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FISH PROTEIN CONCENTRATE

HEARINGS

BEFORE THE

COMMITTEE ON COMMERCE
UNITED STATES SENATE

EIGHTY-NINTH CONGRESS

SECOND SESSION

ON

S. 2720

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO DEVELOP, THROUGH THE USE OF EXPERIMENT AND DEMONSTRATION PLANTS, PRACTICABLE AND ECONOMIC MEANS FOR THE PRODUCTION BY THE COMMERCIAL FISHING INDUSTRY OF FISH PROTEIN CONCENTRATE

APRIL 25, 1966, ABERDEEN, WASHINGTON
MAY 16 AND 17, 1966, WASHINGTON, D.C.

Serial No. 89–64

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FISH PROTEIN CONCENTRATE

APRIL 25, 1966

U.S. SENATE,
COMMITTEE ON COMMERCE,
Aberdeen, Wash.

The Committee on Commerce met, pursuant to notice, at 9:30 a.m., Hon. Warren G. Magnuson presiding.

The CHAIRMAN. The committee will come to order.

The Chair wants to suggest that this is a large room and if you can't hear what we have to say, please let us know so that we can adjust the microphone accordingly.

The Chair has a brief opening statement. Before he makes that statement, he wants to introduce the group sitting here with me at this hearing; the distinguished director of fisheries of the State of Washington, a former colleague of mine in Congress, a man who has been in the fisheries periphery since he was a Congressman from Washington for many years and was a member of the House Merchant Marine and Fisheries Committee. I am very pleased to have Thor Tollefson here with us today. [Applause.]

At my right is a man well known in the fisheries circles, Mr. John Wedin, who has long been the publisher of the Fisherman's News, who has been for sometime ably assisting the committee in fisheries matters, both domestic and international. I am glad to have the services of John Wedin, whom you all know. [Applause.]

We have the distinguished Grays Harbor delegation in the Washington State Legislature with us. I want to ask State Senator Robert L. Charette to introduce his two colleagues and himself.

Senator CHARETTE. We have with us Representative Eric Anderson. [Applause.]

And Representative Jack Burtch. [Applause.]

The CHAIRMAN. We are certainly glad to have you here, as I know that you realize as much as any of us the importance of this whole fisheries industry to this area.

The Chair has a very short statement which he wants to read before we begin the hearing and other matters of importance to the hearing.

Few fisheries developments in the world's long history of sea harvest have held the exciting promise of the kind of process we are going to consider here today. Fish protein concentrate, or fish flour as we sometimes call it, offers a protein solution, we think, to world hunger problems which is almost beyond the imagination of those of us living today.

Staff assigned to this hearing: William C. Foster, Harry Huse, and John Wedin.

The legislation upon which our hearing today is based, S. 2720—which I hope you all got copies of when you came in; if you haven't, the girls who are ably assisting us will be glad to give them to you—which was introduced in the U.S. Senate by Senator Robert Bartlett, of Alaska, and myself, is one approach which might hasten the day when this product might become available for market in quantities substantial enough not only to help us in our nutrition efforts abroad and here at home but also to create a demand large enough to be consistent with the huge hake fishery resources off the American coast.

There is a good reason for expediting this program as the fisheries resources off our coasts are dwindling and the major harvesting efforts are today being performed, as we well know, by some foreign fleets.

I am pleased to note in attendance at today's hearing not only a broad representation of the fishing industry, but also a sizable delegation of students from the Grays Harbor schools. We welcome you, we are glad you are here. We hope you will get some experience out of this meeting here today. I am hopeful you will find the testimony not only interesting but challenging.

I also see many good friends of the fisheries. I only wish time would permit us to call them all or speak to them all, but we must proceed as rapidly as possible.

The prospects for utilization of the unique properties of fish protein concentrate to alleviate our growing problems in world hunger are exciting but they are no less exciting than the prospect of an American fishery fleet eagerly heading to sea to begin the harvest of a new fishery, a kind of a frontier in which there are few remaining in the areas adjacent to our coasts.

The committee, of course, is pleased to hold these hearings in Aberdeen, not only for the opportunity to record testimony firsthand from those close to the pioneering efforts on the offshore resources of Pacific hake, but also some of you might share with us the testimony of those who have been intimately associated with the technical development of the present process for the manufacturing of fish protein concentrate.

We should make it clear at this point that the intention of the proposed legislation is not to bring the Government into the fish-processing business. We are only seeking a method to expedite industry interests and participation in this new field which is largely experimental at this time.

I would commend those of you associated with and responsible for the new fish meal plant in Aberdeen. Though not immediately designed to produce fish protein concentrate, this new facility will receive the Pacific hake catches from a sizable fleet of trawl vessels and reduce the fish to fish meal. New fish processing facilities in this country have been a rarity in recent decades. We not only wish this pioneering effort every success, but we hope that this plant may be the forerunner of many such new facilities as we begin the road back to placing America in her deserved place in the world's fisheries community.

Our witnesses here this morning will develop, I am sure, a good record for study by the Senate committee. I would hope that you would feel free to testify informally if you wish. You may submit your statements to the record in full. We will keep the record open. We are going to hold additional hearings on May 16 and 17 in Wash-

ington. The record will remain open for additional statements from this hearing until May 10. I ask your patience, however, today and your indulgence, because our time here is short. We hope to complete the majority of the statements this morning and we will return for a brief concluding session this afternoon, if necessary, hoping to hear as many of you as might wish to testify.

I have been advised that some of you are appearing specifically to outline the respective advantages of your community or your district for the location of one of the experimental plants outlined in the legislation. We welcome such description and presentation for the record, but it should be understood that the intial determination for sites for these plants, if the legislation is adopted, would be still at the discretion of the Secretary of Interior upon advice from the Bureau of Commercial Fisheries.

I have a further statement that has a bearing on this legislation in a most direct way, and I wish to read it as follows:

Since I arrived in the State on this trip I have heard a good deal of discussion about the Russian vessels offshore and some recommendations for a 200-mile fishery limit. A lot of people have expressed shock at this idea of 200 miles of fishery jurisdiction, but, frankly, the matter is not a new one to me. Just about a month ago in my office in Washington we held a meeting with the Under Secretary of State, Thomas Mann, to talk about this limit problem. Senator Bartlett was there, Don McKernan, and many of us involved in this matter. We had a pretty frank discussion on the whole subject and I can say that we talked about all kinds of limits up to 200 miles and even over in some cases.

We have come a long way in recent years in fishery resource so that when a nation moves to protect its coastal fishery resource it does not necessarily mean that they are moving their limit line for security, territorial rights, navigation, and other things. Just a week ago we all became concerned with this situation which appeared to be critical off the Oregon coast and we immediately called for hearings on another bill, S. 2218, which is a bill by Senator Bartlett, myself, and members of the Senate Commerce Committee. Some Members of the House have introduced the same bill, which specifically called for a 12-mile limit. The hearings on that bill will be on May 18 and 19. I called for two other actions which we think could be helpful on this question, an immediate diplomatic confrontation with the Soviets to discuss conservation and harvest plans and the immediate implementation by the State Department of the 1958 Geneva Fishing Convention, which, by the way, became effective only approximately 30 days ago with the 22d nation becoming signatory to the Convention.

Timing is very important, as you all know, in this whole issue. A resolution, and one that we have passed in the Senate for a world's fishery conference, passed unanimously in the Senate about 3 years ago, it is just now being implemented by the State Department. The 2 years that they require to hold a conference, I think, is too long to wait for action, particularly in view of the fact that the treaty has now taken effect. I think we should make it clear right now that we don't know what offshore limit is in the long-range national interest at the moment. I am sure that the Senator from Alaska will agree with me, however, that 12 miles would be totally inadequate to solve the problem of foreign fishing off our shores.

I know I am going to be accused of acting selfishly in support of fishermen again, but that doesn't bother us here. I am kind of proud of at least trying to do some work in this field. They have said a lot of fishery programs are self-serving, but I think they are going to get some results. Regardless of our final position on jurisdiction, the growing world hunger crisis dictates an immediate meeting at a conference some place with the Soviet Union and others to discuss conservation principles, including the trawls reported by some of our fishermen to be much smaller than ours and the taking of immature fish not yet in the proper harvestable stage. It is my firm opinion that unless we have some kind of a world conference soon to established some basic rules of the game for conservation on the high seas, if we keep this up without that, in 20, 25, or 30 years from now there won't be any fish left for anybody, and I think these other nations ought to realize this.

We are privileged, before we hear from our first witness, to hear the mayor of Aberdeen, Mr. Walter Failor. [Applause.]

Mayor FAILOR. The Honorable Senator Warren G. Magnuson: I am honored to welcome you and your staff to Aberdeen. With the full schedule you have in Washington, we fully appreciate you taking time to come so far in the interest of not only the people of this area but of the people of the entire State of Washington.

We also wish to extend a warm welcome to our guests from the various other cities of our State represented here today.

This is a first for Aberdeen, being honored by having a congressional hearing held here. I know that students in attendance today are also grateful to Senator Magnuson for this rare privilege of witnessing an important Government procedure. The interest in Senator Magnuson's bill, S. 2720, is apparent by the attendance today. We are well aware in Aberdeen of the impact that the hake industry will have on the economic future of this area, and we are most grateful to you, Senator Magnuson, for all your efforts.

Thank you. [Applause.]

The CHAIRMAN. Thank you, Mr. Mayor. I appreciate it.

The Chair wants to also state that Congresswoman Julia Butler Hanson expected to be here but could not because of the pressure of her duties in the Appropriation Committee at this time in the House, but she is going to submit a statement for the record and will attend future hearings.

I want to place in the record, at this time, the bill S. 2720, and I also place in the record a report on S. 2720 by the Department of Interior which came to us on April 22 and also reports of other Government agencies.

(The bill and agency reports follow:)

[S. 2720, 89th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior is authorized to conduct, using his existing authorities, and to encourage and to promote research, studies, and experiments by public and private agencies and organizations to develop the best and most economical processes and methods to

reduce fish which are in abundant supply and which are not now widely sought after for human food, to a highly nutritious and stable fish protein concentrate.

SEC. 2. (a) The Secretary is also authorized to provide for the construction, operation, and maintenance of not to exceed five experiment and demonstration plants for the production of a fish protein concentrate. Such plants shall be designed to demonstrate the reliability and practicability and the economic, engineering, and operating potentials of the processes and methods to reduce fish to fish protein concentrate. Such plants shall be located in such geographical areas as the Secretary determines will demonstrate optimum feasibilty from the standpoint of operation, maintenance, and economic potential.

(b) The Secretary may enter into a contract or contracts for the construction of the plants authorized by subsection (a) of this section, and he may, to the extent he deems desirable, enter into a separate contract or contracts for the operation and maintenance of such plants. Each operation and maintenance contract shall provide, in addition to such terms and conditions as the Secretary deems desirable, for the compilation by the contractor of complete records with respect to the operation, maintenance, and engineering of the plant or plants. The records so compiled shall be made available to the public and to the Congress by the Secretary at periodic and reasonable intervals. Access by the public to the plants shall be assured during all phases of their operation subject to such reasonable restrictions as to time and place as the Secretary may require or approve.

(c) Each constructed plant and its equipment upon the expiration of a period deemed adequate by the Secretary for experiment and demonstration purposes, but not to exceed ten years from the deate of this Act, shall, as promptly as practicable, be disposed of in accordance with the applicable provisions of the Federal Property and Administrative Services Act, as amended.

(d) The Secretary may acquire lands or interests therein, patents, licenses, technical data, inventions, secret processes, supplies, and equipment by purchase, license, lease, or donation to carryout the provisions of this section.

(e) With the approval of the Secretary of the Interior, any fish protein concentrate produced in plants constructed or operated under the provisions of this Act may be sold under title I or IV of Public Law 480, Eighty-third Congress.

SEC. 3. There are authorized to be appropriated not to exceed $5,000,000 for the construction of the plants authorized by this Act, together with such additional sums as may be necessary for the operation and maintenance of such plants, and for conducting the program authorized by this Act.

SEC. 4. The Secretary shall cooperate with public and private agencies, organizations, institutions, and individuals in carrying out the program authorized by this Act.

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., April 22, 1966.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate,
Washington, D.C.

DEAR SENATOR MAGNUSON: Your Committee has requested this Department's comments on S. 2720, a bill "To authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate."

We recommend the enactment of the bill with the amendments suggested herein.

S. 2720 authorizes the Secretary of the Interior to increase his present fish protein concentrate research and experimentation program and to build five experiment and demonstration plants to produce this concentrate. The bill authorizes a maximum appropriation of $5 million to construct these plants and additional sums for operation and maintenance and the program itself.

Our amendments and comments thereon are as follows:

1. On page 2, lines 4 and 5, delete the words "not to exceed five experiment and demonstration plants" and insert "one experiment and demonstration plant."

2. Delete the last sentence in subsection 2(a) of the bill.

3. On page 2, lines 6, 15, 18, and on page 3, lines 1, 21, and 24, delete "plants" and insert "plant".

4. On page 2, line 23, delete "or plants".

5. On page 3, line 4, delete "Each constructed" and substitute "The".

These changes reduce the number of authorized plants from five to one. This plant would be an expanded version of the existing model-scale solvent system developed by the Bureau of Commercial Fisheries of this Department. Studies utilizing the currently available model unit have indicated that a highly nutritious fish protein concentrate (FPC) can be produced using solvent extraction procedures.

It is now necessary to determine whether a similar product can be manufactured on a commercial scale within the economic limits required. It is also necessary to produce larger quantities of FPC for testing purposes—to determine and demonstrate where and to what extent it can be used as a supplement with other food stuffs.

These needs justify the construction and operation of one experiment and demonstration plant by the Federal Government at this time. The safety and wholesomeness of solvent-extracted FPC has, to date, been demonstrated only for hake belonging to the Merlucciidae and Gadidae families, including the silver hake, the white hake, the squirrel or red hake, and Pacific hake. Studies leading to the extension of the solvent process to other families of schooling fishes, notably the menhaden, are now underway, but completion of such studies cannot be anticipated in the very near future. Inasmuch as fishes of the hake family enjoy only a relatively limited geographic distribution in the waters of our east and west coasts, construction, at this time, of five FPC demonstration plants would be premature.

It is possible, however, that when the studies on other families of fishes are completed, additional plants may be needed. At that time, the operation of the single plant proposed herein will permit us to design more efficient solvent-extraction plants, tailored to the specific characteristics of these other families of fishes. In addition, work is underway on two other basic processes for the production of FPC—namely, an enzymatic digestion process and a physical cell disruption process.

It is conceivable that development of either or both of these processes might cause the solvent-extraction process to be relatively uneconomical or even obsolete.

6. We recommend that subsection 2(e) be deleted. Congress is now considering general legislation on the subject of foreign sales and donations of food which would revise the existing Public Law 480 program. We strongly believe the use of fish protein concentrate in international programs should be considered in the context of the general legislation rather than this bill.

7. On page 3, line 21, change "$5,000,000" to "$1,000,000".

We believe that the cost of constructing this single plant will not exceed $1 million. We estimate that about $500,000 will be needed each year to operate and maintain the plant and to conduct on site quality control and engineering experimentation work.

The President's Patent Policy Statement of October 13, 1963, will govern the disposition of rights to any inventions made by an operating contractor under subsection 2(b) of the bill. That Statement provides that since the experimental work will be in the fields affecting public health and welfare and directed to a process or product intended for public use, the Government would normally acquire the principal rights.

We believe enactment of the subject bill, in accordance with the suggested amendments, would provide for the perfection and demonstration of commercial scale processing techniques to produce an economical, highly nutritious, simply stored, and easily transported food substance. Additionally, it would encourage the development of markets for the products produced by these plants. There is widespread interest in the FPC program, as indicated by some fifteen major domestic food manufacturers who indicate an interest in testing the feasibility of incorporating high quality fish protein concentrate into their products. These include baked goods, candy, cereals, nondairy baby foods, and dietary foods. In addition, interest in incorporating FPC in the diets of millions of protein-starved peoples in the developing countries throughout the world has been expressed by organizations such as the Agency for International Development, United Nations Children's Fund, World Health Organization, and the Food and Agriculture Organization of the United Nations.

We have considered alternative approaches to that taken in S. 2720, as amended herein. One possible approach is that of contracting with one or two representatives of the commercial fishing industry to carry out the objectives of this bill. We believe, however, that this approach has two major drawbacks, not apparent in the approach taken by this bill.

The first is the cost. We have estimated that the cost of the demonstration plant approach to produce 3,000 tons of fish protein concentration for one year will be about $1.5 million. We believe the contract approach will result in higher costs for the same amount of fish protein concentrate, especially if we require the contractor to perform in a manner that will carry out all the experiments we plan in the demonstration plant approach in developing a product and a process. It should be emphasized that we do not now have a marketable product. Nor do we know whether it can be manufactured on a commercial scale within reasonable economic limits. Furthermore, the contractor has no present day market for it. The cost of developing all of these items will be substantial to the private investor who must make a return on his investment. The plant constructed by Government, on the other hand, will be operated in a flexible manner and no profit is required.

The second is the fact that we want to benefit the entire industry, not just that portion of industry which has the most money to risk. One must recognize that the commercial fishing industry is primarily composed of many small entrepreneurs. The contract approach would benefit only the largest entrepreneurs in the industry. We believe that such a result is not in the public interest.

In addition, we believe it would take longer to follow the contract approach with uncertain results.

The Bureau of the Budget has advised that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely yours,

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., May 13, 1966.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate.

DEAR MR. CHAIRMAN: This is in reply to your request for a report on S. 2720, a bill "To authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate."

This Department favors enactment of S. 2720 if section 2(e) is deleted. This section is not directly related to the objective of S. 2720. Moreover, H.R. 14929, a bill "To promote international trade in agricultural commodities, to combat hunger and malnutrition, to further economic development, and for other purposes," deals with this subject.

The Bureau of the Budget advises that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely yours,

ORVILLE L. FREEMAN, *Secretary.*

COMPTROLLER GENERAL OF THE UNITED STATES,
Washington, D.C., December 21, 1965.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate.

DEAR MR. CHAIRMAN: This is reply to your letter of October 25, 1965, requesting our comments on S. 2720, 89th Congress, a bill to authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate.

Section 2(a) of the proposed legislation would authorize the Secretary of the Interior to provide for the construction, operation, and maintenance of not to

exceed five experiment and demonstration plants for the production of a fish protein concentrate, which is intended for human consumption.

In producing fish protein concentrate for human consumption the use of whole fish is contemplated. However, it appears from the hearings on Fish Protein Concentrate before the Subcommittee on Merchant Marine and Fisheries, Senate Committee on Commerce, 88th Congress, 2d session, page 18, that the Food and Drug Administration initially expressed an opinion that fish protein concentrate from whole fish would violate section 402(a)(3) of the Federal Food, Drug, and Cosmetic Act, and that on January 25, 1962, the FDA issued a modified definition and standard of identity for fish protein concentrate that did not permit the use of whole fish.

It is our understanding that as of October 31, 1965, the Food and Drug Administration has not approved whole fish protein concentrate for human consumption. Accordingly, you may wish to consider amending this section of the bill to provide for deferment of plant construction until such time as the Secretary of the Interior shall ascertain that the Food and Drug Administration will approve a whole fish protein concentrate for human consumption.

Section 2(b) authorizes the Secretary to enter into a contract or contracts for the construction of the plants and for the operation and maintenance thereof. Each operation and maintenance contract is to provide for the compliation by the contractor of complete records with respect to the operation, maintenance, and engineering of each plant constructed. We understand the term "complete records," as used in the section, to include financial records relating to the cost of operation and maintenance; however, to remove any doubt in the matter, we suggest amendment of the section to specifically require the contractor to maintain appropriate cost records. We further suggest the section be amended to provide that the Comptroller General of the United States or his duly authorized representative shall have access to all pertinent records for the purposes of audit and examination.

Section 2(e) of the bill states that fish protein concentrate produced under this act may be sold under title I or IV of Public Law 480, Eighty-third Congress, which provides for the sale of surplus agricultural commodities in foreign countries. In the absence of language in section 2(e) providing for the disposition of funds received from sales in foreign countries, the applicable provisions of Public Law 480 would appear to be controlling. Should your Committee desire to otherwise provide for the disposition of the funds thus generated, specific provision therefor should be included in section 2(e).

Sincerely yours,

FRANK H. WEITZEL,
Acting Comptroller General of the United States.

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF SCIENCE AND TECHNOLOGY,
Washington, D.C., May 13, 1966.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate,
Washington, D.C.

DEAR MR. CHAIRMAN: Because of the deep and continuing interest of this office in the development and production of wholesome fish protein concentrate, I am taking the liberty of submitting the following comments on S. 2720 which I understand is under consideration by the Committee on Commerce.

S. 2720 would authorize the Secretary of the Interior to promote research and experiment and to provide for the construction and operatin of experimental and demonstration plants for the production of fish protein concentrate.

I am fully in support of the objectives of S. 2720 and agree with its approach. On the basis of the experience gained by the Bureau of Commercial Fisheries in developing a promising laboratory process, I believe that there is need for the construction of a single experimental and demonstration pilot plant which would pave the way for the subsequent construction of semi-commercial and full-scale production plants.

We now have a fragmented, hand-operated laboratory process. A necessary next step is to construct a relatively small experimental, continuous process plant with maximum flexibility for the conduct of engineering research studies under a wide range of conditions. Although the plant might be contractor

operated, the design and trouble shooting in the test plant should be carried out with the intimate involvement of those experienced in the laboratory process and having thorough understanding of the desired characteristics of the final products.

The need for an intermediate experimental plant of this character has been underscored by the Committee on Marine Protein Resource Development of the National Academy of Sciences' Food and Nutrition Board in a resolution adopted October 14, 1965.

By providing reliable economic and engineering data and by demonstrating the wholesomeness and acceptability of the product through the production of small quantities of protein needed for nutritional tests and feasibility studies a government financed program can, in my view, most expeditiously develop competitive commercial interest and investment to increase production, reduce costs and stimulate markets for fish protein concentrate.

I am advised that the Bureau of the Budget has no objection to the presentation of this report from the standpoint of the Administration's program, and that the Bureau concurs with the views contained herein.

Sincerely yours,

DONALD F. HORNIG, *Director.*

U.S. DEPARTMENT OF JUSTICE,
OFFICE OF THE DEPUTY ATTORNEY GENERAL,
Washington, D.C., November 12, 1965.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate,
Washington, D.C.

DEAR SENATOR: This is in response to your request for the views of the Department of Justice on S. 2720, a bill "To authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate."

This bill has been examined, but since its subject matter does not directly affect the activities of the Department of Justice we would prefer not to offer any comment concerning it.

Sincerely,

RAMSEY CLARK,
Deputy Attorney General.

GENERAL SERVICES ADMINISTRATION,
Washington, D.C., May 18, 1966.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate,
Washington, D.C.

DEAR MR. CHAIRMAN: Your letter of October 25, 1965, invited any comments the General Services Administration may care to offer on S. 2720, 89th Congress, a bill "To authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate."

The purpose of the bill is stated in the title.

Section 2(c) of the bill would provide that each plant and its equipment constructed by the Secretary pursuant to the measure would, upon the expiration of a period deemed adequate by the Secretary for experiment and demonstration purposes, but not to exceed ten years from the enactment of the bill, be disposed of in accordance with the applicable provisions of the Federal Property and Administrative Services Act of 1949, 63 Stat. 377, as amended.

GSA has no objection to the enactment of S. 2720.

The enactment of this measure would not affect the budgetary requirements of GSA.

The Bureau of the Budget has advised that, from the standpoint of the Administration's program, there is no objection to the submission of this report to your Committee.

Sincerely yours,

J. E. MOODY,
Acting Administrator.

The CHAIRMAN. Our first witness this morning is Donald L. McKernan, who is well known to everyone in the fishery industry of not only the Pacific Northwest but the United States and in international fisheries, who is the Director of the Bureau of Commercial Fisheries, Department of the Interior. He follows up and discusses not only the report on the bill, by him and by the Department, but some of the matters that we want to bring out at the hearing.

Don, we are glad to hear from you.

STATEMENT OF DONALD L. McKERNAN, DIRECTOR, BUREAU OF COMMERCIAL FISHERIES, U.S. DEPARTMENT OF THE INTERIOR, WASHINGTON, D.C.

Mr. MCKERNAN. Thank you, Senator.

On behalf of Secretary Udall I am pleased to again appear before this committee and its distinguished chairman, Senator Magnuson.

Before talking about some of the aspects of the bill and its need, I should like to very briefly describe the bill.

The Department itself, as you know, in its report of April 22, 1966, approved the purpose of the bill. It does suggest an amendment indicating that, at the present time, it sees the need for only one plant. It recognized on the other hand, that with further development in the laboratory and the further established indication of further needs, there may be some need in the future for Government support of additional plants.

The bill itself, S. 2720, authorizes the Secretary of the Interior to encourage and promote research studies and experiments by public and private agencies and organizations to develop the very best and most economical process to reduce fish that are in abundant supply and which are not now widely sought for human food, in the form of a highly nutritious and stable fish protein concentrate.

It also authorizes the Secretary of the Interior to provide for the construction, the operation, and the maintenance of not to exceed five experimental and demonstration plants for this production. It authorizes the Secretary to enter into contracts for the construction of the plants authorized by this bill and separate contracts for the operation and maintenance of such plants with both public and private contractors.

As you mentioned, the purpose of the bill is not to put the Government in the fish production business. The bill specifically indicates that the plants can be disposed of at any time the Secretary deems desirable, but, at the most, a plant can operate for 10 years. At that time the property must be disposed of by regular Federal methods. The bill authorizes the appropriation of $5 million to construct these five experimental small plants at the approximate cost of one million dollars each.

Senator, that is a very brief discussion of the contents of the bill upon which this hearing is based.

It seems to me, Senator, that in drafting this bill your committee has recognized two important needs for this kind of legislation. First, and some may consider this purely selfish or self-seeking, the U.S. Congress obviously feels that the American fishing industry itself can

be benefited by this bill. I would like to speak to that subject for just a moment.

At the present time this country is consuming, by various means, both for human food and for poultry and stock feeds, about 12 billion pounds of fish each year. We have examined the needs of our country and its citizens in the future and we believe that by the year 2000, a scant 34 years from now, this country is very likely to need close to 30 billion pounds of fish for the consumption and use of its citizens. This then means that our fishing industry has an opportunity that it has never had before. It means that Congress and the Government have an obligation that we have perhaps never highlighted quite so specifically before, to provide ways and means of increasing the use of the resources adjacent to our own coasts better than two times, that is, from our present 12 billion pounds to better than 24 billion pounds.

When one looks at the world consumption of fishery products and the world need for food, one sees an even more astounding picture. At the present time, the world production of all living marine products is somewhere in the vicinity of 60 million metric tons. It is very likely that in 34 years the world's need will be well over 100 million metric tons, or well over twice the present production of fish for food.

Looking at this need from another standpoint, very recently one of our top officials in Washington estimated that over one-half the children born into the world each year die before reaching 5 years of age, these deaths, to a considerable degree, are attributed to malnutrition. The greatest cause of deaths due to malnutrition today is from a lack of protein in the diet. Within the next 34 years, without any question, the world is going to need additional food in tremendous quantities. Pinpointing this to fish itself, we are going to need somewhere between two and four times the amount of production from the sea that we are gaining at the present time.

This, it seems to me, Mr. Chairman, is an urgent need. It is not something we can wait for, it is not something that is simply a whim or notion of a segment of our economy. It is a tremendous need for our Nation and for the world. The benefits to be derived from the full use of the resources of the sea, and especially those resources around the United States, can have a major favorable impact upon the economy of our country and a major impact upon resolutions of, perhaps, the most important problem facing the world tomorrow, that of feeding its hungry billions.

The Department and the Congress, in considering the need for this legislation, also was required to consider whether or not the resources themselves were available. Can the American fishing industry by any conceivable means meet this challenge of more than doubling its catch within the next 30 years? We found that the answer to this question was yes, that the seas and the ocean bottoms, adjacent to the coast of the continental United States and its island possessions, were among the richest in the world and to a considerable degree were less than fully harvested.

At the present time, I mentioned that we are using about 12 billion pounds of fish. Of this, the U.S. catch is only 5 billion, that is, 7 billion pounds is imported into the United States at the present time. Our scientists, in exploring the Continental Shelf and the seas above the Continental Shelf around our vast coastline, have estimated that

64-610—66——2

we very likely could harvest in a conservative manner, that is, on a sustained yield basis, well over 25 billion pounds of fish without really leaving our own shores, without attempting to fish on the high seas.

We will have some expert testimony about the specific areas off the coast of the State of Washington and the Pacific coast. But, very briefly, we believe we can sustain a catch of between 25 and 30 billion pounds off the coast of the United States.

The CHAIRMAN. What we want talk about, to pinpoint, is what people in Grays Harbor County and all around this area are familiar with, a term called sustained yield.

Mr. MCKERNAN. Yes, and that is what I have been talking about, Senator, a potential for a sustained yield harvest of the resources amounting to about 25 or 30 billion pounds. We will later talk more about these resources as they apply specifically to the Pacific coast area.

In considering how the United States might contribute in a major way to the solution of the world food problem the Department sought the advice of the National Academy of Sciences. A very distinguished panel of scientists was appointed by the Academy and they have been reviewing the scientific programs of the Department of the Interior as they relate to the production of new materials, especially the production of fish protein concentrate, or as some people have called it fish flour. The Academy has examined the fish product resulting from our research. They say this product is wholesome, highly nutritious, and, can be, as we have claimed, produced very economically, so economically that people anywhere in the world can afford its life-sustaining properties.

At the present time, our own fishermen are fishing less than their full capacity. There has been some question from time to time as to whether these fishermen could compete with fishermen from other nations. I would like to state flatly for the record that American fishermen are among the most efficient in the world, if not the most efficient in the world, if given adequate equipment and good seaworthy vessels.

The product we are discussing here today, fish protein concentrate, is not itself a new product. People have used the concept of drying fish for centuries, and the product of dried cod called bacalao, was one that was produced very early in the history of our country. What our research people have done is simply to refine this particular product and produce it by a highly technical means, using clean sterile equipment, and have preserved the maximum food benefits obtainable from the fish itself.

Our research has been designed, first, to study the methods of producing fish protein concentrate everywhere in the world. We have examined some of the products that have been produced in South Africa, southeast Asia, in Scandinavia, in Germany, Canada, and in many other countries. We believe that we have made great improvements over any of the products that are now produced. We also believe that when our industry is able to manufacture this concentrate and to market it for human consumption, it will be far ahead of any other fishery industries in the world today. We want to demonstrate, and this piece of legislation gives us the opportunity, the feasibility of this product. We want to learn how it can be incorporated into the diets of developing nations and also how it can be used in our own country.

There is, of course, more than one product. The product that we have produced at the present time, we believe, is only the first of a whole series of fish protein concentrates that can be made from fish found in abundance off our coasts.

Third, the problem of establishing markets, both worldwide markets and markets in the United States, is a matter of great importance. In fact, it is a serious problem itself, because it is not easy and not inexpensive to develop new markets. At the present time it is very likely that the product developed from plants, such as the one we envision under this legislation, would probably be used in food programs for food deficient nations, nations such as India and other developing nations in Africa, South America, and southeast Asia.

We have been busily engaged in gathering a body of data to test the purity and wholesomeness of this product and its suitability for use as human food supplement. We have prepared for the Food and Drug Administration a very complex and considerable amount of scientific information on these points. They are in the process of reviewing our petition at the present time, as you know, Mr. Chairman. We expect a favorable report from them in the near future. This then will allow us to incorporate this product, when it is available, into feeding programs for developing nations and will allow us to develop its use and study the feasibility of its use in food products within the United States.

Mr. Chairman, you will hear more about the development of this product, how the industry will benefit from it, from one of my two colleagues here at this table. You will also hear more specifically about the resources in this part of our great country.

In summary, Mr. Chairman, I want to thank this committee, and especially you, for the continuing support and attention you have given this project. I believe that your interest will be justified. The development of these protein concentrates, made from living resources of the sea, as I mentioned before, will not only benefit mankind but will be a very large factor in improving the fishing industry of this country.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Don.

I have a few brief questions. There are many others which we can place in the record in detail, but one I think everyone here would be vitally interested in, of course one of the keys to a successful fish protein concentrate program, would be the approval of the Food and Drug Administration. What can you tell us about the status of that now?

Mr. MCKERNAN. We have submitted a petition to the Food and Drug Administration for approval of the use of fish protein concentrate as a food additive. This means that if it were approved——

The CHAIRMAN. I think we ought to say when talking about a food additive we are talking about, in simpler terms, a supplemental food.

Mr. MCKERNAN. A supplement to other foods. For example, in the diets of the peoples of southeast Asia, the addition of a few percent, maybe up to 5 percent, of fish protein concentrate would provide the entire daily requirements of animal protein to these diets.

This material has been supplied to the Food and Drug Administration. They are studying it. They have asked for some further

studies or explanations from our scientists. We are in the process of supplying this information to them.

I was hopeful, Mr. Chairman, that we could have had a definite answer about this matter by this time. Further questions, however, have been raised and further discussions are underway between the staff of the Food and Drug Administration and our staff right today. I am hopeful that we will have an answer, and, of course, a favorable answer, within a few days.

The CHAIRMAN. In other words, we are making some progress?

Mr. MCKERNAN. I think so, yes.

The CHAIRMAN. One question that everyone is asking is, if and when the bill passes and the money is appropriated, where are these plants to be located? Of course, you and I have said that the Bureau will make that decision. Could you give us any inkling of what criteria will be used to make this decision?

Mr. MCKERNAN. Mr. Chairman, I want to get out of town alive, of course, but it is quite obvious that there are a few specific criteria which one might list. We have made no decision yet about the location of a plant. Obviously it would have to be close to a source of supply of fish. It also should be relatively close to centers where logistics are easy. It might well be located close to an area where the fishermen and the processors have the interest and the know-how and the capability. Very specificially, there is little question that this area of the State of Washington probably would have most, of not all, of the technical qualifications for such a plant.

The CHAIRMAN. Assuming that the bill is passed into law, would you need any additional funds for your experimental work that you have been doing so very successfully at College Park?

Mr. MCKERNAN. One attribute of a government bureau director is that we can always use more funds. In all seriousness, Mr. Chairman, we are handicapped to some extent by a lack of funds in this area. For example, there are some additional processes that may well prove to be even more important and produce even a better product than the one we have produced so far, through various biological enzymatic digestive processes where a certain amount of chemical digestion takes place in the fish. The resultant products may very well be more important economically because they can be highly flavored and the flavors can be tailored or controlled. In other words, we can produce products from fish that taste, smell and have the texture of beef or cheese or other accepted food products. In fact there is considerable interest in using these processes as a source of flavors, leaving the protein as a second valuable product.

The CHAIRMAN. In other words, what you are saying is that we are just beginning in this field and we can use more experimentation and the amount of funds would dictate as to how we progress?

Mr. MCKERNAN. Yes.

The CHAIRMAN. When we are talking about costs, there has been many references to costs, I want to say to the audience we are going to refer to this matter. The government has a great habit of being alphabetical these days, and we always talk about fish protein concentrate, but for some reason the departments are now calling it marine

protein concentrate, so it will be known as MPC after this. It is a broader term.

Mr. McKernan. That is correct.

The Chairman. Regarding costs for MPC, both within the government and from the industry, I don't think there has ever been an itemized breakdown of such costs whereby the validity of the F.P.C. concept could be evaluated. Could you make roughly and then put in the record in detail an itemization of the costs available at this time?

Mr. McKernan. Yes, Mr. Chairman, we have a summary distributed which contains the capital and operational costs. It will appear in the record as an appendix to the Bureau of Commercial Fisheries testimony.

Needless to say, one of the great advantages of this product is that it can be produced cheaper per unit of protein than any of the common protein concentrates that are now available throughout the world today. It is much cheaper than most sources of meat protein concentrates.

The Chairman. As I understand it, your cost summary will be available to the people who are here, and you will also have a summary which you will put in the testimony?

Mr. McKernan. Yes, I will.

(The information requested follows:)

Bureau of Commercial Fisheries

Comparative Costs-Analyses of Animal Protein Foods

Preliminary studies have been made to determine production costs of MPC. These studies indicate that MPC is lower priced than any presently produced animal protein when expressed on the basis of nutritionally equivalent protein. The studies so far reveal certain sensitive points in production costs. A conversion ratio of six or more pounds of raw fish cause the finished product to vary by a factor at least six times as great. Another sensitive cost factor appears to be plant size. Considerable economies of size are evident. Further investigation is needed before fully reliable cost figures will be available.

Table 3 shows recent processor prices of low cost, high protein animal products. This is compared to an estimated manufacturing cost of $0.25 per pound of MPC. This estimate is not the same as a processor price, because there are no commercial sales of the product and thus no market prices. In the long run, however, the price of any product tends toward its production costs. Thus, when production costs are known, they are reliable indicators of prices.

Even given the uncertainty in the price of MPC, these data show that the price could be considerably higher before it reaches the price of the next best buy, on the basis of nutritionally equivalent protein.

Table 3.—*Cost per gram of protein from animal protein concentrates, January 1966*

Item	Price per pound	Protein per pound [2]	Price of protein per gram
	Cents	*Grams*	*Cents*
Dry milk solids	[1] 15.1	162.8	0.09
Dried eggs	[1] 112.0	213.2	.53
MPC	25.0	[3] 365.7	.07

[1] Source: U.S. Department of Agriculture (price f.o.b. processor).
[2] Source: "Composition of Foods," Agricultural Handbook No. 8, ERS, U.S. Department of Agriculture.
[3] At 80 percent protein.

If the wholesale price of MPC were .09 cents per gram of protein as is dry milk solids, the price per pound would be 34.0 cents. This shows the upper limit which MPC could go, under present prices, before it reaches the price of any other high animal protein product.

A further indication of the economic feasibility of MPC is shown in the following table (Table 4). Certain low cost foods from animal sources are shown with the retail prices expressed on an equal protein basis. These, of course, do not present alternatice choices which a consumer is expected to make in meal planning. It does present cost comparisons of various sources of animal protein. It should be noted that the products listed which are protein fortified show only the amount of protein added. Bread and spaghetti contain a considerable amount of plant protein, as well as the animal protein from eggs, etc., which are necessary ingredients. The source of information did not separate out plant and animal protein.

Dry milk is produced only as a surplus product, after the quantity demanded in higher valued uses has been met. Thus, a significant expansion in dry milk production is not likely. Production in recent years is no more than keeping pace with population increases.[1] Yet the world needs for low-cost animal protein continues to expand rapidly. Thus, the question is not so much how well MPC competes with dry milk, but how products supplemented with MPC or dry milk compare in price and nutrient adequacy with other foods such as those listed in Table 4.

In summary, all indications are the MPC can successfully compete from a cost standpoint with any other high protein product.

Retail cost per gram of animal protein from selected foods, January 1966

Item	Price per pound [1]	Animal protein per pound [2]	Price of protein per gram
	Cents	*Grams*	*Cents*
American cheese	78.0	105.2	0.74
Frying chicken	38.9	57.4	.68
Turkey	49.6	66.6	.74
Eggs, grade A, large	[3] 59.6	52.1	.73
Chuck roast	60.6	71.6	.85
Hamburger	52.4	81.2	.65
Picnic ham	54.9	62.5	.88
Ocean perch fillet	53.0	81.6	.65
Canned tuna	79.2	127.0	.62
White bread	[4] 21.4		
Fortified with 5 percent dry milk solids	21.8	8.1	[5] .19
Fortified with 5 percent MPC	23.9	17.7	[5] .14
Spaghetti	[4] 16.3		
Fortified with 10 percent dry milk solids	17.7	16.3	[5] .19
Fortified with 10 percent MPC	19.7	36.6	[5] .14

[1] Source: "Estimated Retail Prices by Cities," Bureau of Labor Statistics, January 1966.
[2] Source: "Composition of Foods," Agriculture Handbook No. 8, ERS, U.S. Department of Agriculture.
[3] Price per dozen.
[4] Price of unfortified product.
[5] The wholesale price of dry milk solids and estimated manufacturing cost of MPC were doubled to take into account the cost of adding the ingredient as well as the costs of performing the wholesaling and retailing functions.

The CHAIRMAN. That is based on a plant utilizing 16⅔ tons per day on an 8-hour basis in an operating year of 250 days?

Mr. MCKERNAN. Yes; that is correct.

The CHAIRMAN. You have testified in some detail of the interest in the protein needs in the world and you will put in more detail on that in the record at the May 16, 1966, hearing. The legislative report, which the Department submitted as of April 22, 1966, favors construction of only one plant, whereas the legislation suggests that we give the Secretary the authority to have five plants, if he should believe them to be necessary. Would you care to comment on this apparent disagreement between the Interior Department and myself over the number of plants?

Mr. McKernan. Mr. Chairman, I understand your logic and your purpose. On the other hand, the research status of our present process and our present product call for an expansion to another testing level of production. We can make considerable strides toward a production basis for this present product with just one plant. Our needs therefore at the moment are for one plant. The Department's recommendation is that when we need another plant for another process, we come back to the Congress which has usually been responsive to our needs.

The Chairman. Actually, what Senator Bartlett and I have in mind is to have thorough testing. How much would one plant cost?

Mr. McKernan. Approximately a million dollars, Senator, one plant of this size. A full-scale plant operating commercially would be approximately twice this size and approximately twice the cost.

The Chairman. One point I think we should emphasize, one of the prime benefits from fish protein concentrate plants might be the fact that you would have less seasonal fishing, you could have all-year-round fishing. Is that correct?

Mr. McKernan. Oh, yes. Of course when the salmon are running or when other higher priced fish are in great demand, then one would expect the vessels to operate on those fish. If, however, we can use our vessels for greater periods of time during the year, get greater efficiency out of them, then, of course, the cost of operation comes down considerably. Additionally, the fisherman has a longer period of fishing. Finally of course, we could compete better with other sources of protein foods, and this is most important if we are going to regain some of the markets we have lost. I think we can do it. I think that the development of this very important hake fishery that you will hear more about from Mr. Alverson, has great potential for improving the economy of our fishing community here in the Pacific Northwest.

The Chairman. All right, if you will just bear with me for a moment.

The Chair has been told that the students who are here today are going to have to leave in a few minutes. They are not only from schools in the area but they are from this school. They are from Weatherwax High School, Hopkins Junior High School, and Grays Harbor College.

We are very appreciative of you students coming here today and I hope that you will find this hearing of some interest to you and as challenging as it is to many of us. All of us here, the people in the fishing industry, the fishermen, the people interested, all of us appreciate your coming.

I think we ought to give these youngsters a big hand. [Applause.]

Mr. McKernan, there seems to be apparent weakness in our cost analysis. This is not a criticism, because we are just exploring, as it were, which involves the ex-vessel price of fish. Would the proposed demonstration plant help clear this up or strengthen these figures or give us better advice on them?

Mr. McKernan. Yes, I believe so, Senator. It is true we don't know what the cost of the raw material will be until we begin to fish it. Until the fisherman himself finds out just how much outlay he is going to have to make for gear and for specialized equipment, such as pelagic

trawls and new echo sounding devices, we don't really know. At the present time, of course, the cost of some of these unutilized fish in other parts of the world is perhaps as low as a half-cent a pound landed and as high as perhaps 2 cents a pound landed. We have been computing our costs for domestic production on the basis of about $20 a ton, that is a cent a pound, Mr. Chairman. Even at this particular domestic cost, we can produce the product for a very low price, perhaps as low as 13 cents a pound. Now, that is 13 cents a pound for a very high grade protein. I might add that some of the high grade imported meat protein products sell for two, two and a half, or three dollars a pound, so we would be getting a protein at a bargain price. We think our fishermen, with good equipment and good gear, will do very well with some of the available resources at our estimated ex-vessel price or a price somewhere in that vicinity. I don't want to say how much it will cost him. Fishermen will simply have to try out their gear and try out the fish stocks and concentrations themselves to see what their costs are going to be.

The CHAIRMAN. All right, Mr. McKernan, I know we all have several questions that you could answer, but they are more of a technical nature which, I am sure, the technical experts can do a better job on than you or I. We appreciate it, and we will leave the record open for 10 days. I think, Mr. McKernan, that you were as well pleased as I was this morning when I talked to Washington and found that the appropriations subcommittee had put in the bill $100,000 for further research in this field, which is badly needed. I hope that I can hold it in the bill when we start hearings on it in the Senate. This is an item we have long sought.

Mr. MCKERNAN. Yes, Mr. Chairman.

The CHAIRMAN. Thank you very much.

(The statement follows:)

STATEMENT OF DONALD L. MCKERNAN, DIRECTOR, BUREAU OF COMMERCIAL FISHERIES, U.S. DEPARTMENT OF THE INTERIOR

INTRODUCTION

Mr. Chairman and Members of the Committee, on behalf of Secretary of the Interior Stewart Udall, I am pleased to again appear before this Committee and its distinguished Chairman, Senator Magnuson.

Since 1961 the Department of the Interior, through the Bureau of Commercial Fisheries, has been engaged in research and development of an inexpensive, stable, wholesome product of high nutritive quality, hygienically prepared from fish, in which the protein and other nutritive materials are more concentrated than they were in the original raw material. In the early days of our program, the product we then had was commonly referred to as fish flour and then later, as the product was further developed, and seeking a more descriptive term, the product was referred to as fish protein concentrate (FPC). Lately, in the laboratory and within Government generally, the product has come to be known as marine protein concentrate, referred to as MPC.

A definition of the product which we now call MPC would include products of varying characteristics ranging from tasteless, odorless, light colored flour-like materials, to coarse meals having a fish taste and odor, to highly flavored dark colored pastes or powders resembling meat extracts.

In the 5 years that have elapsed since the initiation of this program, there has been considerable progress made leading from bench-scale experiments, involving a few ounces of raw material, to tests in a modern-scale unit in which many hundreds of pounds of raw fish were processed. We are now at the stage where pilot plant operations are necessary to test and confirm a number of engineering

concepts, to demonstrate to the U.S. fishing and food processing industries the practicability of MPC manufacture and the versatility of the product, to produce sufficient quantities of MPC for large-scale feeding and storage tests, and to initiate feasibility studies for the creation and development of markets for MPC-supplemented foods.

This brings us then to a consideration of the bill before this Committee today, S. 2720, as a logical and necessary step in the development of this program. Section 1 of the bill contains a restatement, or rather a more specific statement, of the Department's authority to carry on a program for the development of marine protein concentrate. Section 2 of the bill authorizes the construction, operation, and maintenance of not more than five demonstration plants to be located so as to demonstrate the optimum feasibility of MPC production from the standpoint of operation, maintenance, and the economic potential. Under the terms of the bill the Secretary would be authorized to contact for the construction and operation of these plants with assurances that the information gained from their operation would be made available to the public. Provision is made for disposal of the plants after they have served their purpose and for the necessary acquisition of lands, patents, licenses, technical data, inventions, secret processes, supplies, and equipment necessary to operate the plants. The bill contains an authorization for disposal of the marine protein concentrate produced in such plants under the provisions of Titles I and IV of Public Law 480, 83d Congress. The bill contains an authorization for appropriations up to $5 million for construction and such sums as may be necessary for plant operation and maintenance and the program itself, and authorizes the Secretary to cooperate with public and private entities in carrying out the program as authorized.

In our Departmental report to the Committee on S. 2720, we have indicated that the present status of our program would justify the construction and operation of one experiment and demonstration plant. Our program thus far has demonstrated the safety and wholesomeness of a solvent-extracted product from hake belonging to the *Merlucciidae* and *Gadidae* families, including the silver hake, the white hake, the squirrel or red hake, and the Pacific hake. Studies leading to the extension of the solvent process to other families of schooling fishes are now underway and when they are completed additional plants may be needed. At the present time, however, the operation of a single plant can be justified in this program.

We view the Department's program for the production of marine protein concentrate as an effective means of increased utilization of the fishery resources off our coasts to the betterment of the economics of our fishing industry, and we view the construction of an experiment and demonstration plant as a necessary part of that program. It is responsive to the remarks of the President to the Congress in his "Food for Freedom" message on February 10, when he said:

"The wonders of modern science must also be directed to the fight against malnutrition. I have today directed the President's Science Advisory Committee to work with the very best talent in this nation to search out new ways to develop inexpensive, high-quality synthetic foods as dietary supplements. A promising start has already been made in isolating protein sources from fish, which are in plentiful supply throughout the world."

In order to survey the progress that has been made in the conduct of this program and especially to indicate the need for the construction of a demonstration plant for the production of MPC in sufficiently large volume to satisfy the present needs, we will discuss briefly the raw material resource available in U.S. coastal waters, the origins and objectives of the Bureau's MPC program, especially the results of an accelerated program that was initiated 15 months ago at the direction of Secretary Udall. Our report will conclude with an account of our immediate program needs and our future research plans.

The resource

Although there is not complete agreement, marine biologists estimate that the seas of the world could annually sustain a catch of 400 to 500 billion pounds of fish—a very real potential for supplying critically needed sources of animal protein. Tragically, about 85 percent of this potential supply is now going to waste. This is true despite the fact that nearly every inhabited coastal area has some sort of fishing activity.

Systematic efforts to farm the seas have lagged far behind land efforts. Yet the seas, today a vast reservoir producing animal protein, might with pisciculture techniques provide us with even more protein than we can new estimate.

As an important part of the global picture we must turn our attention to the resources found in the seas around our own U.S. shores, emphasizing especially the available resources of hake and hake-like fishes. These are of particular interest at present since it is these fish that will, most probably, gain initial acceptance by the Food and Drug Administration for use as raw material for the manufacture of MPC.

Starting in the northeast corner of our country, we think of the great fisheries off New England. Our cod fishermen went "down to the sea in ships" during the days of sail. Their hardy and productive exploits form a colorful chapter in the early history of our country. As eating habits changed, dried cod production fell off and other fish took over as fresh or frozen forms. One of the most spectacular advances was that of the redfish. Once considered a "trash fish," its use under the name "ocean perch" increased dramatically, and a yearly production of over 200 million pounds was achieved by 1950. Certain biological evidence leads fishery scientists to believe that large, almost untouched reserves of these redfish may exist outside the areas now fished.

A fish now only partially used by man either directly for food or indirectly for the manufacture of animal food is the silver hake or whiting, (*Merluccius* spp.) and the red hake (*Urophycis* spp). In the New England area there are four species potentially readily available for the manufacture of MPC—*M. billinearis* and *albidas* and *U. chuss* and *tenuis*.

The red hake (*U. chuss*) and the silver hake (*M. bilinearis*) are seasonal migrants, moving insore during the warmer months of the year and offshore in the colder months. This temperature relationship is spelled out in some detail in the attached Appendix.

Figure 11 (Appendix) refers specifically to the red hake. This species moves inshore in April, appearing in concentrations first off Martha's Vinyard and shortly thereafter around Block Island. During the period April through June small and medium otter trawlers average better than 5,000 pounds/hour of dragging. During the summer months relative abundance falls off (the fish are dispersed) to about 2,000 pounds/hour. In September they begin to congregate again prior to the offshore migration and the catch/hour rises again to levels comparable to those obtained in the spring.

The red hake is also taken within the Gulf of Maine and appears to be a separate stock. They appear later, reaching peak abundance off Cape Cod in early summer, at which time the small and medium trawler catch averages between 3,000 and 4,000 pounds/hour. As these fish move northward they are dispersed and avaliable at much lower catching rates.

The silver hake also a migrant species reaches peak abundance on the southern New England grounds late in the summer (see Figure 10 of Appendix 1). At this time the catch/hour averages 3,000 to 5,000 pounds/hour. On Gulf of Maine grounds silver hake arrive much earlier and are steadily harvested through the summer months at the rate of about 2,000 pounds/hour.

The local industrial fishery has depended almost entirely on silver hake and red hake. Two areas, Point Judith offshore and No Man's Island both southern New England grounds, seem to be consistently productive for most of the year. Fishing trips are mostly two-day trips. For each of five years when the industrial fishery was very active, these grounds produced an average of about 100 million pounds annually of silver and red hake during the period April through December.

A flexible fishery, capable of extending the season by fishing offshore during the winter months could radically increase the amount landed by fishing these and other stocks. It must be noted here that the USSR is moving into this offshore area in force at the present time.

There are as yet essentially unexploited stocks of these species and others in the area between the Hudson Canyon off New York and the Virginia Capes.

To summarize, for the period April through December, raw material for MPC would be available in inshore southern New England at catch rates averaging about 4,000 pounds/hour (small and medium trawlers). Early and late in the season these catch rates are considerably higher for short periods of time. Depending upon the intensity of the USSR efforts on the same species, one can expect to be able to take considerably in excess of 100 million pounds per year in such a fishery. If the fishery can be extended to immediate offshore grounds and grounds farther to the east and west, the available resource is at least three times as large.

Great resources also exist off our Middle and South Atlantic coasts. Stocks of red hake could yield 100 million pounds per year; Atlantic herring 50 million. Species not now directly used for human food are termed "industrial fish." An estimated additional 100 million pounds per year of these could be caught along the Atlantic coast.

The Gulf of Mexico is an enclosed sea whose productivity is enriched by the millions of tons of silt and dissolved nutrients washed into it each year from the Mississippi and other rivers. Part of the fertile soil from our Great Plains States ends up here. It can be partially reclaimed by harvesting the marine animals feeding on the nutrients contained in it. Completely unused stocks in the Gulf of Mexico, with their estimated annual potential poundages, include thread herring, 2 billion; anchovies, 1 billion; scaled sardines, 100 million; butterfish, 100 million; little tuna, 500 million; industrial fish, 200 million; round herring, 500 million. Of the fish now caught, many are thrown back because markets for them do not exist at present.

Crossing the Mexico peninsula brings us to the Pacific coast. Here lie enormous stocks of anchovy and jack mackerel, now only partly used. Fishery scientists believe the annual anchovy catch could be increased to 1 billion pounds, while that of the jack mackerel could be increased by 130 million. Besides these, completely unused stocks include saury and dogfish with potential yearly yields of 100 and 54 million pounds, respectively.

Concerning the availability of *Merluccidae* and *Gadidae* in the northeastern Pacific, the following are the species with commercial potential: the Pacific hake (*Merluccius productus*), Pacific truecod (*Gadus Macrocephalus*), pollock (*Theragra chalcogrammus*), and the smaller cods—tomcod (*Microgadus proximus*), Arctic cod (*Boreogadus saida*), and saffron cod (*Eleginus gracilis*). Although the latter three species may provide supplemental production in localized areas, they do not appear to be in sufficient quantities to yield large scale production for MPC. Thus, species suitable for potential use in MPC include the Pacific hake, truecod, and pollock.

