomical rate does not achieve the great potential that is inherent in FPC.

Morocco, as a centre of FPC, could be a source of supply for the African countries that greatly need protein but lack adequate resources for its production. However, the development of such a market depends on the marketing factors discussed above.

The product must be of the highest quality possible. It is a definite mistake to cheapen the quality of a product just because it is being used for emergency feeding. People instinctively act favourably to good-quality products when they are available.

If these structures seem to effect a somewhat cautious approach, they do so because we firmly believe in a full investigation if serious decisions are to be made on investment in FPC production.

Statement by Mr. Mohammed El Bacha, Assistant Director, Office of Fisheries, Government of Morocco

I have been asked to speak of the present position of fisheries in Morocco and of the prospects for the future.

The Government of Morocco, conscious of the dominant role of maritime fisheries in the development of this country, has spared no effort to ensure a significant place for Morocco among maritime fisheries, and also in the field of nutrition. Indeed, in view of the importance of marine products as food, we consider fish, whether fresh or processed as FPC as the solution to the problem of protein deficiency because of its low cost and availability.

Morocco, with its maritime tradition, has seen a considerable development of its fisheries and growth in their production. At the beginning of the century there were only a few light fishing vessels but from this start trawlers with their larger catch were soon supplying fish to the rapidly growing villages. In 1927, the growth of industrial fisheries really began. Thirty-five small sardine motor boats and about 3,000 smaller boats were in operation and every year their number has increased. Pelagic species, which went mainly for processing, were the main catch but fresh fish were also caught for direct consumption.

After several fluctuations, production reached a level of 293,000 tons in 1960. In 1965 it was 240,000 tons of which 167,000 tons were sardines. The main fishing ports for sardines are Agadir, Essaouira, Safi, and Casablanca on the Atlantic and Al Hoceima on the Mediterranean, with the following landings reported: Agadir, 72,000 tons; Safi, 53,000; Essaouira, 24,600; and Al Hoceima, 3,700.

It has been pointed out that the processing industry can use new outlets for the sardine catch since canning has remained at about 2 million cases. A new industry is being developed, which will absorb the surplus sardines from the canning industry and convert them into fish meal and fish oils. Marked by a spectacular development, this industry has largely exceeded its original role and in the last ten years has become established in its own right. In 1965 fish processing was distributed as follows: by-products, 19,800 tons, canned fish, 15,500 tons, frozen fish, 5,500 tons.

Fisheries play a large role in the economic and social life of the country. Over 15,000 maritime workers are employed on over 450 fishing vessels. Like other maritime nations, Morocco has specialized schools for the training of mariners; students are mainly sons of fishermen.

The fishing fleet consists of 317 sardine boats and 103 trawlers. The sardine seiners concentrate mainly in Agadir and the trawlers are distributed between Agadir, Casablanca and Tangier. These vessels are equipped with nylon nets and power blocks but their radius of action restricts them to local waters. Techniques are improving constantly but more equipment is needed to develop this sector. The Government of Morocco has decided to reorganize the profession. A new structure of equipment and boats will help to improve working conditions and increase production.

As the present situation of sardine fisheries is characterized by seasonal and coastal fishing, new objectives have been set forth by the Department for Industrial Fisheries. In the developing of markets, equipment will be adapted to new outlets and the reorganization of this sector with a view to vertical concentration. The chief aim is to provide a continuous supply of fish to processing plants and establish competitive prices.

There are three main points to sum up, first, the reorganization of fisheries, second, the reorganization of industrial fishing, and third, increase and diversification of production. This production will reflect the needs of new industries.

We hope you enjoy success and we hope your meeting will open up new prospects. Thanks to the help of international agencies, we hope to develop an FPC industry, of which SONAFAP is a pilot project. I would like to mention that parallel to this experiment the scientific services of the National Fisheries Department have developed a process for manufacturing soluble and edible FPC.

With these few comments, I trust that I have given you a view of the present fishery situation in Morocco and its prospects for the future.

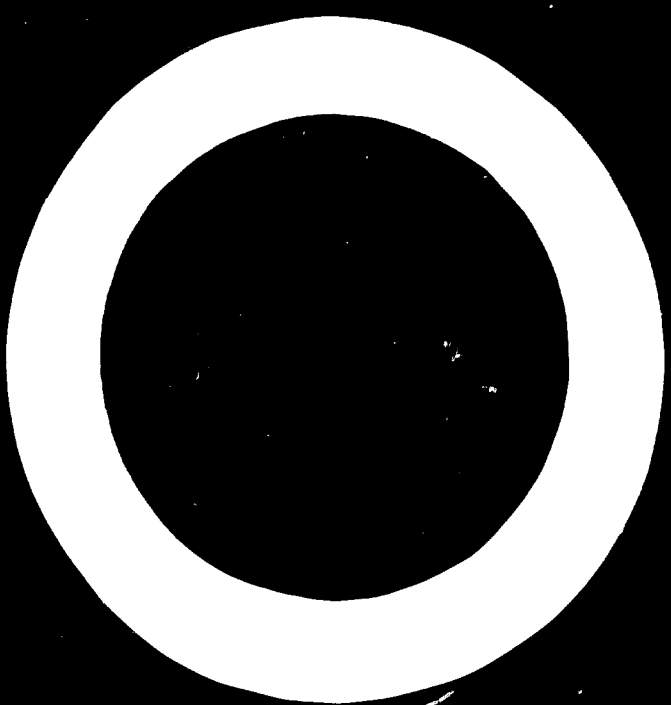
Annex 3

LIST OF PAPERS PRESENTED TO THE MEETING[1/]

ID/WG.48/1	History and present trends in FPC production	O. A. Roels United States
ID/WG.48/2	Some observations on fish processing	N. R. Jones United Kingdom
ID/WG.48/3/Rev.1	Some aspects of planning FPC production facilities	A. Carsten Canada
ID/WG.48/4	The determination of nutritional effectiveness and acceptability of FPC	C. O. Chichester United States; and F. Monckeberg E. Yanez Chile
ID/WG.48/5	Production of FPC from Moroccan sardines	J. Blake United States
ID/WG.48/7	Analysis, testing and uses of FPC	V. D. Sidwell B. R. Stillings G. M. Knobl, Jr. United States
ID/WG.48/8	The Halifax isopropanol process for the manufacturing of FPC	D. R. Idler Canada
ID/WG.48/9	Nutritional value, utilization and quality control of FPC	FAO secretariat
ID/WG.48/10	Utilization of FPC: an analysis to help frame national protein strategies	G. D. Bernstein S. M. Cantor S. H. Chafkin United States
ID/WG.48/11	Potential raw material supplies for the industrial production of FPC	FAO secretariat
ID/WG.48/12/Rev.1	Technical description of operational FPC plant	J. S. Tolin United States
ID/WG.48/13	Proteolysate of sardines	B. De Gero O. Skiredj Morocco

1/ A limited number of copies are available upon request.

ID/WG.48/14	Isobutanol as solvent for FPC production	P. Hevia F. Acevedo S. Kaiser Chile
ID/WG.48/15	Review and assessment of the situation in the Ivory Coast with regard to the use of FPC	A. Faubeau Ivory Coast
ID/WG.48/16	Marketing of FPC and its end-products	J. B. Cordaro



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