Truecod is now utilized extensively by U.S. and Canadian fishermen as a food fish species. Although it does represent a potential source the high demand for Pacific truecod makes it doubtful that this species would be landed for MPC production. Pacific truecode is abundant in the eastern Pacific from Destruction Island off the state of Washington to the Bering Sea, while pollock are abundant in the northeastern Pacific from southeast Alaska to the Bering Sea.

Pacific hake is generally found from Baja California to southeastern Alaska. It is abundant along the Continental Shelf in depths from 30 to 100 fathoms during the spring, summer, and fall months, and a resident population is known to occur within Puget Sound. Pacific hake, is generally found in areas in close proximity to shore and within easy operational range of existing fishing boats. The rate of capture, utilizing the newly-developed *Cobb* pelagic trawls, is sufficiently high to allow large scale production at relatively low cost, under $30 a ton.

Preliminary estimates by Bureau biologists of the Seattle Biological Laboratory in 1964 placed the maximum sustainable yield of hake off Washington and Oregon at 100,000 to 150,000 tons per year or an equivalent of 4 million to 6 million daily 10 gram (80% protein) rations of MPC for 360 days. This would, therefore, be sufficient to supply about 3 to 4.5 million children with enough protein to upgrade adequately their daily ration with animal protein. Although there is no reliable information as yet on the extent of hake populations resident in Puget Sound, a Bureau biologist has estimated the resource at about 5,000 tons.

Too long have the fisheries of our 50th State been confined to the traditional salmon, halibut, and herring. Off Alaska is a vast shallow body of water—the eastern Bering Sea. Here, in a few short years, Japanese and Soviet catches have skyrocketed to over 2 billion pounds per year of such species as cod, pollock, flounder, sole, and king crab. Except for the crab, these cannot now be profitably harvested by American fishermen. A new outlet for fish, such as marine protein concentrate, could drastically change this situation. Even among the "traditional" Alaskan fisheries, an estimated 24 million pounds of herring could be caught each year. The catch of sablefish (now incidental to halibut fishing) could be increased.

In our circumnavigation of the coastal areas of the United States we have probably overlooked many possible sources of marine food. Even those we have

found, however, are impressive. Fisheries specialists have estimated that the annual U.S. catch could be 28.5 billion pounds—over five times the 1959–63 average of 5.1 billion pounds. Much of the estimated 23.4 billion-pound increase would be in species not now taken by domestic fishermen or presently captured in limited volume compared to the size of the resources. Nearly 40 percent of the additional catch would come from waters within 3 miles of the U.S. coast and from interior waters, while about 25 percent would be taken within 3 to 12 miles of the U.S. coast. Atlantic and Gulf waters would supply over 50 percent of the increase; Pacific, about 38 percent; and lakes, streams, etc., 12 percent.

The five Great Lakes amount to inland seas, with possibilities for additional food fish harvests. During the last few decades production has been characterized by decline of the lake trout and increases in alternative species. Current United States and Canadian catches total about 100 million pounds per year. There are great possibilities for increases, however, in such species as the alewife. This has recently become so abundant as to be considered a pest by fishermen, not because it does not have good food potential, but because its demand on the U.S. food-fish market is negligible.

Although not overwhelming in relation to national production, our river fisheries in such great systems as the Columbia and Mississippi-Missouri are not to be overlooked as fishing sources. Possibilities for increased yields are particularly good where power and irrigation dams have created vast artificial lakes and reservoirs. Research is now underway in an attempt to realize this potential for food sources. Success with fish stocks in the reservoirs of the Tennessee River Valley Authority have shown that this can be done.

It should be noted that these estimates of increased potential catch are predicated on sound resource conservation practices and represent the maximum sustainable yield.

Origins and objectives of the BCF marine protein concentrate program

To evaluate accurately the Bureau's endeavors and to understand fully the origins of the Bureau's program, a complex background of considerations must be appreciated.

World food supplies.—In every newspaper, magazine, or scientific publication, we are made aware of the fact that there exists a serious conflict between the population explosion (from which this country is not excluded) and food deficiencies, especially insufficiency in animal protein. I will not belabor this point because I think it is well known. Let me say, however, that compounding the danger of this conflict is the fact that our world picture undergoes very rapid change in many direction. To illustrate the rate of change that is taking place, even within these last 20 months, I would like to remind you that in August of 1964 the prediction was made that within about 30 years the present world population of 3 billion people would double. The prediction today is that by the year 2200 the inhabitants of the globe will number about 5 hundred-billion, which would make the population density of every continent equal to that of Washington, D.C. Even a curb in the population explosion by effective birth-control measures, by widespread famine or by nuclear catastrophe could not prevent a great increase in the number of hungry people in the world.

We are witnessing today a trilogy of changes that have a profound bearing on the harvesting of new food resources and thus on the concept of marine protein concentrate production. One of these changes, of course, is the demographic explosion that I have just mentioned and that I admit is beyond the grasp of my imagination. The other rapid change is the technological revolution that, among other benefits, makes it possible for marine protein concentrates to find their place in the world's larders. The third important and basic change that involves us here and which will aggravate the problem of adequate food supplies which we are facing, is what Harlan Cleveland, of the State Department, called "the revolution of rising expectations." This is a change that has brought the hope and expectations of better living standards and better food supplies to the furthest corners of the earth, and that is constantly forcing technology to satisfy these demands.

One of the reasons why marine protein concentrates are so important in this context of change is the fact that our enlightened moral concepts leave us no choice but to provide the needed food, by newly developed techniques, in new forms, and from new sources. The most critical food shortage today, and for

a long time to come, will be animal protein. Fishes are animals and, therefore, contain proteins that are equal, in their nutritive quality and amino acid composition, to the proteins of land animals such as beef, egg, or milk. Fish can and will, therefore, take their full place in the human diet.

U.S. fishing industry.—Another important factor that was responsible for the initiation of the BCF marine protein concentrate program was the fact that the U.S. commercial fishing industry has lost, to a large extent, its pre-eminent place in the world's fisheries and that it was also realized that the United States desperatedly needed a modern, efficient, and energetic year-round fishing community. It should also be pointed out in this connection that the U.S. per capita consumption of fish as human food has not changed over the last 50 years, remaining at about 11 pounds per head per year, and that over 60 percent of the food fish now consumed in this country is imported.

Utilization of unused fish stocks.—A further point that largely contributed to the initiation of the program was the fact discussed above that large volumes of fish existing in U.S. coastal waters are unutilized or underutilized. In view of the large-scale shortage of animal proteins it was imperative that this large, self-replenishing protein resource be properly and fully utilized.

Development of new methods of preservation.—a further and potent simulus was the realization that over the last 40 years important efforts had been made in many parts of the world, including the United States, to develop inexpensive new methods to preserve fish for the sake of its protein value. The aim was to produce stable, wholesome and nutritious marine protein concentrates suitable for incorporation into human foods. Many ingenious methods were reported in the scientific and engineering literature. Some of these methods utilize solvent extraction procedures to remove water, fats, and oils from the raw material. Certain others employ the use of enzymes or bacteria in order to extract a protein hydrolysate. Still further methods aim at utilizing novel physical methods. Nevertheless, of the many processes that had been offered, not a single one has, so far, been generally accepted or has led to industrial exploitation for human food production.

The realization that many potentially useful methods of producing marine protein concentrates existed, that the need for animal protein was immense, that vast stocks of fish remained unharvested, and that powerful reasons had, so far, prevented this important development from becoming successful—all of these factors were directly responsible for prompting the U.S. Congress to approve and fund the Bureau's program.

Realizing the benefits that this country would reap by the establishment of a U.S. marine protein concentrate industry, it became essential to determine the nature of the stumbling blocks that held back progress in this field.

Obstacles to successful application.—A study of the failures revealed a multiplicity of causes: in some cases engineering and technical know-how in designing MPC production processed had, indeed, been faulty. In others, important toxicological considerations had been neglected. In still further instances it had been impossible to create the right image of the product to enable the material to be sold. In summary, a survey showed that although the technical problems involved in producing marine protein concentrates were certainly not insurmountable it was very obvious that, without the coordinated advice of experts in the fields of nutrition, pediatrics, toxicology, biochemistry, engineering, etc., it would be almost impossible to devise a truly satisfactory method that would be inexpensive, wholesome, safe, and as highly nutritious as the raw material itself and acceptble to the consumer.

There existed another obstacle to the successful development of marine protein concentrates. This obstacle was the informal opinion of the Food and Drug Administration (the details of which are well known to you); an opinion which, in order to be changed, demanded the conscientious and concentrated efforts of scientists from many different disciplines.

In order to achieve the ends that many had in mind a very considerable effort was therefore needed to reach the objectives.

The Bureau, prompted by the above considerations and in order to assist the U.S. industry by initiating the MPC program, proceeded to formulate the following objectives for its research and development program:

First, to study and improve existing methods or to develop new concepts for the manufacture of marine protein concentrates suitable for incorporation into human diets.

The attainment of a satisfactory method would involve a process that would require low initial capitalization, be economical in operation, be flexible for large- and small-scale operation, be flexible to permit operation in those parts of the world where public utilities are limited, result in the production of an end product that would be acceptable to peoples who may have varying taste preferences, cultures and social customs, that would result in the production of end products that would be approved as fully satisfactory and suitable by world recognized experts in the field of nutrition, and that would result in the manufacture of a product that could be inexpensively shipped to distant countries, stored at ambient temperatures for varying periods of time without quality loss, and be easily incorporated into the local diets of undernourished peoples.

Second, to demonstrate the feasibility of a process that would be chosen to produce marine protein concentrates on a demonstration plant- and industrial-scale.

Third, to help establish markets for the marine protein concentrate through food research.

Fourth, to gather a sufficient body of data on both the process and resulting products to convince the Food and Drug Administration as to the suitability of MPC as a human food supplement. We would then expect the FDA to permit the sale in the U.S. of MPC, when produced according to a specific method from specific raw materials.

The achievement of these objectives has been the task of many dedicated scientists and technicians. We have received advice from many sources. We believe that this new food supplement—the first of many potentially valuable MPC products—provides a safe, wholesome, high quality protein source which, we believe, will have a significant impact on the world food problem and will change to a major degree the traditional fisheries of the United States.

You will hear more about the development of this product and how industry will greatly benefit from it, by a world-recognized expert in the field, Mr. Ray Pariser, who is in charge of the project for the Government. You will finally hear about a specific resource, of particular interest to you in this area. Mr. Dayton Lee Alverson, a respected marine biologist has prepared a report on the hake resources off the Pacific coast which he is ready to discuss with you here today.

In summary, Mr. Chairman, I wish to thank this committee and especially you, along with Senator Bartlett of Alaska, for the continuing support and attention you have given this project. I believe your interest will be justified; the development of these protein concentrates made from the living resources of the sea will not only be of major benefit to mankind, but will be a larger factor in improving the fishing industry of this country.

Appendix No. 1

International Commission for the Northwest Atlantic Fisheries

ICNAF environmental symposium, Rome, January 27–February 1, 1964

Title: Relation of Temperature of Fish Abundance and Distribution in the Southern New England Area.

Author's Name and Address: R. L. Edwards, Bureau of Commercial Fisheries Biological Laboratory, Woods Hole, Massachusetts.

Section: A. Effect of physical environmental conditions on the distribution of adult fish (i.e., immediate and seasonal effects).

Convener's Name and Address: A. J. Lee, Fisheries Laboratory, Lowestoft, Suffolk, England.

Note.—The attached page of charts are excerpted from this document. The charts are those referred to in the statement and identified as Figures 10 (a) and (b) and 11 (a) and (b).

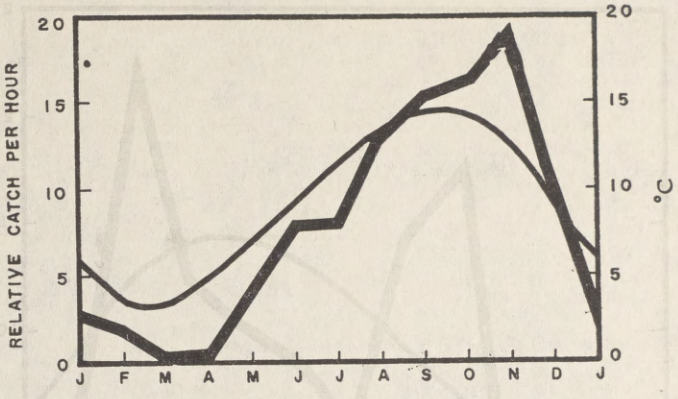

Fig. 10a. Seasonal changes in silver hake abundance on the Southwest ground, for the period 1956 through 1958, and average bottom temperature.

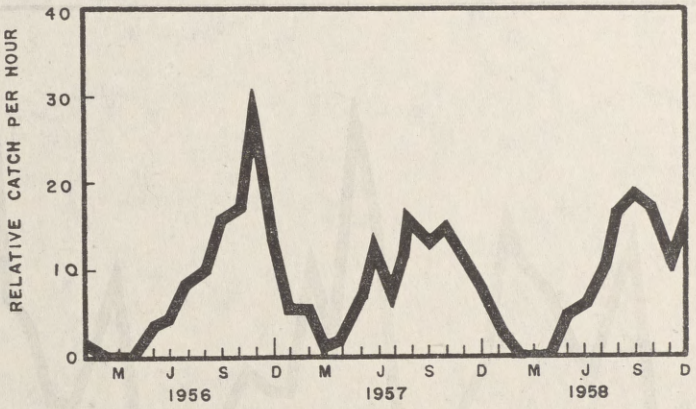

Fig. 10b. Yearly variation in seasonal changes of silver hake abundance.

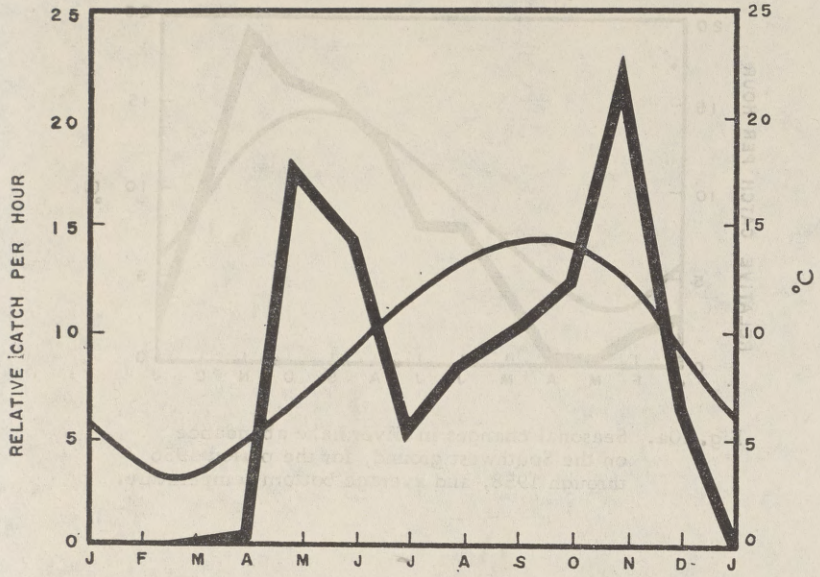

Fig. 11a. Seasonal changes in red hake abundance on the Southwest Ground, for the period 1956 through 1958, and average bottom temperature.

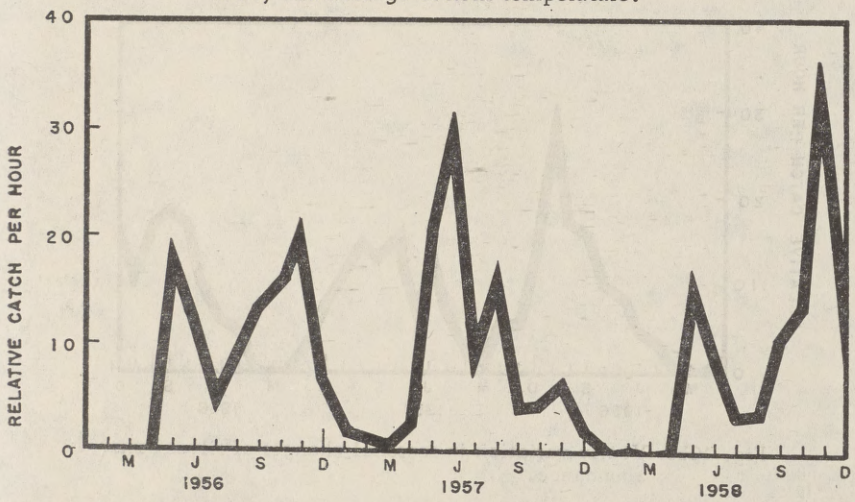

Fig. 11b. Yearly variation in seasonal changes of red hake abundance.

BUREAU OF COMMERCIAL FISHERIES, HUMAN NEEDS FOR PROTEIN, DOMESTIC AND WORLDWIDE

NEED FOR PROTEIN: PHYSIOLOGICAL

The human body can function properly only with a narrow range of physiological limitations, reflecting what the organism needs in terms of nutrients and what nutrients it can derive or synthesize from the food it consumes. Nutritionists recognize that a quantitative sufficiency of good is neither an adequate remedy for hunger nor a guarantee of adequate nutrition. A satisfactory diet to support a healthy vigorous life must contain proteins, carbohydrates, vitamins, minerals, and water. The diet must include not only an adequate supply of total proteins which the body can use or synthesize for repair or replacement of body protein tissues, but also an adequate supply of certain highly specific protein elements which the body needs for manufacture of body tissues but cannot itself synthesize.

Proteins are composed of chains of amino acids, some of which—the so-called "nonessential" amino acids—the human body can synthesize from other forms of ingested food materials. Other amino acids, however, are called "essential" inasmuch as the body unconditionally requires them to insure its normal health and growth but cannot synthesize them itself. There are nine known essential amino acids. These essential amino acids must, therefore, be contained in the food that is eaten. The absence of essential amino acids from many diets is responsible for certain widespread forms of malnutrition.

Proteins of animal origin are known to provide in the proper balance all the essential and other amino acids required in the human diet.

The following excerpts from the 1959 Yearbook of Agriculture further help to establish the need for animal protein.

"Proteins help in the exchange of nutrients between cells and the intercellular fluids and between tissues and blood and lymph. When one has too little protein, the fluid balance of the body is upset, so that the tissues hold abnormal amounts of liquid and become swollen."

"The presence in a protein of all of the essential amino acids in significant amounts and in proportions fairly similar to those found in body proteins classifies it as a complete protein—meaning that it could supply completely the needs of the body for these amino acids. The proportions in which the essential amino acids are required are as important as the amounts. . . . Meat, fish, poultry, eggs, milk, cheese and a few special legumes contain complete proteins. . . . Often the proteins in grain, nuts, fruit and vegetables are classed as partially complete or incomplete because "the proportionate amount of one or more of the essential amino acids is low or because the concentration of all of the amino acids is too low to be helpful in meeting the body's need."

"To have the nutritive value of the mixture of protein in our diets rate high requires only that a portion of the protetin come from animal sources."

"In underdeveloped and heavily populated countries, cereal grains have to be the chief item of diet because they are the quickest, easiest and cheapest food to produce in quantity. The protein from cereals alone are not of high enough nutritional value for normal growth and efficient maintenance. Although some proteins from animals or certain legumes are essential, enough of them may not always be available." [1]

Studies have been conducted to determine the amount of protein needed by various age and sex classes. It is, in general, agreed that protein needs vary not only by age and sex, but to a certain degree according to such factors as body weight. Thus, it is very difficult to express protein needs for a heterogeneous population.

Certain measures have been developed to indicate the adequacy of the protein diet. For this report the reference standard of 60 grams of total protein and 10 grams of animal protein per person per day is used. These are the standards proposed by the Foreign Regional Analysis Division, U.S.D.A.[2] This is lower

[1] *Food,* The Yearbook of Agriculture 1959, Excerpts taken from the articles on "Proteins," and "Amino Acids" by Ruth M. Leverton, pages 57 through 73, U.S. Department of Agriculture, Washington, D.C., 1959.

[2] *The World Food Budget, 1970,* Foreign Agricultural Economic Report No. 19, U.S. Department of Agriculture, 1964.

than the target proposed by FAO and higher than the minimal thought necessary to sustain life.[3]

2. DOMESTIC NEEDS

There is a lack of clinical information indicating any clear-cut protein deficiencies in the U.S. today, compared to that in many of the less developed nations.

However, it is becoming more fully recognized that small protein deficiencies result in listlessness and general lack of ambition even though the cases are not advanced enough to result in death or high susceptibility to disease.

The need for products such as MPC in the U.S. is not so much in correcting widespread and easily recognizable deficiencies, as it is to eliminate the more subtle effects of borderline inadequacies.

The single most important potential benefit for MPC in the U.S. is that of providing a low-cost animal protein source for those on low incomes to free more of their income for the purchase of other needed goods and services.

"In March 1965, about 12 million households comprising 34 million persons were living on cash incomes insufficient to buy goods and services vital to health."[4] This is the conclusion of the Office of Economic Opportunity using the latest accepted measures of poverty which were developed by the Social Security Administration.[5]

In addition to the making of a low-cost animal protein available to families in poverty, a need exists to fill a demand for institutional feeding, that is, military, school lunches, summer camps, and penal and mental institutions. Those responsible for meal planning for these establishments are constantly in search of foods with which to prepare well-balanced diets.

3. FOREIGN NEEDS

In addition to the domestic needs, much more serious protein deficiencies exist in several countries of the world, particularly in the less developed countries. Using the reference standards of 60 grams of total protein per person per day and 10 grams of animal protein, 57 percent of the world population lives in countries where the national average diet is below the reference standard in total protein, and 50 percent lives in countries where the national average diet is below the standard in animal protein.[6]

The use of national averages, multiplied by the population of that country, in measuring nutritional deficiency, in reality, always understates the amount of the deficiency. This is so because consumption, in excess of needs, is not as readily detected as would be a similar deviation on the deficit side. Therefore, the distribution tends to be skewed in that, on the surplus side, a small number of people eating large excesses tend to offset on the deficit side a great number of people with relatively smaller deficits. For example, in the U.S., the national average animal protein intake in 1959–61 was 64 grams per person per day or 638 percent of the reference standard. This means that over five people could be receiving no animal protein for every person consuming six times the minimum number of grams and no deficits would appear based on the average.

Table 2 shows the estimated average intake of animal protein for each deficit nation. Shown also is the protein deficit for each country having an average intake of animal protein less than 10 grams per person per day.

Using somewhat higher standards than those indicated above, the FAO document, *Third World Food Survey*,[7] states that if the world population were to increase according to the "medium" United Nations projection for 1975, world food supplies would need to be increased by over 35 percent merely to sustain the world's population at its present unsatisfactory level of diet. If a reasonable improvement in the general level of nutrition is to be brought about, world food supplies should be increased by over 50 percent and food supplies containing animal protein increased by 60 percent. By the year 2000, using the same world population growth projections, world food supplies must be trebled and animal protein supplies must be increased by approximately 4.5 times present supplies.

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[3] *Third World Food Survey*, Basic Study No. 11, Food and Agricultural Organizations of the United Nations, Rome, Italy, 1963.

[4] *Dimensions of Poverty in 1964*, Office of Economic Opportunity, 1965.

[5] "Counting the Poor: Another Look at the Poverty Profile" by Mollie Orshansky, Social Security Bulletin, U.S. Department of Health, Education, and Welfare, January 1965.

[6] *World Food Budget, 1970*, Foreign Regional Analysis Division, ERS, U.S. Department of Agriculture, October 1964.

[7] *Third World Food Survey*, FAO, United Nations Organization, Rome, Italy, 1963.

TABLE 2.—*Animal protein deficiency by country* [1]

Country	Average annual per capita disappearance of animal protein		Average annual per capita deficit of animal protein [2]		Population		Total annual deficit of animal protein (pounds) [3]	
	1959–61	1970	1959–61	1970	1959–61	1970	1959–61	1970
	Grams	*Grams*	*Grams*	*Grams*	*Millions*	*Millions*	*Millions*	*Millions*
Guatemala	3,285.0	3,431.0	365	219	3.8	5.1	3	2
Haiti	2,482.0	2,591.5	1,168	1,058	4.2	5.1	11	12
Libya	20,987.5	22,192.0	219	----------	1.2	1.4	1	----------
Tunisia	18,578.5	21,827.0	73	----------	4.2	4.8	1	----------
Cameroon	2,883.5	3,321.5	766	328	4.1	4.5	7	3
Congo (L)	1,533.0	1,679.0	2,117	1,971	19.0	24.0	88	103
Ghana	2,555.0	3,394.5	1,095	256	6.7	8.6	16	5
Guinea	1,241.0	1,423.5	2,409	2,226	3.0	4.1	16	20
Ivory Coast	2,299.5	2,628.0	1,350	997	3.3	4.1	10	9
Liberia	1,679.0	2,372.5	1,971	1,278	1.0	1.2	4	3
Nigeria	1,642.5	1,898.0	2,008	1,752	39.4	48.0	173	184
Sierra Leone	1,168.0	1,460.0	2,482	2,190	2.4	3.0	13	14
Togo	1,715.5	1,788.5	1,934	1,862	1.4	2.0	6	8
India	2,628.0	2,847.0	1,022	803	431.7	536.6	965	943
Burma	3,212.0	3,175.5	438	474	22.1	26.7	21	28
Indonesia	1,825.0	1,898.0	1,825	1,752	94.2	117.1	376	449
Thailand	3,321.5	3,650.0	328	365	27.0	35.2	19	28
Mainland China	1,168.0	1,971.0	2,482	1,679	685.7	811.6	3,723	2,981
Total	----------	----------	----------	----------	1,354.4	1,643.1	5,453	4,792

[1] Source: "The World Food Budget, 1970," Foreign Agricultural Economic Report No. 19 ERS, USDA, October 1964.
[2] With 10 grams per person per day standard.
[3] The required pounds of animal products to fill this would be greater because protein content is considerably less than 100 percent.

The effects of malnutrition in the less developed areas were discussed at an international conference on protein malnutrition.

"Out of this program there emerged the conclusion that the most prominent deterrent to progress in developing countries is the failure of healthful development of pre-school children resulting from malnutrition and disease."

Further elucidating on this conclusion:

"Malnutrition in the pre-school child is one of the world's most serious health problems in developing areas. Not only is it killing and maiming the children of today, but also, through physical, mental and emotional damage it will handicap the society of 1984, the next generation.

"The *International Conference on Prevention of Malnutrition in the Pre-School Child* established that:

"I. Pre-school malnutrition is basically responsible for the early deaths of millions of children;

"II. Of those it does not kill, pre-school malnutrition permanently impairs physical growth and probably causes irreversible mental and emotional damage; and that

"III. Pre-school malnutrition is a serious deterrent to progress in developing countries; it weakens the productive capacities of adults surviving from the irreparable damages incurred in early childhood.

"In developing areas, as many as 70 percent of the children may suffer from malnutrition. The maimed survivors become adults lacking the vigor and enterprise essential for productive advancement. Their shortened life span and decreased ability to product, gravely impede the physical, mental, and economic growth of the population." [8]

This clearly indicates that the solution of many of the serious economic development problems will be delayed at least a generation. Despite the importance of adequate protein nutrition to leading a productive healthful life, many nations cannot hope to attain a significant progress for several years. The longer the

[8] Pre-School Child Malnutrition, A summary of an International Conference on Prevention of Malnutrition in the Pre-School Child, organized by the Food and Nutrition Board, National Academy of Sciences—National Research Council, Washington, D.C., December 7–11, 1964.

delay in a significant attack on these problems, the further ahead the time must be set for overcoming them.

The need is clear to seek and utilize low-cost high-protein foods such as MPC in lifting the less developed populations from their present state to productive, healthy individuals, capable of contributing to the advancement of their nation's economic well being.

The CHAIRMAN. The next witness is Dr. Pariser, who is the Chief of the Food Engineering Program of the Fisheries Technological Laboratory of the Bureau, in College Park, Md.

STATEMENT OF DR. ERNST R. PARISER, CHIEF, FOOD ENGINEERING PROGRAM, BUREAU OF COMMERCIAL FISHERIES TECHNOLOGY LABORATORY, COLLEGE PARK, MD., U.S. DEPARTMENT OF THE INTERIOR

Dr. PARISER. Thank you, Mr. Chairman.

Mr. Chairman, members of the committee, ladies and gentlemen, Director McKernan has very ably introduced the Department's views on the Senate bill and has given you some background on the fisheries resources around our coast in a general way. He has also described to some extent why we are doing the work in College Park that we are doing at the moment. My remarks, which I will keep quite brief, will deal largely with a report of the recent accomplishments on this program and on the present and future needs for continuing our work.

Mr. Chairman, almost 20 months ago I had the honor to testify for the first time before this committee in connection with the work on marine protein concentrate at the Bureau of Commercial Fisheries. At that time my colleagues and I were in the process of planning, within the regular MPC program, a number of small- and large-scale experiments to investigate the merits of diverse processing methods of manufacturing marine protein concentrates (MPC) from different species of fish.

At that time, also, you will recollect there was no indication that the Food and Drug Administration would approve an MPC manufactured from whole fish. This position constituted an obstacle for the development of the U.S. fishing and food processing industries insofar as it precluded, for sound psychological and political reasons, the shipment of MPC to overseas countries, and prevented the sale of MPC in interstate commerce in the United States.

A great deal of progress has been made during the last 20 months. Work on a laboratory and model-scale unit level has proceeded satisfactorily. Such encouraging results were achieved that it became possible in the spring of 1965 to attempt to translate knowledge gained in our experimental work into terms of concrete and practical applications.

About 15 months ago Secretary Udall, who has had a continuing interest in this program, decided that we should temporarily freeze work on the broad approach to MPC processing methods and enter into a much accelerated program. The objectives of this program were:

First: To determine and standardize the conditions for the manufacture of marine protein concentrates by one method;

Second: To determine as fully as possible the major nutritional, toxicological, chemical, and bacteriological, and physical characteristics of the resulting product. We hoped that such data would prove to our satisfaction, to the satisfaction of the Food and Nutrition Board of the National Academy of Sciences, and to the satisfaction of the Food and Drug Administration, that MPC manufactured by a selected process was a nutritious, wholesome, and safe protein supplement suitable for incorporation into food products in this country and abroad;

Third: To sketch in general outline the processing economics, the requirements in processing equipment, and the possible cost of the finished product;

Fourth: To study the effects of incorporating the concentrate into various food products to gain an idea of the utility of the concentrate in various food forms;

Fifth: To convince the scientific community at home and abroad of the soundness and the urgency of the need to study the manufacture and use of MPC systematically and scientifically from all the angles and in the light of all the multidisciplinary aspects that have to be considered to insure full success of this development in the minimum of time; and

Sixth: To arouse, amongst other Government agencies and the U.S. fishing and food processing industries, interest for the potential of MPC as an almost immediately available weapon against hunger.

I would now like, with your permission, to relate the results of work that we have carried out during the last 20 months and to delineate what we conceive as being our immediate and future program needs.

The work that was carried out at the Bureau's College Park technological laboratory during the last 20 months encompasses two major phases: (1) An initial phase in which basic processing product parameters were defined; and (2) the accelerated program per se, a short account of which forms appendix 1 to this statement.

Initial phase: During this phase, various processing methods were examined to gather basic product and engineering data and to help delineate major problem areas in the production of marine protein concentrate. An Advisory Committee on Marine Protein Resource Development, established under the aegis of the Food and Nutrition Board of the National Academy of Sciences, and comprised of world-recognized authorities from various scientific disciplines, reviewed and gave help and advice during this initial and subsequent phases. The results achieved during this stage of our work showed that a simple solvent extraction of fish was feasible and promised to lead to the production of a fully satisfactory marine protein concentrate.

Accelerated program: As we have mentioned before, we were requested, about 15 months ago, to engage in an accelerated program.

1. Objectives: The program had the following objectives: Selection of an MPC manufacturing process that we considered to have the greatest and earliest chance of being fully satisfactory and of leading to the production of a satisfactory MPC; collection of the necessary processing data to establish the conditions under which the process would be industrially feasible and economical; collection of

product data necessary to show that the product manufactured by the selected process was wholesome, safe, and nutritious; collection of sufficient data on process and product to satisfy the requirements of the Food and Drug Administration and the National Academy of Sciences and to stimulate interest in the scientific and industrial community.

2. Selection of raw material and process conditions: The decision to engage in an accelerated, short-term program with the precise and prime objective of providing conclusive evidence that a fully satisfactory marine protein concentrate could be manufactured by a specific process made it necessary to narrow sharply, although hopefully only temporarily, the breadth of the program's attack on the overall problem of marine protein concentrate production. It became immediately clear that in order to reach the objectives of the accelerated program the raw material to be used and the processing conditions to be followed had to be kept as simple as possible and be rigidly and realistically defined.

Choice of raw material: In view of the above considerations a raw material of maximum uniform composition and characteristics had to be chosen.

Since fish are known to have widely different habitats, proximate compositions and overall characteristics, and since time to investigate these differences was not available, choice of raw material had to be restricted to one type.

Since only one processing method could be defined and tested in the allotted time and since a single set of processing conditions could not be expected to be equally effective for raw materials of widely different compositions, only one type of raw material could be considered.

Since, finally, a raw material had to be selected that would be easily available in homogeneous catches over long periods of the year, and the selected type of fish had preferably to be a type that was presently underutilized or unutilized by the commercial fisheries and yet be well-known as an edible fish, the hake and hake-like species were selected as satisfying the above conditions.

Choice of processing method: The process that was chosen is based on technology developed by ourselves and others. It consists essentially of a simple isopropyl alcohol extraction which is described in appendix 1 of this report. The method is safe, simple, and economical and largely safeguards the nutritive qualities of the raw material.

Food standard and sanitary precautions: Only fish of food grade quality was to be utilized.

In order, furthermore, to insure bacteriological safety it was considered to be absolutely essential to observe all those precautions normally required in food processing installations. Consequently, processing equipment had to be constructed exclusively of stainless steel, glass, and Teflon.

Testing of MPC: As far as the testing of the finished product was concerned, a large number of examinations were planned to ascertain that the marine protein concentrate produced by the selected method was stable, wholesome, nutritious, and, in every respect, fit for human consumption. The tests that were carried out on the final marine protein concentrate are described in detail in appendix 1.

3. Production and testing of prototype MPC: Several thousand pounds of hake were processed by the selected method; the procedure

was carefully controlled and monitored and yields, processing conditions, et cetera, recorded. The product obtained was submitted to the tests that were referred to above.

4. Collection and evaluation of processing data: On the basis of the process and product data obtained during these production runs, calculations were made to determine, at least approximately, the requirements in capital, power, labor, equipment, et cetera, of an industrial marine protein concentrate production unit. The cost of marine protein concentrate produced in the smallest, economically feasible unit was also calculated by an independent engineering firm.

The above observations, data, test results, and engineering calculations were incorporated into a report which was handed over to the National Academy of Sciences and the Food and Drug Administration.

5. Results: In summary, the major results of the accelerated program can be formulated as follows:

(*a*) The selected process for manufacturing marine protein concentrate can be expected to give reproducible results. Utilizing hake, a finished product yield of 15 percent by weight of the raw material can be conservatively expected.

(*b*) The process, as tested, is simple to operate and requires only standard sanitary equipment.

(*c*) The process is operative, although improvements can be suggested and will, in time, be incorporated.

(*d*) The product resulting from the process is satisfactory from the point of view of its composition, organoleptic characteristics, nutritive value, bacteriological safety, wholesomeness, and chemical composition. It lends itself to incorporation into different foods.

(*e*) The process lends itself to be scaled up to an industrial size; it is anticipated that a plant capable of handling 50 tons of raw fish per day would be the smallest size for economical operation.

(*f*) The cost for the construction of such an industrial unit was estimated to be in the vicinity of $1 million.

The CHAIRMAN. You have in your statement that your best guess now is that a plant capable of handling 50 tons per day would be the smallest size for economical operation?

Dr. PARISER. Yes, sir.

The CHAIRMAN. And the cost of construction of such industrial unit would be $1 million?

Dr. PARISER. That's right.

The CHAIRMAN. And then you have the processing costs per pound?

Dr. PARISER. Yes. The cost for the production of FPC, excluding the cost of the raw material, is about 7 cents per pound. You will see the difference of 100 percent protein weight between the protein in the MPC and in other products. For instance, if you want to calculate the cost of 10 grams of milk protein required for a child, you come to 3 cents for these 10 grams, whereas our product, the protein from fish processed in this way, costs about 7 cents. If you take skim milk solids, the cost would be 1 cent for these 10 grams. For round steak, the same amount, 10 grams of protein would cost about 13.6 cents against 7.

The CHAIRMAN. How much, 14.6?

Dr. PARISER. 13.6, almost 14 cents, against 0.7 cent for the MPC. We collected all this information in a very large volume, handed this

to the National Academy of Sciences. The summary of this report is an appendix to this testimony.

The CHAIRMAN. Is that a reproduction of your processing plant?

Dr. PARISER. Yes, that is the model of the little plant, the flexible experimental plant that we have in Beltsville, Md. It was there that we produced the samples that were submitted to various independent analysts and universities. But this model unit processes only about a hundred pounds a day. If you work 24 hours it could produce a hundred pounds a day from about 600 pounds of raw fish. This is not enough for us to make the necessary tests. We need much larger quantities. This is what the National Academy of Sciences had in mind in their resolution.

The CHAIRMAN. Didn't they say that we ought to go ahead and do something about a larger production? But I would think, knowing the Academy like you and I do, when they said that they probably had put their approval on what we have done, wouldn't that be correct?

Dr. PARISER. Oh, yes; they have approved.

The CHAIRMAN. But they put some "if" on the future.

Dr. PARISER. They have recommended we produce about 3,000 tons for various purposes during the next 2 years. Of course a great deal of engineering and processing investigation will have to be carried out.

(*g*) The processing cost for the production of 1 pound of marine protein concentration from hake was estimated to be in the vicinity of 7 cents. This figure does not include cost of the raw material and profit or marketing expenses, and assumes an operation of the 50-ton-per-day raw material level.

6. Action by the National Academy of Sciences: As we have mentioned above, the Bureau's report, of which appendix 1 to this statement is a summary, was submitted to the Academy's Committee on Marine Protein Resource Development and the contents of the report were discussed in detail with the members of the committee. After several recommendations and changes were made, the committee issued a statement, attached to this report as appendix 2, endorsing the work of the Bureau and suitability of process and product, as described in the report.

The Committee on Marine Protein Resource Development then forwarded the report and its recommendation to the parent organization, the Food and Nutrition Board, which, in turn, endorsed the subcommittee's resolution. Finally, Dr. Frederick Seitz, President of the National Academy of Sciences, wrote a letter to Secretary Stewart L. Udall, informing him of the steps that had been taken by the various committees under Dr. Seitz' jurisdiction.

7. Action by the Food and Drug Administration: The reports of product runs and product tests mentioned above were conveyed to the Food and Drug Administration.

Present and future program needs: From the information and findings presented in the previous sections it can be concluded that a satisfactory marine protein concentrate can be manufactured at a reasonable cost by the process described above and with the species of fish selected for these tests. Investigations, however, in the model-scale unit in which the extraction process was developed permited only the solution of a limited range of problems.

To demonstrate that the selected processing conditions are economical in a large-scale industrial operation, to obtain a realistic appreciation of the characteristics of MPC produced, packed, and stored under industrial conditions, to establish, furthermore, the all-important market and consumer acceptability of MPC, it became imperative that much greater quantities of MPC, produced in a large demonstration or experimental pilot plant, be made available as soon as possible. The realization of this urgent need is also reflected in the recommendation of the Committee on Marine Protein Resource Development of NAS: "The Committee recommends that the U.S. Government, through the appropriate agency or agencies, fund and arrange for the production of FPC suitable for human consumption to the extent that 3,000 tons of such product would have been made available for large-scale nutritional projects within 2 years." The installation of a plant capable of producing the necessary quantities of MPC and the initiation of large-scale storage, feeding, and feasibility studies represent, therefore, our most important present program needs.

In the following paragraphs we will discuss briefly some of the considerations that must be given to the design, construction, operation, and control of such a demonstration plant. We will also discuss what is needed to insure that the product, once manufactured, reaches the consumer in an acceptable form and at a price that he can afford to pay. We will then discuss future program needs that will have to be met as soon as these immediate goals have been reached.

Present program needs: These include two categories: one, dealing with the necessity to design, construct, and operate a demonstration plant as well as the necessity to carry out further engineering and processing investigations, and, two, the requirements for immediate initiation of a comprehensive food research program to determine the properties of the MPC.

ENGINEERING AND PROCESSING INVESTIGATIONS

Plant design and construction: The first and most immediate job that we have to face is the coordination, design, and construction of an MPC demonstration plant. Many studies will have to be conducted with this end in view; for instance, the relationship of plant site to sources of raw material and of transportation. Other studies will be made to determine the availability of skilled and semiskilled labor in the region where the plant is to be constructed, and investigations as to the availability at the plant of fresh water, power, and steam. Yet others will deal with the transportation and storage of solvent.

As to the design of the plant itself, a large number of investigations must be carried out, such as, for instance, the determination of optimum layout, choice of equipment, piping, et cetera. Precautions to insure optimum sanitary conditions on board the fishing vessels, in and around the plant, et cetera, must also be defined.

Specific engineering problems: A number of areas concerning specific processing phases of the MPC manufacture still need investigation and clarification. For instance, the most economical methods of solvent recovery and solvent deodorization have to be determined. The most economical methods of desolventizing the finished product must be developed. A series of problems concerning the recovery and

utilization of the byproduct oil must be given attention in order to make the fullest use of this potentially valuable component.

Storage of the raw material is a further area of process research that should immediately be tackled since a number of new unexamined possibilities offer themselves here that promise to lower the MPC production costs considerably.

Quality control: Quality control devices are required in order to monitor the process and guarantee uniform production output. Novel methods for controlling the purity of the reclaimed solvent and for the determination of solvent content in the extracted material must be devised and engineered.

Analytical control devices presently used on a laboratory scale to determine the composition of the finished product must be automated wherever possible in order to speed up the process of determining the characteristics of the finished product.

Biological MPC processing methods: As we mentioned in the hearings before this committee in 1964, chemical manufacturing processes represent only one possible approach to the production of MPC. Another class of processing procedures that have considerable promise of success, and that would yield products quite different in character to those produced by extraction, are the biological processing procedures. These utilize micro-organisms and enzymes to change the proteins in the raw fish into water-soluble forms, thus rendering them susceptible of separation from the nonproteinaceous components of the fish by conventional means such as centrifugation. A vast array of products with infinitely varied organoleptic characteristics are the end products from such biological procedures, and a study of these methods should be initiated without delay in order to offer to industry at least a glimpse of the attractive and versatile products that could be produced.

Food research: As we pointed out before, the problem of introducing a new food product into the diets of different population groups in an acceptable form and at a reasonable price, presents a problem at least as sophisticated and complex as the development of a satisfactory process and a product.

Before the full benefits of MPC can be realized by the American food industry and, in the cause of freedom, by the underfed world, a considerable body of knowledge regarding product properties in different foods must be established. This information can most effectively be provided by those who have developed MPC processing technology and thus permit industry to initiate product investigation and development.

Initially, a continuing program of basic food research and product compatability evaluation should be established to study the food technology properties and marketing requirements of MPC. Large quantities of MPC, produced in the demonstration plant, and kept under different storage conditions must be studied to evaluate the effects thereof on the product.

An equally vital function of this food research group would be the development of marine protein concentrate utilization.

Large-scale and closely controlled feeding tests must be made to establish confidence in, and to demonstrate efficacy of, the product as

a dietary supplement. The immediate objective of the program conducted by this group would, therefore, be to provide basic information on MPC and products supplemented with it, primarily to generate guidelines for the American food industry as to the suitability and potentialities of MPC, and to conduct, in cooperation with the NAS, feasibility studies on a reasonably large scale.

The program, as envisaged, would consist of several integrated activities:

Collection of information on product needs: The American food industry and various U.S. agencies (AID, food for peace, Department of Agriclture, poverty program), private groups (hospitals and institutions), U.N. agencies (FAO, UNICEF, WHO), and others have accumulated considerable information on consumer product needs and requirements, as well as on the cost and necessary protein supplement characteristics. As an essential part of the proposed program, we must use the data that have been collected and the product requirements that have been defined to insure maximum effectiveness of MPC as a supplement.

Compilation of nutritional data on MPC and products containing MPC: Animal feeding tests must be regularly conducted to insure that the MPC meets the standards of nutritional excellence which can and should be attained. Basic information is also needed on the availability of essential amino acids in MPC. The different levels of MPC supplementation of various food products which are necessary to improve the latter groups nutritive qualities must be determined. Finally, MPC feeding trials with undernourished infants as well as with adults are essential.

Development of new products containing MPC: In a general way we have to show how MPC can effectively and efficiently be incorporated into various existing and new food products. For instance, noodles are presently being formulated, in which MPC and other food ingredients, indigenous to Indonesia, are combined. This work is being conducted under a cooperative agreement with the University of Maryland to demonstrate the feasibility of significantly enriching a common, inexpensive Indonesian food products. Other foods, such as drinks, gravies, pasta products, and the like, need to be developed for world feeding programs. Foods primarily intended for the infant and preschool child are particularly in demand.

Work of this kind is necessary to stimulate and to assist both private and government groups in the application of good nutritional practices utilizing MPC as a protein supplement to domestic and foreign food needs.

Determination of product adaptability, capability, and flexibility: Considerable food technological research is needed to determine how MPC can be adapted to present product needs in the United States and around the world. Considerable research is needed as well to determine the adaptability of the product to various food forms. The product must also be studied to determine the possibilities for its use in other food forms, such as a gel, a foam, a spun product, et cetera.

Cooperative programs: The U.S. food industry, AID, Department of Agriculture, UNICEF, FAO, and others have expressed keen interest in having us cooperate with them in various feeding and nutritional programs now underway or envisaged. For instance, consider-

able interest has been shown in the use of MPC in various products that might be used in India and Thailand.

To insure maximum utilization of food supplements produced under our continuing program of work on MPC concomitant food research and product development work must be continued. Without the catalytic effects of the program proposed the pathway of MPC to the cosumer may be delayed many, many years. In view of the protein malnutrition, so commonplace around the world, we cannot afford any delays.

Future program needs: After the first phase of the MPC program has been completed, that is, after a demonstration plant has been designed and built and MPC from hake produced by isopropanol extraction is coming off the production line, after, in fact, the cornerstone of this new industry has been firmly laid, efforts must be made to extend rapidly the scope of this infant industry.

A great deal more information of a basic nature must be gathered and new problems of engineering, processing, and food research faced and solved.

These will concern the application of knowledge gained in the endeavors conducted hitherto to the processing of different species of fish, such as menhaden, herring, anchovies, sardines, Alaska pollock, et cetera. The indications to date are encouraging in that the approach selected for the processing of hake and hakelike fishes will also be appplicable, with certain changes, to the processing of more oily species. However, it is likely that specific engineering and food research investigations will be needed to determine the best ways in which to process fatty fish and the resulting products and byproducts be utilized. Individual studies in the fields of chemical, biological, and physical processing methods utilizing new raw materials will be necessary to derive maximum benefit. Again, the recovery of byproducts from processing these species will have to be studied.

We anticipate, furthermore, that for the chemical extraction method the use of isopropanol will by no means represent the only feasible approach to the production of MPC. We expect that other solvents, and combinations of solvent, may be devised and prove not only to be as effective, economical, and safe as the presently used solvent, but may also produce other advantages that we still are ignorant of today. Studies will have to be made to investigate and compare the use of different processing methods to produce MPC. Some of these studies could be conducted in our model-scale unit which was designed specifically for this purpose and which is sufficiently flexible to permit the investigation of many different processing variables.

Food research investigations in support of the feasibility studies in different communities will continue to be of the utmost significance.

In summary, Mr. Chairman, we have an opportunity to create a new industry. In time, this industry may well develop into a complex of enterprises varied and profitable. They may also provide the opportunity we need to regain our position as an important fishing nation on the world scene.

Two important benefits come immediately to mind. We can provide impetus for our domestic fishing industry to increase its contribution to our economy. We can provide a food supplement that is low cost, versatile, and needed in meeting the problems of malnutrition in many parts of the world.

The CHAIRMAN. Thank you, Doctor, and we will put your full statement in the record and appendix 1, the research, and that includes a great deal of the costs, doesn't it, that we will have ready for this record?

Dr. PARISER. Yes.

The CHAIRMAN. And then the National Academy of Sciences recommendation, which will be placed in the record immediately following your full statement.

(The material follows:)

NATIONAL ACADEMY OF SCIENCES,
Washington, D.C., December 1, 1965.

Hon. STEWART L. UDALL,
Secretary of the Interior,
Washington, D.C.

MY DEAR MR. SECRETARY: On behalf of the Advisory Committee on Marine Protein Resource Development, operating under our Food and Nutrition Board, I am pleased to transmit two statements concerning fish protein concentrate resulting from the research program of the Bureau of Commercial Fisheries.

The first statement gives the Committee's judgment that fish protein concentrate, from whole hake, as prepared by the Bureau of Commercial Fisheries pocess is safe, nutritious ,wholesome and fit for human consumption. The second statement urges the erection of a suitable pilot plant to provide a source of fish protein concentrate for nutritional projects and studies in developing as well as to obtain needed additional plant operation data. Both statements have the endorsement of the Food and Nutrition Board.

You will note that the Committee recommends continuation of the research at the Bureau of Commercial Fisheries because of the wide range of fish protein concentrates that can be developed which can be used to good effect in meeting the grave problem of protein malnutrition.

We are pleased to have this opportunity to be of continuing service to the Department of the Interior.

Sincerely yours,

FREDERICK SEITZ, *President.*

A RESOLUTION RECOMMENDING CONSTRUCTION OF A SUITABLE PILOT PLANT FOR FISH PROTEIN CONCENTRATE

The Committee recommends that the United States Government, through the appropriate agency or agencies, fund and arrange for the production of a fish protein concentrate suitable for human consumption to the extent that 3,000 tons of such product will have been made available for large scale nutritional projects addressed to human protein malnutrition within two years from this date, or as soon thereafter as possible. The Committee believes that this can be done most effectively by the construction and operation of an experimental pilot plant scale installation, based on the Bureau of Commericial Fisheries process, which can produce about 10 tons of product a day from whole hake. The plant and the production should be under the operational control of the Bureau of Commercial Fisheries, Department of the Interior. This size of plant is also required for further experimentation on the technology of the process so that scale up to an industrial scale by private industry can be more readily accomplished.

Adopted: *October 14, 1965.*

A STATEMENT CONCERNING THE COMMERCIAL PRODUCTION OF A WHOLESOME PROTEIN CONCENTRATE MADE FROM WHOLE FISH FOR HUMAN CONSUMPTION

Since 1963 the Committee, through meetings, through its Executive Secretary, and in discussions with the research workers, has kept a close surveillance on the research program of the Technology Laboratory of the Bureau of Commercial Fisheries at College Park, Maryland. This research is concerned with the development of a fish protein concentrate suitable for human consumption, made from whole fish, which is wholesome, nutritious and capable of commercial production at costs low enough to be of practical value in the mitigation of human protein malnutrition problems.

The Committee has re-examined the Report of the Temporary Committee on Questions Submitted by the Secretary of the Interior concerning Fish Protein Concentrate, dated October 29, 1962, of which a copy is attached hereto. The Committee is of the opinion that the judgments made in that report have now been affirmed.

It became apparent during 1964 that a process using whole red hake gave promise for a suitable fish protein concentrate. The process involved the extraction of water, oil and other unwanted solubles in the fish by the use of isopropanol. On the advice of the Committee, the Bureau of Commercial Fisheries concentrated its work on the necessary process development and testing of this product. A report on the results of this work were reviewed in detail by the Committee at its meeting on September 16, 17, 1965. On the basis of this report, the Committee believes that the fish protein concentrate developed by the Bureau of Commercial Fisheries is wholesome, highly nutritious, stable, safe and capable of economic production and marketing.

Red hake together with silver hake (*Merluccius billinearis*), are abundant on the continental shelf off the Northeast United States and Canada and can be harvested at relatively low cost. A near relative (*Merluccius productus*) occurs in large volumes off the West Coast of the United States, Mexico and Canada. These fish have been used for human food for a long period of time. However, they do not enjoy a sufficiently broad market to utilize the resource fully since their delicate flesh does not stand up well under marketing procedures because of excessive drip (loss of tissue moisture).

The Bureau of Commercial Fisheries process involves the solvent extraction of this fish using isopropanol in a sanitary food plant. The resulting concentrate of the solid parts of the fish retains most of the nutritious material originally in the fish except for the oils and other soluble residues. The product contains a minimum of 80% protein, as well as minerals useful in human nutrition. It is, as manufactured, a dry powder without any distinctive fish odor or taste. It is highly stable and can be stored and shipped economically.

Microbiological tests showed that the processing of the fish further reduced the original low microbial content of the raw material and resulted in a product with exceptionally low total bacterial count.

In this process the oil content of the fish is reduced to a level of 0.2% in the finished product. This level results in a satisfactory, wholesome and stable product. There is also reason to believe that a product with a somewhat higher residual oil content might be equally satisfactory and be cheaper to produce. Further research aimed at elucidating this upper level of satisfactory residual oil content is in progress.

The product obtained by this process, when biologically tested, yielded an average protein efficiency ratio of 3.44 compared to 3.2 for the average casein controls. The difference is statistically significant.

Toxicological tests of a very stringent nature carried out thus far have yielded no evidence that the product is otherwise than wholesome.

The product blends well with other forms of food. The Committee has tested it as an ingredient in beverages, noodles, gravy, bread and cookies. In percentages high enough to be of nutritional significance, the product is scarcely detectable, and in most forms not at all.

The calculated costs of the product in the pilot plant, extrapolated to commercial sized installations, indicate that manufacturing costs will enable the product to be used as an additive to other foods cheaply enough to reach the population of developing countries. The ability of the process to use whole edible fish ensures cheap raw material costs and quantities of raw material adequate for making a major impact on human protein malnutrition problems.

The Committee does not imply by this report that other equally satisfactory and wholesale fish protein concentrates cannot be made from other kinds of whole edible fish by other suitable processes. The work at the Bureau of Commercial Fisheries, Technology Laboratory, and the Committee's work, is continuing and should continue for some years to come because of the possibility of developing a large range of fish protein products that can be used in a wide variety of dietary situations in the World to much good effect.

In the judgement of the Committee, Fish Protein Concentrate, as produced by the BCF process is not in any way filthy or otherwise unfit for human consumption. On the contrary, after reviewing in detail the Bureau of Commercial Fisheries report on the hake project and questioning the BCF research per-

sonnel on further details, the Committee has concluded that the fish protein concentrate made by the BCF process is a product that is wholesome and safe for human consumption, is highly nutritious, blends well as an additive to many types of food normally used, can be produced at a reasonably low cost and, in the view of the Committee, is suitable at present for commercial production, distribution and use in human nutrition.

Adopted: *October 14, 1965.*

REPORT OF TEMPORARY COMMITTEE ON QUESTIONS SUBMITTED BY SECRETARY OF INTERIOR CONCERNING FISH PROTEIN CONCENTRATES

The membership of the temporary committee selected by the Division of Biology and Agriculture and the Food and Nutrition Board was:

W. H. Sebrell, Jr., M.D., Institute of Nutrition Sciences, Columbia University
James B. Allison, Ph. D., Bureau of Biological Research, Rutgers University
Grace A. Goldsmith, M.D., School of Medicine, Tulane University
Harold Humphrey, B.S., Consultant in Food Technology, UNICEF
H. S. Olcott, Ph. D., Institute of Marine Resources, University of Calif., Berkeley
M. B. Schaefer, Ph. D., Institute of Marine Resources, Scripps Institution of Oceanography, La Jolla
R. E. Shank, M.D., School of Medicine, Washington University

This committee met at the NAS–NRC Building on September 26, 1962, together with a delegation from the Bureau of Commercial Fisheries, including H. E. Crowther, John Holston, E. R. Pariser and D. E. Snyder. Howard Eckles was present from the Office of the Scientific Adviser, Department of Interior. Robert Lampman attended on behalf of the Consumer Panel of the Council of Economic Advisers. Ex-officio attendance from NAS included T. C. Byerly, F. L. Campbell, William Paddock, Howard Lewis, Paul Sharp and LeRoy Voris.

The reference questions presented to the committee per letter from Secretary Udall to Dr. Bronk, dated May 31, 1962, were: (1) whether or not such a committee believes that a wholesome, safe and nutritious product can be made from whole fish; (2) whether or not such a product now exists which is suitable for human consumption; and (3) whether or not there is a demonstrable need, either nutritionally or economically, for an inexpensive animal-protein food supplement among the people comprising the lower income groups of the United States.

Secretary Udall requested further that the committee "study all aspects of the problem and make a report." In Dr. Bronk's response to Secretary Udall, dated June 26, 1962, he indicated that the committee would give careful consideration to steps necessary for further course of action.

The three questions posed by Secretary Udall were discussed separately by the assembled group after the delegation from the BCF had presented background information and had responded to questions from the committee as to the present status of research and development of fish protein concentrates. The position of the Food and Drug Administration was noted that fish protein concentrates made from whole fish would be considered adulterated and the actions ensuing from this position were reviewed.

After this discussion the guests were excused and the committee deliberated the questions separately and recorded general considerations as reported below:

(1) Can a wholesome, safe, nutritious product be made from whole fish?

The committee concluded that a wholesome, safe and nutritious product can be made from whole fish. The committee accepted the definition of "a wholesome product" to be a product which is healthful and promotes physical well-being. Products are currently available, produced in the laboratory or in pilot-plants, which have been shown to be safe and nutritious in animal feeding studies. In these studies the nutritional value of fish protein concentrates has been shown to be equivalent to or better than casein. Information is also available that such concentrates have been utilized in human population studies and found to be acceptable.

Properly processed, all portions of the fish can contribute to the nutritional value of a product. A number of fish foods are consumed in the United States which include the whole fish. These are not generally considered to be unwholesome. Fish protein concentrate would seem to be similar and perhaps is more likely to be wholesome because of the techniques of processing. The committee recognizes the necessity of maintaining high standards in the preparation of

food under sanitary conditions and avoiding adulteration or contamination with undue amounts of waste products or extraneous materials. The committee recognizes the principle that suitable levels of tolerance for undesirable contaminants must be developed and prescribed by regulation, as is now done by the Food and Drug Administration for many food products contaminated by pesticides, insect residues, etc. Available exidence indicates that intestinal contents of fish in fish protein concentrates can be bacteriologically and biochemically safe. In view of evident differences in the character of intestinal contents of fish and land animals, the committee regards this as an important area for research.

It is recognized that there are a few species of fish which contain toxic materials and some are not safe at certain times. Further research is needed on this problem. Although these fish are unlikely to be used in fish protein concentrates, such use should be prohibited.

Suitable fish should be selected and bacteriologic, biochemical, physical and toxicologic standards should be developed to assure the production of safe, nutritious and wholesome products. There should be freedom for research and development of such products as powders, granules, liquids or whatever physical forms might prove desirable.

(2) Does a product now exist which is suitable for human consumption?

Several fish protein concentrates have been prepared experimentally which are suitable for human consumption. In addition, products prepared from pilot-plant and small scale commercial plants have been shown to be equally suitable. However, no large scale commercially successful plant is now in operation. Observed difficulties have been in the reproducibility of the quality of the product. Variability in raw material may be expected and minimum standards should be established to control the protein quality and quantity as well as bacteriologic, toxicologic, biochemical and physical quality. Problems of quality control and operational costs have to be resolved. The problem of solvent residues from ethylene dichloride or petroleum fractions was considered not to be of concern but the use of other chlorinated solvents may be of concern.

(3) Is there a demonstrable need, either nutritionally or economically, for an inexpensive animal-protein food supplement among people . . . in the United States?

It is the opinion of the committee that no nutritional need for an animal-protein food supplement has been demonstrated in the United States. However, there is the probability that an inexpensive product of this type might be of value from an economic standpoint. The availability of such supplements would be of great value in meeting food problems presented in times of emergency or by expanding world population. The lack of demonstrable and existing evidence of present need should not interfere with development of new food products.

General considerations

Until a suitable and acceptable fish protein concentrate product can be made available commercially, the committee is of the opinion that there should be no consideration of a definition and standard of identity under the Food, Drug, and Cosmetic Act and that the postponement of public hearings in the matter should be continued indefinitely. Unduly restrictive regulations and judgments as to the wholesomeness, safety and nutritive value should not be made during the period of research on and development of new and possibly valuable food products, such as fish protein concentrates. Such actions constitute a serious handicap tending to discourage research and development initiative.

The committee recommends that government agencies as well as private industries be encouraged to pursue basic and developmental research with the assurance that new wholesome, safe and nutritious food products resulting therefrom will be made available to consumers without prejudice.

The United States is blessed with an abundance of food and, through research, has attained pre-eminence in food production and technology. In order to maintain leadership, broadly based and continuing research, with the freedom essential thereto, is an absolute necessity. Although there may be no demonstrable nutritional or economic need at the persent time by the people of the United States for a fish protein concentrate, the committee re-emphasizes its opinion that the public should not be denied the availability of safe and nutritious new products, and American industry should not be deterred from the research necessary to making such products available. The production of good foods economically should be encouraged by all means, and especially the

development of procedures for the most complete and effective use of protein resources should be commended.

The committee recommends that the Food and Nutrition Board promptly establish the scientific group to advise the Bureau of Commercial Fisheries on their research program on fish protein concentrates as well as other new and nutritionally valuable marine food products, as requested by letter dated May 1, 1962 from Frank P. Briggs, Assistant Secretary of Interior to Dr. Bronk.

MARINE PROTEIN CONCENTRATE

A Summary Report on the Development of a Proposed Commercial Manufacturing Process and on the Properties of a Test Sample

By Bureau of Commercial Fisheries Technological Laboratory, College Park, Md.

FOREWORD

Laboratory and small-scale production studies by Bureau of Commercial Fisheries scientists have demonstrated that a highly nutritious protein concentrate suitable for human consumption can be prepared from fish.

The development of a commercially feasible method for manufacturing such a product has two-fold significance: (1) Marine Protein Concentrate (MPC) can be a powerful weapon in the war on world-wide malnutrition, and (2) large-scale manufacture of the protein concentrate in the U.S. would mean important economic benefits to the domestic fishing industry from the fisherman through the processor. It has been estimated that billions of pounds of fish suitable for use as a concentrated protein product can be harvested annually off the coasts of the United States.

The research summarized in this report was conducted in response to a directive by Secretary of the Interior Stewart L. Udall that the Bureau develop, as rapidly as possible, a commercially feasible method for making a marine protein concentrate that would be nutritious, healthful, wholesome, and inexpensive. This report is based upon Bureau research as well as upon work carried out by other scientists in this country and abroad.

While the results detailed in this report indicate a significant achievement in the technology of manufacturing a protein concentrate from whole fish, it should not be assumed that research in this field is complete. More work needs to be done on species of schooling fish other than the hake used in the initial experiments and other manufacturing processes besides the chemical method require research and refinement. However, the major obstacles have been surmounted and those problems that lie ahead appear amenable to solution.

Donald L. McKernan, *Director.*

ABSTRACT

General information is given on a method to convert red hake into a high-quality marine protein concentrate for human consumption. Plans, as well as estimates of processing and product costs, are shown for a proposed commercial process. Data are presented on the physical, chemical, nutritional, bacteriological, and toxicological studies on marine protein concentrate, produced by a method closely approximating the proposed commercial process.

INTRODUCTION

The world population picture changes rapidly with passing years. In most of the emerging countries during the past 2 decades there have been such significant advances in world health that populations of these countries have increased more rapidly than their economic development. The result is widespread malnutrition, particularly protein malnutrition, for roughly two-thirds of the world population. At the same time, pressures from the population explosion have greatly reduced the proportion of arable land available for crops and more especially for grazing animals that could provide vitally needed animal protein.

Man must, therefore, turn to other sources of animal protein available in enormous quantities and at low cost.

The sea surrounding every continent contains large underutilized or unutilized resources of fish. The present U.S. catch alone, now some 5 billion pounds, could

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be expanded three to five times. What is needed is to develop a method of using fish as a high-quality protein supplement to upgrade lesser qualitity vegetable proteins, which are today the world's principal source of this important nutrient. The nature of the product must be such that it can be stored, shipped, and marketed at normal temperatures throughout the world and yet retain the high nutritional value of the fresh fish. The product must also be inexpensive and be available in a form that can be readily introduced into a wide variety of traditional food products, to ensure that it will find its way into the diets of the peoples in developing countries.

MPC is a high-protein product that meets our requirements. The Bureau of Commercial Fisheries was, therefore, given the task of developing different processes to produce various marine protein concentrates that would meet these specifications. Because of the urgency of the need, Secretary Stewart L. Udall suggested that the research be accelerated to develop as rapidly as possible one simple, practical, and commercially feasible method for the preparation of a wholesome, nutritious, stable, and low-cost MPC.

This report summarizes some of the results of these accelerated MPC investigations at the Bureau of Commercial Fisheries Technological Laboratory, College Park, Md. The laboratory has developed one commercial MPC process and has assessed the properties of a test product, derived from whole fish of one species and prepared by a method that closely approximates the commercial process.

DEVELOPMENT OF A COMMERCIAL MPC PROCESS

On the basis of knowledge and practical experience available to Bureau scientists at the beginning of this accelerated program, we decided to "freeze" all exploratory research and to concentrate on the study of a single solvent extraction method. Isopropyl alcohol was chosen as a solvent because of its unique qualifications, such as usage in other food processing endeavors, low toxicity, low price, low boiling point, good efficiency in extracting water and lipids, and bactericidal properties.

Red hake was chosen as the raw material because (1) it is abundant off the U.S. coast; (2) it is largely unutilized as a food fish; (3) because we could carefully control the quality of the hake supplied to the laboratory; and (4) because this fish is available for a considerable period during the year.

To devise plans for a sound commercial processing method, we followed a logical sequence of development, starting with laboratory experiments and ending in small pilot plant experiments (model-scale unit studies). Because of favorable results in the preceding studies, both as to the process and the product, we were able to use the data to formulate general plans for an industrial-scale plant (50 tons of raw fish processed per 24 hours) and to estimate processing and product costs involved for this size plant during 250 days of operation per year. (This size plant and this number of working days are considered minimum for a commercial endeavor and maximum for a pilot endeavor.)

Our presentation of the plans and cost estimates for the proposed commercial process, however, is preceded by a general discussion of certain factors that need special emphasis because of the process and the raw material. These factors, we believe, are as important to assure the production of a high-quality MPC as are the suggested processing conditions. This section dealing with the proposed commercial process, therefore, is divided into three parts—general considerations, plans for large-scale production units, and processing costs.

General Considerations

The design of a plant for the manufacture of MPC by a solvent-extraction procedure must meet requirements for handling food materials and must provide safeguards against explosions. Superimposed upon the physical requirements and attendant to them is the necessity to define certain specifications for the raw material and the solvent to be used in the process. There are, as well, overall requirements for the sanitation that must be maintained at all stages of the operation.

Physical features of the plant

Among the factors important to an initial decision on the design and construction of a plant are the location and size of the plant and the building materials and requirements.

Location and size of plant.—The efficient and economic operation of a 50-ton-a-day plant (raw fish input) requires a supply of fish for a working schedule of

at least 250 days per year. If costs of the product are to be kept down and quality of the product is to remain high, the plant should be located as near as possible to a source of the desired species of fish. Land transportation from port of landing to plant adds greatly to raw material costs and may detract from fish quality. Preferably the source of fish should be close enough so that most of the fish can be landed the same day they are caught or at least within 24 to 36 hours. If this is impossible, satisfactory preservatives must be used to ensure that the processing plant will handle raw material of high-grade quality.

If emergencies, such as breakdowns, occur at the plant and make it necessary to store the raw fish for a longer time, the fish can be ground, mixed with isopropyl alcohol and held in tanks. By halting enzymatic or bacterial decomposition, the solvent effectively checks the spoilage of the fish. It would be equally satisfactory, if economic considerations warrant, to grind promptly the fresh catch on fishing vessels and hold the ground fish in tanks with recommended levels if isopropyl alcohol. This technique would maintain quality en-route to the processing plant.

Selecting the location and size of the plant requires very careful and deliberate consideration. Failures of several early efforts at MPC manufacture were due largely to lack of such planning and to failure to maintain high-quality in the raw fish supply.

Buildings and process equipment.—The basic principles that determine plant design are (1) MPC is a human food product; (2) an inflammable solvent is used in the process; and (3) to minimize contamination, the storage area for the finished, dry MPC must be isolated from the raw fish handling and processing sections. Regulations covering the first two aspects are well defined in various State codes and include such requirements as stainless steel or ceramic-lined processing vessels, pumps, tanks, and other equipment in contact with the product; fully sanitary (dairy-type) piping and valves of similarly corrosion-resistant material easily disassembled for cleaning; and explosion-proof motors, switches, controls, and other electrical equipment.

Details on requirements for flooring, ceiling, lighting, ventilation, plumbing, water, dust control, cleaning and sanitizing, packaging, and storage may be obtained from various local, municipal, and State codes and from the U.S. Public Health Service and Food and Drug Administration regulations relating to the handling of human food products.

Specifications for the solvent and fish

Solvent.—Suitable quality isopropyl alcohol is available commercially in drums or tank cars. It is synthetically prepared from propylene and is sold, with only traces of impurities, as the anhydrous alcohol or in the form of a constant-boiling mixture with water (91 volume percent isopropyl alcohol) containing 87.7 percent by weight of the alcohol. The specifications for commercial isopropyl alcohol are given in Table 1. Proper storage conditions are important to avoid formation of rust in the container and the contamination of the alcohol by water, dust, and dirt.

Raw material.—The hakes, species of the genera *Urophycis*, *Merluccius*, and *Theragra*, variously known as red hake, ling, squirrel hake, silver hake, walleye pollack (Alaska pollack), whiting, Pacific hake, white hake, southern hake, and merluzza (South American) are all soft-fleshed fish with a maximum storage life in ice of about 10 days. The flesh is white and normally low in fat content. In the usual commercial catch their size is quite variable, apparently even when taken from the same grounds at any given time. Small fish, 9 to 12 inches long and weighing less than a pound sometimes make up the bulk of the New England ground catch, but larger fish ranging up to 25 to 30 inches and 8 to 10 pounds are common.

Although only red hake (*Urophycis chuss*) were used in the research reported here, it is probable that all *Urophycis*, *Merluccius* and *Theragra* species are acceptable for the production of MPC by the solvent extraction method.

On the vessel, the fish should be stowed in ice below deck as promptly as is possible. Under no circumstances should a second trawl load be dumped on the deck until the catch of the previous haul has been stowed properly. The flesh of hake is so soft that a chute to the floor of the hold should be used to minimize bruising of the flesh. Icing should be adequate to chill the fish rapidly and to maintain them at 38° F. or less until they are landed. Use of finely crushed ice will avoid undue bruising of the flesh. Fish should be protected from bulkheads and the outer surfaces of the hull by a maintained layer of ice. The fish and ice should not be piled too deeply in the pens because these fish crush easily.

TABLE 1.—*Commercial specifications for 91 percent and anhydrous isopropyl alcohol* [1]

Type of isopropyl alcohol	Minimum concentration of alcohol	Specific gravities 20°/20° C.		Acidity	Maximum color	Maximum nonvolatile matter	Distillation		Residual odor	Water dilution transparency
		Minimum	Maximum				Minimum initial	Maximum dry point		
	(Percent by volume)	*(G. per ml.)*	*(G. per ml.)*	*(Weight percent of acetic acid)*	*(Hazen units)*	*(Mg. per 100 ml.)*	*(°C.)*	*(°C.)*		
91 percent	91.0	0.8175	0.8190	0.002	10	2	79.7	80.7	None	Clear at infinite dilution.
Anhydrous	99.0	.7876	.7876	.002	10	2	81.5	83.0	None	Clear at infinite dilution.

[1] Either of these commercially available forms of the solvent is considered acceptable for the process herein described. Economic and other considerations would determine choice.

When delivered, the fish should be examined routinely by an experienced inspector to provide satisfactory control of the quality of the raw material. The fish should meet the following general requirements: belly walls should be intact; gills should be still red—not discolored grey or brown; eyes should be normal, with bright color, and not be sunken and clouded; and the skin should be generally intact.

The fish should be unloaded in baskets or boxes or by an elevator conveyor in such a manner that the flesh will not be damaged by cutting, tearing, or crushing. Raw fish in the plant should be stored for as short a time as practical to ensure that the processing equipment operates at an efficient level (average 75 percent capacity during the period on stream). Unless some suitable method of holding the fish is available, as described earlier, vessel landings should not be scheduled so that the raw fish will have to be held at the plant for more than 48 hours—normally, the fish should start through the process within 12 hours after being landed at the plant.

Sanitation

Good food-plant sanitation practices must be followed in the manufacture of MPC to ensure a final product of good quality and one that is safe microbiologically. Sanitation practices should start on the deck of the fishing vessel and be continued through the plant until the finished product has been packaged.

On the vessel.—The film-like coating over the skin of fish often has large numbers of microorganisms, which may contaminate heavily not only the vessel hold but also the deck boards, hold surfaces, and items repeatedly used in handling the fish—such as shovels, wash tanks, baskets, boxes, and penboards. After the fish have been unloaded at the dock, the hold of the vessel and all other surfaces and utensils involved should be washed down thoroughly, preferably with a pressure gun and a detergent solution. After the organic detritus has been removed, a spray of a solution of sodium hypochlorite—300 parts per million of available chlorine—will give effective sterilization.

In the plant.—Many of the features of the building layout, equipment design, lighting, ventilation, and materials-handling process proposed for MPC manufacturing plants are common to any well-designed food processing plant because of their important role in maintaining good sanitation.

Even the best equipment and building construction concepts are of little value, however, unless vital cleaning operations are given continuous attention. In general, it is good practice to flush equipment with cold or preferably lukewarm water (38°–46° C.—100°–115° F.) to remove or loosen adhering particles of fish. Further operations include: (1) cleaning the equipment with a suitable solution at the proper temperature for optimum effect; (2) thoroughly brushing the hard-to-remove solids; (3) rinsing with hot water (82° C.–180° F.); and (4) final sanitizing.

Also important to the maintenance of good sanitation is control of rodent and insect pests. Proper screening and good building construction are effective only if screens are kept in good condition, doors are kept closed, and other safeguards against entrance of these pests are maintained. Insecticides and rodenticides, when needed and where permitted, should be handled with care, because most are toxic to humans and should never be used in such a manner that they might injure plant personnel or contaminate the product. These chemicals should be stored entirely separate from the storage areas holding the product or the packaging material. All such pesticide containers should be clearly and conspicuously labeled as a toxicity and as to proper methods of application.

In the final analysis, the worker is the most important barrier against product contamination, and perhaps more importantly he is responsible for maintaining good sanitation. Each worker should have a regular medical examination. He should be provided with clean protective outergarments and be required to maintain high standards of personal hygiene.

Packaging.—All precautions taken to prepare and package a sterile sanitary product are useful only if the package is effective under all conditions of handling, storage, and distribution. The packaging material itself must be clean and free from substances that might affect product odor, flavor, and appearance, or cause microbial contamination. According to the Federal Food, Drug, and Cosmetic Act, Sec. 402(2)(6), a "food would be deemed adulterated—if its container is composed, in whole or in part, of any poisonous or deleterious substance which may render the contents injurious to health." Other factors

important in a suitable packaging material for MPC are moisture-vapor permeability, gas permeability, heat sealability, stability to sunlight and ultraviolet light, and normal temperature effects. All these factors must be considered.

Plans for Commercial Production Units

Having considered general matters, associated with the commercial production of MPC, we must now turn our attention to matters specific to the construction of a plant capable of processing 50 tons of raw fish per day. The rationale for the selection of process and equipment is presented in this section, after which pertinent operating procedures are described. To illustrate the continuous sequence of the projected production procedure, we present an overall materials-handling schedule, which is followed by a general discussion section.

All of the discussions pertain to a plant with a capacity of 50 tons of raw material per day. Such items, however, as the following schematic flow diagram would remain essentially unchanged for plants with processing capacities either somewhat smaller or larger than that of the 50-ton plant. It would primarily be the dimensions or capacity of the equipment and the schedules of operation that would vary for plants of different capacities. All the equipment discussed is of conventional design and is believed to be readily available.

Selection of process and equipment

Process.—Based on the experimental results obtained to date in this program and on the enigineering analyses performed, a scheme or proposal for the large-scale manufacture of MPC is presented for the information of the public and for review of commercial concerns interested in MPC. The process uses red hake as the starting material and isopropyl alcohol as the solvent for the extraction of water and lipids. A schematic flow diagram is presented in Figure 1, which shows a manufacturing technique that can be described as a three-stage, countercurrent extraction of suitable quality fish by isopropyl alcohol.

Equipment.—In selecting the equipment, we took great care to ensure that every suggested piece of equipment is commercially available and suitable for the processing of a human food product such as is contemplated for MPC.

The equipment chosen for the production of MPC comprises the following major items.

1. Food grinder of the meat-grinder type, easily disassembled for cleaning and sterilizing.
2. Process tanks, including one covered stainless-steel mix tank with variable-speed agitator capable of thoroughly mixing the viscous ground fish-solvent slurry and two covered, jacketed, stainless-steel extraction tanks, each equipped with a variable-speed agitator.
3. Continuous horizontal centrifuge.
4. Conventional solvent recovery plant.
5. Rotating (double-cone) vacuum dryer.
6. Vacuum system with solvent deodorizing equipment.
7. Grinding equipment.
8. Slurry pumps.
9. Solvent-storage tanks.

Operating procedures for the production of MPC

Figure 1 shows an installation capable of processing 50 tons of raw fish per day. The proposed operating procedure for such a plant is based upon the essential operating and equipment features of the model-scale unit in which the simple and successful prototype process was worked out. Just as for the model-scale unit (capacity 600 pounds of raw fish per day), the operation of the larger plant is essentially a countercurrent batch solvent extraction. For the sake of simplicity, we decided to base operating and cost analysis of the projected industrial plant upon the use of the same type of chemical processing equipment used in the model-scale unit. This decision should not be taken, however, to infer that possibly more effective specialized pieces of equipment should not be designed and used, but rather that standard engineering equipment as suggested here is considered adequate, practical, and simple to install and operate.

Raw material pretreatment.—Fresh whole fish are stored in suitable facilities such as sanitary, lined concrete tanks; during storage time the fish are kept at temperatures close to 0° C. (32° F.). A storage capacity of 100 tons of fish

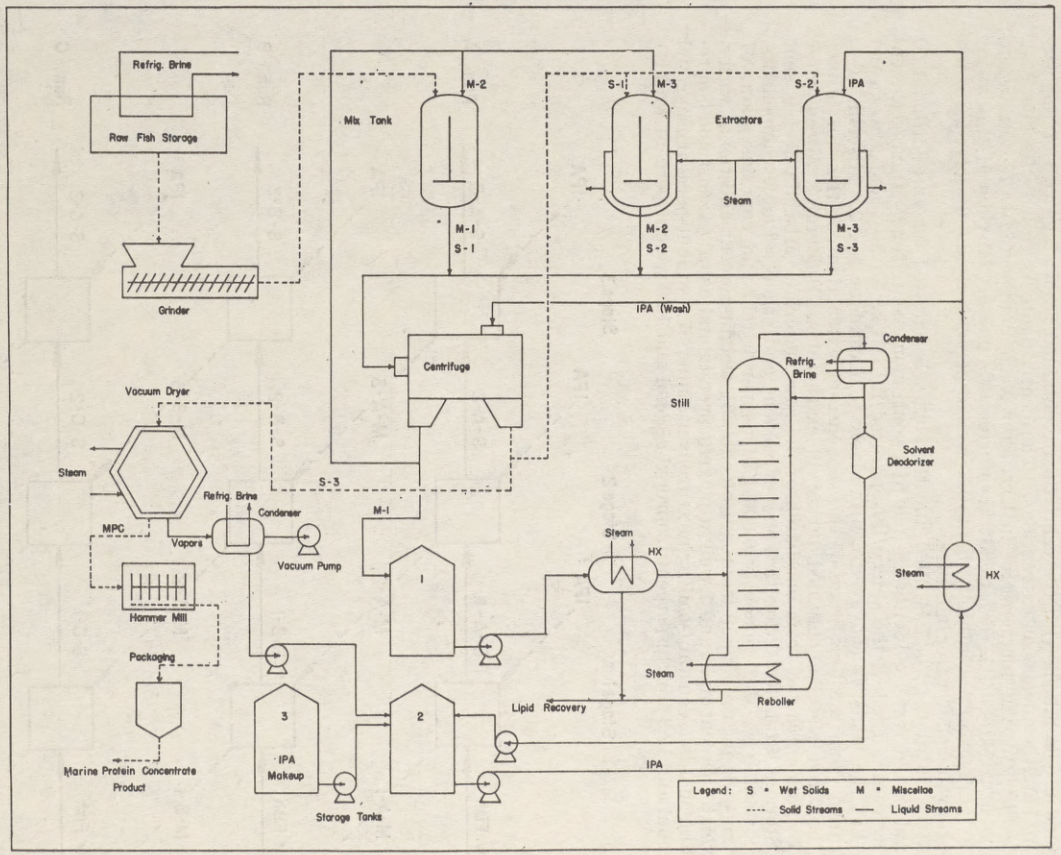

FIGURE 1.—Flow diagram for the manufacture of marine protein concentrate (3-stage countercurrent extraction).

(2-day processing inventory) should be adequate. The amount of refrigeration required is estimated to be equal to the amount of fish processed; that is, 50 tons of refrigeration per day.

The fish are transferred from storage, rinsed with fresh water, weighed, and fed to a grinder by means of a belt conveyor. The ground-up fish is then fed to the first extractor (No. 1) in quantities of 8⅓ tons per batch.

Extraction of water and lipids.—The first stage of the extraction process, the dehydration, takes place in Extractor No. 1, an unheated vessel in which the ground fish is mixed with the centrifugate obtained from stage two of the previous batch sequence of extractions. The centrifugate is called Miscella M–2 (see Fig. 2). The temperature in Extractor No. 1 is expected to be within the range of 20° to 30° C. (68° to 86° F.) during this phase. Miscella M–2 is about 4,250 gallons and contains about 0.5 weight-percent lipids dissolved in the isopropyl alcohol-water mixture.

After Extractor No. 1 is filled and the slurry is agitated for an additional 50 minutes, the vessel contents are fed to a continuous centrifuge. During the ensuing centrifugation, the slurry is separated into Miscella M–1 and a wet cake (S–1); the latter is conveyed continuously to Extractor No. 2. Miscella M–1, obtained from the first stage of the sequence of extractions, is the most dilute of the three miscellae obtained during the extractions. It contains all the water and lipids extracted from one batch of the raw material. Miscella M–1 is sent to Storage Tank No. 1 for recovery of solvent and other valuable components. The volume of M–1 is nearly 6,000 gallons per batch, and contains about 67 weight-percent azeotropic isopropyl alcohol, 31 weight-percent additional water, 1 weight-percent lipid and 1 weight-percent protein and ash. (Azeotropic isopropyl alcohol is a constant-boiling mixture containing 87.7 weight-percent isopropyl alcohol and 12.3 weight-percent isopropyl alcohol and 12.3 weight-percent water.)

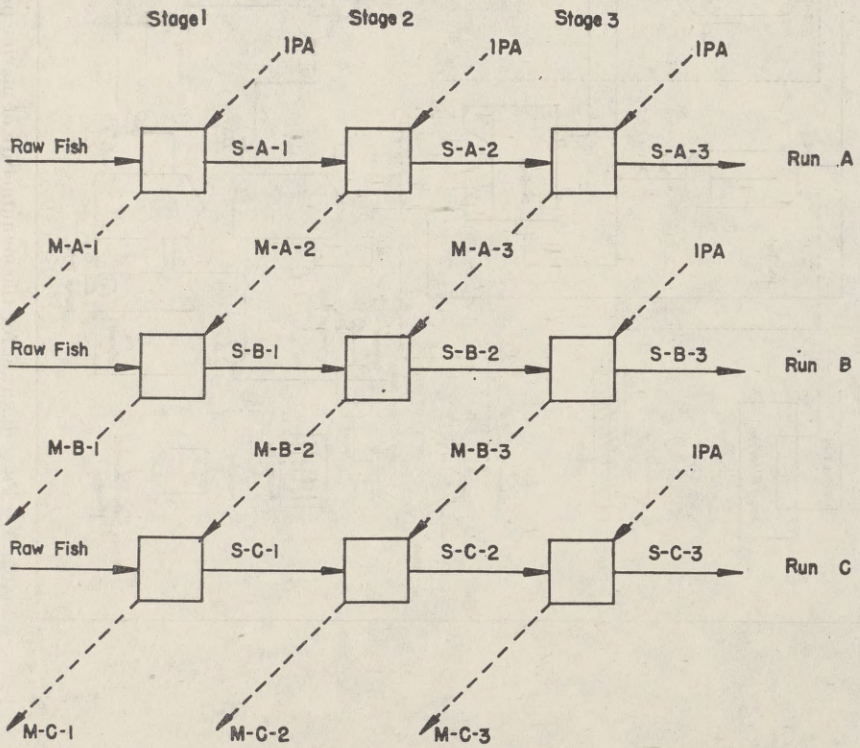

FIGURE 2.—Flow schematic for a series of 3-stage countercurrent extractions.

The second extraction stage takes place in the jacketed Extractor No. 2. The wet cake (S–1) from the first stage is added continuously with agitation to the extractor, which contains the centrifugate, or Miscella M–3, obtained from the third stage of the previous batch sequence of extractions. Extraction temperature during this stage is maintained at about 75° C. (167° F.). Analysis of the cake (S–1) entering the hot extraction stage shows it to be almost completely dehydrated but with a lipid content of about 5 weight-percent. During the 90-minute extraction, the average lipid content of the cake is reduced to about 1 weight-percent, calculated on a dry solids basis.

The contents of Extractor No. 2 are centrifuged, and the resultant wet cake (S–2) is conveyed continuously to Extractor No. 3, which contains 3,400 gallons of freshly distilled and purified hot isopropyl alcohol. Miscella M–2, obtained from the centrifugation of the second extraction stage is delivered to Extractor No. 1 for the next batch.

Extractor No. 3 is also a steam-jacketed vessel in which the third and final extraction step takes place at about 75° C. (167° F.). The wet cake (S–2) is added to the fresh isopropyl alcohol and extracted for about 70 minutes with agitation. During this stage, the lipid content in the solids is lowered to a level of about 0.3 weight-percent.

The contents of Extractor No. 3 are centrifuged and washed with fresh isopropanol for about 50 minutes. Miscella M–3 is sent to Extractor No. 2 for the next batch extraction sequence, and the wet cake (S–3) is conveyed to a desolventizing device, such as, for instance, a rotating vacuum drum dryer.

Desolventization.—Solvent is removed from the wet cake (S–3) in the heated rotating vacuum dryer. The solids content of the wet cake at this stage is about 50 percent, or about 2,500 pounds of dry solids and 2,500 pounds of isopropyl alcohol. The suggested desolventizing temperature should be kept as low as possible and certainly should not exceed 90° C. (194° F.). The percentage of residual volatiles in the MPC is to be less than 1 percent by weight at the end of the desolventizing stage.

Vapors drawn off the solids in the dryer are condensed by using refrigerated brine as the coolant. The composition of the condensate is essentially azeotropic isopropyl alcohol. It is pure enough to be pumped directly to Storage Tank No. 2 for reuse without additional processing. At vacuums of 26 to 29 inches of mercury, about 99 percent of the 2,500 pounds of isopropyl alcohol entering the dryer can be recovered. An estimated 0.5 weight-percent (12.5 pounds) of isopropyl alcohol will probably be lost during the drying operation of one batch.

Treatment of finished product.—The dried MPC is conveyed to a mill, where the MPC is ground to a fine powder. The powder is packaged in 50-pound lined fiberboard containers and sent to storage, ready for shipment.

The three-stage countercurrent extraction process, briefly described above, produces 15,000 pounds of MPC per day from 100,000 pounds of raw, lean fish.

Recovery of solvent.—The bulk of the isopropyl alcohol used in this extraction is recovered from Miscella M–1. Each batch of 8⅓ tons of raw fish yields about 6,000 gallons of Miscella M–1, which is held in Storage Tank No. 1. The miscella is pumped continuously from this tank to a distillation column. The feed material to the column is preheated in a steam-coiled heat exchanger, which also serves as a settling tank for the removal of the relatively fast settling fines.

The azeotropic isopropyl alcohol is recovered by consensing the overhead vapors from the distillation column. Part of the condensate, composed of 87 weight-percent alcohol and 13 weight-percent water, is returned to the still as reflux. The recovered solvent is deodorized with activated carbon or other device to remove trace quantities of odoriferous compounds, such as amines. Storage Tank No. 2 contains the isopropyl alcohol recovered from the vacuum dryer and the distillate from the column; it also contains the isopropyl alcohol required to make up solvent losses. For each batch, the solvent losses are anticipated to amount to about 1 percent of the 3,400 gallons of freshly distilled solvent used—that is, 34 gallons of isopropyl alcohol per batch. A 30-day supply of isopropyl alcohol is stored in Storage Tank No. 3 for process makeup.

The still bottoms leaving the reboiler contain water, isopropyl alcohol, as well as lipids, fine solids (fines) and other water-soluble components.

Recovery of lipids.—One aspect of the plant design that has not yet been defined is the recovery of lipids from the still bottoms. Presumably, the fish oil would exist as a separate phase because of its low solubility in water; therefore, separation should be relatively simple. In experiments performed on the dis-

tillation of Miscella M–1, however, a large portion of the oils adhered to the protein fines. This situation must be anticipated when lean fish are processed—that is, the recovery of a high proportion of the fish oils may require fairly complicated processing techniques. If the miscella is filtered or recentrifuged to separate out the fines before distillation, considerable amounts of oil may be lost with the fines. If the fines are washed with fresh isopropyl alcohol to recover the lipids, the distillation equipment will need to be larger so that the added costs of these additional operations, materials, centrifuges, and other equipment could offset the value of the recovered oil.

Overall material-handling schedule

A visual guide to the countercurrent flow of solvent and wish solids is presented in Figure 2.

The material-handling schedule for a proposed 50-ton-per-day plant is shown for a 12-hour period in Figure 3, which illustrates the contents and activities of the major equipment units. It can be seen that fresh isopropyl alcohol fed from the storage tank to Extractor No. 3 at Hour–3 finally leaves the system as part of the Miscella M–1 at Hour–11. Similarly, the batch of ground fish entering Extractor No. 1 at Hour–0 yields the solid product from the dryer at Hour–9. It is important to note, however, that every 4 hours, a fresh batch of fish (8⅓ tons) enters the first stage of the extraction and that every 4 hours, 2,500 pounds of MPC leave the dryer.

For the 50-ton-per-day plant, the following quantitative relations should be applicable when a lean fish is processed. These values have been used in the assembly of the three-stage countercurrent extraction equipment as well as in the calculation of the materials schedule for each of the six batches to be processed per 24 hours.

1. Ground fish composition:

Water	pounds	13,300
Protein and ash	do	2,950
Lipids	do	420
Total	do	16,670

2. Fresh solvent added:

In mix tank No. 3	gallons	3,400
In centrifuge hot wash	do	1,000
Total	do	4,400
Total	pounds	29,300

3. Solvent to fish ratio:
   Isopropyl alcohol/wet fish—29,300/16,670=1.75/1
   Isopropyl alcohol/dry fish solids—29,300/3,370=8.7/1
4. Solvent recovered:

From distillation column	gallon	4,000
From vacuum drum dryer	do	360
Total		4,360

5. MPC produced:

MPC	pounds	2,500
Solids lost	do	450

Discussion

The capability of this type of process to extract lipids and water from fish was demonstrated in laboratory- and model-scale unit experiments. Probably, we cannot assume that the same efficiency of extraction can be realized in a 50-ton-per-day plant as in laboratory-scale equipment. Certain factors of safety were therefore incorporated in the design of the plant; the ratio of solvent to raw fish was fixed at 1.75 pounds solvent per pound of raw material, corresponding to 25.7 gallons per 100 pounds of fish. This represents an increase in the ratio of solvent used over and above the ratio that small-scale experiments have shown to be effective; the increase is considered desirable in order to present a conservative economic evaluation of the process.

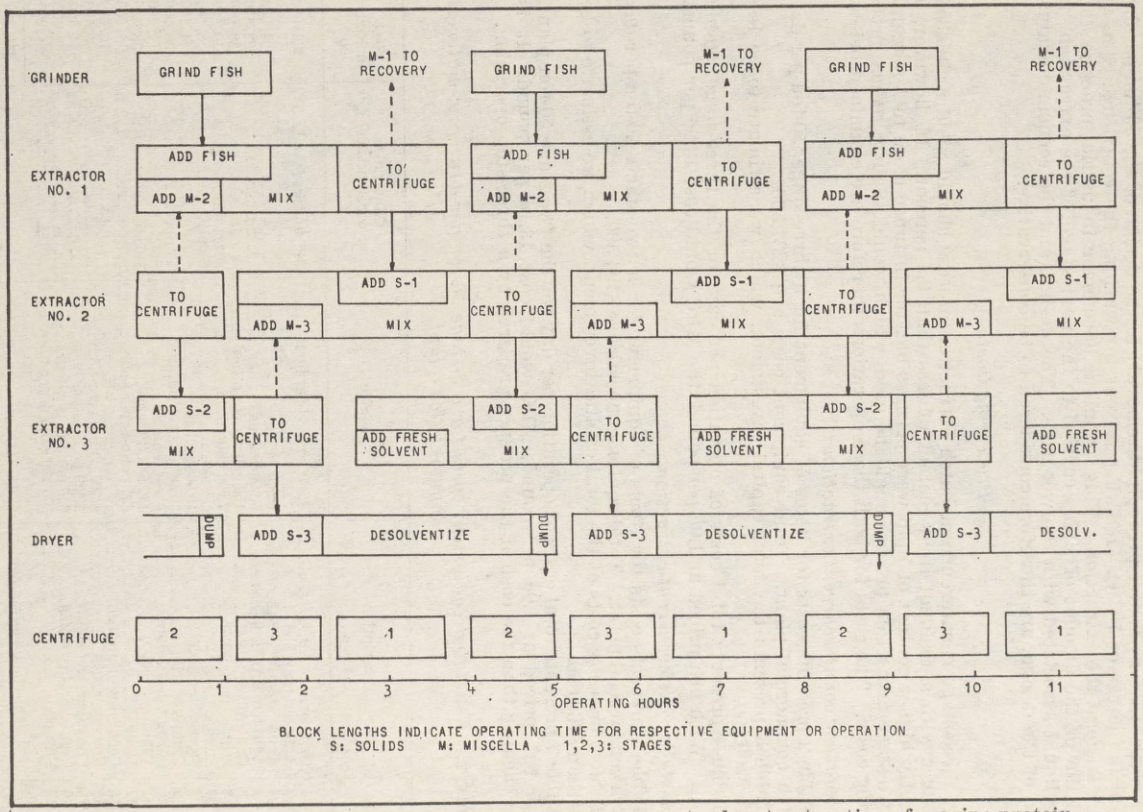

FIGURE 3.—Time schedule of operations for a countercurrent solvent extraction of marine protein concentrate.

In addition to the increased solvent-to-fish ratio, the extraction temperature in the final two mix tanks in the 50-ton-per-day plant will be 75° to 80° C. (167° to 176° F.), because laboratory tests show that this extraction temperature guarantees a satisfactory removal of lipid from fish solids. Since steam-heated tanks are used and the liquid feed is preheated, there should be no problem in maintaining this temperature.

Another factor of safety (for lipid removal) in the design of the 50-ton-per-day plant is the use of 70° C. (158° F.) solvent for washing the centrifuge cake at each stage of the extraction. This technique is common industrial practice and will lower the amount of lipids carried to the next stage of the extraction in the liquid associated with the wet cake. The design, and the economic evaluation of the design, are therefore considered to be conservative.

Processing Costs

A three-stage countercurrent batch extraction process should yield a finished product with a residual lipid content of less than 0.5 percent. If, however, a slightly higher content of lipid were permissible, for instance close to 1 percent, a two-stage extraction process might be used, which would slightly reduce processing costs. The costs for both these operations therefore are examined below.

Three-stage countercurrent extraction

Table 2 presents costs for items of equipment for a three-stage, 50-ton-per-day batch commercial plant. Total equipment costs are $231,500.

Table 3 presents the total capital investment, which we estimate to be less than $900,000.

Table 4 presents total costs of operation per day for the three-stage, 50-ton plant. With fish priced at 1.0¢ per pound, the MPC would cost 13.9¢ per pound.

Two-stage countercurrent extraction

Table 5 presents costs for items of equipment for a two-stage, 50-ton-per-day batch commercial plant. Total equipment costs are $194,500.

Table 6 presents costs of the total capital investment, which we estimate to be less than $760,000.

Table 7 presents total costs of operation per day for the two-stage 50-ton plant. With fish priced at 1.0¢ per pound, MPC would cost 13.1¢ per pound. It is 0.8¢ cheaper than the cost of the product prepared by a three-step operation.

TABLE 2.—*Estimated equipment costs for a 3-stage 50-ton-per-day (raw material input) batch plant*

Item	Description	Size	Material of construction	Estimated cost
1	Grinder	8,500 pounds per hour	316 stainless steel	$11,000
2	Agitated tank T–1	7,500 gallons	do	17,000
3	Agitated tank T–2 (heated)	6,500 gallons	do	24,000
4	Agitated tank T–3 (heated)	6,000 gallons	do	22,500
5	Centrifuge	100 gallons per minute	do	38,000
6	Storage tank ST–1	7,000 gallons	304 stainless steel	10,500
7	Storage tank ST–2	do	Steel	3,500
8	Storage tank ST–3	10,000 gallons	do	4,500
9	Complete still	30 gallons per minute	Copper	30,000
10	Solvent deodorizer	8 feet 3 inches	Steel	1,000
11	Vacuum dryer	150 feet 3 inches	316 stainless steel	38,000
12	Mill	625 pounds per hour	do	5,000
13	Packaging equipment	do	do	10,000
14	Conveyor, fish	8,500 pounds per hour		5,500
15	Conveyor, wet solids	5,600 pounds per hour		4,500
16	Conveyor, dry solids	625 pounds per hour		2,500
17	Pumps	To 100 gallons per minute		4,000
	Purchased equipment costs.			231,500

TABLE 3.—*Total capital investment estimates for a 3-stage 50-ton-per-day (raw material input) batch plant*

Item	Description	Estimated cost
1	Purchased equipment costs (PE)	$231,500
2	Equipment installation (43 percent PE)	99,500
3	Piping (36 percent PE)	83,300
4	Instrumentation (10 percent PE)	23,200
5	Building (40 percent PE)	92,600
6	Fish storage installed (200 tons of fish)	7,000
7	Physical plant cost (PPC)	537,100
8	Engineering and construction (20 percent PPC)	107,400
9	Direct plant cost (DPC)	644,500
10	Contractors' fee (7 percent DPC)	45,100
11	Contingency (10 percent DPC)	64,500
12	Fixed capital (IF)	754,100
13	Working capital (total operating costs for 60 days)	125,300
	Total capital	879,400

TABLE 4.—*Total operating costs per day of a 3-stage 50-ton-per-day (raw material input) batch plant*

Item	Description	Estimated cost
1	Electric power, 1 cent per kilowatt-hour (200 kilowatt-hour)	$48.00
2	Steam, 55 cents per 1.000 pound	224.40
3	Refrigeration. 90 cents per ton (50-ton)	45.00
4	Fish, 1 cent per pound (100,000 pounds)	1,000.00
5	Isopropyl alcohol, 50 cents per gallon (227 gallons)	113.50
6	Supplies and maintenance materials, 0.0015 percent IF	11.31
7	Operating labor, 96 hours at $2.50, 8 hours at $3.50	268.00
8	Maintenance labor, 0.0015 percent IF	11.31
9	Payroll extras, 15 percent of items 7 and 8	41.90
10	General overhead, 30 percent of items 7, 8, and 9	96.36
11	Amortization, 0.0224 percent IF	168.92
12	Taxes and insurance, 0.006 percent IF	45.25
13	Interest on working capital, 0.00725 times sum of above 12 items	15.03
	Total operating costs	2,088.98

NOTES.—For a production rate of 15,000 pounds MPC per day: Total operating cost equals 13.9 cents per pound of MPC.

On a fish-free basis: Total operating cost equals 7.3 cents per pound of MPC.

TABLE 5.—*Estimated equipment costs for a 2-stage 50-ton-per-day (raw material input) batch plant*

Item	Description	Size	Estimated cost
1	Grinder	9,375 pounds per hour	$12,000
2	Agitated tank T-1	5,500 gallons	15,000
3	Agitated tank T-2 (heated)	5,000 gallons	21,000
4	Centrifuge	85 gallons per minute	36,000
5	Storage tank ST-1	5,000 gallons	9,000
6	Storage tank ST-2	7,000 gallons	3,500
7	Storage tank ST-3	10,000 gallons	4,500
8	Complete still	30 gallons per minute	30,000
9	Solvent deodorizer	8 feet 3 inches	1,000
10	Vacuum dryer	100 feet 3 inches	31,000
11	Mill	625 pounds per hour	5,000
12	Packaging	do	10,000
13	Conveyors	14,725 pounds per hour	12,500
14	Pumps	200 gallons per minute	4,000
	Purchases equipment costs		194,500

TABLE 6.—*Total capital investment estimate for a 2-stage 50-ton-per-day (raw material input) batch plant*

Item	Description	Estimated cost
1	Purchased equipment costs (PE)	$194,500
2	Equipment installation (43 percent PE)	86,600
3	Piping (36 percent PE)	70,000
4	Instrumentation (10 percent PE)	19,500
5	Building (40 percent PE)	77,800
6	Fish storage, installed (200 tons of fish)	7,000
7	Physical plant cost (PPC)	455,400
8	Engineering and construction (20 percent PPC)	91,100
9	Direct plant cost (DPC)	546,500
10	Contractors fee (7 percent DPC)	38,300
11	Contingency (10 percent DPC)	54,600
12	Fixed capital (IF)	639,400
13	Working capital (total operating costs for 60 days)	117,700
	Total capital	757,100

TABLE 7.—*Total operating costs per day for a 2-stage 50-ton-per-day (raw material input) batch plant*

Item	Description	Estimated cost
1	Electric power, 1 cent per kilowatt (200 kilowatts per hour)	$48.00
2	Steam, 55 cents per 1,000 pounds	224.40
3	Refrigeration, 90 cents per ton (50 tons)	45.00
4	Fish, 1 cent per pound (100,000 pounds)	1,000.00
5	Isopropyl alcohol, 50 cents per gallon (227 gallons)	113.50
6	Supplies and maintenance materials, 0.0015 percent IF	9.59
7	Operating labor, 72 hours, at $2.50; 8 hours at $3.50	208.00
8	Maintenance labor, 0.0015 percent IF	9.59
9	Payroll extras, 15 percent of items 7 and 8	32.64
10	General overhead, 30 percent of items 7, 8, and 9	75.07
11	Amortization, 0.0224 percent IF	143.23
12	Taxes and insurance, 0.006 percent IF	38.36
13	Interest on working capital, 0.00725 times sum of above 12 items	14.12
	Total operating costs	1,961.50

NOTE.—For a production rate of 15,000 pounds MPC per day, total operating cost equals 13.1 cents per pound of MPC; on a fish-free basis, total operating cost equals 6.4 cents per pound of MPC.

PREPARATION AND PROPERTIES OF MPC TEST SAMPLE

One of the objects of the accelerated program was to demonstrate that a safe, wholesome, nutritious MPC can be made from whole fish. To meet this aim, we prepared an MPC test sample in model-scale unit equipment by an isopropyl alcohol extraction method approximating the conditions of the proposed commercial method. The MPC was then defined according to its various properties.

Preparation of the MPC Test Sample

About 350 pounds of MPC were produced by a batch-extraction process in the model-scale unit, using red hake (*Urophycis chuss*) and isopropyl alcohol. Care and caution were observed at all stages of the procedure, from the handling of the raw material through the processing operation, the packing step, and the storage of the end product.

Procurement of raw material

The red hake used in the production of the test sample of MPC was purchased from the Salt Water Fisheries Co., Provincetown, Mass.

About 3,000 pounds of red hake were caught by otter trawl in an area near No Man's Land, (about five miles south of Martha's Vineyard). On board the vessel, the fish were immedately packed in ice.

After the fish were unloaded they were packed into waxed cartons and frozen. The fish were transported in a refrigerated truck to Beltsville, Md., where they were immediately transferred to the freezer in our plant and kept at 29° C. (—20° F.) until used.

Processing procedure

Sixteen batches of MPC were prepared in the manner described below and ultimately combined as the test sample.

Raw material pretreatment.—For each batch of MPC about 150 pounds of fish were removed from freezer storage and ground. The frozen fish were first reduced to about 1-inch pieces by one pass through a Rietz extructor (prebreaker).[1] The chunks were collected in a stainless steel pot and were then transferred, still in the frozen state, to a Hobart grinder. The fish were passed once through a plant having 5/8 inch holes, then twice through a plant having 1/8 inch holes. The resulting ground product had the textural appearance of ground beef. The temperature of the fish never exceeded 0° C. (32° F.) during this process.

Extraction.—The ground fish were transferred into two 30-gallon stainless steel cans and weighed, and each lot of about 75 pounds of fish was dispersed in 7 gallons of fresh 91 volume-percent isopropyl alcohol. A portable stainless steel agitator was used to slurry the fish and alcohol, the mixing time being 5 minutes. The two slurries were then combined in the mixing tank, and fresh isopropyl alcohol was added to bring the volume of alcohol to 45 gallons. The slurry was agitated for 1 hour. During this time, the temperature of the slurry rose from 0° C. (32° F.) to a final temperature of about 4° C. (40° F.).

The fish slurry was then pumped to a Bird horizontal centrifuge for the separation of the solids and the miscella. The liquid phase was pumped to the storage tanks; and, after they were collected, the solids were weighed and transferred to the extractor. Centrifugation for this stage usually took 1¼ hours.

The solids from the dehydration stage were dispersed in the extractor in 45 gallons of fresh isopropyl alcohol preheated to 79° C. (175° F.). The temperature of the mixture was next brought to about 79° C. (175° F.) and held at that level for 1 hour with constant agitation. The slurry was then pumped to the centrifuge to recover the extracted solids. Part of the miscella from the centrifuge was recycled back to the extractor in order to maintain a pumpable slurry. All of the miscella was finally pumped to storage for future recovery of solvent. This extraction procedure was repeated twice more, using 45 gallons of fresh solvent each time. Centrifugation usually took about an hour for each stage.

The solids from the final-stage centrifugation were weighed and transferred to the tumbling dryer for desolventization.

Desolventization.—Since the dryer was of sufficient capacity to hold about 80 pounds of material, the solids from two runs were combined. The dryer was operated at a vacuum of 27 to 28 inches of mercury and a jacket temperature of 43° C. (110° F.). To avoid balling of the product, the dryer was rotated only intermittently during the first hour. Thereafter, the dryer was rotated continuously throughout the remainder of the run. In general, no more solvent condensed after 4 hours. The jacket temperature was then increased to 54° C. (130° F.) for 1 hour and finally to 66° C. (150° F.) for 1 hour. The jacket heat was then turned off, and the temperature slowly fell to about 27° C. (80° F.). The product was allowed to cool in the rotating dryer under vacuum for 1 to 4 hours.

Mixing of final product.—The eight batches of MPC resulting from the 16 runs were combined into three lots by proportioning from each batch. The three lots were next mixed separately in the tumbling dryer for 1 hour. The product was then subdivided into 20-pound lots, placed in Mylar bags, and stored in tightly closed metal cans at room temperature.

Properties of MPC test sample

Criteria for the evaluation of the MPC test sample included a determination of its physical, chemical, and sensory properties, a determination of its protein quality and its microbiological safety, and an examination of its wholesomeness. These criteria, we believe, provide sufficient data to permit a sound judgment

[1] Trade names referred to in this publication does not imply endorsement of commercial products.

of the quality of MPC from the points of view of acceptability, nutritive value, and safety for use.

Physical properties

The physical definition of the MPC test sample included observations on the color, particle size, distribution, particle identification, and hygroscopicity.

The color of the sample as determined by reflectance measurements was off-white, with a yellowish cast.

The ground sample was classified according to particle size distribution. A particle size distribution of the MPC test sample that passed a 100-mesh screen was derived.

The test sample was also submitted to different conditions of temperature and humidity to determine the rate at which the sample absorbed moisture. Samples stored at 25° C. (77° F.) and 31.0 percent relative humidity equilibrated rapidly, with only a 1-percent increase in weight. At higher humidities, regardless of temperature, the amount of water absorbed was greater and the time for equilibration increased.

Chemical properties

The proximate analyses of the individual batches of MPC test sample and of the composite are given in table 8.

The amino acid composition of the composition of the composite test sample is indicated in table 9.

The nonprotein nitrogen content of the product compared favorable with that in other foods and consisted mainly of amino acids.

Residual lipids in MPC were studied in particular as to their possible role in flavor reversion or in the development of rancidity. Of the total lipids extractable from MPF, 40 percent were identified as neutral lipids (mainly triglycerides and sterols) ; 10 percent neutral lipids (mainly mono- and diglycerides) ; 33 percent phospholipids (predominantly sphingomyelin) ; 8 percent remained uncharacterized. No lipid oxidation had occurred in the sample. Further tests showed that the lipids underwent no oxidative changes even after 3 months' storage of the extracts.

Inorganic analyses of the ash of the MPC sample are presented in tables 10 and 11.

No sand was detected in the sample.

The MPC test product had no fish odor, probably owing to the very small levels of volatile amines observed. Amine hydrochloride mixtures were isolated in quantities of 0.0117 to 0.0134 percent based on the original weight of the MPC. Gas chromatographic separation of the mixtures indicated that trimethylamine, methyl-, and/or dimethylamine, and either ethyl-, diethyl-, or triethyl amines (or a mixture of all three) were present. Hydrogen sulfide, mercaptans, thio-ethers, and disulfides were not present in detectable quantities.

TABLE 8.—*Proximate composition of the raw red hake and of individual batches and composite MPC test sample*

[In percent]

Component	Proximate composition									
	Raw sample	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Batch 6	Batch 7	Batch 8	Composite sample
Protein	15.20	81.78	81.26	78.04	80.74	80.63	79.30	81.85	82.28	81.35
Volatiles	80.21	7.55	7.38	10.78	7.58	7.53	8.91	6.25	7.67	6.73
Ash	3.04	14.35	13.72	13.06	13.80	13.22	13.42	13.48	12.92	13.52
Lipids	5.82	.17	.15	.17	.13	.19	.15	.21	.19	.20

TABLE 9.—*Amino acid composition of raw material and composite MPC test sample* [1]

Amino acid	Percent of protein concentration	
	Raw sample (N×6.25)	MPC test sample (N×6.25)
Lysine [2]	7.40	8.41
Histidine	1.79	2.08
Arginine	6.08	7.13
Aspartic acid	9.51	10.35
Threonine	4.15	4.47
Serine	4.11	4.65
Glutamic acid	14.28	15.39
Proline	4.86	5.21
Glycine	7.82	8.09
Alanine	6.31	6.81
Valine	4.80	5.26
Methionine	3.05	3.30
Isoleucine	4.25	4.56
Leucine	7.06	7.78
Tyrosine	1.78	3.35
Phenylalanine	3.88	4.24
Tryptophan	0.68	1.03
Cystine [3]	0.84	0.77

[1] Values not strictly comparable; loss of alcohol—soluble proteins in MPC sample enhances amino acid percentages slightly.

[2] Of the lysine contained in the product, 93 percent was digestible (available) as determined by chemical analysis.

[3] Microbiological determination.

TABLE 10.—*Spectographic analysis of MPC*

[In percent]

Element	Maximum concentration	
	Based on ash	Equivalent to original material [1]
Sodium centares	5	0.5
Potassium centares	5	.5
Magnesium	2	.2
Silicon	2	.2
Aluminum	1	.1
Strontium	0.9	.09
Iron	.9	.09
Tin	.09	.009
Titanium	.09	.009
Copper	.009	.0009
Zirconium	.009	.0009
Manganese	.009	0009
Barium	.005	.0005
Nickel	.005	0005
Lead	.0009	.00009

[1] Based on an ash content of 12 percent.

NOTE.—Elements checked but not found: zinc, cadmium, indium, bismuth, antimony, arsenic, thallium, gallium, germanium, chromium, cobalt, molybdenum, vanadium, tungsten, and silver.

TABLE 11.—*Mineral content of MPC*

Determination:		Result
Calcium [1]	milligrams per 100 grams	3,780.0
Phosphorus [2]	do	2,930.0
Sodium [3]	do	353.0
Potassium [3]	do	593.0
Chloride [4]	do	1,000.0
Bromide [5]	do	1.5
Iodide [6]	do	.1
Fluoride [7]	do	13.0
Iron [8]	do	18.9
Iodine	micrograms per gram	1.0
Selenium	parts per million	2.0

[1] Official methods of analysis of the Association of Official Agricultural Chemists (1960), sec. 6.011.
[2] Ibid., sec. 2.023.
[3] Ibid., sec. 6.016.
[4] Ibid., sec. 18.008.
[5] Shrader et al., 1942, Ind. Eng. Chem. Anal. Ed. 14, 1.
[6] Houston, 1950, Anal. Chem. 22: 493.
[7] Official methods of analysis of the Association of Official Agricultural Chemists (1960), sec. 24.027.
[8] Ibid., sec. 6.007.

Sensory properties

The test sample was analyzed by the Flavor Profile Method (a scientific approach to organoleptic evaluation) immediately after production and after 9 months' storage at room temperature. Regardless of the age of the sample, the panel described the MPC as typical of a processed dry protein product with no evidence at either time of fishy taste or odor.

Nutritive quality

Rat-feeding tests were made with the MPC test sample immediately after production and after 9 months' storage for comparison against a casein control (table 12).

Microbiological analyses

Total counts of microorganisms were determined for the raw fish used in the preparation of the test sample and for the finished product. The highest count found in the raw fish was 1,500 organisms per gram. The finished MPC sample had counts of about 40 microorganisms per gram. No coliform types of Salmonella organisms were found in either the raw fish or the finished product.

Wholesomeness.—An approach that has become standard in the isolation and characterization of physiologically potent materials such as vitamins and hormones was applied to determine the presence of absence of toxic substances in the MPC test sample. A lot from the test sample was first exhaustively extracted with hexane. Solids residue from that extraction was next extracted with chloroform. That solids residue was extracted with ethanol, and finally the residue was extracted with water. Each of the liquid extracts of these four solvents was concentrated to dryness.

TABLE 12.—*Comparison of the protein quality of MPC prepared by the IPA extraction of hake at zero time and after 9 months' storage at room temperature*

Diets	Average weight gained by rats (grams)	Average weight of food consumed by rats (grams)	Protein efficiency ratio [1]
Casein control	108.2±3.65	338±7.7	3.00
MPC zero time	142.2±2.24	413±5.02	3.24
Casein control	116.2±10.44	332±18.8	3.00
MPC 9 months' storage	137.3±10.5	373±14.5	3.19

[1] Weight gained per weight of protein consumed=protein efficiency ratio (PER). Data have been adjusted based on a PER value of 3.00 for casein.

The test sample, the solids residue remaining after the sequential extractions, and each of the four concentrated extracts were fed to groups of growing rats at very high levels in the diet. The gain in weight, weekly food intake, and food efficiency for each animal in each group were determined. Tests were made for

urine concentration, pH and creatine, creatinine, and uric acid contents. A glucose tolerance test and hematology studies were also made. The animals were killed after 4 weeks, and a complete necropsy was carried out. All unusual gross effects were noted. Enzyme tests on the liver and the serum were also included. The blood serum was examined for lipid and nitrogen content.

The results of all experiments on the MPC sample indicate that there is no marked difference from the control group in any of the factors studied, with the exception of the high level of blood urea nitrogen and nitrogen noted for the high-protein-consuming groups, and a marked increase in urinary creatine and in creatinine in the groups receiving the alcohol and water extracts and the MPC as such. The explanation suggested for the increased creatine and creatinine excretion was that the MPC as such probably had a high creatine content which is accentuated in the water extract and alcohol extract. This possibility is now being examined. Although these results cannot be considered as conclusive, it appears that there is only a small possibility that a biologically active substances is present in the MPC test sample in significant amounts. So far, the results of this study indicate that substances that are biologically active for the rat either are not present in the test sample or are not extractable in the solvents used.

CONCLUSIONS

The accelerated program has shown how MPC can be produced at a relatively low cost by a commercial solvent-extraction method used isopropyl alcohol as the solvent and red hake as the raw material. It also has shown that a test MPC prepared from whole fish by a method approximating the proposed commercial process is highly nutritious, safe, and wholesome and, therefore, should be entirely satisfactory as a dietary supplement for human consumption.

The CHAIRMAN. Let me ask you, Mr. McKernan, the Academy recommends, I think, quite enthusiastically that we proceed here as rapidly as possible. They mentioned 10 tons a day, the plant that would produce about 10 tons from hake, and they mention hake specifically. Wouldn't one of these pilot plants qualify in that respect?

Mr. MCKERNAN. Yes, Mr. Chairman.

The CHAIRMAN. When we are talking about a pilot plant we are talking about what the Academy has suggested here capacitywise?

Mr. MCKERNAN. Yes.

The CHAIRMAN. All right. Thank you.

Mr. Alverson is here, who is the base director of Exploratory Fishing and Gear Research at the Department of the Interior in Seattle, and we would be glad to hear from him.

STATEMENT OF DAYTON L. ALVERSON, BASE DIRECTOR, EXPLORATORY FISHING AND GEAR RESEARCH BASE, BUREAU OF COMMERCIAL FISHERIES

Mr. ALVERSON. Thank you, Mr. Chairman.

The CHAIRMAN. Let me ask you, first, Dayton, we have a nice map up there about hake on the Pacific coast. Is hake in the other seas in the world?

Mr. ALVERSON. Yes, sir. The hake generally refers to a group of fish, a family of fish. They are present throughout the North Atlantic, the South Atlantic, and throughout the Pacific, with the exception of the Northwestern Pacific. They are not off the Russian coast.

The CHAIRMAN. So when we are talking about the resource here, being very conscious of it here as we are, there is also a possibility for other U.S. fishermen on the east coast to also participate in this program?

Mr. ALVERSON. Absolutely.

The CHAIRMAN. If I may interrupt you a minute.

We also have with us the history class from this school. We have some fine young people here from this history class from the school and we are glad to have them here. I hope they will take due note of the complexities of legislative processes.

We are glad to have you here and we hope you will get something out of the hearing. I understand that you are making a complete record of it so you might study a typical hearing, and we are glad to have that done. If you need any help from the Commerce Committee, let us know, we will furnish you with more data.

All right.

Mr. ALVERSON. Mr. Chairman, we have heard considerable testimony, comments, concerning the latent resources, the so-called "bounty of the sea" that exists contiguous to the coast of the United States.

I was mentioning that we might ask ourselves how is a latent resource given dimension, what sort of information and technological data is required to make effective use of a latent resource? Some of the more important types of information that must be accrued and questions that must be answered before we can make effective use of a latent resource would be as follows:

What is the geographic distribution and the depth distribution of the resource and how does this geographic distribution and depth distribution change by season?

What is the magnitude of the resource or the raw material base we are talking about?

As we are discussing living resources, some sort of antecedent information on the population in time is necessary.

Would it make a reliable base for a commercial fishery?

Finally, even if we know these sort of things we must look at the types of existing harvest methods and decide whether or not we can effectively exploit this sort of so-called latent resource with these methods or whether we have to develop entirely new means to exploit the latent resource.

With these sort of questions, let us examine quite quickly what we actually know about the so-called Pacific hake, which, I think, most of you here in the North Pacific are interested in.

I think I would like to go at this point to the chart, if you will give me just a moment.

For a large number of years, Mr. Chairman, the fishermen on the Pacific coast of the United States have known this particular species, the Pacific hake, was abundant. This was as a result of the encounter of the species in their trawls and purse seines.

In the latter part of the past decade, the 1950's, the Bureau started some plankton surveys. They concentrated in the area from about San Francisco down to about Baja California. These surveys revealed some interesting facts about Pacific hake. This particular species was one of the most abundant larvae forms taken in these particular plankton surveys. They took very extensive catches of larvae of Pacific hake off of Baja California, up to about central California, which gave use some idea that this particular species spawn in the oceanic waters off of southern California and the Baja California Peninsula.

In the last several years we have had some fairly extensive studies of the feeding behavior of fur seals, and they are pretty good fishermen themselves. We have found it very interesting that off the coast of California, Oregon, and Washington, again this Pacific hake, the adults of this species form an important part of the diet of fur seals that are working off our coast, also making a living.

Finally, the Bureau has taken some very extensive exploratory surveys from off the southern coast of Vancouver Island down to the Baja California Peninsula. These were conducted mainly in the spring, summer, and fall, with some winter work done off of the California area. These surveys were generally very intensive echo surveys, where we use what we call echo sounders. The results of these surveys showed that there were very large concentrations of hake during the summer months, and I should say spring, summer, and fall months, off the coast of Washington and Oregon. Some of these schools ranged up to 35 miles in length and 5 miles in width. These schools were found all the way down the Oregon coast to about the California border, and then there were schools down off of San Francisco and in the Crescent City-Eureka region. The large hake schools were generally found off-share from depths from about 50 to 70 fathoms. They schooled somewhat above the ocean floor, 5 to 6 fathoms above the ocean floor, off our coast from about 20 miles.

Concerning the quantity of hake, the magnitude of this particular resource, the information comes from two sources: one, the——

The CHAIRMAN. Let me ask you this, are there hake in the Puget Sound?

Mr. ALVERSON. Yes, sir.

The CHAIRMAN. They are not all out in the ocean?

Mr. ALVERSON. No. I should have pointed out there is quite an extensive resident population in Puget Sound that stays there throughout the year.

I would comment that the off-shore stocks apparently migrate north during the spring onto our continental shelf areas and make these large schools off our coast. During the winter they disappear, move to the south, apparently down off the southern California coast, to spawn. This has not been confirmed, but it is the inference from the types of information we have now collected.

The quantity of hake in this particular, what we call, California current system has been estimated——

The CHAIRMAN. Do you think they spawn down there in that green area?

Mr. ALVERSON. That is my particular interpretation of the data.

The CHAIRMAN. Here again, if we are going to go out and harvest them, is the necessity of research on the habits of the hake.

Mr. ALVERSON. That is true, because we infer this from the fact they are absent on our coast during the winter months and the eggs and larvae show up in this particular area [indicating], but we have no direct evidence that this is the type of movement that is taking place. The egg and larvae surveys have allowed us to make some forecasts which suggests that the quantity of hake in this so-called system may be on the order of 3 million tons, that is, about 6 billion pounds.

The quantity of hake off the Oregon and Washington coast during the summer season has been estimated by a different means, by an echo

sounder survey and by sampling with a large mid-water trawl and we have come up with an estimate from 500,000 to 750,000 tons in the area from about the Oregon border up to Cape Flattery on the northeastern coast of our State of Washington.

The CHAIRMAN. How many pounds off our coast?

Mr. ALVERSON. A billion to a billion and a half pounds.

The CHAIRMAN. A billion pounds.

Mr. ALVERSON. Yes.

Now looking at rates of exploration, our biological lab has made an estimate for our area off Oregon and Washington that we should be able to provide a sustained yield in the vicinity of 100,000 to 150,000 tons per year, 200 to 300 million pounds of hake.

The CHAIRMAN. I understand we have had some interesting soundings in the past few weeks and the past few months on anchovies off our coast, too, haven't we?

Mr. ALVERSON. Yes, sir. This past winter we conducted a very extensive survey off the coast of Washington and we came up with some rather fabulous echo traces which appeared to be anchovy. In fact, we had one echo trace, what we call a white line, and when the echo sound white lines, what actually happens is fish above the bottom block out the echo from the bottom because the fish are so solidly schooled.

Finally, now let's go over to the point of the stability of the resource. We have talked about the size of the resource, the distribution, and the seasonal hake pattern. Dr. Isaacs of the Scripps Institution of Oceanography has done some interesting work by looking at the scales. He has found that over the past 1,500 years that the Pacific hake has been a dominant element in the pelagic fisheries off the coast of California. This suggests that this particular species has had fairly good stablity in time. This doesn't mean there aren's fluctuations in abundance, but it means this species has been around a long time and probably will be around for a long time in the future.

Now let us go rather quickly to the harvest method. I think most of us are aware now that this is essentially a midwater species, and the types of harvest systems that were available in the State of Washington allowed us to fairly effectively exploit bottom species that went down on the seabed and we had systems for harvesting fish which were up near the surface. In other words, we were able to exploit the fishes near the surface and the fishes near the bottom, but the hake was in-between, and we sort of had to come out with an entirely new system of exploiting this particular species.

To do this the Bureau has developed a very large what we will call one-boat trawl. This differs from the trawl used in other areas of the world by the sense of two basic characteristics. The method of designing and hanging the net is such that it takes advantage of the hydrodynamic force of the water.

Also, we have come up with what we call a telemetering system which allowed us to take information from the net itself as to the actual depth of the net and relay it through the wires up to the bridge so the fisherman can precisely set his nets in any echo trace he might see. I think the latter particular development has been the critical breakthrough as far as we are concerned in mid-water trawling. You

have to have the ability to set your net in these schools before you are in business and I think this breakthrough has allowed us to do this.

During the past few months fishing hake in the Puget Sound region, and there are several who have been doing this, have averaged 8 to 10 tons per 1 hour of fishing.

We certainly hope to make improvements, but we feel we are now in the stage where we can in the future exploit this particular group of fish.

Finally, in summary, Mr. Chairman, I think we can say that a good deal of information has been collected and technological advances have been made which could accelerate upgrading the potential hake resources of the Pacific coast to an effective resource. We know the adult schools of Pacific hake are abundant over the Continental Shelf in waters between southern California and British Columbia. We know that the species forms large compressed schools over the Continental Shelf and that these schools persist during the spring, summer, and fall months. We have investigated the diurnal migrations of the species and know that it rises to the surface at night and reforms into schools near the seabed during the daylight hours. We have a good idea of the seasonal migration of the animal, some concept of the population, or populations, size inhabiting the California current system. We also have some information from past geological records as to the stability of the species in time, and have developed a rather effective and unique means of capture.

Whether or not we have reached a state where economic, large-scale exploitation can begin is dependent on the general demand for industrial-type species. Any event which would enhance the value and demand for raw material for protein fish concentrate, I guess that is marine concentrate now, will certainly improve the likelihood that Pacific hake will be upgraded from a potential to an effective resource.

Thank you.

The CHAIRMAN. Thank you.

Of course I think we all realize there are some gear problem involved in all these fisheries, new methods, new ideas, but it seems to me if we can establish that the product is there and establish some cost figures that make it feasible, these fishermen with their know-how, will solve their gear problems sooner or later.

Part of the $100,000 about which we are talking, that we hope to keep in the bill will also allow us to proceed with more studies on how to harvest anchovies, is that correct?

Mr. ALVERSON. Yes, sir. I hope we can get after this.

The CHAIRMAN. It might be that you can work on both projects at certain times.

Mr. ALVERSON. I think this would blend very well with the hake, because the hake is essentially a spring, summer, fall fish and the anchovy is found generally during the winter period, so if we could develop this it would give us a year-round resource.

The CHAIRMAN. These are some of the questions to which we want to find answers, this is what everybody is working for.

In the light of your figures on the hake harvest, and I realize they are potential figures, how does this compare with the present dollar-wise total trawl production in the State of Washington?

Mr. ALVERSON. As I recall, there are people who might correct me, the most recent figures of the trawl catches have been in the vicinity of 40 to 45 million pounds per year. This product is worth 5 to 6 cents, I think, on an average per pound. The resource we are talking about, this hake resource, would be 200 to 300 million pounds. We don't want to set a price on it, certain industry people will do that, but it would be very comparable with the entire fishery that is now in existence.

The CHAIRMAN. We are hopeful that it will show what that dollar potential is for our fishermen.

Thank you very much. We will keep the record open, as we said before, for any further details that you want to add.

I know that we called this hearing today quite hastily. We are dealing with a subject on which you, and I would like to do much more work, but we are feeling our way and we are making great progress. We thank you for all your efforts very much.

(The statement of Mr. Alverson follows:)

STATEMENT BY DAYTON L. ALVERSON, BASE DIRECTOR, EXPLORATORY FISHING AND GEAR RESEARCH BASE, BUREAU OF COMMERCIAL FISHERIES, SEATTLE, WASH.

Mr. Chairman and Members of the Committee, a "resource" is defined by Webster as a new or reserved source of supply or something that lies ready for use or can be drawn upon for aid in supplying a need. In a broad context, all natural substances can be considered as resources, as everything on the face of the earth is a reserve source of supply which can be drawn upon. Thus, a resource is a rather vague commodity, and for the purpose of this report, let us use two operational definitions for "potential and effective resources." Let us consider a potential resource as any natural substances (organic or inorganic) occurring in a defined geographic locality, which could be used in the life support systems of man, but which is not now substantially employed for his benefit. This may be contrasted with an effective resource that man has put to use in supplying his needs.

In the light of these operational definitions we can examine the hake or merluccid resource of the Pacific coast of North America. Hakes belong to the family Merlucciidae and are closely related to the cods (Gadidae). They occur in all coastal waters of the Atlantic and of the Pacific Ocean with the exception of the northwest Pacific. Important hake fisheries exist in coastal waters off Europe, eastern North America, and South Africa. In recent years minor fisheries have begun in the waters off Chile, Argentina, and off the Pacific Northwest coast of the United States. In general, however, the hakes in the latter areas remain potential resources.

We might ask, then, how do we make the transition from a potential to an effective marine resource? First, there needs to be an adequate description of the distribution of the "potential resource" in time and space; that is, we must give it shape and position and know how this shape and position change in time. Second, it is necessary to quantify the resource so that we have a concept of the magnitude of the raw material involved. Third, as we are dealing with a living resource, it is desirable to achieve some antecedent information on the historical stability of the population or populations involved. Finally, if existing fishing techniques are not available for harvesting the resource at a profit, it will be necessary to evolve new harvest systems.

At this point let us examine how far along this path we have come regarding the Pacific hake (*Merluccius productus*).

For many years fishermen and scientists have known that the hake was abundant off the west coast of the United States. This was suggested by the incidental catches of hake taken in various commercial gear such as trawls and seines, from sports fishermen who commonly encountered the species during hook and line fishing, and from data collected during biological investigations. Thus, even prior to 1950 it was known that Pacific hake occurred in waters from Central America to the Aleutian Islands.

During the late fifties and the first half of this decade, further information on the distribution and abundance of hake began to emerge as a result of three Bureau-conducted research studies. Results of plankton surveys conducted in waters from Baja California to the Strait of Juan de Fuca indicated hake were one of the most abundant forms occurring in the pelagic fish fauna, and the winter surveys suggested heavy spawning of hake took place in waters between Point Conception, California and Cape San Lucas, Baja California.

In examining the stomachs of fur seals captured off North America between California and Washington during the spring and summer months it was found that hake and anchovies were the dominant food items. North of Washington the importance of hake in seal diets declined rapidly.

Additional information on the general distribution of hakes was obtained during a series of exploratory bottom trawling surveys conducted between southern Oregon and the Arctic in the years between 1950 and 1960. These studies indicated that adult hake were important constituents in groundfish populations off Oregon and Washington, and similar to the fur seal data, showed a marked decline in the availability of the species in waters off Vancouver Island and in the Gulf of Alaska.

Thus the egg and larvae surveys provided a relatively good fix on the southern limit of the abundance of spawning hake and defined the general area of spawning concentrations. The exploratory surveys and the fur seal investigations gave a northern limit to the region of heavy concentration, this boundary lying somewhere off British Columbia.

Seasonal distribution and behavioral patterns and abundance measures of hake within this geographic range, however, were still undetermined. In 1964 and 1965 exploratory cruises were made in order to answer some of these questions. These surveys were conducted throughout the year off Oregon and Washington and during the fall and winter months off southern and Baja California.

Mapping geographic and bathymetric distribution of the species was accomplished by means of acoustical survey techniques; that is, by using an echo sounder to map density and special distribution patterns. The procedure involved making many echo-sounding surveys on preplanned track lines; the track lines following a series of diagonals which ran offshore and inshore across the continental shelf. The echograms were observed continuously during the surveys and positions and intensity of echo traces recorded on sailing charts. In areas where echograms suggested heavy fish concentrations, a large pelagic trawl was fished to determine the species of animals responsible for the echo.

Surveys in 1964 and 1965 demonstrated that adult hake inhabit waters overlying the continental shelf. During daylight hours they form rather large, elongate schools ranging from 5 to 30 miles in length and from one-half to 5 miles in width. The term "school" has been applied here although it is not typical of the type of school one generally encounters in herring or menhaden fisheries. They differ in that they are confined to narrow bands in a depth sense; that is, they are elongated, oval-shaped schools which are only 20 feet from the top to the bottom. During daylight hours and during the spring, summer, and fall of the year, hake schools lie several fathoms off the ocean floor in water depths ranging between 40 and 90 fathoms. They migrate toward the surface at night, and become scattered in the surface layer. Shortly after dawn, the hake reform into schools near the ocean floor.

Seasonal investigation of the availability of hake has shown that the adults disappear from the continental shelf area during winter. At this time they are found in the oceanic waters off southern California and Baja California. It might then be inferred that there is a seasonal north-south movement of the Pacific hake, adults moving north and inshore onto the continental shelf for feeding during spring, summer, and fall, and returning south in the winter to spawn.

If we examine the occurrence of hake concentrations in light of oceanographic features of the northeastern Pacific, it appears that the pattern is closely associated with the California undercurrent system (Baja California to the Strait of Juan de Fuca). A beginning at quantifying the hake populations has been made by examining the eggs and larvae in this current system. By calculating number of eggs spawned, scientists at the Bureau's La Jolla Laboratory have estimated that the standing crop of spawning hake in these waters may be in the order of three million tons.

Further information on the quantity of hake populations off the Oregon and Washington coasts has been obtained from sampling programs conducted with the *Cobb* pelagic trawl. By assuming that the trawl captured all fish in its path, and the fish delineated during the 1964 surveys constituted all schools in existence off Oregon and Washington, the adult hake population was estimated to be between 500,000 and 750,000 tons. It should be noted that this technique provides a minimal estimate.

Information on the stability of hake populations in time has been investigated by Dr. Isaacs of Scripps Institution of Oceanography. A study of scales found in the sediments deposited over the past 1500 years indicates that the Pacific hake and anchovy have been dominant constituents in the pelagic fish populations over this entire time span.

Ideally, the selection or development of a harvesting system for a marine resource can be most effectively accomplished after acquiring antecedent information on distribution and behavior of a species. Unfortunately, determining distribution and behavior patterns is contingent on a satisfactory sampling tool. Hence, some start toward a harvesting device must be made prior to investigating the distribution and availability factors. In 1962 the Bureau's Exploratory Fishing and Gear Research Base in Seattle constructed a large pelagic trawl to sample oceanic fishes. It was designed on the concept that an extremely large net towed at relatively slow speeds would be more effective for capturing midwater species than a smaller trawl towed at high speed. The net had a 160-foot headrope and footrope, with similar dimensions to the breastlines, and was approximately 280 feet long. Several features of the net varied from pelagic trawl design in other parts of the world. The webbing was "hung in" on the rib or support lines, particularly in the upper sections of the net. This allowed a ballooning or parachute-like action to the trawl. Second, the depth of the net was determined by a pressure-sensing unit on the net which transmitted depth information to the wheelhouse through conductors built within the core of the towing cables.

The effectiveness of the *Cobb* pelagic trawl was subsequently demonstrated during exploratory surveys in 1964 and 1965 and in commercial fisheries which are now employing this gear in the Puget Sound region. During the survey work in 1964 a large number of sets were made off Oregon and Washington. Many catches in these sets ranged between 10 and 30 tons of hake per hour fishing.

In the late fall of 1965 and early winter of 1966 commercial hake operations began in Puget Sound. The first boat to enter the fishery was the trawler *St. Michael*, a 72-ft. converted salmon seiner. Using the *Cobb* pelagic trawl and the newly designed electronic telemetering system, the *St. Michael* has taken approximately 2,404,000 pounds of hake in 140 hours (154 drags) of actual fishing time and had an average catch rate of 8.2 tons per hour fishing.

Perhaps even more spectacular was the success of the *St. Janet* which entered the Puget Sound hake fishery early in 1966. The vessel is a 56-foot Alaska limit seiner, powered by a 175 hp diesel engine. Towing a two-third size *Cobb* pelagic trawl, this vessel has taken many capacity loads in three to five tows of the net (35 tons per trip). The *St. Janet* caught 1.2 million pounds of hake in 57 hours fishing time (72 drags).

In summary, we can say that a good deal of information has been collected and technological advances have been made which could accelerate upgrading the potential hake resource of the Pacific coast to an effective resource. We know the adult schools of Pacific hake are abundant over the continental shelf in waters between southern California and British Columbia. We know that the species forms large compressed schools over the continental shelf and that these schools persist during the spring, summer and fall months. We have investigated the diurnal migrations of the species and know that it rises to the surface at night and reforms into schools near the seabed during daylight hours. We have a good idea of the seasonal migration of the animal, some concept of the population (or populations) size inhabiting the California current system. We also have some information from past geological records as to the stability of the species in time, and have developed an effective means of capture.

Whether or not we have reached a state where economic, large-scale exploitation can begin is dependent on the general demand for industrial-type species. Any event which would enhance the value and demand for raw material for protein concentrates or meal will certainly improve the likelihood that Pacific hake will be upgraded from a potential to an effective resource.

The CHAIRMAN. The next witness is William Schumacker, who is the Area Administrator for the Small Business Administration. The reason Mr. Schumacker was called is that we can appreciate that this fishery will involve a great deal of what we like to call small business and Mr. Schumacker is going to testify as to what the Small Business Administration could or could not do in this particular field in case it develops as we think it is going to develop.

Mr. Schumacker is from our own State of Washington. He is the area director of the U.S. Small Business Administration for the whole Pacific coast, and 11 other Western States. His headquarters are in San Francisco.

STATEMENT OF WILLIAM S. SCHUMACKER, SAN FRANCISCO, CALIF., AREA DIRECTOR FOR THE U.S. SMALL BUSINESS ADMINISTRATION

Mr. SCHUMACKER. Thank you, Mr. Chairman. It is a distinct pleasure for me to be back in Grays Harbor. I lived here for 2 years back in 1943 and 1944 when I was in charge of the local Internal Revenue Office.

I am very much interested in S. 2720. I am here today, Mr. Chairman, on behalf of the U.S. Small Business Administration. I am especially interested in the Grays Harbor area for it is an area of labor surplus. As you know, we participated in the loan that made possible this entity here in Grays Harbor County, Pacific Protein, Inc.

This bill which would authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by our commercial fishing industry of fish protein concentrates is of particular interest to the Small Business Administration. You may be assured that you will have our support, as the fishing industry, not only here but in many areas, needs a fishery that will give more days fishing per year for our fishermen.

The hake fishery holds out that promise, and there is great interest up and down the Pacific coast—a new fishery is an exciting event.

We in SBA can visualize what an industry of this type would mean to anyone of the labor-depressed fishing communities. We hope that the Secretary of the Department of the Interior will give consideration to these communities.

This installation that is under construction at this time, Pacific Protein, Inc., is a result of an effort of the local community through a local development company. They used the facility of section 502 of the Investment Act which provides financing for this type of installation.

Mr. Chairman, I am available today to those people who represent other communities of this area, and I would be more than happy to discuss this very important program with them. It is a program where a local community can show their desire to help and create jobs. They will make the decision on the type of installation or the type of business to be created, the Federal Government offers moneys to provide this financing.

Once again, Mr. Chairman, it is a pleasure and privilege for me to be back in Grays Harbor County and to be with you today here in Aberdeen.

The CHAIRMAN. Thank you, Mr. Schumacker. I wanted to have your testimony to evidence the interest of the Small Business Administration in this project. This is a new thing, this is literally small business the way we always intended small business to be. It would employ a great number of people, and it fits right into what we try to do to keep up the economy of the smaller communities.

Mr. SCHUMACKER. It is a program where the local people make the decision on what is needed. We merely offer the financial help to provide this.

The CHAIRMAN. I think interest in projects of this sort carry out, in essence, the very goals of the Small Business Administration program.

Thank you very much.

Mr. SCHUMACKER. Thank you.

The CHAIRMAN. Mr. Schumacker was accompanied by some of the people who handle the Small Business Administration directly in the State, and if they wish to add to the testimony of Mr. Schumacker we will keep the record open.

The next witness is my old colleague, Thor Tollefson, who is now engaged in fisheries again in the State of Washington. I would like for you to make some comments, if you wish, on the hearing and the bill and such things as may be of interest at this time.

STATEMENT OF THOR TOLLEFSON, WASHINGTON STATE DIRECTOR OF FISHERIES, OLYMPIA, WASH.

Mr. TOLLEFSON. Thank you, Senator.

I have given copies of my statement to your staff. I do not wish to read the entire statement, but I would like to read excerpts from it.

The CHAIRMAN. We will put your statement in the record in full.

Mr. TOLLEFSON. I want to publicly pay my respects to the man who has contributed so much to the fisheries of the United States and especially the State of Washington. I know of no one in Congress who has contributed more, and I speak of you, Mr. Chairman.

The CHAIRMAN. Thank you.

Mr. TOLLEFSON. I want to commend you and your committee for giving consideration and study to the subject matter of the proposed legislation, the potential that it proposes seems to me to be tremendous, not only with respect to benefits and the economy of fishery States of our Nation, but also with respect to the benefits which will apply to hungry nations of the world. Utilization of presently unused stocks of fish will give new life to our fishing industry and will boost the economy of those States in which that industry plays an important role. Further than that, Mr. Chairman, the proposed legislation could resolve in a great asset for the President's war on hunger program. As he pointed out in his February 10 message to Congress, food products in the world, food production, has not kept pace with the population growth. He said that millions of lives are today threatened by hunger and that food production must be increased. He pointed out that despite the fact our Nation had supplied over 140

million tons of food to hungry people during the past decade, the problem of world hunger is more serious today than ever before. He warned that, and I quote:

> The time is not far off when all the combined production on all of the acres of all the agriculturally productive nations will not meet the food needs of the developing nations unless present trends are changed.

He proposed that the United States lead the world in a war against hunger.

Here, then, is a clear challenge for our Government and our fishing industry. The Government, under the policy proposed by the President, must lead and show the fishing industry the way in which both can meet the challenge. Theoretically, perhaps it would be possible for man to subsist simply on plant proteins for all the essential animal acids are present in the plant protein, as practically all of man's food energy is from the cereal grains such as wheat, corn, rice, barley, millet, peas, soy beans, and so forth, and these and the sulfur containing animal acids that man needs in his diet to stay in energetic health are needed, thus, as a practical matter the human needs also a considerable amount of animal protein. Fish protein contains all of the animal acids required by the human body. Nutritionists of the World Health Organization, FAO, and UNICEF say that 1½ billion people are presently living under conditions of protein malnutrition, damaging to health and energy, and that 500 million people are suffering actual sickness because of inadequate protein. It is considered that 30 grams per day of animal protein in the human diet is sufficient for maintaining the body in vigorous health, and 15 to 30 grams per day is considered to be on the borderline of a healthy situation, and less than 15 grams per day is considered in the danger zone. By the per capita daily consumption of animal protein in some selected countries, the United States is 66 grams, Japan 15 grams, Egypt 13 grams, Pakistan 8 grams, and India 6 grams. Experts say that the ocean is capable of producing at least 10 times more fish protein than presently is the case. Most of the fishes of the sea now die of natural death and return their components to the sea. In the ocean, then, are to be found the food resources which the President says the world needs so desperately, but those of us who have worked with fisheries know that before these resources can be made available and palatable most effectively and at the lowest possible cost they will have to be reduced to fish protein concentrate, that is, marine protein concentrate, right now, and that is one of the things that the pending proposal seeks to do.

It seems to me, Mr. Chairman, and members of your committee, you are here considering, essentially, the inducement of industry to get into the business of manufacturing marine protein concentrate on a scale large enough to utilize the vast fish protein resources of the sea. This would not only be beneficial to us, but would benefit also the millions of hungry people in the world whom we would like to help.

I thank you, Mr. Chairman.

The CHAIRMAN. I thank you, Thor, and I could return the compliment. I know of no one that has paid more attention to fisheries in Congress than you. By reading the papers lately I believe that you are paying a great deal of attention to our fisheries here at home. The State of Washington will have a big stake in its inland waters in this matter, and it is very important that we have this fine cooperation

between your department and the commercial fisheries of Washington and Oregon on this matter.

Now, George Johansen is here. He represents a large segment of fishermen in many areas of fisheries. We always welcome his testimony and advice in these matters. The reason I am calling on him now is he must go back to Seattle. He is in the middle of negotiations on the next season's salmon fishery, which we want to clear up, if we can, George, as soon as possible, so we can get busy on that feature of our fisheries.

STATEMENT OF GEORGE JOHANSEN, SECRETARY-TREASURER, ALASKA FISHERMEN'S UNION, SEATTLE, WASH.

Mr. JOHANSEN. Mr. Chairman, Mr. Tollefson, members of the committee, distinguished guests. I haven't prepared a statement because the pressure of business these last few weeks was such that I did not have the time; however, we will prepare and send one in later on.

I would just like to, Mr. Chairman, take a few minutes to discuss informally some of the things pertaining to this legislation.

The CHAIRMAN. George, if you would talk just a little louder in the mike so they can hear better.

Mr. JOHANSEN. First let me say that it is a pleasure to have the opportunity to appear before your committee. I don't recall how many times during the past 15 years I have testified on various fishery matters; it has been a good many times.

The CHAIRMAN. George has appeared before the House and Senate committee so much that sometimes when he walks in they have him take a seat up on the dais because they think he is a member.

Mr. JOHANSEN. In any event, we certainly appreciate the interest you have shown in the American fisheries, and I believe that even though we have problems today in our fishery fields, these problems would have been a great deal worse if it had not been for the chairman of the Senate Committee on Commerce.

The CHAIRMAN. Thank you.

Mr. JOHANSEN. I would also say that we have had diligent service by some of the Members on the House side, also. However, the mainstay of our fisheries and the help that we have received has come from the Senate Commerce Committee. We believe in this bill and we support it wholeheartedly. We believe in it because the purpose, as we see it, is to utilize fishery stocks not now extensively used. What is more important, the proposed legislation offers hope of a tremendous increase in our fishery food supply. This will supplement our own needs and at the same time offer opportunity for the United States to significantly enhance its position by being able to alleviate the hunger of those less fortunate than we are. Thus, it seems to me there are advantages which extend far beyond monetary returns. Most of the big nations are keenly aware of the opportunities that are offered by the seven seas. Some of these foreign nations might even be ahead of us at the present time.

The CHAIRMAN. George, right there, I don't know, either. Mr. McKernan, I am wondering if there are any other comparable, let's say, latent fisheries in the world, of the type we are talking about?

Mr. MCKERNAN. There very likely are some latent resources.

The CHAIRMAN. Are there any countries—I think what George and I were thinking about—are there any countries that are well ahead in this hake production doing what we are talking about, what we think we ought to do now?

Mr. MCKERNAN. No.

The CHAIRMAN. So we are even—at least as of today—we are unique in this field, but there are hake resources all over the world, natural fisheries resources.

Mr. MCKERNAN. Yes.

The CHAIRMAN. Thank you.

Mr. JOHANSEN. I am glad to hear that, because a good many times we have been behind on some of these vital matters and I believe if we are first, for a change, this is all to the good.

In any event, I do think that the United States needs to go ahead as quickly as possible. I think we need these pilot plants; we need the necessary experimentation so that we can come up with not only an abundance of protein food, but also a food that can be produced at a reasonable cost. I think these two things go very well together.

I think we can go a little farther and see some other benefits that we could obtain from this legislation. I think we ought to recall that the United States is a big importer of foreign fish. This is something that we have protested over a number of years, because we felt that by importing all of this fish our own fishermen have had to suffer economically. When, as Mr. McKernan stated earlier today, we consumed roughly 12 billion pounds——

The CHAIRMAN. To be exact at this point, I have the figures here. We take about 4 billion, 500 million plus pounds of fish ourselves, U.S. fleets. Our total use from what we catch and what we import is over 12 billion pounds. So, you can see the gap that is involved and the importance of this new raw product, from 4.5 to 12 billion, in-between.

Mr. JOHANSEN. I would say, Mr. Chairman, this presents a pretty lopsided picture and I for one have never been able to understand the import policies we have followed for a good many years, because these import policies have not only done us harm, marketwise, but because of the ease with which some of these foreign nations have been able to sell their products on American markets we have encouraged some of these foreign nations to come ever closer to our coast in obtaining the raw products they need to fill their markets which we could fill if we had the opportunity.

Coming back to this legislation, I believe because of this policy that we have followed over a number of years in regard to foreign imports, we have been forced into a kind of conservation deal that we otherwise perhaps would not have. We have been forced into conserving our coastal stocks because we were not in a position to fish and sell them on our own markets. We believe that because of this enforced conservation we have not only attracted foreign nations to come in here more and more, but we have also made it possible for foreign nations, as I said earlier, to be able to sell their fish on the world market and further restrict American sales.

We have observed both Russia and Japan for a number of years fishing off the coast of Alaska. This is bothering us and there hasn't been much we could have done about it. Perhaps, I think the resolution you passed in the Senate some 3 years ago dealing with the World

Conference of Fisheries offers great possibilities of talking conservation to these people.

The CHAIRMAN. There isn't any reason now for any delay in setting up the machinery for this, as the 1958 Geneva Convention about which you know, was implemented last month with enough signatures to make it a living document. Now we can begin; is that correct?

Mr. JOHANSEN. Well, I didn't know until this morning that it had actually been implemented.

The CHAIRMAN. Yes. We received a sufficient number of signatures a month ago. Now it is a document that can be put into operation. Russia and Japan still are not signators, but there are 22 that are. The Netherlands was the 22d to sign up and make it then an operable document. This was just last month.

Mr. JOHANSEN. I was pleased to learn this morning that this had received the necessary ratification. I believe it offers very great opportunity for us to provide conservation rules that will safeguard our coastal stocks. I think one of the significant things about the Geneva Convention is that it does not necessarily deal with inside your territorial waters, but it deals with the resources in your coastal waters outside of your territorial limits as well. However, I think we must recognize this, Mr. Chairman, that in discussing conservation we must be able to show some utilization and as of now we have not been in the best position to discuss conservation because we simply have not scratched some of these resources which we could have utilized if we had had an opportunity to do so.

The CHAIRMAN. And would not this that we are talking about be one?

Mr. JOHANSEN. That is what I am coming back to. This legislation, in addition to offering employment and hope to feed not only our own people but other people of the world as well, also gives us an opportunity to utilize the product and strengthen our position with respect to discussing conservation with some of these foreign nations that may fish off our coasts. To that extent I believe that this bill is not only important as far as a food base, but important all the way through as to employment, conservation, and preservation of coastal fishery stocks.

The CHAIRMAN. I will at this point place in the record the Convention on Fishing and Conservation of Living Resources of the High Seas. This Convention entered into force March 20, 1966, 30 days after the deposit of the 22d ratification. I now read article 2, which says:

> As employed in this convention, the expression "conservation of living resources on the high seas" means the aggregates of measures rendering possible the optimum sustainable yield for these resources so as to secure a maximum supply of food and other marine products. Conservation programs should be formulated with a view to securing in the first place a supply of food for human consumption.

(The Convention follows:)

CONVENTION ON FISHING AND CONSERVATION OF THE LIVING RESOURCES OF THE HIGH SEAS

The States Parties to this Convention,

Considering that the development of modern techniques for the exploitation of the living resources of the sea, increasing man's ability to meet the need of the world's expanding population for food, has exposed some of these resources to the danger of being overexploited.

Considering also that the nature of the problems involved in the conservation of the living resources of the high seas is such that there is a clear necessity that they be solved, whenever possible on the basis of international co-operation through the concerted action of all the States concerned.

Have agreed as follows:

ARTICLE 1

1. All States have the right for their nationals to engage in fishing on the high seas, subject (*a*) to their treaty obligations, (*b*) to the interests and rights of coastal States as provided for in this Convention, and (*c*) to the provisions contained in the following articles concerning conservation of the living resources of the high seas.

2. All States have the duty to adopt, or toco-operate with other States in adopting, such measures for their respective nationals as may be necessary for the conservation of the living resources of the high seas.

ARTICLE 2

As employed in this Convention, the expression "conservation of the living resources of the high seas" means the aggregate of the measures rendering possible the optimum sustainable yield from those resources so as to secure a maximum supply of food and other marine products. Conservation programmes should be formulated with a view to securing in the first place a supply of food for human consumption.

ARTICLE 3

A State whose nationals are engaged in fishing any stock or stocks of fish or other living marine resources in any area of the high seas where the nationals of other States are not thus engaged shall adopt, for its own nationals, measures in that area when necessary for the purpose of the conservation of the living resources affected.

ARTICLE 4

1. If the nationals of two or more States are engaged in fishing the same stock or stocks of fish or other living marine resources in any area or areas of the high seas, these States shall, at the request of any of them, enter into negotiations with a view to prescribing by agreement for their nationals the necessary measures for the conservation of the living resources affected.

2. If the States concerned do not reach agreement within twelve months, any of the parties may initiate the procedure contemplated by article 9.

ARTICLE 5

1. If, subsequent to the adoption of the measures referred to in articles 3 and 4, nationals of other States engage in fishing the same stock or stocks of fish or other living marine resources in any area or areas of the high seas, the other States shall apply the measures, which shall not be discriminatory in form or in fact, to their own nationals not later than seven months after the date on which the measures shall have been notified to the Director-General of the Food and Agriculture Organization of the United Nations. The Director-General shall notify such measures to any State which so requests and, in any case, to any State specified by the State initiating the measure.

2. If these other States do not accept the measures so adopted and if no agreement can be reached within twelve months, any of the interested parties may initiate the procedure contemplated by article 9. Subject to paragraph 2 of article 10, the measures adopted shall remain obligatory pending the decision of the special commission.

ARTICLE 6

1. A coastal State has a special interest in the maintenance of the productivity of the living resources in any area of the high seas adjacent to its territorial sea.

2. A costal State is entitled to take part on an equal footing in any system of research and regulation for purposes of conservation of the living resources of the high seas in that area, even though its nationals do not carry on fishing there.

64-610—66——6

3. A State whose nationals are engaged in fishing in any area of the high seas adjacent to the territorial sea of a coastal State shall, at the request of that coastal State, enter into negotiations with a view to prescribing by agreement the measures necessary for the conservation of the living resources of the high seas in that area.

4. A State whose nationals are engaged in fishing in any area of the high seas adjacent to the territorial sea of a coastal State shall not enforce conservation measures in that area which are opposed to those which have been adopted by the coastal State, but may enter into negotiations with the coastal State with a view to prescribing by agreement the measures necessary for the conservation of the living resources of the high seas in that area.

5. If the States concerned do not reach agreement with respect to conservation measures within twelve months, any of the parties may initiate the procedure contemplated by article 9.

ARTICLE 7

1. Having regard to the provisions of paragraph 1 of article 6, any coastal State may, with a view to the maintenance of the productivity of the living resources of the sea, adopt unilateral measures of conservation appropriate to any stock of fish or other marine resources in any area of the high seas adjacent to its territorial sea, provided that negotiations to that effect with the other States concerned have not led to an agreement within six months.

2. The measures which the coastal State adopts under the previous paragraph shall be valid as to other States only if the following requirements are fulfilled:

(*a*) That there is a need for urgent application of conservation measures in the light of the existing knowledge of the fishery;

(*b*) That the measures adopted are based on appropriate scientific findings;

(*c*) That such measures do not discriminate in form or in fact against foreign fishermen.

3. These measures shall remain in force pending the settlement, in accordance with the relevant provisions of this Convention, of any disagreement as to their validity.

4. If the measures are not accepted by the other States concerned, any of the parties may initiate the procedure contemplated by article 9. Subject to paragraph 2 of article 10, the measures adopted shall remain obligatory pending the decision of the special commission.

5. The principles of geographical demarcation as defined in article 12 of the Convention on the Territorial Sea and the Contiguous Zone shall be adopted when coasts of different States are involved.

ARTICLE 8

1. Any State which, even if its nationals are not engaged in fishing in an area of the high seas not adjacent to its coast, has a special interest in the conservation of the living resources of the high seas in that area, may request the State or States whose nationals are engaged in fishing there to take the necessary measures of conservation under article 3 and 4 respectively, at the same time mentioning the scientific reasons which in its opinion make such measures necessary, and indicating its special interest.

2. If no agreement is reached within twelve months, such State may initiate the procedure contemplated by article 9.

ARTICLE 9

1. Any dispute which may arise between States under articles 4, 5, 6, 7 and 8 shall, at the request of any of the parties, be submitted for settlement to a special commission of five members, unless the parties agree to seek a solution by another method of peaceful settlement, as provided for in Article 33 of the Charter of the United Nations.

2. The members of the commission, one of whom shall be designated as chairman, shall be named by agreement between the States in dispute within three months of the request for settlement in accordance with the provisions of this article. Failing agreement they shall, upon the request of any State party, be named by the Secretary-General of the United Nations, within a further three-month period, in consultation with the States in dispute and with the President

of the International Court of Justice and the Director-General of the Food and Agriculture Organization of the United Nations, from amongst well-qualified persons being nationals of States not involved in the dispute and specializing in legal, administrative or scientific questions relating to fisheries, depending upon the nature of the dispute to be settled. Any vacancy arising after the original appointment shall be filled in the same manner as provided for the initial selection.

3. Any State party to proceedings under these articles shall have the right to name one of its nationals to the special commission, with the right to participate fully in the proceedings on the same footing as a member of the commission but without the right to vote or to take part in the writing of the commission's decision.

4. The commission shall determine its own procedure, assuring each party to the proceedings a full opportunity to be heard and to present its case. It shall also determine how the costs and expenses shall be divided between the parties to the dispute, failing agreement by the parties on this matter.

5. The special commission shall render its decision within a period of five months from the time it is appointed unless it decides, in case of necessity, to extend the time limit for a period not exceeding three months.

6. The special commission shall, in reaching its decisions, adhere to these articles and to any special agreements between the disputing parties regarding settlement of the dispute.

7. Decisions of the commission shall be by majority vote.

ARTICLE 10

1. The special commission shall, in disputes arising under article 7, apply the criteria listed in paragraph 2 of that article. In disputes under articles 4, 5, 6 and 8 the commission shall apply the following criteria, according to the issues involved in the dispute:

(*a*) Common to the determination of disputes arising under articles 4, 5 and 6 are the requirements:

(i) That scientific findings demonstrate the necessity of conservation measures;

(ii) That the specific measures are based on scientific findings and are practicable; and

(iii) That the measures do not discriminate, in form or in fact, against fishermen of other States.

(*b*) Applicable to the determination of disputes arising under article 8 is the requirement that scientific findings demonstrate the necessity for conservation measures, or that the conservation programme is adequate, as the case may be.

2. The special commission may decide that pending its award the measures in dispute shall not be applied, provided that, in the case of disputes under article 7, the measures shall only be suspended when it is apparent to the commission on the basis of *prima facie* evidence that the need for the urgent application of such measures does not exist.

ARTICLE 11

The decisions of the special commission shall be binding on the States concerned and the provisions of paragraph 2 of Article 94 of the Charter of the United Nations shall be applicable to those decisions. If the decisions are accompanied by any recommendations, they shall receive the greatest possible consideration.

ARTICLE 12

1. If the factual basis of the award of the special commission is altered by substantial changes in the conditions of the stock or stocks of fish or other living marine resources or in methods of fishing, any of the States concerned may request the other States to enter into negotiations with a view to prescribing by agreement the necessary modifications in the measures of conservation.

2. If no agreement is reached within a reasonable period of time, any of the States concerned may again resort to the procedure contemplated by article 9 provided that at least two years have elapsed from the original award.

ARTICLE 13

1. The regulation of fisheries conducted by means of equipment embedded in the floor of the sea in areas of the high seas adjacent to the territorial sea of a State may be undertaken by that State where such fisheries have long been maintained and conducted by its nationals, provided that non-nationals are permitted to participate in such activities on an equal footing with nationals except in areas where such fisheries have by long usage been exclusively enjoyed by such nationals. Such regulations will not, however, affect the general status of the areas as high seas.

2. In this article, the expression "fisheries conducted by means of equipment embedded in the floor of the sea" means those fisheries using gear with supporting members embedded in the sea floor, constructed on a site and left there to operate permanently or, if removed, restored each season on the same site.

ARTICLE 14

In articles 1, 3, 4, 5, 6 and 8, the term "nationals" means fishing boats or craft of any size having the nationality of the State concerned, according to the law of that State, irrespective of the nationality of the members of their crews.

ARTICLE 15

This Convention shall, until 31 October 1958, be open for signature by all States Members of the United Nations or of any of the specialized agencies and by any other State invited by the General Assembly of the United Nations to become a Party to the Convention.

ARTICLE 16

This Convention is subject to ratification. The instruments of ratification shall be deposited with the Secretary-General of the United Nations.

ARTICLE 17

This Convention shall be open for accession by any States belonging to any of the categories mentioned in article 15. The instruments of accession shall be deposited with the Secretary-General of the United Nations.

ARTICLE 18

1. This Convention shall come into force on the thirtieth day following the date of deposit of the twenty-second instrument of ratification or accession with the Secretary-General of the United Nations.

2. For each State ratifying or acceding to the Convention after the deposit of the twenty-second instrument of ratification or accession, the Convention shall enter into force on the thirtieth day after deposit by such State of its instrument of ratification or accession.

ARTICLE 19

1. At the time of signature, ratification or accession, any State may make reservations to articles of the Convention other than to articles 6, 7, 9, 10, 11 and 12.

2. Any Contracting State making a reservation in accordance with the preceding paragraph may at any time withdraw the reservation by a communication to that effect addressed to the Secretary-General of the United Nations.

ARTICLE 20

1. After the expiration of a period of five years from the date on which this Convention shall enter into force, a request for the revision of this Convention may be made at any time by any Contracting Party by means of a notification in writing addressed to the Secretary-General of the United Nations.

2. The General Assembly of the United Nations shall decide upon the steps, if any, to be taken in respect of such request.

ARTICLE 21

The Secretary-General of the United Nations shall inform all States Members of the United Nations and the other States referred to in article 15:

(*a*) Of signatures to this Convention and of the deposit of instruments of ratification or accession, in accordance with articles 15, 16 and 17;

(*b*) Of the date on which this Convention will come into force, in accordance with article 18;

(*c*) Of requests for revision in accordance with article 20;

(*d*) Of reservations to this Convention, in accordance with article 19.

ARTICLE 22

The original of this Convention, of which the Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations, who shall send certified copies thereof to all States referred to in article 15.

IN WITNESS WHEREOF the undersigned Plenipotentiaries, being duly authorized thereto by their respective Governments, have signed this Convention.

DONE at Geneva, this twenty-ninth day of April one thousand nine hundred and fifty-eight.

Mr. JOHANSEN. Well, now, if we could get the State Department moving on a world conference.

The CHAIRMAN. Let me read article 6, and this is very significant:

A coastal state has a special interest in the maintenance of the productivity of the living resources in any area of the high seas adjacent to its territorial sea.

It does not limit it to its territorial sea, it says "adjacent." This is what we have been wanting for a long time.

Mr. JOHANSEN. This is what I said earlier, Mr. Chairman, that they have the power to write regulations and rules for a fishery even outside its territorial waters and they have the power under this convention to initiate unilateral action if a foreign nation fishing on those stocks fail to negotiate on those issues within a reasonable time. I think we might also say this, that it does not offer a cure-all for the simple reason that those nations that have not subscribed to it in the first place are not necessarily bound by the convention. On the other hand, having been established as part of international law it carries a lot of weight, particularly when you can come up with a sound argument on conservation.

The CHAIRMAN. The Chairman wants to announce, that implementing this we have set up a further meeting on the whole international matter with the State Department. It is, I believe, to be on the 15th or 16th of May. We have a reply from Thomas C. Mann who is the Under Secretary of State for Economic Affairs, wanting to sit down with us and talk about this convention. There will be several representatives from our area and from other fishing states.

Mr. JOHANSEN. I think that will be very helpful. In any event, in order to make a long story short, I believe that this legislation is a step in the right direction, not only a step in the right direction, but it is a necessity and a must if we intend to make claim to the fishery stocks that we have.

The CHAIRMAN. Could I have a minute?

We are having the hearings on the off-shore limit bill on the 18th of May, but our meeting with the Secretary is going to be on the 11th, prior to the hearing.

Mr. JOHANSEN. As I was saying, I think this bill is necessary. I think we have to go ahead with it, and I think that we are not only going to benefit from it foodwise, we will benefit from it economically. We will benefit by it by showing utilization of these stocks and therefore enforcing conservation on these stocks. There are a good many benefits connected with it, and for that reason we wholeheartedly support the purpose and aims of S. 2720.

I would like in conclusion, Mr. Chairman, to mention one other thing. I might be out of order in doing this, but I believe that it is a subject that is close to my heart and I think that we should again begin to think in terms of taking certain action in regard to reorganizing our present fisheries. By that I mean we have now come to a point in our history where we need a Department of Fisheries. I find that in the present departments, like in the State Department, we have some difficult things to talk about, to discuss and to consider, and when you come to fish you have reached the bottom rung of the ladder and more often than not you get no consideration on the merits of the fishery question itself. These questions are decided on the merits of foreign policy or some other questions that may be pending and I believe we ought to have a department of our own with a Secretary on a Cabinet level who would speak for the fisheries on the merits of these fisheries. I really believe that in addition to the fisheries, oceanography could also be included in this department. We have studied and we have read a lot about oceanography lately, and this is one of your accomplishments in the Senate, Mr. Chairman. You have taken far more note of it than most of our other Senators and have done a lot of work on this project. We need to do a lot more, and I think we need to have a separate department for fisheries and oceanography. I believe that unless we do come to that decision sooner or later we are not going to be able to deal with these fishery matters that are becoming increasingly important as the years go by. As a matter of fact, I don't know of anything that is becoming so important as studies of the sea and deriving food from the sea. To that extent I certainly advocate to you that some action should be taken to establish that department.

Thank you, Mr. Chairman.

The CHAIRMAN. I don't disagree with you and I haven't in that matter for a long, long time, but at least first, the minimum we should have is a higher policy level in the State Department.

Mr. JOHANSEN. I will submit a prepared statement for the record. I appreciate the opportunity of being here.

(The statement referred to above follows:)

STATEMENT IN SUPPORT OF S. 2720 RE FISH PROTEIN CONCENTRATE

By George Johansen, Secretary-Treasurer, Alaska Fishermen's Union, Seattle, Washington

Reference is made to the hearing held in Aberdeen, Washington, recently on S. 2720, which deals with appropriations by the Federal Government to finance construction of five pilot plants for conducting necessary experimentation to make possible satisfactory methods to produce a product in compliance with standards endorsed by the Food and Drug Administration.

The National Academy of Sciences has endorsed Fish Protein Concentrate as a food supplement. The need to supplement the diet of hungry people is a real necessity, which must be met. Because fish can be obtained at reasonable prices, and tests have shown this raw material to be a source of high quality protein, failure to enact this legislation could seriously hinder the United States in meeting its obligation—not only to the hungry of the world, but to its own citizens as well.

The testimony at Aberdeen, Washington, clearly enumerates the many benefits we can obtain from fish protein concentrate, and stresses that the major cause of malnutrition throughout the world is a lack of protein. Therefore, it would be repetitious on our part to cover the same ground, but there are other considerations which we feel necessary to mention.

For some years we have noted a steady expansion of Russian and Japanese fishing fleets off the coast of Alaska. In recent months Russian nationals have also started fishing operations off the coasts of Washington and Oregon. The size of these fleets plus their up-to-date equipment which is capable of harvesting millions of pounds of fish each day the vessels are operating, make it imperative that serious consideration be given to conservation of the fisheries in our coastal waters. Because of foreign competition, the American market has been depressed; consequently, we have not used these fisheries resources as extensively as otherwise would have been the case. Hence, we are not in the best position to discuss conservation. S. 2720 offers a real opportunity for American fishermen to participate in a fishery which will be of utmost importance economically and as a food supply.

It is interesting to note that Russia produced 5,600,000 tons of fish in 1965, while the United States—according to our 1964 figures (we do not have complete figures for 1965)—produced only 2,638,000 tons. Our production did not significantly increase in 1965, so one may assume Russia is out-producing the United States, 2 to 1, at present.

In addition to providing the answers we need to initiate a meaningful production of what is termed "marine protein concentrate," S. 2720 will also help to reverse the downward trend in fishery production which we have experienced for the past several years. Our statement on S. 2720 would not be complete without quoting President Johnson, in his message to Congress on Feb. 10, 1966, entitled "War on Hunger," in which he said:

"We must develop inexpensive, high-quality synthetic foods as dietary supplements. A promising start has already been made in isolating protein sources from fish, which are in plentiful supply."

On February 2, 1965, the President told Congress:

"We need to know much more about the effects of nutritional deficiency: the cheapest and best ways to apply technological advances and how to develop new, rich sources of protein. I am requesting funds for aid to expand basic and applied research in this area."

We are gratified to note the concern of the Administration in this subject. We believe the President's statements should be taken as a complete endorsement of the purpose of S. 2720.

We commend Senator Warren G. Magnuson and Senator E. L. "Bob" Bartlett for taking the initiative in introducing this legislation, which can mean so much to all of us. We strongly urge approval and speedy passage of S. 2720.

The CHAIRMAN. Thank you, and I hope the negotiations go well.

Mr. JOHANSON. Well, we signed one contract; I hope we can get agreement the next one, also.

The CHAIRMAN. John Haydon is here. He is a member of the advisory board of the Washington State Department of Fisheries and the Washington State Department of Commerce and Economic Development. John is a member of the Seattle Port Commission, also, and very prominent in maritime and fishery matters.

John, we will be glad to hear from you on this matter, specifically on the bill or in a general way, as you wish.

STATEMENT OF JOHN M. HAYDON, MEMBER OF ADVISORY BOARDS, STATE OF WASHINGTON DEPARTMENT OF FISHERIES, DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT; VICE CHAIRMAN OF PUGET SOUND OCEANOGRAPHY STUDY COMMITTEE

Mr. HAYDON. On the State's potential, Mr. Chairman, I don't think it is necessary to go into the need for the commercial manufacture of maritime protein concentrate, and I will have trouble with this statement because I have fish protein all the way through here.

Half the world is lacking because of nutritional deficiency that we can see, and maritime protein concentrate we can see is the most valuable food supplement now available. It is extremely feasible to produce this commercially in the best testimony of experts who have appeared in many of your hearings and with which you are familiar.

Of course, the State of Washington has a vital interest in the question being considered here today, whether or not one or more production plants should be placed into production and the marketing of a product itself. Although this State is one of America's most important fish producing areas we have felt the effects and absorbed our share of the gradual decline of the U.S. position in world fishery production. Our State has become more and more dependent upon imported fishery products, some from other States and much from abroad. Washington's belief in the value of two-way commerce and the freest kind of trade possible is under continuous emphasis by our State officials and the leaders of our private industries. At the same time, this leadership recognizes that much more must be done within the State of Washington to expand our own industries, to create new products and new markets out of the reservoir of raw resources, production talent and marketing ability as yet unused.

Important international trade development legislation was introduced in the last session by you, Senator Magnuson, and I believe this is undergoing hearings now. It tests the desire of this State to further its participation in foreign commerce and within this context, the possible production of fish protein concentrate, at long last, can be viewed as an exciting and practical opportunity for which Washington is uniquely fitted for a number of reasons. First, the vast quantities of the raw resource needed to produce fish protein concentrate have been located in Washington's waters through an imaginative exploratory program of the Bureau of Commercial Fisheries and implemented by private industry. A steady supply of this resource now seems assured.

Secondly, private industry has evinced a willingness to invest and take an active part in the production and distribution of this new resource. Pacific Protein, Inc., is a leading example of what can be done with private investment. But it should be emphasized that it is only through the construction of these pilot plants under Federal leadership that the full commercial benefits will eventually be realized.

Geographically, Washington lies far closer, by virtue of its Great Circle navigation routes, to the millions of people in the major countries of the Pacific Rim who stand most in need of the health-giving

benefits of fish protein concentrate. For example, the ports of this State are closer to major Far East markets by 1 or 2 days sailing time than other ports on the Pacific coast.

The depth of our talent resources assures a meaningful cooperation to the Federal Government in the construction and businesslike operation of a first fish protein concentrate pilot plant. In effect, this is insurance on the Federal investment for these talent resources can help substantially in providing practical answers to the problems involved in getting this program underway. I will mention only a few sections of this talent. It starts with our trained fishermen and their vessels, private industry in all aspects of the fishing business, our scientific structure in the University of Washington School of Fisheries, the State department of fisheries, the Fisheries Research Institute, and the cooperating Federal agencies heavily established here, which are the Bureau of Commercial Fisheries, Coast Guard, Coast and Geodetic Survey, and the Environmental Science Services Administration, which only recently announced that the Puget Sound areas has been designated the center of its western activities and Pacific Ocean activities and its west coast branch of the Oceanographic Institute would be built on Puget Sound. Maritime labor leaders are here in depth and interested in helping with this project.

Factor five, and I think this should be given particular emphasis, is our unique international marketing experience because it fits in particularly well with the distribution and sales problems to be faced as fish protein concentrate gets into actual production. Our wheat producers have carried out an amazingly successful marketing program in the Far East. In the process, they have literally changed the dietary habits of several million people. The intricate programing used to achieve this success is available. Washington producers of beans, peas, and lentils are now engaged in similar programs abroad. Our poultry industry, our plywood industry, and others are actively creating new markets abroad, not only in the Far East but in Europe.

Gov. Daniel J. Evans and 40 members of a trade team from private industry and government are just now returning from the State of Washington pavilion participation in the Osaka International Trade Fair and visits to Formosa, Korea, the Phillipine Islands, and Hong Kong, creating new opportunities for the sale of Washington products in those countries. This is not a new effort, because it has been going on continuously since 1951, I think the longest continuous operation of its kind postwar in the United States. A wealth of foreign marketing experience has been gained in a hard, practical fashion, and it is available for assistance in the marketing of fish protein concentrate.

Factor six, our location——

The CHAIRMAN (interrupting). What we are talking about could well be one of the most attractive and sought-after products in the Orient, of all things that we have to offer.

Mr. HAYDON. It could be, particularly because it can be combined so quickly to foods to which people are already accustomed as a supplemental diet.

Finally, our strategic location in reference to more than two-thirds of the U.S. Continental Shelf area, the huge land-water mass which

contains and from which must come the fishery resource to feed a heavy, constant fish protein production, I think it is meaningful to emphasize our location in relation to this Continental Shelf as we consider the establishment of pilot plants. While the location of the first plant is not the question being considered here today, these elements which should have bearing on location are hard to escape. Not only is Washington strategically located, but the fortunate geography, applying as practically as it does to the fish protein concentrate program, applies just as practically to a vital national need for Continental Shelf exploration and exploitation.

In June 1964 the United States signed an international agreement which grants each nation the right to explore and exploit its Continental Shelf to a depth of 655 feet and deeper where the capability exists to do so. The real sleeper in this agreement, and it is as binding as a treaty, is this phrase:

> The rights to exploit natural resources of the seabed and subsoil of areas beyond the Continental Shelf may be obtained by the nation with the technological or engineering capability to first exploit them.

We have seen, as Mr. Johansen mentioned, and others, the foreign nations fishing off our shores. If we fail to carry out our proper Continental Shelf programs we are just as likely to see foreign nations exploiting our natural resources just off the 200 meter line of the coast of Washington and other coastal States. We have seen major oil companies invest and produce; we have seen gold starting to be mined beneath the sea; diamonds are now being mined beneath the seas; new fishery resources have been located, and plans are being carried out to utilize these resources.

The United States lags behind in its programs to find and use the resources of the Continental Shelf. Much important work has been done, but other countries have done more. Unless our program gets into gear, Americans may well find foreign nations busy exploiting the sea's resources just a few miles off American shores at the 655-foot depth line. As you well know, you have held so many hearings on this subject, we lag behind the other countries.

Ironically, the United States is only belatedly coming to realize the economic implications. Oceanographic development has toddled along on starvation diet funds while billions are spent on space programs. No one debates the importance of space, but the economic benefits are few, and I think the subject we are considering here today indicates the almost instantaneous commercial benefits of programs like these, and others will come out of Continental Shelf development.

To emphasize our strategic location, the land area of our country is 3,615,211 square miles, roughly. The surface area of the Continental Shelf adjacent to the United States is 850,000 square miles, approximately one-fourth this country's present size. Roughly, two-thirds of this entire amount lies in Alaska and the State of Washington. This is a dramatic statistic in my opinion and in the opinions of others who have studied it, because this is the area from which not only the hake will come, but the Alaskan pollack and other fish which much feed an expanding fish protein concentrate program. Almost half the Pacific lies off the State of Washington.

In hearings on Senator Warren Magnuson's oceanographic bill S. 944, now heading for House-Senate conference, Adm. Edward C.

Stephan, former oceanographer of the Navy, put it this way: "A new continent has been opened up," and this is true. This is what we are looking at today. Industrialists, labor leaders, fishermen, scientists all have attested to this, and it is my opinion that what we are looking at here today very well could be the type of imaginative project which could open up and start a meaningful U.S. program in the Continental Shelf development with the Pacific Northwest area playing a leading part in that project. Our State of Washington has its existing departments along with its newly organized State marine on tap ready, willing, and able to assist the efforts behind Senate bill 2720. These people will join with private industry, the public courts, the university and oceanographic groups, and the concerned Federal agencies, long located in our State, to help in every way possible.

The production of fish protein concentrate and the distribution of its life-strengthening qualities to our domestic markets and to the undernourished populations of the world is truly a rare opportunity with a unique combination of humane and commercial elements not often found.

The State of Washington not only wants to be in the forefront of this program, it is determined to be.

Thank you.

The CHAIRMAN. Thank you, John.

Let me ask you this. Don't you believe that one of the most important aspects of us paying attention to this economic food potential and use of a resource such as hake, for example, the most important thing we can do is to go out and show that we have a use for it and we are going to use it? You and I know that you can't solve any international problem with anyone by saying, "oh, you are doing something to the ocean," and they say, "Well, you are not using it, you aren't taking advantage of it." This is what we have to be thinking about, whether it be hake, anchovies, or any other resource we have out there. Until we do that we are not going to get very far at a conference table, the reasons being obvious. I think the real importance of this is that we are showing that we intend to make use of these resources. Is this what you suggest?

Mr. HAYDON. And we can make use, too. In all honesty, I believe that the job done by the wheat people in this State was a more difficult one than selling this health-giving protein concentrate to people in foreign nations, because wheat was a complete changeover of diet, whereas this will merely supplement the diet to which people are accustomed.

(The full statement of Mr. Haydon follows:)

STATEMENT OF JOHN M. HAYDON, MEMBER OF ADVISORY BOARDS—STATE OF WASHINGTON DEPARTMENT OF FISHERIES, AND DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT; VICE-CHAIRMAN, PUGET SOUND OCEANOGRAPHY STUDY COMMITTEE RE PRODUCTION OF FISH PROTEIN CONCENTRATE—ITS POTENTIAL FOR THE STATE OF WASHINGTON

Mr. Chairman and members of the committee: I do not believe it is necessary to discuss the vital worldwide need for the development of practical and economic methods of producing and distributing fish protein concentrate. Outstanding scientists, health experts, fishery leaders and industrial executives have produced a mass of testimony presented to hearings of this and other Congressional committees, indicating that:

1. More than half—57 percent—of the world's population suffers from a lack of sufficient protein.

2. Fish Protein Concentrate is probably the most valuable food supplement suitable for alleviating this international health (and political) problem.

3. Actual, commercial production and marketing of fish protein concentrate is feasible and can contribute significantly to the economic health of the United States—particularly those sections of the country containing great coastal fisheries and huge areas of relatively unexplored Continental Shelf—as, at the same time, it helps alleviate world-wide malnutrition, thus building a positive political image for the United States among the developing countries.

The State of Washington has a vital interest in the question being considered here today: Whether the Congress should authorize the construction and operation of five pilot plants for the production and marketing of fish protein concentrate.

Although it is one of America's most important fish-producing areas, Washington has felt the effects and absorbed its share of the gradual decline of the United States' position in world fisheries production. Along with other U.S. areas, Washington has become more and more dependent upon imported fisheries products, some from other states, much from abroad. Washington's belief in the value of two-way commerce and the freest kind of trade possible is under continuous emphasis by our state officials and the leaders of our private industries. At the same time, this leadership recognizes that much more must be done within the State of Washington to expand our own industries, to create new products and new markets out of the reservoir of raw resources, production talent and marketing ability as yet unused.

Within this context, the possible production of fish protein concentrate—at long last—can be viewed as an exciting and practical opportunity for which Washington is uniquely fitted for a number of reasons:

1. Vast quantities of the raw resource needed to produce fish protein concentrate have been located in Washington's waters through an imaginative exploratory program of the Bureau of Commercial Fisheries, and implemented by private industry. A steady supply of this resource now seems assured.

2. Private industry has evinced a willingness to invest and take an active part in the production and distribution of this new resource. Pacific Protein, Inc. is a leading example. But it should be emphasized that it is only through the construction of these pilot plants under Federal leadership, that the full commercial benefits will eventually be realized.

3. Geographically, Washington lies far closer, by virtue of its Great Circle navigation routes, to the millions in the major countries of the Pacific Rim who stand most in need of the health-giving benefits of fish protein concentrate. For example, the ports of this state are closer to major Far East markets by one or two days sailing time.

4. The depth of our talent resources assures a meaningful cooperation to the federal government in the construction and business-like operation of a first fish protein concentrate pilot plant. In effect, this is insurance on the federal investment, for these talent resources can help substantially in providing practical answers to the problems involved in getting this program underway. I will mention only a few sections of this talent. It starts with our trained fishermen and their vessels, private industry in all aspects of the fishing business; our scientific structure in the University of Washington School of Fisheries; the State Department of Fisheries; the Fisheries Research Institute; and the cooperating federal agencies heavily established here: Bureau of Commercial Fisheries, Coast Guard, Coast and Geodetic Survey, and the Environmental Science Services Administration. This latter has only recently chosen this state as the designated center of its western and Pacific activities. Fishermen, scientists, educators, businessmen and maritime labor leaders are here in depth; they are experienced and interested in helping with this project.

5. *Washington's unique international marketing experience* fits in particularly well with the distribution and sales problems to be faced as fish protein concentrate gets into actual production. Our wheat producers have carried out an amazingly successful marketing program in the Far East. In the process, they have literally changed the dietary habits of several million people. The intricate programming used to achieve this success is available. Our producers of beans,

peas and lentils are now engaged in similar programs abroad. Our poultry industry, our plywood industry and others are actively creating new markets abroad, not only in the Far East but in Europe.

Governor Daniel J. Evans and 40 members of a trade team from private industry and government are just now returning from the State of Washington Pavilion participation in the Osaka International Trade Fair—(Washington is the only state in the United States accepted as an exhibitor at this immense fair, as it was the only state in the United States accepted to exhibit at the Tokyo International Trade Fair)—and from opening new trade opportunities for Washington products in Japan, Korea, Hong Kong, Formosa and the Philippines. This is not a new effort. Under the direction of Washington State International Trade Fair, Inc., it has been going on continuously since 1951, a wealth of foreign marketing experience gained in hard, practical fashion—and available for assistance in the marketing of fish protein concentrate.

6. Washington's strategic location in reference to more than two-thirds of the United States' Continental Shelf area, the huge land-water mass which contains—and from which must come—the fishery resource to feed a heavy constant fish protein production.

It is worthwhile to emphasize Washington's location in relation to Continental Shelf mass as we consider the establishment of pilot plants. While the location of the first plant is not the question being considered here today, those elements which should have bearing on location are hard to escape. Not only is Washington strategically located, but the fortunate geography—applying as practically as it does to the fish protein concentrate program—applies just as practically to a vital national need for Continental Shelf exploration and exploitation.

Engineers and scientists are now puzzling over the problem of how to explore the Continental Shelf, that great mass of land lying off our coasts out to the 655-foot depth line. A score of treasures lie waiting, untapped: physical, mineral, chemical and animal resources which, as our normal supplies of these things are depleted, will be needed to satisfy man's wants—in numerous cases, man's vital needs for existence.

In June, 1964, the United States signed an international agreement which grants each nation the right to explore and exploit its Continental Shelf to a depth of 655 feet and deeper where the capability exists to do so. The real sleeper in this agreement—and it is as binding as a treaty—is this phrase, "The rights to exploit natural resources of the seabed and subsoil of areas beyond the Continental Shelf may be obtained by the nation with the technological or engineering capability to first exploit them."

Literally, this means that the rights to extract, process, use or sell the resources beyond the shelf will go to those nations which first develop and use the instruments, equipment and technologies necessary to do the job. Major oil companies are gradually perfecting at tremendous cost their methods of taking oil from beneath the sea. Much more oil lies yet to be discovered. Already gold and diamonds are being mined beneath the sea, and new fishery resources, like the vast schools of hake off the Pacific Coast, have been located, and plans are being carried out to utilize them.

The United States lags behind in its programs to find and use the resources of the Continental Shelf. Much important work has been done, but other countries have done more. Unless our program gets into gear, Americans may well find foreign nations busy exploiting the sea's resources just a few miles off American shores at the 655-foot depth line. Current foreign harvests of fishery resources off U.S. coasts are a realistic harbinger of what will happen in other potentially rich areas unless this country is first to develop the techniques and the programs.

Ironically, the United States is only belatedly coming to realize the economic implications. Oceanographic development has toddled along on starvation diet funds while billions are spent on space programs. No one debates the importance of space, but the economic benefits are few. Marine resource development, however, offers vast areas of future activity for private industry to invest, because they will create profitable activity.

The land area of the United States is 3,615,211 square miles. The surface area of the Continental Shelf adjacent to the United States is 850,000 square miles—approximately one-fourth this country's present size. The most dramatic statistic is that almost 70 per cent of all U.S. Continental Shelf is in Washington and Alaska, 550,000 square miles alone in Alaska with the Puget Sound area the closest and most logical center of scientific and service support.

In hearings on Senator Warren Magnuson's oceanographic bill S. 944, now heading for House-Senate conference, Adm. Edward C. Stephan, former oceanographer of the Navy, put it this way: "A new continent has been opened up." A parade of scientists, industry leaders and military officials in last year's House and Senate hearings on proposed oceanographic legislation, repeated again and again that Continental Shelf exploration is a vital national need, that we are trailing our foreign competitors, and resources that would normally almost automatically be assumed U.S. property may be developed for the benefit of other nations under the terms of the International Convention of the Continental Shelf.

The presidents or board chairmen of 12 of America's largest industries said this in a letter to the President last year: " * * * freedom from want is possible but only if we add to the land's productivity the most fertile and least used of man's resources—those of the seven seas. Potentials for almost limitless feed production, for supplementing the land's minerals, for an inexhaustible supply of pure water, for new sources of fuels and energy, for a revitalized, superior merchant marine, and even for harnessing wind and weather, exist in the world's oceans, if we can but learn to apply our American technological genius to their use. This learning and utilization, as industry is coming to realize, provides opportunities for economic growth, unparalleled since the industrial revolution."

The industry letter added: "We envision industry's contribution as part of a team effort in which the federal agencies, the congress, the universities, the states and the business-industrial communities develop and implement a coordinated national program that builds on the work already accomplished and in progress, but which welds the many diffuse and scattered present interests into a cohesive whole."

Again, the bulk of America's Continental Shelf—almost three-fourths of the total potential—lies in the Pacific Northwest and Alaska. This fabulous gift of natural oceanographic geography almost arbitrarily dictates that the main thrust of a United States Continental Shelf development program should be centered on Puget Sound.

The area has the talent, the energy and the knowledge. These things are buttressed by a magnificent and protected inland ocean laboratory, Puget Sound, alone in America in its oceanographic uniqueness. Add to this a federal acceptance that it is far past time to get going, that shelf development is a vital "national need" and this project can become a practical, profitable reality.

Today, as this question of pilot plants is considered, your committee is, in truth, looking at a program which can emphasizze in a colorful and profitable way the need for a meaningful Continental Shelf resource development plan. *The fish protein concentrate program might well be the spark needed to energize the United States program so long overdue.*

Our State of Washington has its existing departments, along with its newly organized State Marine Sciences group, on top, ready, willing and able to assist this effort. They will join with private industry, the public ports, our universities, our civilian fisheries and oceanographic groups, and the concerned federal agencies, long located in our state, to help in every way possible.

The production of fish protein concentrate and the distribution of its life-strengthening qualities to our domestic markets and to the under-nourished populations of the world is truly a rare opportunity with a unique combination of humane and commercial elements not often found.

The State of Washington not only wants to be in the forefront of this program—it is determined to be.

The CHAIRMAN. We will recess at this time until 2:30.

(Whereupon, at 12 noon, the hearing was recessed, to reconvene at 2:30 p.m. the same day.)

AFTERNOON SESSION

The CHAIRMAN. Come to order, please.

Our first witness is John A. Earley who is president of the Port of Grays Harbor Commission, and who has had a long, deep interest in this matter. I must say while he is coming up here that the committee

and all of us involved would like to thank the port and all of those who helped us in arranging all the details for this meeting, particularly Hank Soike, and everyone else. We appreciate it very much.

STATEMENT OF JOHN A. EARLEY, PRESIDENT OF PORT OF GRAYS HARBOR COMMISSION

Mr. EARLEY. Thank you very much, Senator.

Senator Magnuson, as you are well aware, the various ports in the State, in this State, have long been interested in the legislature of the State of Washington and, as such, they have been assigned the role of industrial developers in their own local areas, this, of course, in addition to their other duties.

The port of Grays Harbor in recognizing this grave responsibility has with the help of the PUD bill within its own organization formed the Industrial Development Division, managed by Henry E. Soike. The port commission upon hiring this man charged him with three responsibilities, No. 1, to help all of our existing industries and try to keep them healthy and competitive; No. 2, to search for new industries and payrolls, preferably of the nonsawdust variety, and No. 3, to develop sites and facilities which would promulgate water oriented cargoes, both export and import.

In the furtherance of this program the port of Grays Harbor obtained, with the aid of Local 2 with approximately 1,000 additional acres at Bowerman Field in cooperation with Grays Harbor County Commission, one of the industrial development districts known as I.B.B. No. 2, and, also, the Willapa and Chehalis Rivers is now being prepared for Pacific Protein, Inc. This corporation through the aid of Senator Magnuson, the Bureau of Fisheries, the Congress of the United States and, incidentally, the port of Grays Harbor, is now embarking upon a tremendous new endeavor particularly directed at the hake fisheries. A fleet of fishing craft is being assembled, buildings are being prepared, and dock facilities are in progress. The West Port Basin is being dredged and the machinery is being assembled. The research of the raw material has been completed. The market has been tested and customers obtained, this for a product that will principally be devoted to the food supplement of animals and poultry.

Further fields have been explored and with the advent of this hearing we hope to develop this material for the more direct benefit of mankind. We in Grays Harbor are now producing logs, lumber, plywood, pulp, and pulp machinery for the world. We are helping in a large way to provide shelter for these materials for a largely growing population, both foreign and domestic.

We are willing, I would rather say extremely anxious, to assume the responsibilty in concert with the Government of the United States of the tremendous task of harvesting the seas and supplementing the diets of the starving world population. We as a port commission serving Grays Harbor County have access to the raw material, the fishing fleet base, the manufacturing know-how, the basic equipment, the water, the rail and highway transportation, the skilled labor for scientific, manufacturing, and fishing purposes, the land, the availability of risk

capital, and the willingness to cooperate with the humanitarian aids of Congress and the U. S. Government.

We urge that you, Senator Magnuson, in concert with Senator Bartlett in the Committee on Commerce, proceed with diligence on the passage of S. 2720, and we pray for a speedy enactment of this bill.

Thank you very much.

The CHAIRMAN. Thank you, John.

Of course, the port and its members and Hank Soike and all the rest of you have already given us a lot of cooperation and I want to repeat that we thank you for it. I know of no area that has been more vitally interested and had more vision in this matter than this area. Actually, you have done some pioneering in the field of fish concentrate, anyway, and I think you are to be complimented. If I may divert a little bit, you ought to be complimented, too, on what you have been doing for the development of the recreational resources of this area in preparing for the future, and that is what we are talking about here.

Mr. EARLEY. Thank you very much for coming down.

The CHAIRMAN. Next we have one of the pioneers in protein products, Wesley W. Benefiel, who is the vice president and general manager of Pacific Protein Co.

STATEMENT OF WESLEY W. BENEFIEL, VICE PRESIDENT AND GENERAL MANAGER, PACIFIC PROTEIN, INC., ABERDEEN, WASH.

Mr. BENEFIEL. Thank you, Mr. Chairman.

I wish to thank the committee for the privilege of appearing before them today as an industry representative regarding Senate bill 2720.

Section 2(a) of Senate bill 2720 reads in part as follows: "Such plants shall be designed to demonstrate the reliability and practicability and the economics, engineering, and operation potential of the processes and methods to reduce fish to fish protein concentrate."

Passage of this bill will provide a bridge from what has essentially been laboratory operation to a commercial operation. Private industry often builds small commercial size plants to confirm changes in known processes and since this product is a new food item and under the jurisdiction of the Food and Drug Administration, provisions in this bill are wise and necessary to assure commercial use of the process in the shortest possible time.

As has been pointed out earlier by Dr. Pariser and Mr. McKernan and Mr. Alverson, there is a tremendous need for FPC currently in the world, not only do we have the imbalance of the distribution of animal proteins right now, but the projections indicate that there will be a tremendous population growth and most of this population growth will occur in those areas that are already deficient in animal protein. The furthest estimates made of the additional amounts of raw material off our shores indicate that we do have the raw materials here if we could find a market for them, and certainly MPC as it has been recently named would provide this market. The need in terms of FPC was estimated in 1960, Mr. Chairman, at about 5 million tons to bring the population's diets up to a subsistence level at that time. I think Dr. Pariser's current figures are on the order of 67 million tons, and this would equate that to about probably 36 to 45 million

tons of raw product. This is a tremendous potential for our fishermen and one that they are willing to share in the resource off our shores. We think that this is the only way, as you pointed out earlier, that we can reverse the trends of other nations harvesting our resources right off our shores. We also have noted, reading available literature on the FPC, that there are several nations working on this and if they do come up with a product before we do that achieves acceptance as economical, once again our fishermen could very well be faced with a diminishing market and inability to compete with the foreign nation's fleets.

There is one other area in this bill that we think has a tremendous value, and that is that the marketing value, the need has been well pointed out, and if we ignore the problem of translated need to market we could be in serious trouble. I think the work already done by the Bureau indicates that some of FPC operations in the past have not paid any attention to the background of cultural differences of the people, and this is where they are running into trouble, but any market developed will take time, effort and money, and determining the best ways to include FPC into the world's food strains will not be done very easily. Certainly a ruling by the Food and Drug Administration would be helpful in this area, but even with the favorable ruling there is going to be quite a bit of work involved.

If we may divert from the bill for just a moment I would like to mention why we think the Grays Harbor area is a natural site for this. We at Pacific Protein became aware of the possibility of fish protein concentrate shortly after being contacted by the Seattle office of the Bureau of Commercial Fisheries some 2 years ago relative to the hake resource, and we followed it for a couple of years as closely as we could since that time. Part of our work involved a trip to College Park to talk with Dr. Snyder and Dr. Pariser and look over the facilities. We noted with interest that the major work was being done on hake. So FPC has been very much in our thinking since we started to establish the facilities for the reduction plants to fish meal for animal food additives, and we think that this has led to the following advantages for establishing an FPC installation here. First, the site is a central one. The resource has, as discovered and defined by the Bureau of Commercial Fisheries, has always produced sizable concentration of fish fishable from this area. This has not always held for other possible locations on the coast and the Grays Harbor area also offers the advantages of excellent utilities, transportation, and a varied community, so a labor force could be attracted and held in this area.

We actually did rule out one site that in our opinion was much too remote to attract and hold a labor force, especially the type that will be required to operate an FPC plant. As part of our planning we felt that the hake would be utilized very possibly over a wide area, so we wanted to be sure that the size of the site was sufficient to offer this utilization. The site that we now have, Industrial District No. 2, that Commissioner Earley mentioned, with the reduction plant and an FPC plant of the kind described in your bill, would only occupy about one-third, less than one-half of the total land in the site. Other facilities that will be provided as a result of this reduction operation are pier and dock facilities, adequate unloading systems, and probably the most important would be the boats. As you are very aware, be-

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cause you were instrumental in achieving in the Senate last year, there are very few fishermen who have the skill to operate the trawl system, and that is the reason the Bureau is providing technicians for that use this year in that project and knowledgeable fishermen are going to be the basis from which any sort of venture in this area will be successful. The fleet will represent an investment of approprimately three-quarters of a million dollars.

We have been gratified by the response in this area and we are sure that it shows the confidence in the work done by the Seattle Bureau in designing this gear and finding a resource. In addition, our investment group in this has been very aware of the possibilities of FPC and encourages our efforts to stay in contact with it and eventually enter the field. Our community relations have been very good. The local development corporation was formed in this area to assist us in establishing this business and it has helped us very much in the problems involved in any venture of this kind. In addition to the port of Grays Harbor, the city of Aberdeen has been very cooperative. We have generally been welcome in the area. We know that further diversification of the utilization of the hake resource will be welcomed even more in the form of an FPC installation.

One thing that might be interesting to the committee and there are some letters attached to your copy, Mr. Chairman, of this testimony, we received some publicity in a national magazine recently and we took out a few of the letters we received from all over the country and some foreign countries of people interested in FPC. So we know the Bureau work and everybody else's work concerned with this is certainly very much in the public's mind today.

One letter from the Peace Corps in Tunisia is talking about using it in a prekindergarten system over there, but they point out they would not consider using it until the full passage and clearance was received from the Food and Drug Administration, and they are writing your office for the status of this.

We have a letter from a pharmaceutical firm that they think this has potential in various low-income groups, geriatric groups, in addition to possible field rations for the Armed Forces.

A lady who is taking a doctorate in economic anthropology points out if this could be marketed in a candy bar form our children could satisfy their sweet tooth and still get the nutrients that they should have.

These are just a small sample of the type of letters we have received.

The CHAIRMAN. We will put those all in the record. I am just looking at them and they are very interesting. They come from all over the world, don't they?

Mr. BENEFIEL. Yes, they do, sir.

(The full statement of Mr. Benefiel and the letters mentioned above follow:)

STATEMENT OF W. W. BENEFIEL, VICE PRESIDENT, PACIFIC PROTEIN, INC., ABERDEEN, WASH.

Mr. Chairman, Members of the Committee, Ladies and Gentlemen, Students: I wish to thank the committee for the privilege of appearing before them today as an industry representative regarding Senate Bill 2720.

Section 2(a) of Senate Bill 2720 reads in part as follows: "Such plants shall be designed to demonstrate the reliability and practicability and the economics,

engineering, and operation potential of the processes and methods to reduce fish to fish protein concentrate".

Passage of this bill will provide a bridge from what has essentially been laboratory operation to a commercial operation. Private industry often builds small commercial size plants to confirm changes in known processes and since this product is a new food item and under the jurisdiction of the Food and Drug Administration, provisions in this bill are wise and necessary to assure commercial use of the process in the shortest possible time. Time is important if the need is to be met.

NEED FOR F.P.C.

For several years scientists of the United Nations (UNICEF, FAO, WHO) and other scientists interested in food and nutrition have been pointing to problems either now in existence or rapidly approaching which if ignored, could have disastrous results for man.

They point out that presently approximately six hundred million people of our world population receive the major share of animal protein available in the world, while two billion people suffer to a greater or lesser extent from a lack of this type of protein. Further that among these two billion people who are suffering from a lack of protein, those hardest hit and damaged most physically are pregnant women, children, and nursing mothers.

Current population projections indicate that world population will double by the year 2,000 with most of this increase taking place in areas already deficient in animal protein. The result of ignoring this problem can only be imagined, but further misery resulting from hunger will certainly not lend itself to a stable world political situation.

While we are fast running out of arable land, we are currently only harvesting a small percentage of the total protein available from the world's oceans. Scientists of the various United Nations organizations have indicated the development of an economical fish protein concentrate is the best hope for alleviating the present world deficiency in animal protein. This need was estimated in 1960 at five million tons to provide minimum diets for population existing at that time.

Although no large scale protein deficiency is thought to exist in the United States, there have been several areas where interest has been expressed in the use of such a product. Interest in the tasteless, odorless product which the Bureau of Commercial Fisheries at College Park, Maryland, as produced has been shown by manufactures of many food items. These include possible use in breads, cookies, donuts, crackers, noodles, breakfast food, cereals, baby foods, cake mixes, etc. The inclusion of fish protein concentrate in the above mentioned foods would increase their nutritional values and were the basis for the inquiries received.

Institutions which are on limited budgets offer a good potential for the use of F.P.C. in order to give maximum nutrition value per dollar expended.

The United States Government under its "Food for Peace" program could by inclusion of F.P.C. ship the type of nutrition abroad that is vitally needed. This is a large tonnage operation and even small percentages of F.P.C. included in the shipments would offer a large total market. President Johnson in his February message to Congress on "Food for Freedom" referred to the desirability of use of F.P.C. in this area.

IMPACT ON FISHERIES

F.P.C. should be developed as a commercial reality as soon as possible if the American fisherman is to benefit from this development.

It has been estimated that nearly one half of the catch of commercial fishermen is now discarded at sea since some of the species caught have no markets. In addition several other species are either not utilized at all presently or greatly under utilized. The aggregate additional tonnage that could be used in this fashion has been estimated at various levels, from a low of an amount equivalent to what we are now harvesting, to quantities several times our current harvest.

Contrast to this the 1960 meeting in Rome in which the Food and Agricultural Organization estimated a world need for F.P.C. at approximately five million tons to bring the then existing populations diets up to acceptable levels. This is a staggering potential market and one in which the American fishermen badly need to share if we are to reverse the trend of other nations harvesting fishery resources off our shores.

We also note that several other nations are attacking this problem and if they are successful in marketing a commercial product that gains wide acceptance before we do, our fishermen will continue to face shrinking markets.

MARKETING VALUE IN BILL

An additional benefit from passage of this bill lies in the area of marketing. Although these are relatively small plants, enough product will be produced to develop the start of a marketing structure. This may seem to be a parodox when the tremendous potential has just been described, but translating this to actual markets will take time, effort, and money. Determining the best ways to include F.P.C. into the worlds food stream, levels of use, and actual mechanics of accomplishing these things will not be done with any degree of certainty until the product is available and approved by the Food and Drug Administration.

A ruling by the Food and Drug Administration would certainly clarify the direction or directions which would be profitable to explore further but the essential problem will be to translate the need to market.

Preparations by Pacific Protein to Facilitate Entry into F.P.C.

Shortly after being contacted by the Seattle office of the Bureau of Commercial Fisheries relative to the Hake resource off our coast, we became aware of the possible use of the Hake in F.P.C. After informing ourselves by reading the available literature on F.P.C. and talking with the Bureau people in the Seattle office, we visited with Doctor Snyder and his staff at College Park in the spring of 1965. We were shown samples of the products, production facilities, and noted with interest that the major source of raw material being used was Hake. Because of the uncertainty of the future attitude by the Food and Drug Administration we felt that commercial production of F.P.C. might not come for perhaps five years. Hopefully that the diligence of this committee will make it possible to shorten this time. We did resolve to do nothing in the establishment of the reduction plant which would detract from the eventual utilization of the Hake resource in the F.P.C. Conversely where ever we could we tried to build in advantages for the eventual establishment of F.P.C. facilities.

The establishment of the reduction plant has led to the following advantages for establishing an F.P.C. installation here:

CENTRAL SITE LOCATION

The Port of Grays Harbor is the most central location to the Hake resource as discovered and defined by the Gear Research and Exploratory Group of the Bureau of Commercial Fisheries. Sizeable concentrations of fish always occurred during the season within fishable distance of the Harbor while this has not always held for other possible locations also had negative features such as remoteness which would increase transportation charges and make it difficult, if not impossible, to recruit and hold a labor force. In fact one site was ruled out because of this very feature. We felt that the labor for a reduction plant might be possible but most certainly the type of individual needed for an F.P.C. plant could not be attracted to the area.

On the other hand the Aberdeen area offers excellent utilities, service by several truck lines, service by three railroads and is a large enough community with enough varied activity to attract and hold a labor force.

SIZE OF SITE

Through the cooperative efforts of the city of Aberdeen and the Port of Grays Harbor an adequate site was made available to us. The reduction facility and an F.P.C. plant of the kind described in Senate Bill 2720 would occupy considerably less than half the total acreage available to us. Industrial land of the type necessary for this business is in short supply in the Harbor area and additional suitable sites will probably not be available for three or four years at economic rates.

OTHER FACILITIES PROVIDED AS A RESULT OF REDUCTION OPERATION

(1) Pier and Dock facilities which can be used for other uses including F.P.C. (2) Adequate unloading system for reduction and human consumption. (3) Fleet of boats knowledgeable in harvesting this resource. As this committee is

undoubtedly aware, the harvest of Hake requires skills which the fishermen do not now have. This is the reason that the Gear Research and Exploratory Group is providing technicians this year to train the fishermen in the use of the telemetry gear and the pelagic trawl.

In addition to this the fleet will represent a total investment by the fishermen of approximately $750,000. We have been gratified by response of fishermen in entering this fishery and we think it shows a confidence in the work done by the Bureau of Commercial Fisheries and both designing and perfecting the telemetry gear and defining the resource.

INVESTMENT GROUP

About 95% of the total investment in Pacific Protein has come from Grays Harbor County residence. This group has been aware of our interest in fish protein concentrate and has encouraged us in our efforts to enter this field.

COMMUNITY RELATIONS

A local development corporation was formed from a group of business leaders in the Grays Harbor area to assist Pacific Protein in the establishment of this industry. Their cooperation has been very helpful in meeting the many problems involved in such an endeavor.

In addition the Port of Grays Harbor and the City of Aberdeen have been most cooperative in our dealings with them.

The area has welcomed this industry, it would welcome further diversification of this industry in a form of F.P.C. installation.

GENERAL INTEREST IN F.P.C.

As a result of recent publicity in a national publication, Pacific Protein has received letters from all over the United States and several foreign countries expressing an interest in F.P.C.

Some indicated an interest in becoming involved in the marketing of F.P.C. while others expressed interest of a general nature.

We have included copies of a small number of representatives letters and attached them to this document.

Finally, Mr. Chairman, we note that the committee of the National Academy of Sciences which worked with the Bureau at College Park on the fish protein concentrate project made the following statement "in the committees judgment fish protein concentrate from whole Hake as prepared by the Bureau's process is safe nutritious and wholesome and fit for human consumption". We know of no other facility expressly erected to utilize the Hake resources off our shores at the present time.

LANCET PHARMACEUTICALS (CANADA) LTD.,
New Westminister, British Columbia, Canada, April 14, 1966.

Mr. JOHN STEVENS,
Pacific Protein Inc.,
Aberdeen, Wash.

DEAR MR. STEVENS: Thank you for the courtesy that was extended me during my recent visit with you. Our conversation was very interesting with regard to the use of F.P.C. for human consumption.

I have contacted several authorities on this and have come up with coinciding thinking. Yesterday I had a long talk with Dr. M. Pernarowski, B.S.P., M.S. (Purdue), Ph. D. (Purdue) who is Associate Professor of Pharmaceutical Chemistry at the University of British Columbia. He was also formerly with Canadian Food and Drug Directorate. We discussed groups that have a generally low nutritional level. They are Geriatric, Low income groups, Social Welfare groups. It was also pointed out that the Armed Forces could benefit by F.P.C. use as a supplement, particularly when in the field. It would also be of value to persons on a diet for losing weight, this would give them an excellent source of protein. In this case it would have to be incorporated into a product I.E. Metracal. In summation it would appear that F.P.C. has a definite place in the Domestic market and particularly the Foreign market. As we are well aware, there

are a lot of people in the World that are near starvation, F.P.C. would be a wonderful contribution for these peoples diets. Let me know if there is anything else I can do on this end.

Am returning the literature you gave me under separate cover.

Wishing you the best of luck with your enterprise.

Yours sincerely,

R. V. HABGOOD.

UNITED STATES OF AMERICA PEACE CORPS.,
AMERICAN EMBASSY,
Tunis, Tunisia, April 8, 1966.

Mr. JOHN STEVENS,
President, Pacific Protein, Inc.,
Aberdeen, Wash.

DEAR MR. STEVENS: I read an article recently in Time magazine regarding your interest in Fish Protein Concentrate. My interest in this material dates back to a previous article in Time or Newsweek of several years ago. At present, I am in a position where I may be able to help put this material to practical use. However, I would prefer to have more information on FPC prior to making my decision.

The material would be used as a protein supplement to a diet given to preschool children during their participation in a kindergarten program now being developed by the Peace Corps. The kindergartens are to be located in five small oasis villages in Southern Tunisia. Meat and other protein sources are both difficult to obtain and expensive to buy in this region. The immediate supervisor of the program, which will involve approximately 20 Peace Corps Volunteers and their Tunisian counterparts, is an American pediatrician. This physician and myself have discussed the possibility of setting up a double-blind study utilizing FPC. At any rate, the possibilities of the utilization of FPC in the field are tremendous, and we would be interested in investigating the possibilities of FPC's use in our program.

I am looking forward to receiving any material you may have of an investigational nature, i.e., animal experimentation, progcessing data, nutritional data, etc., regarding FPC. I am also writing to Senator Warren Magnuson for information on FPC's status with the United States Government. Of course, no final decision on the possible use of FPC here can be made until full U.S. Government approval of it has been granted for human (infant) feeding.

Yours truly,

ROBERT P. YOUNES, M.D.,
Peace Corps Physician/Tunisia.

ST. LOUIS, MO., *April 3, 1966,*

Mr. JOHN STEVENS,
Pacific Protein, Inc.,
Aberdeen, Wash.

DEAR MR. STEVENS: I have been following the progress of the nascent fish protein industry for several years. It is an enterprise in which I am very interested and about which I have done a great deal of thinking. I am writing for three reasons—to wish you luck, to suggest one product, and to inquire why my broker has been unable to buy me any stock in your corporation.

I am completing a PhD in Asian Studies and economic anthropology, and since 1956 I have spent 7 years traveling throughout Asia, Africa and the Arab World—which explains my concern with protein diet supplements. I may have taken my B.A. Phi Beta Kappa, Summa cum laude, first in my class, but the suggestion I am going to make comes not from any academic qualifications, but good consumer horse-sense. In fact, if you consulted with a child it would undoubtedly be his first suggestion. Put your fish protein into a candy form. For the American market, a 10¢ candy bar—"Pro-Bar" made of 1 oz. FPC and 1 oz. carbohydrate candy (about two or three hundred calories.) This would be the meal on the run that *is* a meal—you might even include vitamins. For a dietary supplement to be given in schools, you could bulk package the protein in the form of candy squares (I would suggest a protein content equal to 30 grams of pure protein, as a dietary supplement—though 15 grams would certainly

be better than nothing.) For institutions, put the protein in a pudding mix—or could it be used as an all-purpose thickener, like corn starch?

Good luck in your enterprise. If you ever have trouble with contacts abroad, I might be able to help you (I put Pet's Incap people onto the right contacts in India.)

If there is stock for sale in your corporation, please let me know. I like to own a small part of things I really believe in (I was, for instance, a first day purchaser of Comsat and an early purchaser of Honda.)

By the way, what is the pure protein content of your FPC? And have you got a price on it yet. (Corn protein, minus the two amino acids vegetable proteins lack, sells for about $75 per ton at 35 pct protein content, at the factory, here in the corn belt.)

Again, the very best of luck to you.

Yours most sincerely,

DIANE LYNN WALDRON-SHAH.

COLUMBUS, OHIO, *March 16, 1966.*

Mr. JOHN STEVENS,
Pacific Protein, Inc.,
Aberdeen, Wash.

DEAR SIR: I have been following the machinations of the FDA for some time in its appraisal of FPC and I believe it is only a question of time until they stop being foolish. I am also a great believer in the efficacy of FPC as a cheap but excellent nutritional source.

Until I read the article in Time about hake and your company it did not enter my mind that there might be an investment possibility here. Is there? I would be greatly appreciative for any information in this regard.

Respectfully submitted.

JESSE EISEN.

SEATTLE, WASH.

Mr. JOHN STEVENS,
Pacific Protein, Inc.,
Aberdeen, Wash.

DEAR MR. STEVENS: The recent article in Time Magazine about FPC caught my eye the other day because I am in the process of preparing an article for Professor H. C. L. Merillat of the American Society of International Law for consideration of the State Department concerning the Soviet Seven-Year Plan, particularly relating to FPC.

It happens that FPC first came to my attention in 1960 when I was managing the fisherman's co-op in Bristol Bay and publishing the *Alaska Fisherman.* The previous year I had attended the Four Nation Fishermen's Conference in Vancouver and had heard Mr. Alexander Ivkin's report on the Soviet Seven-Year Plan—Mr. Ivkin at that time was the Secretary of the Food Worker's Union of the USSR—and the connection wasn't very hard to make that the Russians may in fact be diverting a substantial portion of their distant water catch into the production of FPC.

Two years later I entered law school at the University of Washington, and have been exploring the legal and political aspects of this problem ever since.

I would very much appreciate an opportunity to come to Aberdeen and show you the material I have both for the benefit of your comments and suggestions and also to gain additional first hand information about FPC. I am also interested in your views on some kind of international accord so that industries such as yours could be assured of some kind of protection from the encroachment of foreign fishing fleets. I'm particualrly sensitive to this problem because of my experience in Bristol Bay—and I know only too well what an intensive pelagic effort can do to stocks of fish.

If it would be convenient for me to see you this week, please either drop me a line or call me at ME 3–5546 in Seattle. I'm leaving this afternoon for Portland and expect to return to Seattle on Tuesday. While in Portland, however, I will be at the Caravan Motel or at the home of friends whose phone number is (Oregon City) 656–8166. My thought is that if it should work out that way, I could stop in Aberdeen on my way back to Seattle.

Looking forward to an opportunity to talk to you, I am,

Sincerely yours,

DENTON R. MOORE.

LAIDLAW & CO.,
New York, N.Y., March 30, 1966.

PACIFIC PROTEIN, INC.,
Aberdeen, Wash.
(Attention of Mr. John Stevens, President).

DEAR MR. STEVENS: A client of ours has read with much interest the article on Page 94 of the March 19 issue of Time in which your company is mentioned. Our Research Department has been unable to obtain any information in the regular sources available to them, and I am writing to ask you if it is possible for our client to buy shares of stock in your company. She is just a small investor, but she was much intrigued by Time's statement that half-ounce of FPC may be capable of providing a child with his daily need of animal protein at a fraction of a cent.

Any information which you are able to send along to me will be much appreciated.

Very truly yours,

LAURANCE B. RAND.

AMECO ITALIANA,
Turin, Italy, March 22, 1966.

Re fish protein concentrate.

DEAR SIRS: It came to our knowledge that you are experimenting a new type of fish protein concentrate to be used as supplement with the food processing, being this new product of high nutritional value.

This product interests us a great deal from the commercial point of view and we would be prepared to discuss with you, in due course, the possibility of marketing it in Italy, as soon as your product is certified.

Although our main line are pumps of all kind and hydraulic products, we are very well introduced with the food processing plants and chemical outfits.

For a brief reference, we are the Italian branch of A.M.E. Co.—African Motors & Engineering Company, of Mogadiscio, Somali Republic (East Africa), dealers for Ford Motor Co., Peerless Pumps, Food Machinery Corp., and several other U.S. accounts. The company is registered with the Department of Commerce in Washington DC, and is holder of the original invitation reported for World Trade Directory on September 24, 1964.

We should be delighted to hear from you in conjunction with your developments and plans for the future. We are a good company and want to do a good job for you. If you need further references and details, please do not hesitate to write.

Yours faithfully,

DOMENICO BOCCHIOTTI, *Director.*

WITTERIED & MORRIS,
Paris, France, March 21, 1966.

Re the article in Time.

Mr. JOHN STEVENS,
President, Pacific Protein, Inc.,
Aberdeen, Wash.

GENTLEMEN: May we request that you please write and tell us if you are interested in appointing us exclusive sales representatives on a sales commission basis for your Protein (fish) when you are in production? Best of references. Thanks for writing.

Yours truly,

J. E. WITTERIED.

FORTUNE FOODS, INC.,
San Francisco, Calif., March 22, 1966.

PACIFIC PROTEIN, INC.,
Aberdeen, Wash.
(Attention: Mr. John Stevens, President).

DEAR MR. STEVENS: We are very interested in an article printed in Time magazine, dated March 18th, 1966.

We have long been aware of the possibilities of the West Coast hake fishery. We have submitted many samples in the form of fillet to various export markets. The results have been unfavorable since the flesh of the fish is very soft. As you are probably aware, Hake as produced in South Africa and South America are

a highly edible variety and we were in hopes of complementing these exports with our Pacific Coast variety. We recently have concluded that our West Coast product is not the same specie or at least does not have the same characteristics in the flesh fillet.

Now we read of the possibility of using the product for fish-protein concentrate, FPC.

We realize that before the product can be utilized in the United States, it must be passed by the Food & Drug Administration and we look hopefully for this to happen. Meanwhile, there remains a tremendous export potential and it is in this area that we are most interested.

We have been in the fish and seafood business for the past 20 years and during the last 5 years have expanded our efforts into Australia, New Zealand, all Far Eastern countries including the areas of hunger and poverty as well as Western Europe. We offer our services in helping you develop and explore these markets.

We would be most obliged in receiving some information regarding your plans in the area of export and if in order, a personal meeting can be arranged.

Very truly yours,

G. B. WILLIAMSON, *General Manager.*

STANFORD UNIVERSITY,
DEPARTMENT OF ATHLETICS AND PHYSICAL EDUCATION,
April 11, 1966.

JOHN STEVENS,
President, Pacific Protein Inc.,
Aberdeen, Wash.

DEAR MR. STEVENS: I have been interested to read briefly about your work toward the development of a protein capsule, and would be extremely interested in finding out more about your work.

We plan to begin some studies here with respect to weight loss and nitrogen balance.

Could you please send me more information on your findings. It is possible that we could work your capsule into our research.

Thank you.

Sincerely,

WILLIAM L. LELAND,
Director of Wrestling.

BECKER-DAVISON CORP.,
Seattle, Wash., April 13, 1966.

PACIFIC PROTEIN INC.,
Aberdeen, Wash.

(Attention: Mr. John Stevens, President).

GENTLEMEN: Through the local newspaper and the Time Magazine we learned of the fish-protein concentrate you recently developed. We wonder if you would be interested to work with an export agent to develop the foreign market for this product.

We have good established contacts in the Far East and South American countries who can effectively distribute this type of products. If you do not already have someone doing this job for you, we would be very glad to work with you in developing these markets.

If you are interested in this proposal, we would appreciate your reply.

Very truly yours,

LUIS W. TAM, *Export Manager.*

ABDULAZIZ M. OTAIBI & CO.,
Kuwait, Arabia, March 21, 1966.

MESSRS. PACIFIC PROTEIN, INC.,
Care of Aberdeen Chamber of Commerce,
Aberdeen, Wash.

GENTLEMEN: Our good friend Mr. J. Twinam, the Commercial Attache at the American Embassy here in Kuwait, has given us your address as leading producers of protein from fish. We would like to know if you are interested in

a joint venture for erecting in Kuwait a processing plant to produce protein and fish oil.

We will be looking forward to your reply and until then please accept our kindest regards.

Sincerely yours,

H. A. TAJI, *Consultant*
(For Mechanical, Electronic and Water Engineering).

MEISTER TRADING CORP.,
New York, N.Y., April 8, 1966.

Mr. JOHN STEVENS,
President, Pacific Protein, Inc., Aberdeen, Wash.

GENTLEMEN: While reading the March 18th 1966 copy of Time Magazine, I came across a lengthy article detailing the future possibilities for the processing of HAKE, a common fish found in your part of the country, into an animal powder which has been tentatively named FPC.

As you know, a protein derivitive if processed cheaply and in great quantities would have wide acceptance in this country as a food and dietary supplement for children and adults. If passed by the Federal Food and Drug Administration as safe for human consumption, I see no reason other than the problems involved in introduction to the American public for the success of FPC as a marketable item.

Our firm has valuable contacts in the northeast with Boards of Education and distributive outlets who we feel would be interested in testing your product in the open market. To this end, would appreciate opening correspondance with future possibility of business opportunities between our two firms.

With nothing more for the moment and awaiting your news with interest, I remain,

Very truly yours,

WARREN S. MEISTER, *Vice President.*

The CHAIRMAN. I might say to the audience that some of the letters are from other foreign countries in which they would like to be your agent.

Mr. BENEFIEL. We had a couple, Mr. Chairman, that suggested if the Food and Drug Administration could not pass it in this country that they would be happy to put a plant up in their country and they were sure they could get the approval from their country for it.

The CHAIRMAN. Let me ask you this. A lot has been said today about an economic breaking point for the amount of tonnage that you would have to put through a plant. I think the figure suggested was 50 tons a day. How many tons do you process down there?

Mr. BENEFIEL. Our plant will process 25 tons an hour, and we are programed on the basis of 20 hours actual running time a day, so the process on a practical basis is 500 tons.

The CHAIRMAN. What fish will you be using?

Mr. BENEFIEL. We will be using hake only.

The CHAIRMAN. I can't help repeat the importance of this potential. The basic cold figures are that we now produce in this country 4,400 million pounds of fish food. We have a current demand for 12 billion pounds. We have a 7½-billion-pound gap. That shows just what opportunities we have; unless we act to utilize these latent fish resources, the gap will get larger instead of smaller.

Mr. BENEFIEL. There is one other area not in the testimony which I would like to make comment on, Mr. Chairman, that is the two parallel areas here that seem to be developing about the same time, in some areas, at least, they represent a departure from past Bureau activities, and that is a group, the work done by the group in Seattle under Mr. Alverson on the development of this gear and the ability

to find the fish, and also the developing by Dr. Pariser and his group in College Park. It seems to me that these twin developments are the areas that are going to help the fisherman more in this country than probably anything else. The other work that is being done, or has been done in the past by the Bureau, lots of times left a big gap between the scientific work and the actual practical application. We feel that these areas are now being plugged by the founding of programs such as Mr. Alverson is working on and Dr. Pariser. I hope that can be expanded.

The 22 billion pounds they talk about would produce approximately 2 billion or less pounds of FPC, and it is a small portion of this.

The CHAIRMAN. Thank you very much. The next witness is Mr. Torgerson.

STATEMENT OF JACK TORGERSON, ABERDEEN, WASH.

Mr. TORGERSON. Ladies and gentlemen, Mr. Chairman, I am a resident of Aberdeen, Wash., and have been here since 1928. I have made my living by commercial fishing for 20 years, fishing in Alaska during the summer and in the coastal crab fishery during the winter, and in the fall gill netting.

Many of the fisheries here on the Pacific coast are now in an overcrowded condition, brought about either by a shortage of market for the fishermen's catch or by a decline of available fish, as is often the case with salmon.

What is needed to restore the Pacific coast fishing industry to its former position of greatness are new fisheries, such as that for Pacific hake which we are talking about here today. I am very appreciative of the work of the Federal Bureau of Commercial Fisheries in assisting in the development of the kind of gear necessary for the harvest of these now wasted ocean resources, and I am equally appreciative of the work you have done, Senator Magnuson, in helping us build a needed new fishing industry.

New fisheries are rare here on the Pacific coast, and I have watched with great interest the development of the important king crab fishery in Alaska. I remember in 1957, when I was halibut fishing in Seldovia, Alaska, I kept hearing about the king crab; in fact, there were just a very few boats and they drug for them, they didn't use pots. I think there were about five boats fishing out of there. I kept hearing about these king crab, so I decided one day when we caught one I was going to cook it just to see how good it really was, because, being a dungeness crab fisherman, I thought I would like to find out. I cooked one in the pot and I kind of compared it like hamburger to T-bones. But I am told that the Alaska king crab fishery has made a finer financial contribution to Seattle than the return of the great gold rush. This year on Kodiak Island alone they produced over 100 million pounds, and they just passed it up each day, so it is something that is really growing.

What I am trying to do here is draw a comparison between what this tiny king crab industry has grown to as compared to what I believe the hake industry will grow to in a few years. In my opinion, the hake fishery has a greater potential than the wealth now given to the Pacific Northwest and Alaska from the king crab.

It is my belief that our present methods of fishing are throwing nature out of balance. We are taking a select number of desirable species and letting growing quantities of unmarketable species to increase at will. We seek salmon, crabs, and a few of the bottom fish species, but we allow the hake, the dogfish, and the anchovy resources to explode. A proper cropping of these huge stocks may very well prove to be of great benefit to the now marketable species, not only in the reduction of predators, but in the better availability of food.

The hake is not discarded in many foreign countries. In the British Empire the red hake is considered a real delicacy, and in Australia and New Zealand this specie is also consumed in large quantities.

I have caught them with a gillnet at the mouth of the Columbia River by the thousands and their sides were bulging with anchovies. When the hake are eating the anchovies, they are consuming the natural feed for the salmon. The hake is noted for its straight gut, they are all heads and mouth and taper straight back to nothing. They are built for eating, even having teeth on their tongues. I know all about this as I have two boys, one 15 and one 16, and they are built much the same way, thought I have not noticed teeth on their tongues.

The Pacific coast draggers have long been plagued by catches of hake which they were unable to sell. It has been a real nuisance to them, almost as bad as the dogfish has been for the Puget Sound draggers and those fishing to the north. I believe also that the capture of hake will be of great benefit toward better survival of the salmon, bottom fish, and dungeness crabs, and will help all fishermen and sportsmen, alike.

As I mentioned earlier, one of the problems in the Pacific fishing industry is that of overcrowding, and I think the conversion of fellows like George Bold, Francis Miller and myself, this is on a small scale, getting out of the crab business will help the fellows in Westport who definitely need help.

We need legislation like Senate bill 2720 to speed up the development of processes so that we can move ahead with fish protein concentrate. The Pacific Protein plant here in Aberdeen will receive our catches for processing into fishmeal, but the big future for the hake resources, I believe, will be in its conversion to marine protein concentrate.

There are many other firms looking at sites here on Grays Harbor and elsewhere for processing Pacific hake. I look upon the Pacific protein plant as only a beginning, and I welcome the opportunity to participate in this effort which I am convinced will grow to a position of greatness in the Pacific fisheries.

Thank you.

The CHAIRMAN. I would gather from that you might intend to fish for hake?

Mr. TORGERSON. Yes.

The CHAIRMAN. Have you ever fished for hake?

Mr. TORGERSON. No, sir; I have not. I had three small boats and I sold them and I am in the process of buying one large one to go hake fishing, though.

The CHAIRMAN. Have you seen the proposed gear out here in the lobby?

Mr. TORGERSON. Yes, sir; I have, Senator. I have a net exactly the same as that now ordered and the drag doors and will be in production, we hope, about the first of June. Whatever day the plant is ready we will be ready.

The CHAIRMAN. Do you think that gear will handle it?

Mr. TORGERSON. Yes, I've got confidence in it.

The CHAIRMAN. We always make some adjustments, but at least it is a good beginning.

Mr. TORGERSON. I just can't say enough for the fellows up there at the Bureau of Commercial Fisheries. Like I said before, I fished 20 years and never went up there. In fact, Wes Benefiel was the fellow that told me I should go up there and see them; in fact, he took me there and introduced me to Mr. Dayton Alverson and Mr. McNeely. And, actually, I felt bad for myself and for the other fishermen, because, boy, those fellows up there are really doing a hundred percent bangup job. I just wondered why I was so blind that I had not known this, that they were doing that wonderful a job.

The CHAIRMAN. I am glad you found out the Government wasn't so bad after all.

Now Mr. Saletic, who is President of the Congress of American Fishermen, where is he? Is he here? We will leave the record open for him, I am sure he has something he wants to put in the record.

(The statement of Mr. Torgerson follows:)

STATEMENT OF JACK TORGERSON, ABERDEEN, WASH.

Mr. Chairman, my name is Jack Torgerson. I am a resident of Aberdeen, Washington, and have been here since 1928. I have made my living by commercial fishing for 20 years, fishing in the Bristol Bay salmon fishery during the summer and in the coastal crab fishery during the winter.

Many of the fisheries here on the Pacific Coast are now in an overcrowded condition, brought about either by a shortage of market for the fishermen's catch, or by a decline of available fish as is often the case with salmon.

What is needed to restore the Pacific Coast fishing industry to its former position of greatness are new fisheries, such as that for Pacific hake which we are talking about here today. I am very appreciative of the work of the Federal Bureau of Commercial Fisheries in assisting in the development of the kind of gear necessary for the harvest of these now wasted ocean resources, and I am equally appreciative of the work you have done, Senator Magnuson, in helping us build a needed new fishing industry.

New fisheries are rare here on the Pacific Coast, and I have watched with great interest the development of the important king crab fishery in Alaska. I remember in 1957, when I was halibut fishing in Seldovia, Alaska, I kept hearing about king crabs. One day we caught one on a hook and I cooked it in a pot in the galley. It was good but, frankly, did not measure up to the texture and flavor I enjoyed with the dungeness crabs. To me it was like comparing horse meat to T-bones, but today, I am told the Alaska king crab fishery has made a greater financial contribution to Seattle than the return from the great Gold Rush.

In my opinion, the future of the hake resources off the Pacific Coast has an even greater potential than the wealth now realized to the Pacific Northwest and Alaska from the king crab.

It is my belief that our present methods of fishing are throwing nature out of balance. We are taking a select number of desirable species and letting growing quanities of unmarketable species to increase at will. We seek salmon, crabs

and a few of the bottom fish species, but we allow the hake and anchovy resources to explode. A proper cropping of these huge stocks may very well prove to be of great benefit to the now marketable species, not only in the reduction of predators, but in the better availability of food.

The hake is not discarded in many other foreign countries. In the British Empire the red hake is considered a real delicacy, and in Australia and New Zealand this specie is also consumed in large quantities.

I have caught them with a gillnet at the mouth of the Columbia River by the thousands, and their sides were bulging with anchovies. When the hake are eating the anchovies, they're consuming the natural feed for the salmon. The hake is noted for its straight gut, they're all heads and mouth and taper straight back to nothing. They're built for eating, even having teeth on their tongues. I know all about this as I have two boys, one 15 and one 16, and they are built much the same way, though I have not noticed teeth on their tongues.

The Pacific Coast draggers have long been plagued by catches of hake which they were unable to sell. It has been a real nuisance to them, almost as bad as the dogfish has been for the Puget Sound draggers and those fishing to the north. I believe also that the capture of hake will be of great benefit toward better survival of the salmon, bottom fish and dungeness crabs.

As I mentioned earlier, one of the problems in the Pacific fishing industry is that of overcrowding and the conversion of George Bold, Francis Miller and myself from the crab fishery to hake will be of benefit to those remaining crab fishermen.

We need legislation like S. 2720 to speed up the development of processes so that we can move ahead with Fish Protein Concentrate. The Pacific Protein plant here in Aberdeen will receive our catches for processing into fish meal, but the big future for the hake resource, I believe, will be in its conversion to Fish Protein Concentrate.

There are many other firms looking at sites here on Grays Harbor and elsewhere for processing Pacific Hake. I look upon the Pacific Protein plant as only a beginning, and I welcome the opportunity to participate in this effort which I am convinced will grow to a position of greatness in the Pacific fisheries. Thank you.

Kenneth Olsen, with the Alaska Fishermen's Union, Astoria, Oreg.

I understand there is a group from Astoria and also a group from Bellingham.

STATEMENT OF KENNETH O. OLSEN, AGENT, ALASKA FISHERMEN'S UNION, ASTORIA, OREG.

Mr. OLSEN. Mr. Chairman and members of the committee, I would like to thank you for the opportunity to present a statement.

The Alaska Fishermen's Union represents primarily people associated with the fisheries of Alaska and also the Otter Trawl Fisheries off the Oregon and Washington coast. Many of our members, when not employed in Alaska, take part in the different fisheries of the entire Pacific coast.

We wish to speak in support of Senate bill 2720. The need for a plant to economically produce on a large scale marine protein concentrate for human consumption is well known. The nation that first comes up with a practical way of doing this will be in a position to revolutionize the well-being of over half of the world's population.

We support the principle of five plants to start with as there are bound to be a few wrinkles to iron out when moving up from a laboratory model. The more plants established the better the chance to arrive at the most efficient method in a short time. You will have more personnel to solve problems and will also be training more men to lead the future expansion of this promising industry.

With foreign fisheries encroaching on our coasts, the time is short. We must utilize to the maximum sustained yield the resources directly adjacent to our shores if we wish to remain a world power. We presently are rated fifth in world fish production, with a static fishery, while most of the nations of the world are expanding their fisheries at a fantastic rate. Any nation can utilize his own land area as he sees fit, but the nation with established historical fishing rights in international waters under our present policy of freedom of the seas may be hard to move out of an area. A foreign nation's position would be especially strong, if this Nation started first to utilize a natural replenishing resource that we as an adjacent coastal State was wasting through lack of technology or just plain lack of interest in the well-being of our oldest industry, fishing.

Fish protein concentrate production appears to be a field wide open for some rewarding firsts in making this world a better place to live and dispelling the chronic hunger that has plagued our world all through recorded history. It may well be of much greater and lasting importance than having the first man on the moon. As the most affluent society on this earth, it seems to us that this bill is the minimum effort we can afford to put out in this direction.

Here we are proposing to invest $5 million in a program that has the potential to erase much of the misery from the lives of a billion and a half people. Could we do less?

Assuming the war effort in Vietnam is costing us around a billion a month, this 5 million would only be what it costs us to run this war 3 to 4 hours. It is also less than one one-hundred-thousandths of our gross national product. When we have stakes that actually may be the whole future of this world, we have a gamble we cannot afford to pass.

Using hake for fish protein concentrate would allow us here in the Northwest to begin harvesting a resource that is presently being wasted. It would also assure us that we could maintain our position in the world fisheries even if a fishery such as menhaden should experience a drastic reduction in catch. Presently menhaden constitutes about half our total fish production. There is a large self-replenishing natural resource in hake right adjacent to our west coast that is estimated to equal, if not exceed, the menhaden populations of the east and gulf coasts. We must utilize this resource before other nations decide to harvest it. We cannot afford to delay any longer.

I wasn't really worried too much when Russia put up the first sputnik. I thought it would give us the impetus to do what should have been done before and also give us a good understanding of the potential of our adversary for world influence. Well, we seem to be reacting in one direction only. Billions to conquer outer space and pennies for inner space, where, in all probability, the whole future well-being of our world lies. Presently Russia is having built on one contract in one yard in Poland nine research vessels, all over 300 feet long, of a size we can't even match. The foresight shown by the Russians in being first in outer space appears to be headed for another victory, to be first in inner space. We must not delay any longer.

The CHAIRMAN. You brought out one point there. I want to ask this question. Would you agree with me that it is going to be rather difficult for us to confront other nations who are, or might be thinking

about, or actually are in a resource on the high seas unless we intend to utilize it or unless we are taking advantage of it, would it not?

Mr. OLSEN. I believe we would be in a poor position with anybody we tried to talk to if we were not using this resource ourselves. We don't have any right to waste a resource.

The CHAIRMAN. And this would be a step in the right direction, we would show the world we are not only going to make a contribution to them in the way of protein, but we are sensibly utilizing a resource off our shores and that, therefore, we would have something to sit down and talk about?

Mr. OLSEN. Yes; we definitely need it. This is what we need, we have to get started with this fishery, we have to harvest it some way, and the more plants we can start on this fish protein concentrate, the sooner we will solve the problem and get it on a practical basis, the whole world would be better off, and the United States especially.

The CHAIRMAN. Mr. Entrikin is with the Whatcom County Development Council in Bellingham.

We are glad to hear from you.

(The letter submitted by Mr. Olsen follows:)

ALASKA FISHERMAN'S UNION,
Astoria, Oreg., April 25, 1966.

Senator WARREN G. MAGNUSON,
Chairman, Senate Committee on Commerce
Washington, D.C.

Mr. Chairman and members of the Committee, I would like to thank you for the opportunity to present a statement.

I am Kenneth O. Olsen, Astoria Agent of the Alaska Fishermen's Union. The Alaska Fishermen's Union represents primarily people associated with the fisheries of Alaska and also the Otter Trawl Fisheries off Washington and Oregon. Many of our members when not employed in Alaska, take part in the different fisheries of the entire Pacific Coast.

We wish to speak in support of Senate Bill 2720. The need for a plant to economically produce, on a large scale, marine protein concentrate, for human comsumption is well known. The nation that first comes up with a practical way of doing this will be in a position to revolutionize the well-being of over half the world's population.

We support the principle of five plants to start with as there are bound to be a few wrinkles to iron out when moving up from a laboratory model. The more plants established the better the chance to a arrive at the most efficient method in a short time. You will have more personnel to solve problems and will also be training more men to lead the future expansion of this promising industry.

With foreign fisheries encroaching on our coasts, the time is short. We must utilize, to the maximum sustained yield, the resources directly adjacent to our shores if we wish to remain a world power. We presently are rated fifth in world fish production, with a static fishery, while most of the nations of the world are expanding their fisheries at a fantastic rate. Any nation can utilize his own land area as he sees fit, but the nation with established historical fishing rights, in international waters, under our present policy of freedom-of-the-seas, may be hard to move out of an area. A foreign nation's position would be especially strong, if this nation started first to utilize a national replenishing resource that we as an adjacent coastal state was wasting through lack of technology or just plain lack of interest in the well-being of our oldest industry—fishing.

Fish protein concentrate production appears to be a field wide open for some rewarding firsts in making this world a better place to live and dispelling the chronic hunger that has plagued our world all through recorded history. It may well be of much greater and lasting importantce than having the first man on the moon. As the most affluent society on this earth, it seems to us that this bill is the minimum effort we can afford to put out in this direction.

Here we are proposing to invest five million dollars in a program that has the potential to erase much of the misery from the lives of a billion and a half people. Could we do less?

Assuming the war effort in Viet Nam is costing us around a billion a month; this five million would only be what it costs us to run this war 3 to 4 hours. It is also less than one hundred thousandth of our gross national product. When we have stakes that actually may be the whole future of this world, we have a gamble we cannot afford to pass.

Using hake for FPC would allow us here in the Northwest to begin harvesting a resource that is presently being wasted. It would also assure us that we could maintain our position in the world fisheries even if a fishery such as menhaden should experience a drastic reduction in catch. Presently menhaden constitutes about half our total fish production. There is a large self-replenishing natural resource, in hake, right adjacent to our West Coast, that is estimated to equal if not exceed the menhaden populations of the East and Gulf Coasts. We must utilize this resource before other nations decide to harvest it. We cannot afford to delay any longer.

I wasn't really worried too much when Russia put up the first Sputnik. I thought it would give us the impetus to do what should have been done before and also give us a good understanding of the potential of our adversary for world influence. Well, we seem to be reacting in one direction only. Billions to conquer Outer Space and pennies for Inner Space, where in all probability, the whole future well-being of our world lies. Presently, Russia is having built, on one contract, in one yard in Poland, nine research vessels. All over 300 feet long, of a size we can't even match. The foresight shown by the Russians in being first in Outer Space appears to be headed for another victory, to be first in Inner Space. We must not delay and longer.

I thank you gentlemen,

KENNETH O. OLSEN, *Agent.*

STATEMENT OF JOSEPH W. ENTRIKIN, WHATCOM COUNTY DEVELOPMENT COUNCIL, BELLINGHAM, WASH.

Mr. ENTRIKIN. I thank you very much, Mr. Chairman.

The reason we are here is to talk over Bellingham as a site. However, I think the important thing is that Bellingham is vitally interested in the passage of this bill and we strongly urge the establishment of such a plant in the Pacific Northwest.

My remarks, then, are made essentially toward Mr. McKernan, and we invite him to look over the Puget Sound area to see what it has to offer.

I have delivered 30 copies of our report to your secretary——

The CHAIRMAN. You have submitted here this brief covering all phases of this, and we will put all that in the record.

Mr. ENTRIKIN. That's right. I do not intend to read those here or submit them in person. I only wish to say that there is tremendous enthusiasm for this project. There is tremendous enthusiasm in Bellingham to have it in Bellingham. But the thing is that we know in Bellingham that regardless where this plant will go, we have the greatest faith in the world that there is a tremendous future for the MPC plant.

The CHAIRMAN. I think the record ought to be straight here. We are talking about a prospective bill that would set up x number of pilot plants to see how we can do this job better and to give some guidance to those in private industry that may want to participate in what we think has a great potential in a new fisheries resource. And wherever the pilot plant or plant may go would not mean that such fine communities as Bellingham, with all the assets it has in this par-

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ticular field, wouldn't be very interested in the possibility of participating in this hake fishery, because you heard here this morning a great deal of these fish are in Puget Sound and in your area.

Mr. ENTRIKIN. We are keenly aware of this, sir. At this point I would like to advise the committee that Mr. Mitch Evich, who perhaps is the authority on hake fishing, intended to be here this morning with the Bellingham contingent but was unable to come down.

What I was going to say to Mr. McKernan was that the Puget Sound area has the facilities to make this thing go and we urge him to take a good look at the Pacific Northwest.

The CHAIRMAN. Oh, I can hardly keep my eyes off the Pacific Northwest. I am often accused of never looking any other way.

Mr. ENTRIKIN. You, sir, are an authority on this area.

I would, too, like to mention section 2(a), which says in part—

Such plants shall be located in such geographic area as the Secretary determines will have optimum feasibility from the standpoint of—

We are confident that when our presentation has been examined by your committee you will share with us the view that nowhere else may the full potential of this new industry be tested with the accuracy that can be attained in the Pacific Northwest.

Thank you very much.

The CHAIRMAN. Thank you.

I am sure the people up in Bellingham are just interested in this whole matter as anyplace else in the State or Pacific Northwest, because it could be a source of great potential fishery for that area, too, a new one. You know, it is very exciting to have a new fishery show up in this country, and this is what I think you are thinking about.

Mr. ENTRIKIN. I certainly am, sir. I might say in this little statement we are giving you you will notice that the Fishermen's Cooperative Association of Seattle representing some 1,000 boats is strongly endorsing this bill. They are also alined, as a matter of fact, with the Bellingham site as well as the Fishermen's Marketing Association of Washington, which represents 95 percent of the State's trawler fleet, and we urge your close inspection of particularly these two letters. You might expect that the chamber of commerce and our council as well as the rest of Whatcom County is strongly in favor of it.

Thank you very much.

The CHAIRMAN. OK, and I will see that this statement is transferred on to the Department of the Interior. A copy of the statement is placed in the record.

Thank you, Joe.

(The statement and letters follow:)

WHATCOM COUNTY DEVELOPMENT COUNCIL, INC.,
Bellingham, Wash., April 25, 1966.

Re hearing on Senate bill 2720.

SENATE COMMERCE COMMITTEE,
Aberdeen, Wash.

HONORABLE MEMBERS: It is my pleasure to lead off the presentation by Whatcom County and by the city of Bellingham. Our delegation has traveled well over 200 miles for the purpose of offering this committee a concise and honest appraisal in support of Bellingham's desired role in the fish protein concentrate industry.

We now submit the thirty requested copies of Bellingham's presentation. Please note that endorsements have been tendered by all facets of the community including the Port of Bellingham, the local fishing industry, Whatcom County, the city of Bellingham, the State of Washington Employment Security Office and very strong endorsements by the Fishermen's Cooeprative Association of Seattle representing some 1,000 boats, as well as the Fishermen's Marketing Association of Washington which represents 95 percent of the state's trawler fleet. The Whatcom County Development Council, of which I am the director, represents every Chamber of Commerce throughout Whatcom County, as well as other agencies both public and private. In most cases there are representatives of these groups to speak on their own behalf today.

We note that Sec. 2(a) of the subject bill says in part, "Such plants shall be located in such geographic areas as the Secretary determines will demonstrate optimum feasibility from the standpoint of operation, maintenance, and economic potential." We are confident that at the conclusion of our presentation you will share with us the view that nowhere else in the Pacific Northwest may the full potential of this new industry be tested with the accuracy attendant to a Bellingham site.

Respectfully yours,

JOSEPH W. ENTRIKIN, *Director.*

WHATCOM COUNTY BOARD OF COUNTY COMMISSIONERS,
Bellingham, Wash., April 18, 1966.

Re hearing on Senate bill 2720.

SENATE COMMERCE COMMITTEE,
Aberdeen, Wash.

HONORABLE MEMBERS OF THE COMMITTEE: We are pleased to advance our endorsement of the plan for the development of a fish protein concentrate industry. We regret not being able to attend your hearing, but previous commitments in Bellingham make it impossible.

The delegation of representatives from Whatcom County have our earnest support. They represent a community which is seriously committee to providing an attractive climate for research endeavors and for industrial development.

Factors to be considered are a highly skilled and productive labor force in Whatcom County, familiar with fisheries technology; our proximity to the resources of a dynamic State College; our excellent harbors and a natural location for fish processing. We also have in operation all of the necessary facilities and services for large-scale industrial development, available sites, deep water frontage, railroad facilities, natural gas, abundant power, good roads, plenty of water and an adequate airport. Our location is free of ocean fogs the year around and has sheltered access to excellent bottom fishing.

In view of these advantages, we urge your serious consideration of Whatcom County as a location for one of the new fish protein plants.

Sincerely yours,

H. C. HALVERSON, *Chairman,*
R. E. GRAHAM, *Commissioner,*
E. R. HAXTOX, *Commissioner.*

BELLINGHAM, WASH., *April 20, 1966.*

SENATE COMMERCE COMMITTEE,
Care of Mr. Joseph W. Entrikin, Director,
Whatcom County Industrial Development Council,
Bellingham, Wash.

GENTLEMEN: I want to assure you of the full endorsement and complete cooperation of the City of Bellingham in the bid to have the new Fish Protein Concentrate Plant located in Bellingham.

This community is completely oriented in all phases of the fishing industry including the fishing for Hake which has been pioneered by one of our local fishermen, Mitchell Evich, who with his boat and crew have been involved in the research as well as the fishing procedures. Our fishing fleet is well equipped and manned by the finest and most qualified fishermen on the entire coast.

Bellingham has all the necessary facilities for handling all types of fish products including one of the largest and most modern cold storage plants in the

United States. In addition to the aforementioned facilities there are two excellent fillet plants with well qualified equipment and employees.

The Port of Bellingham is known as the finest all weather port on the coast allowing the fishing fleet to operate 12 months a year. The Port also has a tremendous improvement and expansion program going, preparing for all proposed industries relating to waterfront activities.

We in Bellingham are also blessed with excellent transportation facilities, including water, truck, railroads, etc.

I want to assure you gentlemen that the entire citizenry of the City of Bellingham and the surrounding area is completely and wholeheartedly behind this effort to secure this plant.

Respectfully yours,

JOHN E. WESTFORD, *Mayor.*

STATEMENT BY THE BELLINGHAM CHAMBER OF COMMERCE REGARDING A PILOT FISH PROTEIN CONCENTRATE PLANT, APRIL 25, 1966

The following information is offered in support of Bellingham, Washington, as a site for a pilot fish protein concentrate plant:

1. Bellingham is a seaport, located on the inland waters of Puget Sound, and is a leading producer of products of the sea. Its ocean products interests extend as far north as the Bering Sea. As a result, Bellingham and its populace are familiar with the industries that stem from harvesting of the sea and are very receptive to any industrial innovations that stem from such harvesting. There is no need for education or indoctrination of the citizens of Bellingham regarding the importance to the community of such an industry, nor is there any requirement for training of a source of labor for the development of it.

2. Bellingham, and its surrounding communities, are well able to provide financial backing for a pilot fish protein concentrate plant. The four commercial banks in Bellingham alone have some sixty to seventy million dollars in deposits readily available and are ready and able to provide the normal banking requirements for any project such as the proposed Plant.

3. The port of Bellingham has on its properties sufficient space for the proposed Plant. Furthermore, this space is adjacent to existing fish processing and cold storage facilities, of major proportions.

4. Ample utilities are readily available in the form of electric power, water, access roads, and natural gas. As evidence of this it is only necessary to point to the choosing of a site close to Bellingham for the large, new INTALCO plant.

5. Bellingham is the home port for a large number of commercial fishing boats. This fishing fleet can provide enough fish for the proposed plant, year round.

6. Bellingham is served by rail, highway, air, and ship. It has a very effective organization in the Whatcom County Traffic and Rates Bureau to keep its freight rates equitable with other coastal locations. It is the closest port of any consequence to Alaska. It is striving to become the southern terminus of a marine highway between Puget Sound and Southeastern Alaska. Interstate Highway No. 5 passes through the city, and three railroads serve the area. A modern and busy airport is on hand, and the Port facilities are modern and constantly growing.

7. Finally, Belllingham *wants* this plant! We feel it would be a natural for our town, and that our town would be a perfect setting for the plant. Plant employees would be people who are perfectly familiar with the fishing industry, and it would not be necessary to train new personnel to any degree.

PORT OF BELLINGHAM,
Bellingham, Wash., April 22, 1966.

Subject: Fish protein concentrate production center proposal to locate in Bellingham, Wash.

SENATE COMMERCE COMMITTEE,
Aberdeen, Wash.

HONORABLE MEMBERS OF THE COMMITTEE: The purpose of this letter is to endorse and support a program to locate a fish protein concentrate production center in Bellingham, Washington. It will list the factors which, from the point

of view of a Port District, would make Bellingham a sensible location for such a center.

ITEM 1: Bellingham is today a leading fish catching, processing and freezing center in the Pacific Northwest: it has been such for nearly a hundred years. Our community is proud of its marine heritage and thinks constructively on matters relating to its waterfront. It welcomes the opportunity to expand waterfront industry.

ITEM 2: Bellingham has, in full operation today, the largest, most modern bottom-fish industry on the Pacific Coast. This includes a fleet of boats, unloading and buying stations, processing, freezing and cold storage facilities for all commercial species of sea food. Complete service facilities exist, backing-up, supporting and supplying fisheries with shipbuilding and repair, chandlery, outfitting, fueling, banking, etc.

ITEM 3: Bellingham is an all weather, all year, deep water seaport within 100 miles of the Pacific Ocean, served by comprehensive systems of rail, highway, water and air transportation.

ITEM 4: Bellingham is the main seaport city of a rapidly growing Port District, the Port of Bellingham. The Port hereby offers to support this project to the full extent of the Port's capability.

ITEM 5: No less than three entirely suitable waterfront sites, owned by the Port of Bellingham, are available today for location of a fish protein concentrate production center. All have deep water access, protected piers and are served by trans-continental railroad connections and all utilities. In addition, two are adjacent to operating bottom-fish processing plants and cold storage warehouses, and are planned, by mid-1967, to be connected to a modern, municipal, industrial sewage treatment system.

The Port of Bellingham, as well as the entire Bellingham Community, is prepared to do all in its power to assure that a fish protein concentrate production center in Bellingham will succeed.

Very truly yours,

T. J. GLENN, *Manager.*

FISHERMEN'S COOPERATIVE ASSOCIATION, INC.,
Seattle, Wash., April 18, 1966.

BELLINGHAM CHAMBER OF COMMERCE,
Bellingham, Wash.

DEAR SIRS: We of the Fishermen's Cooperative Association wish to go on record, as supporting the Port of Bellingham for the location of one of the Pilot Plants for Fish Protein Concentrate.

We think Bellingham is the best location because:

1. Bellingham offers a deep water port for the larger boats without any river bar to cross.
2. Bellingham has the best cold storage plant in the state of Washington.
3. Bellingham has the labor force to supply the man power for new plants.
4. Bellingham has the all purpose transportation for movement of product, water borne, railroad, and air freight, truck transport.
5. Bellingham has Natural Gas for heat energy, and plenty of clean water.
6. Bellingham has the know how, and ability to get new industry started.

We feel these points are a must for new industry such as Fish Protein Concentrates. Also it is centrally located for both inside and outside fishing.

Respectfully yours,

[SEAL]

FRED L. BULLOCK, *Manager.*

A true copy, attest:

N. A. LIDSTONE.

FISHERMEN'S MARKETING ASSOCIATION OF WASHINGTON, INC.,
Seattle, Wash., April 20, 1966.

SENATE COMMITTEE ON COMMERCE,
Bellingham, Wash.

GENTLEMEN: I have been advised that plans are being formulated for a pilot plant to process hake and other fish into a flour concentrate.

Our Association represents approximately 95% of all the trawlers fishing out of the state of Washington and we delivered around 40 million pounds of bottom

fish last year. Two-thirds of this production was landed at fish plants in the city of Bellingham. These fish plants, situated in Bellingham, are primarily set up to handle trawl caught fish. It is my opinion that this location has many advantages for the contemplated pilot processing plant.

Outlined below are my reasons for endorsing Bellingham for the proposed operation—

1. Two fishing vessels, the "St. Michael" and the "St. Janet", during the winter of 1965 and early 1966, under very limited market conditions, produced substantial tonnage of hake from northern Puget Sound, within a radius of 3 or 4 hours of Bellingham. This proves Puget Sound will sustain a hake fishery. This would be of particular importance to the trawlers during the winter months when the weather conditions are too severe on offshore grounds, particularly the smaller vessels.

2. The offshore fishing grounds, within one hundred miles of Cape Flattery, will produce untold and untapped quantities of hake, turbot, dog fish, Bellingham sole and rat fish that presently is not being utilized in any way. This could run into the millions of tons. In order to have a year around production of these species, the plant should be located in the Puget Sound area. Weather conditions along the Coast, particularly to the South of Cape Flattery, would curtail winter operations. The reason for this curtailment is that the southern ports below Cape Flattery are all bar harbors and not natural harbors as is the entrance to the Straits of Juan de Fuca and the Puget Sound area. The winter fishery off of Oregon and the lower part of the state of Washington is shut off due to weather conditions. The trawlers in our Association, fishing out of Cape Flattery in the winter months, get in approximately 50% more fishing time than any place else along the Pacific Coast.

3. The trawlers represented by our Association are able, with very little modification in fishing equipment, to take advantage of a plant such as you contemplate. As all of our boats sail from the Puget Sound area it is only logical that the plant be located in the Puget Sound area.

To sum up, it is my opinion that an operation such as you plan is long overdue and is a much needed program for the utilization of the various species going to waste for lack of a plant of this sort. The location of the plant at Bellingham is ideal. It is sheltered from all weather and close to the fishing grounds where these species can be found in abundance.

If you need any further information, please feel free to contact me in this regard.

Very truly yours,

DAN LUKETA, *Manager.*

CITY OF BELLINGHAM, WASH., *April 20, 1966.*

SENATE COMMERCE COMMITTEE,
Care of Joseph W. Entrikin, Director, Whatcom County Industrial Development Council, Bellingham, Wash.

GENTLEMEN: The City Council of the City of Bellingham would like to go on record as lending its full support to the bid to obtain the location of the new Fish Protein Concentrate Plant in Bellingham.

We feel that Bellingham has much to offer that falls right into line with this type of plant. Not only do we have a very large and modern cold storage plant located on the waterfront but we also have two fine fillet plants which are well staffed and equipped.

Over the years the fishing fleet and its related industries have played an extremely important part in Bellingham's economy. We feel that our fishing fleet is one of the finest anywhere on the coast and that we have a sufficient working force familiar with and available for this type of industry.

At the present time the Port of Bellingham, which already offers extremely fine facilities to industry and shipping, is engaged in a wide improvement and expansion program preparing for any future industries which would be related to the waterfront.

We feel that we can offer any impending plant excellent transportation, including rail, trucking and marine.

We sincerely hope that you will give Bellingham every favorable consideration in the location of a site for this future Fish Protein Concentrate Plant.

Very truly yours,

THE BELLINGHAM CITY COUNCIL,
JACK C. MALLAHAN, *President.*

STATE OF WASHINGTON, EMPLOYMENT SECURITY DEPARTMENT,
Bellingham, Wash., April 13, 1966.

Mr. JOSEPH W. ENTRIKIN,
Director, Whatcom County Development Council, Bellingham, Wash.

DEAR MR. ENTRIKIN: The composition and characteristics of the Whatcom County labor force is such that we feel that it would be advantageous labor-wise for a commercial fishing industry to locate a plant in Whatcom County.

The annual average number of persons in the Civilian Labor Force in Whatcom County for the year 1965 was 28,200, ranging from a low of 25,660 in January to a high of 34,560 in July. The annual average for the year 1964 was 27,470, which shows over a 1.0 per cent annual average increase for the twelve-month period. In comparison, the annual average number of people unemployed in Whatcom County in 1965 was 1,650 or 5.9 per cent of the Civilian Labor Force.

An analyzation of the availability of labor for a specific operation leads to the necessary consideration of a number of factors such as:

1. If a firm operates on a year-round basis without substantial layoffs or cutbacks, it will attract workers from many seasonal industries common to this immediate area as well as counties adjacent to Whatcom County.

2. Heavy construction in Whatcom County peaked in February, 1966, and, for the immediate foreseeable future, will continue to taper off and increase the availability of workers with a wide variety of skills.

3. Generally, the available skilled workers are nearing middle age or are middle aged and older; thus, there is a substantial supply of partially trained, through education or experience, applicants seeking work plus many unskilled or inexperienced people of all ages. I would say that approximately 25 per cent of our applicants seeking work are partially trained.

4. During and following World War II, women worked in many of Bellingham's industrial plants. Some of these industrial firms are now defunct (lumber and wood products). The point is that during a labor shortage women can be and are utilized effectively in various types of industrial plants. It is estimated that the number of women available in this area for factory work would be between 150 to 200.

A current analysis of our applicant file, of those seeking work, by occupation revealed the following.

Occupational title:	*Number of applicants*
Entry:	
Office workers	105
Service occupations	65
Fisherman	87
Entry:	
Machine trades	35
Structural trades	36
Industrial workers	76
Truckdrivers	50
Cannery laborers	58
Laborer, manufacturing	69
Labor, construction, etc	90
Total	671

This group of applicants seeking work represent approximately 44 per cent of our applicant file and with some additional on-the-job training would appear to be a good potential source of available factory workers.

In addition to those individuals who are currently registered for work, there are many people originally from Whatcom County who have secured employment in Seattle or other areas, but who still maintain a local residence. These people have kept in touch with industrial developments in Whatcom County with the object of returning whenever employment, for which they are qualified, becomes available to them. We also draw on the available labor supply from adjacent counties.

As you know, we have a substantial fishing industry centered in Bellingham and Blaine; however, due to the recent closure of one of our fish canneries, many skills related to this industry are not now being utilized locally nor will they be within the immediate foreseeable future. Labor-wise this is a rare oppor-

tunity and should be seriously considered by any fishing industry seeking a new plant site.

If we can be of any further service to you in this matter, please advise.

Very truly yours,

P. J. GRANDQUIS, *Manager.*

Mr. Robert Schoning, director of the Fish Commission of Oregon. We appreciate having you here today.

STATEMENT OF ROBERT W. SCHONING, DIRECTOR OF THE FISH COMMISSION OF OREGON, PORTLAND, OREG.

Mr. SCHONING. I am Robert W. Schoning, director of the Fish Commission of Oregon, Mr. Chairman, I am representing that organization today. We have——

The CHAIRMAN (interrupting). You represent the commission?

Mr. SCHONING. Yes.

We have statutory responsibility for the protection, preservation, propagation, cultivation, development, and promotion of all fishes except game fish within the waters of the State and consequently have an interest in S. 2720.

We strongly favor the general principle and purposes of this bill which is to develop a practicable means for the production of fish protein concentrate.

There are tremendous quantities available but presently unused species of fish off the Pacific coast. They are highly nutritious and can be caught with present gear and know-how or by equipment and techniques our enterprising industry and governmental agencies can develop. If caught and used in sufficient quantity they could significantly aid in attacking the hunger problem in this country and the world. With an increasing demand, other stocks of these and possibly other species will be located, captured, and marketed. The fishermen and the fishing industry as well as associated interests would unquestionably benefit from this potential tremendous expansion by converting a renewable natural resource into new wealth.

The basic problem to date relates to the inability to convert this type and quantity of fish into a usable, marketable product in an economical manner. If there is a demand for the product, the price is right, and the supply adequate, the future should be bright.

As we see it, S. 2720 will provide the needed catalyst by utlizing present technical knowledge as a basis for economically developing fish protein concentrate from presently unused fish species.

In recent weeks the Russians have been catching great quantities of bottom-dwelling species off the coast of Oregon. There is a good possibility that the Japanese might also participate just as both have done in the North Pacific on a massive scale. S. 2720 could provide the initial incentive for the U.S. fishermen to fish off our own shores for species not now utilized by us but which other nations might otherwise harvest in these waters. Some other nations are now converting many of these species into fishmeal.

Oregon has a very important otter trawl fishery with annual landings exceeding 30 million pounds with a potential of many times that if there were a market for all species our fishermen could catch.

Much research in fisheries technology has been done in Oregon by private industry and State agencies. Last month scientists from Ore-

gon State University and the Fish Commission of Oregon received the Department of the Interior Conservation Award for developing a fish-food for salmon, largely composed of fish products. It is estimated that about 8 million pounds will be produced this year, much of it in Oregon.

In Oregon the fish are available, the know-how has been demonstrated, and the industry is cooperative. Consequently, Oregon is an excellent potential site for one of the plants provided for in this bill.

We realize there is still much to be learned about catching, developing, and marketing the product, and there will be some significant problems. However, the hour is late and the need so urgent. The work should begin as soon as possible so we can get on with solving the problems.

We see this bill as another valuable aid to better development and utilization of the Nation's fisheries resource just as the Commercial Fisheries Research and Development Act (Public Law 88–309) has already been and the Anadromous Fish Act (Public Law 89–304) will soon be. The chairman, as one of the sponsors of both bills, is very cognizant of their great value and continued need.

In summary the Fish Commission of Oregon strongly supports the principle and purposes of S. 2720 and urges implementation of it at the earliest possible time.

We appreciate the opportunity to comment today.

The CHAIRMAN. I thank you for coming up here from Oregon, and we appreciate the support of you people down there. It seems to me you are going to benefit just as much as Washington or any other States on the Pacific coast if we can proceed with this worthy project. Of course, the fact, I am a little bit perturbed that everybody wants a pilot plant, but I am sure that Oregon will participate in this new industry whether the pilot plant is there or not.

Mr. SCHONING. No question about it.

The CHAIRMAN. The pilot plant is merely to give the know-how for people to go out and do it in different places, and there is no place better, I would think, or no people more experienced in this any more than Oregon fishermen, and there has been a great interest down there in this for a long time.

(The full statement of Mr. Schoning follows) :

STATEMENT OF ROBERT W. SCHONING, DIRECTOR, FISH COMMISSION OF OREGON

I am Robert W. Schoning Diretcor of the Fish Commission of Oregon, and I am representing that organization. We have statutory responsibility for the protection, preservation, propagation, cultivation, development, and promotion of all fishes except game fish within the waters of the state and consequently have an interest in S. 2720.

We strongly favor the general principle and purposes of this bill which is to develop a practicable means for the production of fish protein concentrate.

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this type and quantity of fish into an useable, marketable product in an economical manner. If there is a demand for the product, the price is right, and the supply adequate, the future should be bright.

As we see it, S 2720 will provide the needed catalyst by utilizing present technical knowledge as a basis for economically developing fish protein concentrate from presently underutilized fish species.

In recent weeks the Russians have been catching great quantities of bottom dwelling species off the coast of Oregon. There is a good possibility that the Japanese might also participate just as both have done in the North Pacific on a massive scale. S. 2720 could provide the initial incentive for the U.S. fishermen to fish off our own shores for species not now utilized by us but which other nations might otherwise harvest in these waters. Some other nations are now converting many of these species into fish meal.

Oregon has a very important otter trawl fishery with annual landings exceeding 30 million pounds with a potential of many times that if there were a market for all species our fishermen could catch. Much research in fisheries technology has been done in Oregon by private industry and state agencies. Last month 3 scientists from Oregon State University and the Fish Commission of Oregon received the Dept. of Interior Conservation Award for developing a fish food for salmon, largely composed of fish products. It is estimated that about 8 million pounds will be produced this year, much of it in Oregon.

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In summary the Fish Commission of Oregon strongly supports the principle and purposes of S 2720 and urges implementation of it at the earliest possible time.

We appreciate the opportunity to present testimony at this hearing.

The CHAIRMAN. We have Mr. George Pigott, who wants to testify briefly.

STATEMENT OF GEORGE M. PIGOTT, THE CAPE FLATTERY CO., SEATTLE, WASH.

Mr. PIGOTT. Mr. Chairman, I appreciate the honor that your office has shown me by a letter written last month requesting my opinion as a consulting engineer and an educator regarding fish protein processes. I think you are going to have to indulge with me, I will have to call it FPC, as my testimony has FPC throughout. Furthermore, we brainwashed Seattlites figure MPC is missile production center.

I have been most interested in FPC and improved fishmeal production since 1948, when my professional career began with the fishery technology group now under the Bureau of Commercial Fisheries. I believe I started my career in this area parallel with Mr. Lee Alverson. Eighteen years of association with the fishery industry has included research and development surveys and projects, many of which have culminated in a wider variety of published technical papers, patents, and patents pending. This has been distributed between public and private industry and education.

When Mr. C. P. Anderson contacted me last October on a consulting job about existing commercial fishery potential, the techniques and equipment for solvent extraction had reached the stage of process feasability in our industry provided the other factors essential for a profitable project could be found equally economic. In order that no new development be overlooked, I made a very complete review of all existing methods and processes. Domestic and foreign plants and processes were studied, enzymatic digestion was closely examined, some laboratory tests and analyses of products were conducted, and during this same time Mr. Anderson established and resolved the other problems relative to a large project. Finally we jointly evaluated edible processing as a primary or corollary operation to fishmeal. In late December we concluded that a solvent extraction plant utilizing any fish located at Neah Bay, Wash., and capable of producing FPC, but with financial feasibility based on fishmeal and oil, offered the soundest initial project in this overall program. From this basic project FPC and other specialized high-market-value products can be produced as the market demands. The total project concept appeared so promising that I elected to be more than a consultant to Mr. Anderson and to back up my beliefs by joining him in an unlimited partnership commitment. As of last Saturday, when we had our final meeting with the Makah Tribal Council, they elected to include their participation in the project as equity in the company. Therefore, Mr. Chairman, as a general partner in the Cape Flattery Co. with the Makah Indian Tribe and Mr. Anderson, and not as a consulting engineer or a member of the University of Washington College of Fisheries faculty, I would like to submit the following formal statement to your committee:

We would appreciate your consideration of the following in your deliberations on Senate bill, S. 2720, concerning authorization and appropriations relative to fish protein concentrate, and in your other recommendations relative to fisheries, their development, and research for further expansion and improvement of fishermen and seacoast community economics.

1. We ask your support for exploratory and developmental research in delineating commercially potential fishery resources, and the development of their maximum economic utilization, the benefits of which have been so ably demonstrated by the results of past hake research programs.

2. We particularly commend and urge your committee's continuing interest and support of domestic approval by the U.S. Food and Drug Administration of fish protein concentrate.

3. We ask your committee to recommend to the U.S. Food and Drug Administration, the approval of FPC as it may be produced from any fish species; providing only, that marketed product specifications be limited to quality and sanitary requirements.

We ask, that at such time as FPC may be approved, the production from any plant, even though not financed through experimental funds, will have an equal opportunity in selling its products to, or through, or be licensed for foreign sale by the U.S. Government under titles I or IV of Public Law 480, 83d Congress, or any other program of authority with competition for sale based solely upon delivered product quality and price.

Chairman Magnuson, our company has applied for an Economic Development Administration loan to establish a fish protein extraction plant at Neah Bay, Wash. It is believed that this project's 27 new full-time plant jobs, 32 to 48 fishermen engaged full time, and new indirect benefits to supporting businesses, from $800,000 to over $1,200,000 annual payments for fish, and over $100,000 payroll, will all materially assist the economic structure of the Makah Indian Tribe, Clallam County, and the State of Washington, and that this project will demonstrate and create, through use of an improved process, a new and more stable fishery for the Northwest and Alaska.

We particularly wish to commend the Seattle and Pacific Northwest office of the Bureau of Commercial Fisheries whose enthusiastic cooperation and stimulating encouragement assisted us immeasurably in establishing the basic concepts of this project, and defined the nature and size of the resources and problems. The Bureau of Commercial Fisheries convinced ourselves of the sufficiency of raw material for the project.

The hake research is but one example of the value of the Bureau's programs, and demonstrates the economic potential of this specie. Additional information over a long time period should improve economic predictability. Similar program directed at other species or areas would perhaps reveal other unrecognized resources of equal or even greater importance.

After a study of the history of fishmeal plants, we were convinced that the conventional reliance on a single fish specie has been the strongest contributing factor to the often repeated failures of industrial fisheries. Therefore, while hake will be an important project raw material, it was felt essential to find a process capable of utilizing all species of fish with approximately equal feasibility.

Based on detailed investigation of existing and proposed processes, it was concluded that, at this time, the VioBin process demonstrated the greatest proven economic feasibility. The conventional plant's necessary reliance on a single specie, or very limited number of species, plus process losses of valuable nutrient constituents, plus very large daily raw material requirements, combine to present a too uncertain a picture for long-range investment.

Enzymatic digestion techniques appear to offer a most promising future, but lack the detailed engineering and pilot plant operating figures necessary to reliably evaluate and design a commercial facility today.

Solvent extraction processes using methyl, ethyl, isopropyl and tertiary butyl alcohols, and hexane, among other solvents, were all carefully examined. Also investigated were solvent processes in which pH was controlled by additions of acids and alkalies. Reliance on single fish species, unproven operating feasibility, low product quality and/or of limited product marketability were found to exist with all but the VioBin process today, which I underline "today." Perhaps in the future other solvent processes may be shown equal or superior; but, at this time, only this process has demonstrated commercial feasibility by operations over a 10-year period. Therefore, this project will solvent extract fishmeal from any specie of fish that may be legally processed.

Hake is only one possible resource. Turbot, dogfish, skate, eel, sculpin, and others are all expected to be major resources. In fact, with all fish being usable, any specie might be the primary resource at a given time. Only the more valuable food fish will be separated from the catch, for this process has the further advantage of accepting the fish in any combination of specie. Fishermen's valuable time need no longer be wasted by sorting.

This process makes practical the long-desired concept of total fish utilization. Fishermen now can be genuinely efficient, taking and keeping all their catch. Past wastages, for lack of a market, now can be eliminated. Industrial fishermen contracted for this project need not spend costly time seeking a particular specie, or sorting the catch beyond removal of the more valuable edible species. A single price per ton will be paid for all fish delivered. Therefore, without laws or regulation, bounties or control programs, simple economics of the easiest catch will direct industrial fishing effort to the most abundant specie automatically leveling the fishing resources on all grounds.

As suggested by Mr. McKernan, this project's total fishery utilization may actually encourage the growth of premium food fish species through weeding out the industrial fish from the grounds, and reduce pressures on common food sources. Laws can limit overfishing of food fish, but more bountiful living and feeding grounds may promote their expansion. Certainly economic utilization of industrial fish is to be preferred to control eradication or bounties, both as suggested for dogfish.

Perhaps equally important to fishermen, and many seaside communities, is that fishmeal plants need no longer be tied to the uncertainty of catches in single species. Private capital for fishmeal plants can now look to normal investment periods in place of requiring an economic return over a 3- or 4-year period, and seaside communities can accept these plants without the fear of obnoxious processing odors, sometimes found even with edible plants.

FPC produced by this process (the plant being so designed as to convert to FPC production in a few months) has been shipped abroad for medical and feed testing. The company made direct inquiry to those recipients—we have made a very extensive investigation beyond that carried out by the company which developed the process—in Central and South America, Asia, and Africa, and found this FPC generally acceptable and of proven biological value in many instances. European marketing firms have expressed interest in distributing plant production.

The tremendous human need for FPC, its proven benefit to individuals, the potential dramatic and political effect on entire populations, all demonstrate beyond question the immediate importance of FPC in the future of mankind. However, these letters received from abroad raise certain questions concerning the effective distribution of FPC, which may be solved only at the highest Government levels.

Our project, demonstrating the advantages of this solvent process, accepting any fish specie in any combination for the economic benefit of a depressed area, offers a concept of total fishery utilization. Through this process all fish are economic through FPC, all fish are potential food for the peoples of the world.

Thank you, Mr. Chairman.

The CHAIRMAN. I want to suggest that the matter of Makah Indians, we have discussed their situation with them, oh, several times in Washington, and although they are not separate from the idea of what we are trying to do here, but they have a separate problem in this field that we think can be worked out regarding an overall fishmeal, as you pointed out, production plant, and to get it going. They have availability to other sources which a private group would not have, and we are hopeful that this can work hand in hand, but they are two different things, although the processing and the idea is the same.

Now you are talking about a general food meal reduction plant, aren't you?

Mr. PIGOTT. No, sir, we are talking about a solvent extraction process that is currently capable of producing an animal feed that can compete with the current market.

The CHAIRMAN. So it would be a protein, you could produce protein concentrate out of that?

Mr. PIGOTT. With an additional step. Very economically we can convert it to FPC.

The CHAIRMAN. Have you in mind what kind of a plant that you——

Mr. PIGOTT (interrupting). Yes, sir. It is designed—I have all the engineering drawings.

The CHAIRMAN. It is in the design stage?

Mr. PIGOTT. Yes, sir. We have an option on everything involved.

The CHAIRMAN. How much will it cost?

Mr. PIGOTT. $1,000,000.

The CHAIRMAN. That is kind of a common figure around here, that million dollars.

Mr. PIGOTT. We are going to process 200 tons per day through our plant.

The CHAIRMAN. Well, the research has told us, you heard this morning, that you can reach some economic feasibility in anything over 50.

Mr. PIGOTT. Yes. We figure at 200, with a rather minimum operating time, we can hit a break-even point quite rapidly. Unfortunately, or fortunately——

The CHAIRMAN (interrupting). You intend to use all kinds of fish?

Mr. PIGOTT. Yes, sir.

The CHAIRMAN. Dogfish?

Mr. PIGOTT. Yes, sir. There are certain fish that can be used very effectively on the feed market. Now, there are certain species where we will not be able to produce them for FPC.

I would like to point out that we are not against your bill, it would be very advantageous to us to have a large commercial producing plant and an experimental plant anywhere in the vicinity to which we would have complete access to their records.

The CHAIRMAN. Sure it would help everyone no matter what processes they are using or what, as long as they are in this periphery of concentrate and meal and things. Hake for the pilot plant will do the work.

(The full statement of Mr. Pigott follows:)

THE CAPE FLATTERY CO.,
Seattle, Wash., April 24, 1966.

Re S. 2720

Senator WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate, Washington, D.C.

DEAR CHAIRMAN MAGNUSON: We would appreciate your consideration of the following in your deliberations on Senate Bill "S. 2720" concerning authorization and appropriations relative to "Fish Protein Concentrate," and in your other recommendations relative to fisheries, their development, and research for further expansion and improvement of fishermen and sea coast community economics.

1. We ask your support for exploratory and developmental research in delineating commercially potential fishery resources, and the development of their maximum economic utilization, the benefit of which has been so ably demonstrated by the results of past Hake research programs.

2. We particularly commend and urge your Committee's continuing interest and support of domestic approval by the U.S. Food and Drug Administration of Fish Protein Concentrate.

3. We ask your Committee to recommend to the U.S. Food and Drug Administration, the approval of FPC as it may be produced from *any* fish species; providing only, that marketed product specifications be limited to quality and sanitary requirements.

4. We ask, that at such time as FPC may be approved, the production from any plant, even though not financed through experimental funds, will have an equal opportunity in selling its products to, or through, or be licensed for foreign sale by, the U.S. Government until title I or IV of Public Law 480, 83 Congress, or any other program or authority with competition for sale based solely upon delivered product quality and price.

Honorable Chairman Magnuson, our company has applied for an Economic Development Administration loan to establish a fish protein extraction plant at Neah Bay, Washington. It is believed that this Project's 27 new full time plants jobs, 32 to 48 fishermen engaged full time, new indirect benefits to supporting businesses, for $800,000 to over $1,200,000 annual payments for fish, and over $100,000 payroll, will all materially assist the economic structure of the Makah Indian Tribe, Clallam County and the State of Washington. And that this Project will demonstrate and create, through use of an improved process, a new and more stable fishery for the Northwest and Alaska.

We particularly wish to commend the Seattle and Pacific Northwest office of the Bureau of Commercial Fisheries whose enthusiastic cooperation and stimulating encouragement assisted us immeasurably in establishing the basic concepts of this Project, and defined the nature and size of the resources and problems. The Bureau of Commercial Fisheries convinced ourselves of the sufficiency of raw material for the Project.

The Hake research is but one example of the value of the Bureau's programs, and demonstrates the economic potential of this specie. Additional information over a longer time period should improve economic predictability. Similiar programs, directed at other species or areas, would perhaps reveal other unrecognized resources of equal or even greater importance.

After a study of the history of fish meal plants, we were convinced that the conventional reliance on a single fish specie has been the strongest contributing factor to the often repeated failures of Industrial Fisheries. Therefore, while Hake will be an important Project raw material, it was felt essential to find a process capable of utilizing all species of fish, with approximately equal feasibility.

Based on detailed investigation of existing and proposed processes, it was concluded that, at this time, the VioBin process demonstrated the greatest proven economic feasibility. The conventional plant's necessary reliance on a single specie, or very limited number of species, plus process losses of valuable nutriant constituents, plus very large daily raw material requirements, combine to present a too uncertain a picture for long range investment.

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Solvent extraction processes using methyl, ethyl, isopropyl and teritiary butyl alcohols, and hexane, among other solvents, were all carefully examined. Also

investigated were solvent processes in which pH was controlled by addditions of acids and alkalines. Reliance on single fish species, unproven operating feasibility, low product quality and/or limited product marketability were found to exist with all but the VioBin process. Perhaps in the future other solvent processes may be shown equal or superior; but, at this time, only this process has demonstrated commercially feasibility by operations over a 10 year period. Therefore, this Project will solvent extract fish meal from *any* specie of fish that may be legally processed.

Hake is only one possible resource. Turbot, dogfish, skate, eel, sculpin and others are all expected to be major resources. In fact, with all fish being usable, any specie might be the primary resource at a given time. Only the more valuable food fish will be separated from the catch, for this process has the further advantage of accepting the fish in any *combination* of specie. Fishermen's valuable time need no longer be wasted by sorting.

This process makes practical the long desired concept of "total fish utilization". Fishermen now can be genuinely efficient, taking and keeping all their catch. Past wastages, for lack of a market, now can be eliminated. Industrial Fishermen contracted for this Project need not spend costly time seeking a particular specie, or sorting the catch beyond removal of the more valuable edible species. A single price per ton will be paid for all fish delivered. Therefore, without laws or regulation, bounties or control programs, simple economics of the "easiest catch" will direct Industrial Fishing effort to the most abundant specie automatically leveling the fishing resources on all grounds.

As suggested by Mr. McKernan, this Project's total fishery utilization may actually encourage the growth of premium food fish species through "weeding out" the Industrial Fish from the grounds, and reduce pressures on common food sources. Laws can limit overfishing of food fish, but more bountiful living and feeding grounds may promote their expansion. Certainly economic utilization of Industrial Fish is to be preferred to control erradication or bounties, both as suggested for dogfish.

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Our Project, demonstrating the advantages of this solvent process, accepting any fish specie in any combination for the economic benefit of a depressed area, offers a concept of total fishery utilization. Through this process, all fish are "economic"; through FPC, all fish are potential food for the peoples of the world.

Respectfully submitted.

GEORGE M. PIGOTT.

STATEMENT OF JEAN H. HALLAUX, MANAGER, ASTORIA CHAMBER OF COMMERCE, ASTORIA, OREG.

Mr. HALLAUX. Mr. Chairman, members of the committee, on behalf of the Astoria Chamber of Commerce, Astoria, Oreg., I express thanks for the privilege of appearing before the committee.

The Astoria Chamber of Commerce Fisheries Committee held a meeting on the 21st of April to discuss the proposal of Senate bill 2720. Representation at this meeting included fisherman unions, re-

search people from both biological and technical departments and laboratories, and the fish industry of Clatsop County, which includes all those concerned with catching and processing fish and fish products. Discussion was held on the development and potential of fish protein concentrate. Samples of the concentrate produced from hake that were processed in the Oregon State University Seafood Laboratory were shown and methods of catching the fish needed and the uses of FPC were discussed.

The fisheries committee recommended, and it has been ratified by the executive committee of the Astoria Chamber of Commerce that we endorse the intent and purpose of Senate bill 2720, that this program should be undertaken by the Department of the Interior and that the Congress of the United States should authorize the Secretary of the Interior to proceed and fund this program appropriately, and, further, that such pilot plants are proposed in this bill be constructed and operated by the Department of the Interior and that further research on the availabity and methods of catching such species desirable for the production of fish protein concentrate be handled in the same manner. To properly manage and conduct the studies, and equitably disseminate production information regarding techniques and discoveries, we suggest that an industry policy council be set up with appropriate members selected from the fishing industry of the United States. This council should meet and set policy on the program as it develops, in cooperation with the Department of the Interior.

Mr. Chairman, we in Oregon are also appreciative in your efforts on behalf of the commercial fishing industry that our Congressman from the First District in Oregon has introduced a companion measure in the House of Representatives.

While it appears as a real effort to establish one of the MPC plants in the State of Washington, we would suggest to the committee and the Secretary of the Interior for their consideration and information, that the established industry and the information they possess, the research programs underway and being considered by the Oregon State University Seafoods Laboratory at Astoria, and in addition the Oregon State University Department of Food, Science and Technology has 87 teaching and research people, of which 22 are in the seafood section.

The central location in the Pacific Northwest marine fishery makes Astoria, Clatsop County, Oreg., an ideal location for the promotion of such an outstanding program as is being considered here today, and to further emphasize this point I have added to my prepared remarks, and I will refer to the criteria announced earlier today.

Mr. Alverson spoke of the great amounts of hake off our shores, and this would appear to be the answer to the source of raw material. We are located at the mouth of the Columbia River, serviced by all methods of transportation, which should satisfy the logistics problems. Astoria is the heart of Oregon's fish processing plants, some 13 firms handle all species of marine life in both canning and fresh-fish procedures. Here also are based a great number of ocean-going fishing boats for the State of Oregon. Presently one plant is ready and is capable of processing 50 tons of hake per day for fishmeal at this time. They and others have also indicated a desire to enter into the MPC field as soon as it is economically feasible.

64-610—66——9

We in Astoria have long fought for the commercial fishing industry, and we again thank you for this opportunity and for your efforts to increase the commercial fishing industry. We eagerly await the passage of Senate bill 2720.

Thank you.

The CHAIRMAN. Thank you, Jean. I am sure that when we get this done wherever they might begin to do some further research, that they are fully cognizant, the Department's fully cognizant of the fine work done down there at the OSU in this field, and, as a matter of fact, I think they worked together on this whole thing, each one takes advantage of the other's experience, because they do a fine job. I am glad you mentioned them, and I am sure that the Department agrees with me, the fisheries people. So we thank you and Astoria will be naturally deeply interested in this matter because there again it is the other fisheries, this whole fish potential lies off their periphery, too. Thank you.

(The full statement of Mr. Hallaux follows:)

STATEMENT OF THE ASTORIA CHAMBER OF COMMERCE, ABERDEEN, WASH.

Mr. Chairman, members of the committee, on behalf of the Astoria Chamber of Commerce, Astoria, Oregon, I express thanks for the privilege of appearing before the Committee. The Astoria Chamber of Commerce Fisheries Committee held a meeting on the 21st of April to discuss the proposal of Senate Bill #2720. Representation at this meeting included 15 fisherman unions, research people from both Biological and Technical departments and laboratories, and the fish industry of Clatsop County, which includes all those concerned with catching and processing fish and fish products. Discussion was held on the development and potential of fish protein concentrate. Samples of the concentrate produced from Hake that were processed in the Oregon State University Seafood Laboratory were shown and methods of catching the fish needed and the uses of FPC were discussed.

The Fisheries Committee recommended and it has been ratified by the Executive Committee of the Astoria Chamber of Commerce, that we endorse the intent and purpose of S.B. 2720 that this program should be undertaken by the Department of Interior and that the Congress of the United States should authorize the Secretary of the Interior to proceed and fund this program appropriately, and further that such pilot plants as proposed in this bill be constructed and operated by the Department of the Interior and that further research on the availability and methods of catching such species desirable for the production of fish protein concentrate be handled in the same manner. To properly manage and conduct the studies, and equitably disseminate production information regarding techniques and discoveries, we suggest that an Industry Policy Council be set up with appropriate members selected from the fishing industry of the United States. This council should meet and set policy on the program as it develops, in cooperation with the Department of the Interior.

Mr. Chairman, we in Oregon are appreciative of your efforts in behalf of the commercial fishing industry. We are most gratified that our congressman from the 1st district in Oregon has introduced a companion measure in the House of Representatives.

While it appears there is a real effort to establish one of the MPC plants in Washington, we would suggest to the committee for their consideration and information, that the established industry and the information they possess, the research programs underway and being considered by the O.S.U. Seafoods Laboratory at Astoria, and in addition the O.S.U. Dept. of Food, Science and Technology has 87 teaching and research people, of which 22 are in the seafood section. The central location in the Pacific Northwest marine fishery makes Astoria, Clatsop County, Oregon an ideal location for the promotion of such an outstanding program as is being considered here today.

To further emphasize this point, I would refer to the criteria announced early today. Mr. Alverson spoke of the great amounts of Hake off our shores.

This would appear to be the answer to the source of raw material. Our area is located at the mouth of Columbia River, serviced by all methods of transportation satisfies the logistic problems. In Astoria, Clatsop County, Oregon, is the heart of the Oregon fish processing industry, some 13 plants handle all species of marine life. Here also, is based the greater number of ocean going fish boats in the state of Oregon. Presently our plant is ready to process 50 tons of Hake per day for fish meat at this time. They and others have also indicated a desire to enter into the MPC field as soon as it is economically feasible.

We in Astoria have long fought for the commercial fishing industry. We again thank you, Mr. Chairman, for this opportunity and congratulate you in your efforts to increase the commercial industry. And we eagerly await the passage of S.B. 2720.

STATEMENT OF LEON A. VERHOEVEN, EXECUTIVE DIRECTOR, PACIFIC MARINE FISHERIES COMMISSION, PORTLAND, OREG.

Mr. VERHOEVEN. I am Leon A. Verhoeven, executive director of the Pacific Marine Fisheries Commission, an interstate compact agency of California, Idaho, Oregon, and Washington.

The Pacific Marine Fisheries Commission is very much in favor of Senate bill 2720, to expedite the production of fish protein concentrate, which is also called fish flour, and today I learned it is to be called MPC. We are particularly pleased that the Senate Committee on Commerce has chosen to hold a hearing on the Pacific coast on this subject.

Vast quantities of fish, particularly hake, anchovies, pollock, arrowtooth flounder, rex sole, Pacific Ocean perch, and other rockfishes, exist off the Pacific coast of North America. At present, because of insufficient market demand, these resources are only slightly exploited by United States and Canadian fishermen. Our failure to exploit these resources to their maximum sustainable yield is a temptation to foreign fishermen to harvest species like halibut, petrale sole and other fishes, which are being fully exploited and scientifically managed, respectively, by our own fishermen and fishery agencies. The present invasion of fishing areas off Oregon and Washington by distant sea fleets of Russian trawlers and mother ships is an example of such harvesting. The Russian fishing vessels that have appeared off California, Oregon, and Washington recently are only the vanguard of more and larger fleets such as have swept through the Bering Sea, Gulf of Alaska, and British Columbia fishing areas. Because of the presently limited markets in North America for some of these species and the possibility of importation of some of these fishes caught by foreign fishermen fishing in waters adjacent to our shores, there is little incentive for our fishermen and industry to take the monetary risks necessary to exploit these species and to compete with foreign countries such as Russia, which has said its fishing activities are based on a need for protein rather than for profit.

The United States can use more protein than it presently is, and there are many areas in the world where persons are suffering from malnutrition, particularly malnutrition caused by a lack of protein. Agricultural experts tell us that the era of consistent, large surpluses of land-produced foods in the United States is rapidly coming to an end. The time has come to look to the underutilized food resources of the oceans.

Fish protein concentrate can be manufactured from many of the presently underutilized species of fish. It offers us an inexpensive means for improving the diet of poverty-stricken individuals in the United States and of alleviating protein malnutrition in many parts of the world. Fish protein concentrate would also create a greater and more diversified demand for fish. This would encourage our fishermen and industry to compete with foreign fishermen. It would result in a more rational utilization of all species rather than an upsetting of nature's balances by the overexploitation of some species and the neglect of others. The depletion of the sardine and the population explosion of the anchovy off our coast is an example of a change in nature's balance, which may have been caused by man.

Senate bill 2720, by authorizing the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practical and economic means for the production by the commercial fishing industry of fish protein concentrate, will do much to expedite the full utilization by our own fishermen of fishery resources adjacent to North America and to lessen protein malnutrition throughout the world. The Pacific Marine Fisheries Commission thanks the Senate Commerce Committee for this opportunity to testify in favor of Senate bill 2720.

I thank you.

The CHAIRMAN. Would you agree with me or many other people that unless we do start to utilize these resources, we aren't going to have much of a claim on them, are we?

Mr. VERHOEVEN. You are very right, Senator.

The CHAIRMAN. You can't sit down at a conference table and claim something you are not using or apparently don't want to use or utilizing.

Mr. VERHOEVEN. No; you have to attach some value to it yourself and prove your sincerity.

The CHAIRMAN. And, secondly, I think you make a very important statement when you say this also brings about—this is an added feature to this which has not been brought up here today hardly at all, it is a rational utilization of all species of fish so that the cycle of nature is not disrupted, and I think that is important. So I am glad to have this testimony, and we appreciate your coming here and appreciate the attitude of the commission. Thank you very much.

Mr. VERHOEVEN. Thank you very much, Senator.

The CHAIRMAN. Now, if there is no one else that wants to testify; Mr. Bez, do you want to testify?

Mr. BEZ. No, thank you, Senator, I just came here to listen.

The CHAIRMAN. Dr. Pariser, I am going to recommend to these people here that are interested that when we recess that you might stay where you are and some of us would like to discuss those charts with you over there. I think they are very important to those of you who are interested.

If there is no one else, why, I want to again repeat that these hearings would not have been possible without Port Commission Chairman John Earley and Commissioner Yearout. In addition, Dr. Edward P. Smith of the Grays Harbor Junior College made the signs and Aberdeen School District No. 7 helped out. Mayor Failor expedited

the traffic and everybody has been very helpful, and Hank Soike, of course, has been the yeoman in getting some of these things fixed up for us.

As I said today at noon, this hearing has been run so well compared to the way we run them in Washington, D.C., I think I will hold them all outside of the Capitol after this, take a nice trip and meet with the people involved, and I think it is a good idea.

I want to thank the press and the radio and television, because they have been more than interested in covering what they believe, and I am sure just like we do, a very important thing. I want to thank everybody, and with that the meeting will recess.

I want to assure you that, No. 1, we expect to keep that amount of money that was put in the Interior appropriation bill, I believe today or—yes, today or Saturday, so that we can go on with some future research, Doctor, on these things.

No. 2, we will proceed to see if we can't get this bill moving so we can fund it sometime this session, probably in the supplemental appropriations, and the Department is back of it, and I am sure we can get the Bureau of the Budget convinced of the importance of the expenditure, I hope, of this amount of money. Don McKernan has his fingers crossed back here.

Mr. BEZ. I changed my mind, Senator; I am going to testify.

The CHAIRMAN. You are? All right, you have my permission. Come right up here.

And, No. 3, we are going to, as I stated this morning, we have a series of conferences and meetings with not only the State Department, but others involved so we can now begin to make some progress toward an international conference in hopes we can arrive at some guide rules for conservation on the high seas. I hope the fishermen will agree with us on this and can all be unified in this effort.

Senator Bartlett is going to hold hearings May 18 and 19 on the bill on the 12-mile limits.

And, lastly, we are hopeful that we can achieve a better semblance of fishery consciousness in not only the departments of governments, but in Congress itself.

Now, this is Mr. Bez, who is no stranger to the fishing industry.

STATEMENT OF NICK BEZ, PETER PAN SEAFOODS, SEATTLE, WASH.

Mr. BEZ. Thank you; thank you, Senator.

Mr. Chairman, ladies and gentlemen, my name is Nick Bez. I am not going to say very much.

I am in favor, 100 percent, with your bill, I think it is a great thing. I have paid some interest to it in the last few months and I hope that you put it over, which I know you will, knowing you as well as I do. You never tackle anything that you don't put it over, so that is almost a cinch that you are going to get 5 million. But those 5 million, when you get them don't let Director McKernan spend it where he wants to, limit him to one single plant for the concentrate and then use the other millions for other things, If he is going to have five pilot plants, virtually you are going to get in competition with private business. This we don't want, you know that, and one plant can do a good job.

I don't care where he builds it, whether he builds it in Alaska or the Pacific coast or where it is, but I don't think we should have more than one pilot plant for each species or each kind. Then you can have some money left for the different things, because there are other different products that can be developed outside of an extract. Five plants are not going to furnish more information than one.

I think this is going to be a beginning of doing something for the Pacific coast and we are 20 years behind our competitors.

As you know, the fishing industry is going down, so something like this is needed and needed right away. I hope it is started soon. In fact, I am thinking seriously of building a plant myself.

The CHAIRMAN. Well, they say you have a reputation of never starting anything you don't finish either.

Mr. BEZ. I have not started yet.

The CHAIRMAN. The Department of the Interior decided, suggested that we have one plant. I thought that maybe they might want to have another one maybe on the east coast, and I don't know, but if we can get one good one working, I will be satisfied.

Mr. BEZ. Maybe on the east coast they will be entitled to it. I have been fighting for this kind of thing since 1933 or 1934. I fought in Roosevelt's first term and when I was on the advisory committee for two vessels, one for the Pacific and one for the Atlantic, research vessels, and unfortunately we got the appropriation and everything went through. I worked like a slave for 2 years on it, but it came in the wrong time.

The CHAIRMAN. Well, I want to say before we close that Mr. Bez and, oh, I could name all kinds of others in the fishing business, have discussed on many occasions informally, formally, have deplored, let's put it this way, the fact that we have been sort of straitjacketed in our fishing and we have never taken advantage or gone out and harvested the potential of the seas off our shores, and I am sure you agree with me. Again I want to reiterate this, we don't have much standing with other people if we are not going to go out and use the things ourselves.

Mr. BEZ. No, definitely we don't, because we have not used the natural resources that we have that are abundant to us, and when the Japs and the Russians and the other countries come, why, if we don't try to do something we have nothing to say about it, because there it is in international waters and it is there for everybody. How will we chase them away if we don't use it?

The CHAIRMAN. Well, we will proceed.

On this happy note I thank you all again and the committee will recess until the next hearing, when I hope to close the hearings on this bill.

Thank you so much everyone.

(Whereupon, at 4 p.m., the committee adjourned.)

FISH PROTEIN CONCENTRATE

MONDAY, MAY 16, 1966

U.S. SENATE,
COMMITTEE ON COMMERCE,
Washington, D.C.

The committee met at 10:10 a.m. in room 5110, New Senate Office Building, Hon. E. L. Bartlett presiding.

Senator BARTLETT. The committee will be in order.

The purpose of the hearing this morning is to receive testimony on S. 2720, a bill proposing a national program on fish protein concentrate research. Late last fall I introduced this bill and Senator Warren G. Magnuson joined me as cosponsor.

The legislation directs the Secretary of the Interior to promote the development of fish protein concentrate through an accelerated research program. The bill gives to the Secretary the same type of general authority to promote research and development as is presently provided in the saline water program including the construction of five demonstration plants. In my opinion, the world need for an inexpensive fish protein concentrate is as urgent as the need for an inexpensive process to produce fresh water from the sea. What we require, and what we urgently require, is an accelerated program of research in which Government, industry, and universities can cooperate in discovering various processes and approaches to meet the world need for protein.

I do not wish to minimize the importance that this development will be in the utilization of the coastal fishery resources of the United States. The U.S. fishery catch could be increased fivefold if a market were made available through the use and sale of a fish protein concentrate. Although the predominant untapped fishery resource is off Alaska, it is certainly true that enormous fishery resources are also found off Washington, Oregon, California, the gulf coast, and the Atlantic.

But basically the legislation is needed to help meet the world hunger problem. The Bureau of Commercial Fisheries has done an outstanding job in respect to the recommendation already accomplished. The Bureau should be congratulated. But now a new magnitude of effort is needed and this legislation will assure that this effort is made.

The first witness this morning will be Representative Keith, Member of Congress from the Commonwealth of Massachusetts, who has on all occasions demonstrated his abiding interest in the preservation and development of American fisheries.

Congressman Keith.

STATEMENT OF HON. HASTINGS KEITH, A REPRESENTATIVE IN CONGRESS FROM THE 12TH CONGRESSIONAL DISTRICT OF THE STATE OF MASSACHUSETTS

Mr. KEITH. Thank you, Senator. I am Hastings Keith, Congressman from Cape Cod from Greater New Bedford, Martha's Vineyard, and Nantucket. Pardon the commercial. Mr. Chairman, I welcome this opportunity to come before your committee and talk about a matter that has long been of interest to me. It has come to my attention that the Food and Drug Administration has raised several questions regarding the fish protein concentrate process submitted for approval by the Bureau of Commercial Fisheries. Since the nature of these apparent problems is technical, I shall leave it to the representatives of these two agencies to discuss them before the committee.

Suffice it to say, Mr. Chairman, that unless and until the FDA and the Bureau of Commercial Fisheries overcome the discrepancies in their findings and resolve the problems, these hearings may be a waste of our time. I would like to proceed with my prepared testimony just the same, however, for I hope and believe the facts will once again point up the world's great need for fish protein concentrate and also demonstrate that the FDA has a long history of bureaucratic foot dragging and negativism in this matter.

Senator BARTLETT. May I interrupt you at that point, to express with you the hope and additionally the belief that these differences will be reconciled and will be reconciled in the early future. I have every confidence that this will be the case.

Mr. KEITH. I share your hope, I am not sure I share your confidence. We have been waiting very patiently for this for a long time, Senator. And from time to time we have been advised that "just be patient, Congressman, they are about to resolve this problem."

And we actually prepared, a group of interested New England Congressmen, a letter to Dr. Goddard asking him to expedite his action in this matter, and this letter was held up for some time, because it was reported, reliably reported, that approval was just around the corner. And then on May 11, an article appeared in the New Bedford Standard Times indicating that the Food and Drug Administration contends that fish flour product being developed by the Bureau of Commercial Fisheries, a protein concentrate food additive, designed to feed the undernourished populations of the world contains too much residue of lead and isopropanol alcohol used in processing fish flour. Apparently they are now concerned about the residue of the process that was adopted by the Bureau of Commercial Fisheries. Presumably there should be some coordination between Food and Drug and the Bureau prior to the adoption of this method, because they are now finding a residue that they should have, I think, none should be there when they chose to adopt this particular method. And I think that they have got to have a more positive attitude in this Bureau, and a recognition of the facts of chemistry and biology, that you can always find traces of something if you look far enough. And I believe they have discovered lead in seven parts per million in the residue after the Bureau of Commercial Fisheries process has been concluded. And their current attitude is that zero tolerance is all that is permitted and that you are not going to find. So something has to be done.

And just prior to coming here today, I called Dr. Strayer, who as you probably know is the head of the Harvard School of Public Health, and I read my statement to him and he concurred in my comments with reference to both the residue and the attitude of Food and Drug.

It seems to me that the Food and Drug has got to adopt a more positive manner insofar as food is concerned. Their attention at the moment is going to the more interesting problem of regulating the drug industry, and meanwhile people are starving throughout the world who could have much better hope of a long life if they had this produce that is the subject of your hearings this morning. We need, it seems to me, to keep these people alive. This will do it. And then maybe they will live to use some of these drugs that we are quarreling about at the moment.

Senator BARTLETT. My confidence is based upon inexpert opinion that without too much discussion the lead content can be reduced to a tolerance that will be safe to food and drug, and likewise the alcohol, although sometimes I wonder why they would want to diminish the content of alcohol, otherwise they could have two for one.

Mr. KEITH. Well, all of these clouds sometimes have silver linings. I can recall what happened to the cranberry industry by an overzealous Food and Drug Administration. And it cost the Federal Government $10 million to overcome that error. We are losing millions of dollars, in my view, commercially, in the value of this product as it is caught, and turned into fish protein concentrate, employing people, but we are losing untold millions of dollars in good will that could result from the availability of this to the underdeveloped nations, the have-nots.

I don't know, in view of the extemporaneous comments that you and I have made, that my statement should be read in its entirety.

Senator BARTLETT. Why don't you? It isn't long. I think everyone in the audience would like to hear it.

Mr. KEITH. Thank you, Mr. Chairman. It was in 1960 that I first became vitally interested in the subject. The VioBin Corp. had a plant in my district that was producing FPC for underdeveloped countries. In 1962 I visited Peru and Mexico for the House Interstate and Foreign Commerce Committee and I found great enthusiasm for this powdered extract of fish. Since it is 80 percent protein, does not spoil and is very cheap—2 or 3 cents worth would supply all the protein needs of a child for a day—it would be the answer to the prayers of hungry millions.

Two billion people in the world are undernourished and their most common deficiency is protein. The children whose pictures we often see, with their large, sad eyes and distended stomachs, are suffering from a disease known as Kwashiorkor. Children who do not get enough high quality protein frequently develop Kwashiorkor as the aftermath of one of many common infections. The results may be stunted growth, both mental and physical, and reduced productivity for the rest of their lives. In many countries this disease is one of the major causes of death among children.

At the time I visited Latin America, scientists were doing intensive studies in feeding children FPC, and they were quite pleased with the results. I enclose for the record an article concerning the work of one

of the scientists I visited. It includes pictures of a severely malnourished child before and after he was fed FPC.

As I reported to Chairman Harris of the Interstate Commerce Committee, FPC provides a kind of protein not available in grain of any kind. The composition of the protein in FPC is more closely related to that needed by the human body than even protein-rich soybeans. A certain amount of animal protein is essential to good health, and FPC is the cheapest food yet devised. Doctors at the Hospital Infantile in Mexico told me that if they had a supply of FPC as then manufactured by the VioBin Corp., "it would be of great benefit to the Mexican people, particularly the children." They planned to use it to supplement the Mexican's basic tortilla diet.

For the record I have brought along some pictures of my trip. Some are of children with Kwashiorkor and other serve to illustrate the conditions of abject poverty in which so many of the people live.

Mr. Chairman, the seas today are abundant with fish that will die of old age. Experts estimate that the world's oceans could yield some 400 million tons of fish annually, or eight times the present catch. Our own coastal waters could yield five times the harvest of today. The implications for our sagging fishing industry are enormous. We have tried to revitalize it through construction subsidies to produce more modern vessels. If we can find a way to satisfy the Food and Drug Administration on FPC, our fishermen will have a much-improved market for their catch.

The basic complicating factor, however, is the attitude of the Food and Drug Administration. The Administration's approval of FPC is obviously necessary because it would be extraordinarily tactless to send food abroad that we will not eat ourselves. Yet, as of today, FPC still has not received FDA approval.

If the Chair does not object to my reiteration of a story which I am sure the committee knows well by now, I would like to give a brief recapitulation of events.

The FDA's objection in the past has been that FPC was made from whole fish and was, therefore, "adulterated" and unfit for human consumption. Moreover, Mr. George Larrick, then Commissioner of the Food and Drug Administration, declared that FPC would be esthetically objectionable to American housewives, containing as it did intestines, heads and tails of fish. Since I never knew anyone who bothered to clean a clam or a sardine, this struck me as absurd. In 1961 I made the statement that "Rejecting fish flour on the grounds that it might be esthetically objectionable to someone would be as ridiculous and as tragic as banning penicillin from use by the medical world because it is derived from mold." I think that now public opinion concurs in this view.

In the summer of 1961 a move was made to establish marketing standards which would enable fish flour to be sold. The FDA's choice of standards, however, required that FPC be made from cleaned fish. The expense of this proposal completely defeated the purpose of FPC so the next move—made by me and others—was to try to get FDA to change its regulations enough to permit FPC to be sold. Unfortunately, this effort failed, so we resorted to funding research at the Bureau of Commercial Fisheries to develop an acceptable form

of FPC. In the opinion of the National Academy of Science, the Bureau has done this.

And where do we stand today? A petition has been in the hands of the Food and Drug Administration since February, but we still are waiting for its response. I recently joined some of the Massachusetts Congressmen and Senators in writing a letter to Commissioner Goddard urging a prompt decision.

Just last week an article appeared in the New Bedford Standard-Times—a newspaper that has done responsible and balanced reporting on this matter since the controversy first began. The article quotes Mr. Ezra Levin, president of VioBin Corp. and perhaps the earliest developer of FPC, as saying that VioBin does not need Government funds to produce an edible FPC. I have no doubt that this is true. Unfortunately, due to the FDA's objections, VioBin's FPC will not solve the problem.

Other representatives of industry indicated to me that, in view of the possibility the FDA would not accept a new method they might devise, they could not take the risk involved. It appears that to satisfy the need is to satisfy the FDA, and to satisfy the FDA may be impossible.

If my fears are realized insofar as Mr. Levin's process is concerned, and if Food and Drug does approve the Bureau of Commercial Fisheries methods, then the bill you have before you today is necessary. It would permit the development of the FPC manufacturing process to get going rapidly. One pilot plant could be built right away and perhaps another next year. I would strongly urge that the Bureau of Commercial Fisheries make maximum use of the experience of industry and contract out as many of their operations as possible. After all, it is industry that will have to carry the ball when all Government participation is phased out. The entire effort should therefore be a cooperative one with the emphasis on industry.

My bill places no limitation on the number of plants with the idea that right now we cannot be sure of how many will be needed. Each time the Secretary of the Interior proposes to build a plant, he will have to come to Congress for the appropriation. We might decide after building three plants that private industry has developed the facilities and expertise to carry on the work. If five plants are named in the legislation, industry may mistakenly count on this number.

In summary, Mr. Chairman, I had hoped that the bill you have before you today would be appropriate at this moment. But there are two clouds hanging over it which must be cleared away before the Congress recommends the construction of pilot plants.

The first cloud—and it has a silver lining—is that of the VioBin petition. If lightning should strike the FDA and it approves the VioBin petition, then all our problems are removed. This, however, is a remote possibility.

The second cloud—and it's a dark, heavy one—is that of obtaining FDA approval on the process developed by the Bureau of Commercial Fisheries. This process, I repeat, has been approved by the National Academy of Sciences, but now it is being stymied by bureaucracy. This is the same agency that frivolously condemned the cranberry industry. The error of its ways in this instance cost our country $10 million.

Resolving the FPC problem could conceivably save hundreds of thousands of children and adults in the world's have-not nations from starvation. All of this, of course, has tremendous implications in the field of economics and foreign policy.

We as a nation are spending billions of dollars in foreign aid hoping to sell democracy and the free enterprise system to the developing countries of the world. It seems strange that, as capable as our Government is, we are unable to solve this relatively simple problem. Our scientific research and our industrial know-how are adequate. The bureaucratic dilemma is what must be solved.

I urge your continued interest in getting the FDA to move constructively to find a way to approve this product and this process. And once this is done, I hope that both branches will take whatever action is necessary to make FPC available to the hungry people of the world.

Thank you.

Senator BARTLETT. Thank you very much, Congressman, for a splendid statement. I have only one question on the next to the concluding page you said the first cloud and it has a silver lining, is that of the VioBin petition. If lightning should strike the FDA and it approves the VioBin petition, then all of our problems are removed.

By that you mean if approval is given here that the industry in general will be ready to move into this area without any Government participation at all?

Mr. KEITH. That is my belief. Mr. Levin, head of that corporation, is truly civic minded. He has made his product available to scores of underdeveloped nations. The results have been uniformly good, and I would not swear that I had heard him say this, but I believe I have heard him say it, and I believe it to be the case, that his process is one that would be made available to other corporate enterprises.

Senator BARTLETT. Do you know how closely associated his process is with that developed by the Bureau of Commercial Fisheries?

Mr. KEITH. I think it is quite parallel, but I believe that he uses a different solvent.

Senator BARTLETT. Does he have a plant now?

Mr. KEITH. He has a plant now in the city of New Bedford.

Senator BARTLETT. And it is producing protein concentrate?

Mr. KEITH. Yes; but it is not of a sort that is designed primarily for a food supplement. It is designed primarily, I believe, for animal food. But it can be adapted to the end product that we seek.

Senator BARTLETT. You spoke about your trip down to Mexico and Peru, Congressman Keith. And you informed the committee that FPC was being fed to the children there. Where did that come from; do you know?

Mr. KEITH. That came from theVioBin Corp., Mr. Levin. I went specifically to Mexico and off into the countryside, knew the very poor of small towns, and visited a hospital where they were using this to treat children suffering from malnutrition. Then I went to Peru, and up in Lima, there is a Dr. Graham who has been using this for some time and the results of his experiments have been extraordinarily successful. This is well known in the public health field, and Dr. Stayer, to whom I referred, has been the one with whom I have consulted on many occasions and he says the VioBin product as such would need no further modification and that in all of its employment in these

many different countries, to the best of my knowledge, there has never been any adverse results.

All of the results have been beneficial.

Senator BARTLETT. You mentioned some pictures. Do you have those?

Mr. KEITH. I regret to say that in my haste to get over here I did not bring the pictures. But there are about 10, 8 by 10 pictures, showing children in hospital beds with distended stomachs, emaciated bodies, and then pictures taken later on that show them with very healthy little bodies.

Senator BARTLETT. If you will send those over to me, I promise, cross my heart, that they will be returned safely.

Mr. KEITH. I will be delighted, sir.

Senator BARTLETT. Thank you very much, Congressman, for your helpful statement.

(The article entitled "Fish Flour Action Delayed," follows:)

FDA FINDS LEAD, ALCOHOL TRACES—FISH FLOUR ACTION DELAYED

(By Everett S. Allen, Standard-Times Staff Writer)

WASHINGTON, May 11.—The Food and Drug Administration contends the fish flour product being developed by the Bureau of Commercial Fisheries, a protein concentrate food additive designed to feed the undernourished populations of the world, contains too much residue of lead and of the isopropyl alcohol used in processing fish to flour.

This is why FDA approval of the Interior Department's "marine protein concentrate," which has been expected imminently, has not been forthcoming. What the present delay means is subject to various interpretations.

The May 7 issue of Chemical Week commented that "the future of fish flour . . . has been placed in some doubt by questions raised by the FDA . . . Interior officials profess to be puzzled. They say their samples show lead residues well below the tolerance levels generally accepted for foods and FDA has given no lower tolerance level targets to shoot for.

NOT WORRIED

"The Interior process was supervised by outside food chemists and a special panel of the National Academy of Sciences. These groups plan to meet with FDA officials to seek agreement."

Here in Washington, BCF personnel who have worked on the project acknowledge they have been asked for more information, but say they are not concerned. They do not thing there is anything unusual in the FDA request. They believe the alcohol content can be reduced considerably and say they are going to submit more samples.

Private enterprise, specifically VioBin Corporation of Monticello, Ill., of which New Bedford Fish Products Corporation, Carl H. Larsen, general manager, is a subsidiary, is convinced its several-year effort to get FDA approval of its fish flour is greatly enhanced by this development.

A principal reason for this is that while "several thousand" parts per million of isopropyl alcohol have been found in the Government product, according to reliable sources, VioBin maintains there is none in its fish flour.

An added argument offered by the Illinois-New Bedford company is that "hundreds" of persons, including babies in more than 30 countries, among them Thailand, Ghana, Colombia, Formosa and Mexico, have been fed its product "with proved nutritional benefit and without ill effect, or complaint."

The Government product has not been subjected to comparable "feeding tests."

On April 21, VioBin petitioned for FDA approval of a fish flour product specifically comparable to the DCF protein concentrate in that it would be prepared from "hake and hake-like species" as was the Government's. VioBin also has produced flour from other species as well, but has tailored its latest petition to match that of the Interior Department.

NOTICE PUBLISHED

Notice of the VioBin request was published in the Federal Register of May 3, further encouraging the proponents of a private-enterprise product.

Meanwhile, Ezra Levin, president of VioBin, took exception—not to FDA's handling of the fish flour matter—but to the BCF's effort to produce a product acceptable to the Government.

Moved to comment by Senate Commerce Committee hearings on a bill to provide Government fish-flour pilot plants, Mr. Levin said:

"VioBin can provide fish protein concentrate by interesting capital in using our methods. If the U.S. wants any amount of FPC made under the rules and regulations of the FDA, we will guarantee to produce it at a specific price, incidentally, which is half of what the BCF estimates the cost will be for the product it proposes. There is no problem of money for research as far as we are concerned. All we need is an order.

HIGHEST OBJECTIVE

"To do research to utilize the fishing resources of the U.S. and to convert them into FPC is an objective of the highest order, and could lay the groundwork on which private capital can proceed to provide food needs of national and international significance.

"I would not hesitate to say, however, that to permit the Department of the Interior to direct this research would be a mistake. They are not equipped by training, experience or administrative judgment to direct such a development."

Mr. Levin suggested the committee "carry out a private investigation of what they (Interior Department) did with the $2,000,000 that has been spent. You would be surprised at the scattering of funds for basic research, unnecessary travel and a host of impractical ideas that did not deal with the objective of FPC produced immediately."

RECOMMENDATION GIVEN

The VioBin president recommended that if Federal research funds were approved, they should be spent under the approval of independent engineering groups, such as are at MIT or the University of Illinois. He offered "every cooperation, with the definite understanding that none of these funds would go to any VioBin plant."

Levin also revealed that this month the first plant for the production of FPC outside the United States by the VioBin method will be contracted for Peru.

A House bill calling for Government pilot plants to test the different processes for production of FPC has been filed by Representative Hastings Keith (R.-Mass.). It differs from other similar proposals in providing that FPC will be eligible for distribution under the provisions of the Food for Freedom Act.

In this connection, Mr. Levin added, "VioBin does not need Government funds for providing FPC. We will guarantee to produce it as fast as plants can be erected, at a specified price based on cost of fish and FDA requirements for production.

WILL LICENSE ANYONE

"We will license anyone to produce FPC. If the quantity is specified under the Food for Freedom bill, any quantity can be made available within nine months."

In April, the BCF's Technological Laboratory at College Park, Md., produced a report on the development of marine protein concentrate, its name for FPC.

Mr. Levin takes issue with the report as follows:

Report, Page 3: "The efficient and economic operation of a 50-ton-a-day plant (raw fish input) requires a supply of fish for a working schedule of at least 250 days per year."

Levin: "Commercial fishermen state that 250 days of catching hake and hake-like species is not possible. The fact, as substantiated in the New Bedford and in the Seattle areas, is that catches of raw material of 90–95 percent hake would be limited to approximately 100 days."

RED HAKE USED

(The BCF experimentation was conducted with 3,000 pounds of red hake, caught by otter trawl in an area near Nomansland, south of Martha's Vineyard.)

Report: Page 15: "With fish priced at 1 cent a pound . . ."

Levin: "This report, in estimating costs, specifies 1 cent a pound for raw material. This is misleading. In outlining these specifications to commercial fishermen in the New Bedford and Seattle areas, fishermen stated that industrial fish of all species for fish meal currently are bringing 1 cent a pound. Pet food manufacturers will pay $40 a ton for such fish, without concern about icing.

"A fish fillet producer states that hake brought in under the specifications as outlined in this publication could well be considered for filleting and sold as edible fish. The reason that hake, an excellent flavored and textured fish, is not now used for human food is the fact that it deteriorates quickly. Under the rigid specifications demanded for production of FPC by the method herein described, this deterioration might be eliminated and hake might become a commercial edible fish.

CONCLUSION REACHED

"The conclusion of fishermen that can easily be confirmed is that 3 cents a pound for raw material would be a minimum cost for a product specified by the Bureau of Commercial Fisheries. This would mean an increase of 12 cents for raw material for one pound of FPC."

Report: Page 19: (The fish) . . . were packed into waxed cartons and frozen . . . were transported in a refrigerated truck . . . (and) transferred to the freezer and kept at 29 degrees Centigrade until used."

Levin: It is apparent that the (BCF) pilot-plant study was made with frozen fish. Our experience has established the fact that frozen fish is entirely different from unfrozen fish for processing on a large scale . . . The fact is that an engineering feasibiliy based on frozen fish cannot be applied to fresh fish."

Report: Page 13: "One aspect of the plant design that has not yet been defined is the recovery of lipids (fatty substances containing fish oil) from the still bottoms . . ."

PROBLEM UNSOLVED

Levin: "The report acknowledges that the recovery of lipids is an unsolved problem. But it cannot be ignored in setting up a plant. The recovery of the oil is of basic importance. Menhaden is a fish from which we have produced excellent FPC. Herring and anchovy are others. These species can well be included within the specifications as outlined in the bureau's requirement for a clean, wholesome fish of a single species that would make FPC.

"The oil could well pay for a large part of the cost of the operation. An analysis of this report reveals enough about the condition required to remove the oil: This process (the BCF's) is impractical for a high-oil fish. Thus, we must conclude from this report (1) that removal of the oil from the alcohol-water-oil emulsion is a problem that has not been solved; (2) if it were solved, the process could not be used for a high-oil fish."

Levin's general conclusion was that because accepted fish species would not be available as many days a year as the Government report estimated, and because the lipid recovery problem had not been solved in terms of their method of production, a fish plant utilizing the BCF method could not be operated profitably.

Senator BARTLETT. Congressman Clausen, we are glad to have you here from the State of California.

Mr. CLAUSEN. Glad to be here, nice to be with any neighbor from the north.

Senator BARTLETT. Do you have a prepared statement?

Mr. CLAUSEN. Yes, sir.

Senator BARTLETT. We will be very, very glad to hear from you.

STATEMENT OF HON. DON H. CLAUSEN, REPRESENTATIVE IN THE CONGRESS OF THE UNITED STATES, FROM THE FIRST DISTRICT, STATE OF CALIFORNIA

Mr. CLAUSEN. Thank you very much, Senator, for permitting me to appear before your committee. It is certainly a great pleasure as always.

I appear before you today in support of S. 2720, which is for the purpose of establishing demonstration plants for the production of fish protein concentrate and is the same as my bill, H.R. 13347.

I would like to express my wholehearted support for this legislation. Since my arrival in Congress, I have been deeply concerned with the need to develop the resources of the sea and to convert them to the benefit of man. I feel certain that 1 day our marine resources will provide many of man's future needs—from food and water to important minerals.

I think the benefits from this legislation are twofold and obvious. First, the standard of living of poor, malnourished people throughout the world will be improved. I cannot say that the fish protein product which is the intended end result of this bill will eliminate the problem of protein deficiency among the undernourished peoples of the earth, but I think I can safely say that it will go a long way toward eliminating this problem.

Knowledgeable estimates list well over a billion people among those who suffer from chronic malnutrition from protein deficiency. This is particularly destructive to the health of infants. If we can improve their diets with fish protein concentrate, they will be able to be more productive and their outlook on life will surely be improved.

There is no way to measure the intangible results that come from a healthier diet, but I am sure we could look forward to far-reaching consequences that might, perhaps, include better relationships between nations as well as between man.

With our technology at such an advanced state, we should not tolerate a world in which over a billion people cannot get the bare necessities for good health. And, when we have the chance to do so much good with the simple legislative measure we are considering today, we must not pass up the opportunity.

In addition to the benefits that will accrue to our friends throughout the world, our own Nation stands to improve itself through the provisions of this bill. Our fishing industry, now competing for its very life with the fleets of other nations, can gain a great deal from the development of this new industry. Much of the vast amount of fish now caught but necessarily thrown back can be utilized by the new process for additional income to fishermen. Also, newly developed methods of midwater trawling have made it feasible for our fishing fleets to catch large quantities of fish that have been nearly unobtainable prior to this recent development. These fish can also be used for the production of fish protein concentrate and will aid our fishing industry.

Additionally, from the magnificent research conducted by the Bureau of Commercial Fisheries in conjunction with the National Academy of Sciences, we are now just beginning to tap the possibility of extra-nourishing synthetic foods. I think we will find that passage of this legislation will result in new industries that will contribute substantially to our own economy as well as enriching diets all over the earth. It is for this reason that I introduced this bill in the House and have come here today to express my hope that its passage will come in the not too distant future.

I do hope that this committee will not grant its approval to any amendments which would decrease the scope of this program. I am

referring, of course, to the proposal to limit the authorization to just one plant. I do not believe one plant would be sufficient to meet the great expectations we have. I believe that the construction of several plants, preferably all five, would allow greater flexibility in the type of research conducted, would provide us with more of the essential data, and would help us move toward commercial production more rapidly.

In discussing this with some people prior to my appearance at this time, I felt, Senator, it is absolutely necessary because of the varying species in the United States and the waters contiguous to the United States that we develop a geographical balance in our research. That is one reason I believe the No. 5 is necessary.

For the record, Mr. Chairman, I hope to see a fish protein plant established in my congressional district under this legislation. I am quite frank to say that the north coast of California would be an ideal location for one of these plants. We have the fishing fleet, we have the harbors, and we certainly have the necessary supplies of fish available. My congressional district contains more than half of all the commercial fishing vessels in California. And, it is within reach of sufficient fish to furnish the needed protein for diets of millions of now malnourished people. I would like to stress that my interest in this bill is not provincial, but I do want to bring the assets of our area to the attention of this committee.

I also want to reiterate my vehement opposition to the position of the Food and Drug Administration on the matter of fish protein concentrate. I know that the FDA is presently in the process of reconsidering its original stand that this product is unfit for human consumption, but I want to make clear my belief that the stand they have taken is unrealistic and unwise. I certainly hope that by the time we are ready to begin commercial production of this product, the FDA will be ready to allow us to use it with all its healthful benefits.

Mr. Chairman, the State of California has expressed its endorsement of this legislation. Governor Brown recently announced his support for this bill by stating that he planned to "ask the Federal Government to develop and implement a fish protein concentrate program for the utilization of latent marine fisheries resources such as hake and saury to provide dietary supplements for the undernourished people of the world and to assist the California fishing industry."

Also, the California State Legislature has recognized the importance of this measure and I have with me a copy of a resolution passed by the assembly and the senate urging us to pass the bill at the "earliest time." I would like to request respectfully that this resolution be included in the hearing record.

Senator BARTLETT. It surely will be.

(The resolution follows:)

ASSEMBLY JOINT RESOLUTION NO. 14—RELATIVE TO EXPERIMENTAL FISH PROTEIN CONCENTRATE PLANTS

Whereas, The development of a means for low cost production of fish protein concentrate would mean that more than a thousand million human beings, who now suffer the misery of chronic malnutrition, would have an opportunity for a better diet; and

Whereas, Protein deficiency diseases are the largest single source of infant mortality in the world today; and

Whereas, The ocean resources off California contain vast numbers of fish, other than anchovies, such as the Pacific hake, which could be used for such a program without endangering either their population or the other fish resources of the state; and

Whereas, Proper development of a fishery for such purpose could greatly aid the commercial fisheries of this state and be a subtantial addition to the state's economic prosperity; and

Whereas, The Conservation and Wildlife Committee of the California Assembly has considered this matter on numerous occasions and attempted to further the development of a program to provide such a concentrate; and

Whereas, California has increased its expenditures in this area, including an appropriation in the budget for this year of $92,000 from the state's General Fund for research; and

Whereas, Legislation has been introduced in Congress which would authorize the expenditure of 5 million dollars for the construction of up to five experimental fish protein concentrate plants in the United States; and

Whereas, The earliest possible construction of such plants is essential to the development of an acceptable fish protein concentrate which can so immeasurably aid in relieving the suffering of so many persons in the world; now, therefore, by it

Resolved by the Assembly and Senate of the State of California, jointly, That the Legislature of the State of California respectfully memorializes the Congress of the United States to enact legislation at the earliest possible time to authorize construction of experimental fish protein concentrate plants; and be it further

Resolved, That the Chief Clerk of the Assembly is directed to transmit copies of this resolution to the President and Vice President of the United States, to the Speaker of the House of Representatives, and to each Senator and Representative from California in the Congress of the United States.

Mr. CLAUSEN. While our military actions in Vietnam and our other military commitments in other nations are gaining all the headlines, I have long felt that the most proper, most effective way to achieve peace and stability throughout the world is to organize and escalate an economic and technological "freedom offensive," thereby minimizing the need for military activity.

I am quite excited about the prospects for using fish protein concentrate as a tool in the freedom offensive. We are shipping great quantities of wheat to India now merely to keep the people from starvation. If we were only able to add relatively small quantities of fish protein concentrate to the wheat, we could move from merely postponing starvation to improving their health and allowing them to lead the productive lives that are necessary to develop a self-sufficient society.

I do not think that anyone who knows the potential of this product will call us dreamers for our belief in what we are going to achieve through this legislation. I feel that rarely does our Government have such a chance to do so much with such a small investment.

I thank you for the courtesy you have extended by allowing me to make this statement.

Senator BARTLETT. Thank you very much.

Do you know if hearings have been held in the House on any of these bills?

Mr. CLAUSEN. Not to my knowledge.

Senator BARTLETT. Do you know if any are scheduled?

Mr. CLAUSEN. Not to my knowledge.

Senator BARTLETT. They are probably awaiting the outcome of these hearings.

Mr. CLAUSEN. I think this is true. But I am sure there will be lots of pressure. Mr. Keith and I will be bringing pressure on the committee.

Senator BARTLETT. I am glad you stated such a positive view as to the desirability of more than one plant, as recommended by the Department of the Interior. It seems to me that this situation is exactly comparable to that of the saline water demonstration. A number of plants were built in a number of places seeking different processes in an effort to discover which would be the best, and you and I know that the work done out here at the laboratory in Maryland has been based exclusively on red hake.

Now it might be that in respect to other fisheries, other processes might come into being. I don't think we should foreclose the opportunity of other processes or more efficient production that might be devised by one plant as compared with another. So I am particularly glad that you stated this.

Mr. CLAUSEN. I fully agree with everything the Senator has said. But in addition to the species, the varying species in the waters that are contiguous to the United States, I do want to make a strong emphasis on this economic offensive that I have reference to. And the strategic location of these various plants are continguous to the Atlantic and Pacific and the gulf, they could in my judgment place us in a stronger position to work with the political subdivisions to the south, to the east, as well as to the west.

Senator BARTLETT. Thank you very much.

Mr. CLAUSEN. Thank you, Senator.

Senator BARTLETT. The next witness is Dr. Bernard S. Schweigert, head of the department of food science, Michigan State University, East Lansing, Mich.

STATEMENT OF DR. BERNARD S. SCHWEIGERT, HEAD OF THE DEPARTMENT OF FOOD SCIENCE, MICHIGAN STATE UNIVERSITY, EAST LANSING, MICH., AND CHAIRMAN OF THE MARINE PROTEIN RESOURCE DEVELOPMENT COMMITTEE OF THE NATIONAL ACADEMY OF SCIENCES; ACCOMPANIED BY GEORGE K. PARMAN, EXECUTIVE SECRETARY, MARINE PROTEIN RESOURCE DEVELOPMENT COMMITTEE, FOOD AND NUTRITION BOARD, NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D.C.

Dr. SCHWEIGERT. Mr. Chairman, I have a prepared statement which I would be pleased to read or summarize, if you would prefer, later.

Senator BARTLETT. I would prefer that you read it, please, because I think your testimony is going to be of great importance, and we want to hear it all.

Will you please identify the gentleman accompanying you?

Dr. SCHWEIGERT. Yes. I would like to introduce Mr. George Parman, who is executive secretary of the Advisory Committee to the National Academy of Sciences.

I am B. S. Schweigert, professor and chairman, department of food science at Michigan State University, and am appearing as a member and Chairman of the Committee on Marine Protein Resource Development of the National Academy of Sciences by an invitation extended through President Seitz' office of the National Academy of Sciences. The present membership of the Committee is as follows:

Dr. Bernard S. Schweigert, food science and nutrition, Michigan State University, East Lansing, Mich.

Dr. W. M. Chapman, marine resources, Van Camp Sea Food Co., San Diego, Calif.

Dr. C. O. Chichester, food science and technology, University of California, Davis, Calif.

Dr. James A. Crutchfield, economics, University of Washington, Seattle, Wash.

Dr. Paul Gyorgy, nutrition and pediatrics, Philadelphia General Hospital, Philadelphia, Pa.

Dr. Harriet Hardy, industrial toxicology, Massachusetts Institute of Technology, Cambridge, Mass.

Dr. John Liston, microbiology, University of Washington, Seattle, Wash.

Dr. Harold S. Olcott, food science and technology, University of California, Berkeley, Calif.

Dr. Milner B. Schaefer, marine biology, University of California, La Jolla, Calif.

Dr. Nevin S. Scrimshaw, food science and nutrition, Massachusetts Institute of Technology, Cambridge, Mass.

Mr. George K. Parman, executive secretary, Marine Protein Resource Development Committee, Food and Nutrition Board, National Academy of Sciences, Washington, D.C.

This is the second appearance of a representative of the National Academy of Sciences on this subject and the Academy itself has been closely involved in advising on the research and development of fish protein concentrate since 1963. You will recall that in 1962 the Academy was asked to appoint an ad hoc committee to initiate a study to determine—

(1) If a wholesome, safe, and nutritious product could be made from whole fish;

(2) If a product now existed which was suitable for human consumption; and

(3) If there was a nutritional or economic need among lower income groups of the United States for an inexpensive animal-protein food supplement.

The findings of this ad hoc group were covered in detail in the hearing on fish protein concentrate held by your subcommittee on August 14, 1964. In essence, the ad hoc committee concluded that a wholesome, safe and nutritious product could be made from whole fish. The committee pointed out, however, that, at that time, a satisfactory process, properly controlled, for preparing such a product on a large scale was not in operation.

The Bureau of Commercial Fisheries then undertook research to develop a process for preparing a suitable fish protein concentrate product. Again the Academy was asked to form an advisory committee to guide and advise the Bureau in all phases of the research, and particularly in those areas involving nutritional and public health questions.

In August 1964, at a hearing before this subcommittee, Dr. Floyd Daft, then chairman of the advisory committee, presented a statement reviewing the situation regarding the research program at that

time. His statement concluded with the following resolution, adopted by the advisory committee and approved by the Food and Nutrition Board of the National Academy of Sciences under which the committee operates:

Endorsing the Continuance of Research and Development for the Production of Fish Protein Concentrates and Other Products Suitable for Human Consumption From Whole Fish.

The committee has reviewed the program and progress of the work being done by the Bureau of Commercial Fisheries to investigate the production of fish protein concentrates for human consumption. The committee wishes to commend the Bureau of Commercial Fisheries for the comprehensive nature of its efforts, the conduct of its program and the precautions and safeguards it has incorporated to insure that the products resulting from its research would be wholesome, safe, and nutritious.

The committee believes that the Bureau of Commercial Fisheries should continue to give effective attention to the problems concerned with the manufacture of wholesome, inexpensive fish protein concentrates and the other products for human consumption from whole fish which retain the nutritional values as fully as possible.

In September 1965, the advisory committee received a complete and voluminous report from the Bureau of Commercial Fisheries on the process that had been developed to make fish protein concentrate by the isopropanol extraction of hake. After carefully reviewing all of these data the advisory committee adopted the following statement which was subsequently approved by the Food and Nutrition Board and by the Academy and forwarded to Secretary of the Interior Udall by Dr. Frederick Seitz, President of the National Academy of Sciences:

A Statement Concerning the Commercial Production of a Wholesome Protein Concentrate Made From Whole Fish for Human Consumption

Since 1963, the Committee, through meetings, through its Executive Secretary, and in discussions with the research workers, has kept a close surveillance on the research program of the Technology Laboratory of the Bureau of Commercial Fisheries at College Park, Maryland. This research is concerned with the development of a fish protein concentrate suitable for human consumption, made from whole fish, which is wholesome, nutritious, and capable of commercial production at costs low enough to be of practical value in the mitigation of human protein malnutrition problems.

The Committee has re-examined the Report of the Temporary Committee on questions submitted by the Secretary of the Interior concerning fish protein concentrate, dated October 29, 1962, of which a copy is attached hereto. The Committee is of the opinion that the judgments made in that report have now been affirmed.

It became apparent during 1964 that a process using whole red hake gave promise for a suitable fish protein concentrate. The process involved the extraction of water, oil, and other unwanted solubles in the fish by the use of isopropanol. On the advice of the Committee, the Bureau of Commercial Fisheries concentrated its work on the necessary process development and testing of this product. A report on the results of this work were reviewed in detail by the Committee at its meeting on September 16, 17, 1965. On the basis of this report, the Committee believes that the fish protein concentrate developed by the Bureau of Commercial Fisheries is wholesome, highly nutritious, stable, safe, and capable of economic production and marketing.

Red hake together with silver hake, Merluccius billinearis, are abundant on the continental shelf off the Northeast United States and Canada and can be harvested at relatively low cost. A near relative, Merluccius productus, occurs in large volumes off the West Coast of the United States, Mexico, and Canada. These fish have been used for human food for a long period of time. However, they do not enjoy a sufficiently broad market to utilize the resource fully since

their delicate flesh does not stand up well under marketing procedures because of excessive drip, loss of tissue moisture.

The Bureau of Commercial Fisheries process involves the solvent extraction of this fish using ispropanol in a sanitary food plant. The resulting concentrate of the solid parts of the fish retains most of the nutritious material originally in the fish except for the oils and other soluble residues. The product contains a minimum of 80 percent protein, as well as minerals useful in human nutrition. It is, as manufactured, a dry powder without any distinctive fish odor or taste. It is highly stable and can be stored and shipped economically.

Microbiological tests showed that the processing of the fish further reduced the original low microbial content of the raw material and resulted in a product with exceptionally low total bacterial count.

In this process the oil content of the fish is reduced to a level of 0.2 percent in the finished product. This level results in a satisfactory, wholesome and stable product. There is also reason to believe that a product with a somewhat higher residual oil content might be equally satisfactory and be cheaper to produce. Further research aimed at elucidating this upper level of satisfactory residual oil content is in progress.

The product obtained by this process, when biologically tested, yielded an average protein efficiency ratio of 3.44; compared to 3.2 for the average casein controls. The difference is statistically significant.

Toxicological tests of a very stringent nature carried out thus far have yielded no evidence that the product is otherwise than wholesome.

The product blends well with other forms of food. The Committee has tested it as an ingredient in beverages, noodles, gravy, bread, and cookies. In percentage high enough to be of nutritional significance, the product is scarcely detectable, and in most forms, not at all.

The calculated costs of the product in the pilot plant, extrapolated to commercial sized installations, indicate that manufacturing costs will enable the product to be used as an additive to other foods cheaply enough to reach the population of developing countries. The ability of the process to use whole edible fish ensures cheap raw material costs and quantities of raw material adequate for making a major impact on human protein malnutrition problems.

The Committee does not imply by this report that other equally satisfactory and wholesome fish protein concentrates cannot be made from other kinds of whole edible fish by other suitable processes. The work at the Bureau of Commercial Fisheries, Technology Laboratory, and the Committee's work, is continuing and should continue for some years to come because of the possibility of developing a large range of fish protein products that can be used in a wide variety of dietary situations in the World to much good effect.

In the judgment of the Committee, Fish Protein Concentrate, as produced by the BCF process is not in any way filthy or otherwise unfit for human consumption. On the contrary, after reviewing in detail the Bureau of Commercial Fisheries report on the hake project and questioning the BCF research personnel on further details, the Committee has concluded that the fish protein concentrate made by the BCF process is a product that is wholesome and safe for human consumption, is highly nutritious, blends well as an additive to many types of food normally used, can be produced at a reasonably low cost and, in the view of the Committee, is suitable at present for commercial production, distribution and use in human nutrition.

Adopted: October 14, 1965.

At the same time the following resolution was adopted and forwarded through Academy channels to the Secretary of the Interior Udall:

A Resolution Recommending Construction of a Suitable Pilot Plant for Fish Protein Concentrate

The Committee recommends that the United States Government, through the appropriate agency or agencies, fund and arrange for the production of a fish protein concentrate suitable for human consumption to the extent that 3,000 tons of such product will have been made available for large scale nutritional projects addressed to human protein malnutrition within two years from this date, or

as soon thereafter as possible. The Committee believes that this can be done most effectively by the construction and operation of an experimental pilot plant scale installation, based on the Bureau of Commercial Fisheries process, which can produce about 10 tons of product a day from whole hake. The plant and the production should be under the operational control of the Bureau of Commercial Fisheries, Department of the Interior. This size of plant is also required for further experimentation on the technology of the process so that scale up to an industrial scale by private industry can be more readily accomplished.

Adopted: October 14, 1965.

From this history it is obvious that a great deal of excellent research work has been done in a comparatively short time in developing a suitable process for preparing a wholesome and nutritious fish protein concentrate from whole fish.

The committee met on April 21, 22, 1966, to review recent research results obtained by the Bureau of Commercial Fisheries and to consider provisions of Senate bill 2720. The committee is of the opinion that more research needs to be done on marine protein concentrates. First, there is an urgent need for an experimental pilot or demonstration plant for the present isopropanol extraction process. Such a plant is needed to obtain operating data required in the design of large-scale commercial plants. The present small plant in Beltsville, Md., is designed for research, not for tests on production on a pilot plant scale, and it is impossible to safely translate the operating data on this plant to the design of a commercial plant turning out 50 to150 tons of product per day. An intermediate scale plane is required. This approach is common and sound practice in the development of any process and our committee supports the proposed authorization of such plants outlined in Senate bill 2720.

Of equal importance, the demonstration plant would be a source of fish protein concentrate for studies on feasibility. Any food product is practical and worthwhile only when it becomes used by people. The potential market for fish protein concentrate is large, but to realize this market fish protein concentrate will have to be introduced into a variety of foods used in a variety of cultures both in the United States and abroad. This will require not only continuation of comprehensive food technology studies but also will require acceptability and feasibility studies both in the United States and abroad. The fish protein concentrate cannot be "just added" to a food. The effect on the nutritive value of foods, on taste, texture, costs, and other considerations must be carefully evaluated. Such studies are particularly important in the developing countries where food varieties tend to be limited and food habits are traditionally ingrained in the cultures. Anything added to the indigenous food must be acceptable. The committee has no doubt that fish protein concentrate will be widely acceptable but the point is best established by careful testing, not by opinion. The committee urges consideration in this bill for additional moneys for technological and acceptability testing for each type of fish protein concentrate which may be developed in the further research program.

As research results become available, addition pilot-sized plants may be needed for studies with other extraction processes developed, with biological methods, or with other types of fish such as fatty fish which may require a different process.

In connection with these programs with pilot-sized plants, it is important to pursue research on the quality and other characteristics of the marine protein concentrates prepared by the isopropanol and alternate methods of processing. The committee considers it most desirable that the Bureau of Commerical Fisheries utilize their authority to award grants as well as contracts at other institutions for research on fish protein concentrates in addition to carrying out work in their own laboratories. Such grants are highly useful, particularly in the exploratory stages of research.

In conclusion, we recommend, on behalf of the Committee on Marine Protein Resource Development of the National Academy of Sciences that authorization be provided for pilot-type facilities for production of marine protein concentrates and that additional funds for research be provided for the food technology and feasibility studies on the products that will be available from such plants.

We have two specific suggestions to make regarding the provisions of the bill:

(1) We recommend that the bill specifically provide a sum for research on the food technology of the various fish protein concentrates developed.

(2) We also recommend providing funds for research on feasibility and utilization of the various products developed.

Senator BARTLETT. Thank you very much, Mr. Schweigert.

Mr. Foster, do you have any questions?

Mr. FOSTER. Thank you, Mr. Chairman. I have only one question, and I would ask the witness, in reference to his statement, on page 7, the second paragraph, in which you indicate that additional pilot plants might be needed, if the witness could expand on that a bit, and illustrate what types of research might be conducted in these other plants.

Dr. SCHWEIGERT. I would be very happy to. This paragraph relates to possibilities of alternate processes being developed, which could lead to different or related types of marine protein concentrates. Specific examples might be the use of a fermentation process or other biological methods to transform the whole fish into an acceptable and highly nutritious marine protein concentrate, which may be more applicable to certain types of fish, as compared to the isopropanol method, which is a certain kind of prototype method carried out under research conditions. We anticipate that further research will lead to other processes of the biological or fermentation type.

We also envision that possibly other extraction methods may turn out to be desirable, either from economic or other reasons as it applied to specific species of fish, other than the research done with hake, with the isopropanol method.

So there may be a family of products that have unique applications in nutrition, depending on economics, raw material, and innovative potential the food industry might have based on such research.

Mr. FOSTER. So you can see the possibility for the need for more than one demonstration project in the future?

Dr. SCHWEIGERT. We definitely can.

Mr. FOSTER. Thank you.

Senator BARTLETT. Doctor, please turn to page 5 of your statement. The first paragraph is in these words:

> The product obtained by this process when biologically tested yielded an average protein efficiency ratio of 3.44, compared to 3.2 for the average casein controls.
> The difference is statistically significant.

Frankly, I don't understand this. I wish you would explain it.

Dr. SCHWEIGERT. Very good. I am afraid this is a little scientific jargon, Mr. Chairman. It refers to the classic test used to evaluate the protein quality of foods in feeding tests with experimental animals.

When we use the term, "protein efficiency ratio," we are referring to the weight gain of the animal per unit weight of protein consumed. So, the higher the number, the better the protein quality.

In other words, 3.44 means that they gained more weight on a fish protein concentrate protein than they did on the casein control. Now that is important, because casein is the principal protein of milk and it is used as sort of a reference standard in such protein evaluation studies.

Here we have an example of a protein, a particular fish protein concentrate, showing a better protein quality per unit of protein than we did from casein, the principal protein of milk. And then the statement, "the difference is statistically significant" means that, by evaluating the performance of every animal on each of the two feeding experiments, it wasn't just chance that these differences were observed, but they are real.

In other words, it is not experimental error. It is a true scientific fact based on that experiment.

Senator BARTLETT. Thank you. I was reading a report made by the Bureau of Commercial Fisheries relating not only to the research which has already been done, but projecting industrial production of fish protein concentrate, and, as I recall it, the statement was made in this report that, if fish could be purchased for 1 cent a pound, the concentrate could be produced for 13.9 cents a pound.

Is this not an extraordinarily low cost? Extraordinary for protein, for a product that has, as you say, about 80 percent protein?

Dr. SCHWEIGERT. It certainly is a moderate cost. We also reviewed that report, Mr. Chairman, and with those assumptions, these are the calculated estimates of the commercial cost. Of course that is not quite the equivalent of actually having the operating data, but the projections indicate it is feasible to do it economically.

I believe, if one includes some additional items, the cost would certainly not exceed 20 cents a pound, which compares rather favorably with other types of protein resources that the world has available for such critical feeding problems.

Senator BARTLETT. I should think it would be very low comparatively.

Dr. SCHWEIGERT. It is certainly in the ballpark, as we say, of feasibility.

Now I am also a little reluctant, speaking as an individual, to be real precise about this figure, until we see commercial applications.

Senator BARTLETT. Of course you can't be, because all of the data are based upon laboratory experiments and projections made from them.

Dr. SCHWEIGERT. Right.

Senator BARTLETT. Now why is it that every effort to date has been made to conduct research on a fish that does not have much oil to begin with, and then this is followed by an extraction of all of the oil that can be extracted? Why is this in——

Dr. SCHWEIGERT. Well, one of the important things is to remove the oil from the fish so that one has a stable product, because the fats from fish can readily become rancid, or off-flavor, or odorous. This must be avoided in such a product. This is therefore more feasible, and we supported this, to start with a low-fat fish, to minimize the research problems of extracting the fish to an oil level that would be low enough to provide a stable product.

Senator BARTLETT. So that it could be stored for months or perhaps years and still be useful?

Dr. SCHWEIGERT. That is the indication in all research data obtained to date.

Senator BARTLETT. Then, as I recall your statement, your recommendation is that now tests be made to determine how much higher that oil content might be, without making the product unstable?

Dr. SCHWEIGERT. That is correct. It is conceivable that a slightly less extensive extraction process could be used and would be slightly less expensive, if the little higher oil level didn't result in a deleterious product. That requires further research.

Senator BARTLETT. It is obvious you are telling us, among other things, that splendid results have been obtained from the work heretofore done over in Maryland, but much research remains to be accomplished as to different processes and different values that might be put on the product.

Dr. SCHWEIGERT. That is correct.

Senator BARTLETT. I wish, Dr. Schweigert, you would tell us a little bit more about the need to make any protein product or any other food, for that matter, acceptable to the people who are to use it.

I recall some years ago going down to AID, or their predecessor agency, and seeking to persuade them to buy Alaska black cod for use in Asia. And we were told that the people in southeast Asia didn't know anything about black cod. They had never heard of black cod, and we were further told that there are situations where people will starve half to death rather than to adapt themselves to a food that is to them foreign. And I wish you would comment on this.

Dr. SCHWEIGERT. Well, Mr. Chairman, you brought up one of the most exciting and yet most frustrating areas in the field of food science and nutrition, and that is an objective appraisal of peoples' reactions to foods. They are so tied up in cultures and emotions, it is extremely difficult to predict how a certain item will be accepted. And we know of no other way than carefully designed testing to determine this.

Everybody is an expert of food. Everybody has an opinion on food, and very few facts are available to shed light on the situation. And we have many examples in our nutritional and food science studies where inadequate attention was paid to what people would

really eat, and commercial companies can attest to this, and it is very difficult to predict.

And it is true that in certain cultures, if it is an unfamiliar food, or if it has a religious taboo, or something, they really would starve to death rather than eat it. And this is documented.

I know of no other way than careful testing to know what one is doing, because there are many examples, and scientists can be included; they get highly enthusiastic about something that is good for people, but that doesn't mean they are going to eat it, or follow the advice. And it is the human factor we are dealing with.

Senator BARTLETT. We have the same inhibitions in our own society, do we not?

Dr. SCHWEIGERT. We surely do.

Senator BARTLETT. I can remember going to a cocktail party given by a man who alleged himself to be a friend of mine and he gave me a hors d'oeuvre, and the meat on it was very tasty. I ate it, and enjoyed it, and he promptly told me it was rattlesnake. And I departed immediately for the bathroom.

Dr. SCHWEIGERT. That is a beautiful example of this, Mr. Chairman.

Senator BARTLETT. Dr. Schweigert, in this very area it will be much easier, will it not, to add protein to protein-deficient diets with the use of this concentrate, because it can be blended with foods customarily used in a particular country?

Dr. SCHWEIGERT. That is one of the reasons I believe our optimism has sound justification. It doesn't mean that there will not be alternate ways of getting such proteins to people. As you well know, dried fish itself has a great value in international commerce. But to really get a broad base for the children and the needs that those children have for protein, it seems most feasible to have a supplement of significant protein value in foods they commonly eat.

Senator BARTLETT. Now, you recommend that we do what is needed to be done to learn the degree of acceptability.

Let me ask you this: Have you ever eaten bread to which this concentrate has been added?

Dr. SCHWEIGERT. Yes, I have.

Senator BARTLETT. Was there any taste of the concentrate?

Dr. SCHWEIGERT. No. It was not detectible. The particular experimental product consumed had a slightly grayish color, but no demonstrated taste. I might add that individual scientists can be wrong, too, about testing. It takes a carefully controlled experiment. But my own personal observation was it was very successfully done as an experiment by the Bureau of Commercial Fisheries.

Senator BARTLETT. In South Vietnam, for example, I imagine very few people, if they use bread at all, buy it from the corner grocery. They bake their own, if they use it. And I suppose this is one of the areas you will want to explore. Are we going to persuade those people to throw in a little batch of fish protein concentrate?

Dr. SCHWEIGERT. This is a complicated problem, of course, and will require specific study for specific areas. There are several avenues

available to the approach. One, of course, could be sold as packets to be added, and this will require considerable educational process. It may be something that can be worked in with another source of food that they use, and not rely specifically on bread.

Mr. Parman has looked at some of those particular areas in the world. I wonder if you would object if he commented on that.

Senator BARTLETT. On the contrary, we would be happy.

Mr. PARMAN. Of course, the point you raise, Mr. Chairman, is the important one. It comes back to the broad interpretation we put on feasibility. It means searching for the foods. It may be you introduce a new form of food. If you are going to help children, for example, it might be smart to make a food based on rice and fish protein concetrate, cooked up as a gruel. There may be traditional foods to which you could add the concentrate at central plants. All of this would have to be determined by a carefully worked out study to see what is the best approach, where you get the greatest consumer acceptance.

I have had the experience of overseas introduction of foods and you cannot just go in and give these foods and say it is good for you, therefore you must eat it. People must be convinced they like it, and that they want it. And this is the essence of getting the food over. Otherwise, we are just in an exercise of academics, we are not in the matter of feeding people.

I have seen prisoners after the war in the Philippines refuse to eat food because it was foreign to them and they were starving. You have to learn what people want and then supply them. This is the essence of good marketing and selling.

Senator BARTLETT. It would be ideal if the supplement could be added at a central point. But lacking that possibility in some cases, I should imagine that in a village for example, referring again to that which Congressman Keith said, you might have some very dramatic demonstrations of what a child, the condition of a child was before the use of the supplement and afterward, and that I would think would serve as a very rapid educational process.

Mr. PARMAN. Yes, but it has complications, too. You have to make sure you don't have a bout of diarrhea just after you introduced the food, or they will go away from it.

Dr. SCHWEIGERT. You need to work with public health officials, with local leaders and you might find an acceptance by a certain family is more important than the nutritional charts on protein deficiency ratios.

Senator BARTLETT. You have to have leadership in the recipient country.

Dr. SCHWEIGERT. You sure do.

Senator BARTLETT. This discussion leads me to request you to expand a bit on the two recommendations you made at the conclusion of your statement, because I think they are very important and we ought to have your further thoughts, more detailed thoughts concerning these recommendations.

Dr. SCHWEIGERT. Yes. The specific recommendations are to provide funds for continuing research on the food technology phase. By that we mean flavor, color, texture, ways of utilizing the products in

connection with other foods, their stability on storage, their microbiological characteristics, that is, to be sure that they continue to be low bacterial counts.

The second part refers to the area we have been discussing, feasibility and utilization, in other words, how to best incorporate such products into foods that people will eat. And envisioning that a pilot plant would be available to provide sufficient quantities, in order to carry out that second recommendation. Because the existing small experimental plant here is not of a size or for a purpose to achieve that second objective. We would need a new pilot plant-sized operation. And in fact, then, continuing research needs to go along with the availability of such plant to make the most effective utilization of the plant for the purposes intended. And hopefully that would minimize the crash nature of the research program which has been evident at the Bureau of Commercial Fisheries, which we feel is not conductive to the most effective research over a long period of time.

Mr. Parman has reminded me the food technology studies and feasibility studies would involve how to best incorporate such marine protein concentrates into native foods. I referred briefly to that, but I am pleased he reminded me to highlight that point.

Senator BARTLETT. Thank you. I am not going to ask you to engage in any quarrel or even debate with the Food and Drug Administration. But I would, for the sake of the record, want to repeat one statement you read from the report of the committee, your committee, because I think it is extremely important. That sentence was in these words:

> On the basis of this report, the Committee believes that the fish protein concentrate developed by the Bureau of Commercial Fisheries is wholesome, highly nutritious, stable, safe, and capable of economic production and marketing.

Gentlemen, the committee thanks you very, very much for your important testimony.

Senator BARTLETT. Senator Muskie, the next witness, Dr. Moseman, has kindly consented to defer his statement until you have testified.

STATEMENT OF HON. EDMUND S. MUSKIE, A U.S. SENATOR FROM THE STATE OF MAINE

Senator MUSKIE. Thank you very much, Mr. Chairman. Thank you sir. I really didn't intend to butt in. I just came over to take advantage of the first opportunity to address myself to this subject.

Mr. Chairman, I appreciate this opportunity to testify in support of S. 2720, the bill which you introduced and which I was privileged to cosponsor. In my judgment this bill provides the key to the utilization of the almost unlimited marine food supply represented by unharvested billions of pounds of fish.

Until this time we have not been able to utilize this vast protein food potential, since no method existed which would make its production commercially feasible. The Bureau of Commercial Fisheries had now developed a practical method of extracting fish protein concentrate from hake, mullet, herring, and other fish. After sucessfully using laboratory techniques the method was further developed and improved in a larger scale unit. Based on this research, we can fore-

cast the manufacturing potential whereby the cost of the production can be brought as low as 14 cents a pound, producted by a plant with a capacity of 50 tons of raw fish a day. Fish can be used as they are caught, with no need for time consuming fileting or other expensive procedures.

We are all aware of the condition of protein starvation that today exists for almost two-thirds of the world's population. The world is faced with the threat of doubling its population within the next 100 years. In view of the foreseeable exhaustion of land and resources resulting from this population increase, FPC offers an unparalleled opportunity to meet the world's food shortages.

Mr. Chairman, I would like to submit the rest of my statement for the record, and I would like to supplement it in this fashion, briefly.

Understandably in my statement, as in yours, there is tremendous interest in the development of this process, and in the construction of experimental fish protein concentrate plants, as provided by S. 2720. I would like to take this opportunity to introduce to the committee—I understand he will testify later—Mr. James Dudley, executive vice president of Marine Colloids, Inc., of Rockland, Maine. This firm is one of several Maine companies which has expressed interest in the potential food values of FPC. Marine Colloids has a long and successful history and I might say it is a fascinating story in the production of food from the ocean; namely, the processing of seaweed, through the development of extracts, for use in products such as ice cream, gelatins, and baby food. As an expert in the field of chemical processing, Mr. Dudley is highly qualified to speak on this subject. I am happy to commend him to the committee for consideration of the testimony which he is able to give.

I think if you really have the time to probe into the experience of this company in this facinating field of utilizing what had previously been apparently useless marine growths and products, you would find it a fascinating story too.

Senator BARTLETT. We are going to listen to it when the time comes. And before you leave the stand, Senator Muskie, I want to record for the record the fact that ever since I have been in the Senate, which is contemporaneous with the time you have been in the Senate, yours has been a powerful voice and you have given remarkably effective assistance in our cooperative efforts to build up the fisheries of the United States, to restore them to their former place of glory, to stop the downward trend. And your support of this particular bill is sincerely appreciated. Aside from the humanitarian values which would be derived from the production of this concentrate, and I guess we would all agree that is the most important thing involved, the fact is now as you know so well, that most of our domestic production of fish comes from the coastal fishery. Some of your fishermen, the New England fisherman, and comparatively small fraction of the other fishermen in the United States go out beyond the coastal waters. Practically all of the fish are caught within our territorial waters. If this bill is passed and implemented, we will at long last have a tool which will permit our fishermen to go out on the high seas and compete effectively with other nations which are now so energetically building up their fleets and taking so much of the fish of our coasts.

The committee thanks you for your statement and appreciates your support.

Senator MUSKIE. Thank you, Mr. Chairman. May I again express my appreciation for your leadership, without which we wouldn't be moving anywhere.

Senator BARTLETT. Thank you. We certainly will hear with interest, Mr. Dudley.

(Balance of Senator Muskie's statement follows:)

The characteristics of the concentrate itself are most encouraging. A dry, flour-like substance, with water and oil removed, it contains almost all of the proteins and minerals of the original fish. Fish protein concentrate, virtually tasteless and odorless, when blended with breads, cookies, noodles and beverage materially increases the nutritive value of foods to which it is added.

Despite the success achieved in FPC research, we must prove that the production of this abundant source of protein is profitable through construction of a plant with the capacity to provide accurate and reliable commercial manufacturing cost information. The engineering feasibility has already been domonstrated and cost factors appear favorable. However, economic feasibility can only be shown by a full scale demonstration. This bill proposes to make possible the construction, operation and maintenance of several demonstration plants placed in localities where operations will yield maximum information and guidance for the establishment of a full-scale industry. Passage of this legislation can provide a solution to the food needs of the world. It is an investment that not only should but must be made.

Senator BARTLETT. The next witness is Dr. Albert Moseman, Assistant Administrator for Technical Coperation and Research, Agency for International Development, Department of State, Washington, D.C.

STATEMENT OF DR. ALBERT H. MOSEMAN, ASSISTANT ADMINISTRATOR FOR TECHNICAL COOPERATION AND RESEARCH, AGENCY FOR INTERNATIONAL DEVELOPMENT, DEPARTMENT OF STATE, WASHINGTON, D.C.; ACCOMPANIED BY DR. MAX MILNER, CHIEF, NUTRITION BRANCH, OFFICE OF TECHNICAL COOPERATION AND RESEARCH, AGENCY FOR INTERNATIONAL DEVELOPMENT, DEPARTMENT OF STATE, WASHINGTON, D.C.

Senator BARTLETT. Dr. Moseman, you are accompanied by, for the record?

Mr. MOSEMAN. I have with me Dr. Max Milner, Chief of our Nutrition Branch in the Office of Technical Cooperation and Research.

Senator BARTLETT. Fine enough. You may proceed.

Dr. MOSEMAN. I appreciate this opportunity to appear before your committee to discuss the significance to our foreign aid efforts of S. 2720, a bill to authorize the Secretary of the Interior to develop practicable and economic means for the production by the commercial fishing industry of fish protein concentrate.

The Agency for International Development is deeply concerned about the problem of protein malnutrition in many areas of the world. In a message to AID field missions in July 1965, Administrator David Bell stated:

AID health personnel are now of the view that correcting serious protein deficiencies of preschool children would make a greater contribution to development than any other health measures—malaria eradication, sanitation, and

water supply not excluded. It is clear that food for peace donations alone cannot solve this problem; and that coordinated efforts by our agricultural, health, industry, and community development programs will be required if progress is to be made.

Of special concern is the level of protein in diets of infants, particularly in the weaning period, and children under 6 years of age. Malnutrition at this age level not only causes death for millions of children but may cause irreversible retardation of mental and physical development of those who survive.

The shortened life, decreased, resistance to infectious diseases, impaired physical and mental development, and generally decreased production capability may seriously hamper social and economic development.

In the past 12 months, the Agency for International Development has taken special action to strengthen our cooperative efforts in nutrition. A Nutrition Branch has been established in our Office of Technical Cooperation and Research.

Dr. Max Milner, formerly with UNICEF as senior food technologist, joined the Agency on February 1, 1966, to furnish technical leadership to field programs in nutrition and to guide an expanding program of research. Dr. Milner is here with me today.

It is our conviction that the world's protein deficit is of such magnitude that all feasible approaches and resources necessary to achieve its solution must be perfected and mobilized. The following activities are included in the AID program designed to improve nutritional levels in developing countries:

1. We are encouraging the improvement of production of animal proteins, including dairy products, beef, swine, and poultry.

2. We are studying the development of formulations and processing technology for economical grain-based, protein-supplemented foods for young children. These mixtures, which are now being readied for shipment and distribution under the food for peace program in several countries including India, now utilize wheat and corn, as the cereal components and defatted soy flour and dry skim milk as the protein supplements.

When fish protein concentrate of suitable quality, and in adequate supply is available at a reasonable cost, it will be an important added resource for use in these types of food fortification programs.

3. We are accelerating crop breeding research programs, aimed at upgrading by genetic means the nutritive value of major food and feed grains, including corn, sorghums, and wheat.

This effort has been given strong impetus by recent research at Purdue University where it has been conclusively shown that two genes can be introduced into almost all types of corn, producing a doubling of the amino acide lysine as well as significant increases in tryptophane, methionine, and cystine. The result is a dramatic increase in the nutritive value of the cereal protein component to a level comparable to that in animal proteins.

The replacement of standard varieties of corn, sorghums, and wheat with strains having protein of the potentially higher quality would have a profound effect on the nutritional status of many cereal-eating populations. It is clear, however, that the full impact of this research will not be achieved for a number of years to come.

4. Food processing studies, financed by AID and conduced by the U.S. Department of Agriculture, to improve the utilization for food purposes the oilseed protein resources from cottonseed, peanuts, and soybeans.

Many tropical countries where portein malnutrition is widespread, have abundant quantities of such materials which are at present largely diverted to fertilizer use or to animal feeding.

5. Introduction, expanded cultivation, and genetic improvement of grain legumes (peas, beans, pulses) which are the traditional and accepted protein dietary mainstays of many less developed countries, including India and countries in Africa. Efforts are underway also to introduce soybean culture in a number of less developed countries for use in processed, protein-rich foods.

6. Supplementation of wheat foods with the commercially available amino acid lysine, to improve their nutritive value. We are planning a pilot study in a wheat-eating country now receiving major imputs of U.S. Public Law 480 wheat, to determine the extent of nutritional improvement and increased efficiency of utilization that might be achieved from wheats supplemented with lysine.

The foregoing examples furnish some evidence of the efforts being made by the Agency for International Development to increase world supplies of proteins. They reflect our real concern and the variety of resources we are exploring.

The U.S. Department of the Interior's new publication, Fishing Leaflet 584, entitled "Marine Protein Concentrate," released last month, provides a clear and concise description of the process and the product developed during the past 2 years at the Bureau of Commercial Fisheries Technological Laboratory in College Park, Md.

The blandness of the product, its apparent freedom from toxic factors, and its high protein biological value are most impressive. It is hoped that the projections of costs will prevail up to larger industrial levels of processing.

We are hopeful that there may be favorable action by the Food and Drug Administration on this product which not only will permit use of a domestically processed product for food use at home and abroad, but also will enable the Agency for International Development to consider more effective programs of technical guidance and related assistance to food-needy countries which have adequate fish resources for establishing local fish protein concentrate industries.

It is recognized that while significant progress has been made in producing an acceptable fish protein concentrate, much remains to be done. The present isopropyl alcohol deodorizing and defatting process and its product represent only a beginning toward an array of processes and products which appear to be feasible.

The isopropyl alcohol product processed from whole red hake, as described in Fishing Leaflet 584 provides only a limited demonstration of the broader potentialities of fish protein concentrate.

Since its major use will be as a protein supplement in staple foods, more evidence is needed of its compatability as a food additive, whether it improves or otherwise favorably modifies staple foods.

It has been correctly pointed out that addition to common foods of a material which improves nutritional quality alone will not insure its acceptance by undernourished populations.

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The present BCF process should be tested with many other species of fish, particularly those available to less developed countries which are confronted with serious protein deficiency problems.

The original range of investigations to explore additional processing approaches to prepare useful fish protein concentrates, which were postponed in favor of immediate development of the isopropyl alcohol technique, might usefully be pursued.

Preservation by enzyme processing and production of powders of improved color, stability, and solubility should be studied.

The United Nations agencies have frequently pointed to the fact that in some societies a completely bland, taste-free product is not required and indeed may not be desired.

Sanitary, nutritionally safe, and acceptable products retaining fish flavor, suitable for a variety of food cultural patterns, should be developed, particularly if the costs of such products would be less than the present material.

New products such as fish protein concentrate may not become widely accepted without careful investigations to determine feasible approaches to their introduction into various foods and into different cultural patterns. Such studies should be concerned also with assessment of effective techniques for marketing and promotion.

Much work remains to be done in examining food habits and preferences of the various cultures or ethnic groups which might benefit by supplementation of their foods with fish protein concentrate.

The development of indigenous recipes using various combinations of fish protein concentrate should be undertaken as an integral part of such studies.

Mr. Chairman, the Agency for International Development is deeply interested in the further perfection and utilization of fish protein concentrate materials and we regard the expanded research and development activities that would be made possible under S. 2720 as of direct and positive benefit to our foreign aid efforts.

Senator BARTLETT. Thank you very much, Dr. Moseman. Naturally the acting chairman who originally introduced the bill is very happy to have your affirmative statement for the record.

It may be inferred, then, that you heartily endorse the recommendation made by Dr. Schweigert and Mr. Parman that there be additional work—maybe I should strike the word "additional"——

Dr. MOSEMAN. We have been working very closely with Dr. Schweigert and his staff at Michigan State University, and with Mr. Parman and his committee of the National Academy of Sciences, and we are very much interested in seeing further work undertaken, research work.

Senator BARTLETT. Particularly perhaps regarding acceptability of the product.

Dr. MOSEMAN. The acceptability and also—well, acceptability from the standpoint of the various ethnic groups or cultures around the world. I think this is a field that requires substantial exploration, because as has been pointed out earlier this morning, people do have very strong food preferences.

Senator BARTLETT. The committee has been told that many of these underdeveloped countries are deficient in protein. Perhaps Dr. Mil-

ner could give us some comparison with the use of protein in the United States in diets, with that of whatever area of the world he might want to select.

Dr. MILNER. Yes, Mr. Chairman, I shall be glad to do this. There have been a number of very convincing surveys in this area within the past few years, done not only by international groups and by U.S. agencies, but also to a considerable extent by nutritionists in their own national environments.

The well-to-do countries, in terms of protein consumption, including the United States, Europe, Australia, and so forth, are consuming protein in their diet at the rate of from 75 to 100 grams per day per capita. Some 50 to 75 percent of this protein is from animal sources, that is protein of the highest biological quality.

At the other end of the spectrum we have countries such as India and Pakistan, which seem to be obtaining no more than 40 to 45 grams of protein per capita per day, and more than 75 percent of that comes from vegetable protein resources, in other words, materials of somewhat lower protein value.

I think this trend is fairly common when one compares the protein-rich countries, as we may call them, to those which are protein poor. And the impact, of course, is greatest as Dr. Moseman indicated, on the preschool child, that is on the infant particularly at the time of weaning and on through the fourth or fifth birthday, when they are growing at the rate which is greater than at any other period of their lifetime, that is when the need for protein in tissue building is at a maximum.

This is the basis for the statement Dr. Moseman paraphrased, given originally by Mr. Bell, based on a great deal of scientific investigation indicating the very critical nature of the need for protein in developing countries, particularly for young children.

Senator BARTLETT. How many grams of protein daily do the nutritionists believe a person ought to have?

Dr. MILNER. I can't remember the exact figure of the National Academy of Science Committee on Food and Nutrition but I believe around 75 grams are recommended for adults in this country. In India the authorities there believe that possibly 48 to 50 grams are sufficient in India.

There has been a tendency, we believe, to include a margin of safety in some of the figures that are published by the National Academy.

Senator BARTLETT. I am particularly interested in the statements that have been made that if these youngsters, babies, and children up to 5 or 6 years of age, don't receive enough protein, they are made subject to diseases, and are shorter lived than otherwise would be the case. Does this have quite an effect upon the mortality rates?

Dr. MILNER. Yes. While it may be true the ultimate cause of death may be due to disease, it has become clear that the primary cause is the debilitation or weaking of the infant caused by malnutrition, which lead then to the disease doing the final job. This is the general case.

Senator BARTLETT. And I assume that that infant when and if he reaches maturity, isn't physically capable of doing that which he would be had he been properly fed?

Dr. MILNER. This has also been established, Mr. Chairman, in a number of very objective studies. From the technical point of view,

it is clear that a child, even when fed at the mother's breast, receiving perhaps the best of all protein foods, requires some supplementation beginning certainly not later that the sixth month. Children in many developing countries start out at birth apparently fully equal in size and physical development to those in the developed countries. After the fourth or sixth month, their development, certainly their physical development, decreases below the optimum, because, frequently, of lack of supplementation, as I indicated. The problem becomes far more intense than at the point of weaning, when they go from the mother's breast, where at least they—are getting some good protein, to the generally starchy, bland, low protein diet characteristic of many developing countries. This is the time of greatest importance in growth and development.

People look around these countries and see 8- to 9-year-old children that are as small as the 5- and 6-year-olds in our country. This is quite common. There is also the added problem, now being documented in further research, that there is apparently damage to the central nervous system at this critical time which may not be remissible in later times of life.

Senator BARTLETT. As a nutritionist, do you believe that the problem of making a fish protein concentrate acceptable can be solved?

Dr. MILNER. Well, I believe that the demonstration provided by the work at the Bureau of Commercial Fisheries and the great deal of previous work done not only in this country, but in many other countries over the last 10 or 15 years—and I would emphasize, Mr. Chairman, that there has been a great deal of work done in the other countries and other places, on this process—all of these indicate to that of the process is entirely feasible and should certainly be applied as quickly as possible.

Senator BARTLETT. Thank you very much. Mr. Foster.

Mr. FOSTER. Thank you, Mr. Chairman. I would like to raise one question for the record. On page 3, one sentence spoke of your food fortification program and how fish protein concentrate, if approved, could fit into that program. Would you give for the committee a little more detailed statement as to how that program works?

Dr. MOSEMAN. We are very much interested in utilizing the various sources of protein supplementation and we realize that we have had skim milk and such materials, but it would certainly give us a greater range of potential for effective fortification if we could have in addition to the materials we now use some of the fish protein concentrate materials that seem to be feasible from this country.

We realize, for example, that the supplies of skim milk powder are not inexhaustible. So we are very much interested in developing additional protein sources.

Mr. FOSTER. Does this product appear to be comparable to the ones you are now using?

Dr. MOSEMAN. We have had only limited experimentation with this material and this is one of the reasons that we would certainly endorse the broader program of research contemplated in this bill, to give us the background information of the suitability of materials, and the kinds of incorporations we might make into some of the products that are being prepared for shipment abroad.

Mr. FOSTER. You pointed out some of the problems involved in acceptability in the foreign country to food. Have you had a problem in terms of the acceptability of some of the protein supplements sources that you are now using?

Dr. MOSEMAN. Not so directly because most of the materials we are shipping abroad are products that the local people consume normally. It is when we modify, rather drastically, the shape, texture, general appearance and flavor of materials that we run into resistance. The comments earlier this morning suggested that people had resistance to different types of fish. I might say that discrimination toward food materials is a pretty broad problem.

People who are not accustomed to eating wheat, for example, as in the areas of south India, where they are accustomed to eating rice, do not accept wheat as a substitute. Likewise, people who are dependent upon wheat as their principal caloric supply, do not shift over to some other cereal grain, whether it be sorghum, rice, or so on. So we do have a very distinct preference for products that are traditional elements in their diets.

Mr. FOSTER. But if they do eat wheat and you add to it defatted soy flour, at the present time, as I understand it, are you suggesting that the people in that area are accustomed to the taste of defatted soy flour, so there is no problem, but there might be with fish protein concentrate, which has no taste?

Dr. MOSEMAN. No, I think here it depends entirely on the extent to which you add the materials and the extent to which you modify flavor or texture of the product. So I wouldn't say there would be any greater or less preference for a protein supplement from either soybeans or fish protein concentrate.

Mr. FOSTER. Thank you.

Senator BARTLETT. There is some discussion yet, even, in persuading some people to accept wheat, when they have been used to rice, is that correct?

Dr. MOSEMAN. That is correct. The one demonstration that I personally observed was in 1950, when there was a food shortage in south India. We visited a large commercial company installation where they furnished the noon meal for the employees of the plant. In this case they did not have rice in the area because of the short monsoon, they did not have available rice from imports, so they were using wheat and some potatoes in the lunch program. We observed a small riot in the compound at the noon hour, where the workers complained that they were rice eating people and that eating wheat upset their digestion. They were complaining about their company and the Government, because they said that "if you were willing to pay the price, you could get us rice." Food preference is strong on the part of most individuals. In time they may shift. But it takes time.

Senator BARTLETT. I thought that, too, when I was told that certain people in certain places might not accept the Alaskan black cod. This seemed at the beginning incomprehensible to me, because no more tasty food ever came from anywhere.

Thank you gentlemen, very much.

Is Mr. Dudley here?

Mr. DUDLEY. Yes, Mr. Chairman.

Senator BARTLETT. Is this a convenient time for you to testify?
Mr. DUDLEY. Yes, sir.
Senator BARTLETT. Fine.

STATEMENT OF DR. JAMES R. DUDLEY, EXECUTIVE VICE PRESIDENT, MARINE COLLOIDS, INC., SPRINGFIELD, N.J.; ACCOMPANIED BY HAROLD E. JAHN, GENERAL MANAGER, PROTEIN ISOLATES DIVISION

Dr. DUDLEY. Mr. Chairman, I have a prepared statement I would like to read, with your permission.

Senator BARTLETT. If you please. And for the record, will you please identify your associate.

Dr. DUDLEY. My associate is Mr. Harold E. Jahn, general manager of our Protein Isolates Division.

Mr. Chairman and members of the committee, by way of introduction, it might be well first to describe briefly the background of our company and our purpose in appearing at this hearing.

Marine Colloids and its predecessor companies have been engaged for over 30 years in harvesting seaweeds throughout the world and for processing them on our east coast to produce extracts used in the food, pharmaceutical, and cosmetic industries. Some of our personnel have also been engaged for over 10 years in research and development directed toward the isolation of protein concentrates from various sources. As a result of this program, we now operate manufacturing facilities on the west coast for producing protein concentrates derived from certain oil seeds, such as soybeans and sesame seeds. Such products are used to supply or supplement the protein content of many foods now consumed in this country.

In view of our long chemical processing, marine and food experience, we believe that we are well qualified to render an informed opinion on the subject matter of Senate bill 2720.

The growing world shortage of food protein and the need to develop new sources to provide adequate nutrition for present and future generations here and abroad is well known and need not be elaborated upon at this point. However, it is our opinion, in view of this shortage, that both Government and industry bear a responsibility to investigate and develop new sources and processes which offer economic promise of increasing the present supply of food protein. It is for this reason that we have made a thorough investigation of the experimental work that has been conducted by governmental agencies and private industry, an excellent review of which was presented by Mr. Donald L. McKernan, Director of the Bureau of Commercial Fisheries in his statement appearing in the record of the hearing held by your Subcommittee on Merchant Marine and Fisheries an August 14, 1964.

In the course of our investigation, we have made visits at the pilot plant in Beltsville, Md., operated by the Bureau of Commercial Fisheries to produce a marine protein concentrate by solvent extraction with isopropyl alcohol. Utilizing published data and information gathered from our visits, we have studied this process in compari-

son with other solvent extraction processes and biological processes as they exist at Beltsville and at other locations.

Our conclusion is that sufficient experimental data have been accumulated to show that processes have been developed for production of fish protein concentrates that are practical from the engineering point of view. We have further concluded that while cost factors appear favorable, these processes have not been operated on a large enough scale to demonstrate practicality from the economic point of view, particularly from the standpoint of producing a product for human consumption.

This finding parallels our experience in the development of processes for the production of protein concentrates derived from oil seeds, in which case we demonstrated engineering feasibility in a pilot plant similar to the one at Beltsville and then constructed a plant capable of producing 500 pounds per hour of product to demonstrate economic feasibility.

We therefore believe that it will be necessary to construct and operate one or more prototype plants of sufficient size to develop the necessary manufacturing cost data for edible marine protein concentrate. Assuming this is the case, there are a number of questions that must be answered, such as choice of the process to be used and the size, number, and location of the plant or plants to be constructed.

After considering these questions, we agree with the recommendations of the Bureau of Commercial Fisheries that first priority should be given to the isopropyl alcohol solvent extraction process for two reasons. First, this solvent is now commonly used in the processing of food products. Secondly, a review of what is known about the various alternatives indicates to us that marine protein concentrate made by this method offers the best possibility of early approval for use in foods.

Although we do not use isopropyl alcohol in our own process for producing protein concentrates from oilseeds, we do use it in our extraction of seaweeds to produce food additives. We have found its use in our process, which is similar to the one developed at Beltsville, to be safe, efficient, and economical when properly handled in the specialized equipment we have designed for it. In our process, we have developed an ability to produce a finished product having no measurable residue of isopropyl alcohol, and our totally enclosed system permits almost complete recovery of the solvent for reuse. Although residual isopropyl alcohol has been a problem in the process as far as it has been developed at Beltsville, we see no reason, in view of our own experience, why this probelm cannot be solved in the course of further process development work.

We also agree with the findings of the Bureau of Commercial Fisheries, as published last month in Fishery leaflet 584, that a plant designed to process 50 tons of raw fish per day represents a good compromise in size for the combined pilot and commercial purposes of a demonstration plant. We do not agree, however, with the equipment costs they have estimated for a plant of this size. Based on our recent experience in replacing equipment for purposes of modernizing and automating our plant facilities in which the isopropyl alcohol process is used, we would estimate that the equipment costs would be nearly

twice as much, or approximately $450,000. Applying the same installation cost factors against this figure as were used in the Bureau of Commercial Fisheries report, the cost of the completed plant would be approximately $1,500,000.

As previously stated, we recommend that isopropyl alcohol be the solvent of choice for initial operation of a prototype plant. However, there are a number of other solvents that have been shown to offer promising possibilities for practical use, and we believe that the design of a prototype plant should be such that it can be operated to demonstrate the relative merits of alternative solvents. We would expect that some of them, such as ethyl alcohol and tertiary butyl alcohol, could be employed in an isopropyl alcohol plant with little or no modification of the equipment. The use of certain other solvents, however, would require modifications of or additions to the equipment to make it operable. We therefore recommend that provision be made for an additional $500,000, if required, to provide the flexibility needed to investigate alternative solvent processes as a means of insuring the development of the most economical process. Our recommendation is that a total of $2 million be appropriated for discretionary allocation for each plant.

As to the number of plants, usual commercial practice for installing prototype plants utilizing nonperishable raw materials would be to construct one plant only. In this case, however, there are some overriding considerations that lead us to the recommendation that a minimum of two plants be constructed and operated. First, the Committee on Marine Protein Resource Development of the National Academy of Sciences has recommended that 3,000 tons of marine protein concentrate be made available for large-scale nutritional projects within 2 years. This quantity represents the full production capacity of a 50-ton-per-day plant for a 2-year period. Obviously, this recommendation cannot be fulfilled with one plant. With time needed for passage of a bill authorizing funds, selection of a plant site and operating personnel, and design and construction, it would be unrealistic to think that a plant could be operating within a year from now. Once a plant is operating, usual startup problems can be expected and some time will be required to reach full capacity. A reasonable estimate of full operation would be at the end of 1967, when fish harvesting would be entering its low period.

Second, Mr. McKernan pointed out in his statement at the Aberdeen hearing that not only is there a seasonal variation in the harvest, but the species of hake and hakelike fish vary around the shores of the United States, as well as their availability.

Furthermore, the present state of the fishing industry and economic factors affecting manpower and the potential for expanding the harvesting of fish also varies around our shores. As was pointed out by Mr. McKernan at the Aberdeen hearing, 60 percent of the food fish now consumed in this country is imported. In addressing ourselves to the development of an FPC industry, it will, therefore, be necessary to consider not only the usual problems associated with processing and distribution, but it will also be necessary to be concerned about expansion of the fishing industry.

It is for these and related reasons that it is our recommendation that provision be made for a minimum of two demonstration plants.

Further, we recommend that at least one plant be located on the east coast and at least one of the west coast, the choice in each case to be governed primarily by economic and practical considerations relating to the harvesting of fish, coupled with the prerequisites defined by the Bureau of Commercial Fisheries with respect to onshore facilities for food processing.

In conclusion, it is our recommendation that means be provided, as are contained in Senate bill 2720, and as modified by the suggestions we have made today, to proceed with the construction and operation of manufacturing facilities to demonstrate the economic feasibility of this promising possibility for alleviating the food shortage problem.

Finally, Mr. Chairman, if you or the members of the committee have any questions or would like further elaboration of any of the points we have touched upon, Mr. Jahn and I would be pleased to comply.

Senator BARTLETT. Where is the headquarters of your company, Dr. Dudley?

Dr. DUDLEY. Springfield, N.J.

Senator BARTLETT. Where is your west coast plant?

Dr. DUDLEY. In San Jose, Calif.

Senator BARTLETT. You use soybeans there, chiefly, you said.

Dr. DUDLEY. At the present time we are using chiefly soybeans. We also process sesame seeds in this plant.

Senator BARTLETT. You estimate the cost of a plant at $1,500,000.

Dr. DUDLEY. That is correct.

Senator BARTLETT. Is my memory correct that the Bureau of Fisheries estimated the cost to be $700,000 plus?

Dr. DUDLEY. I think somewhat in excess of that.

Senator BARTLETT. Somewhat in excess of that.

Do you believe the biological processes referred to earlier today offer promise?

Dr. DUDLEY. Based on what we have seen in comparing the two processes, in their present stage of development, we believe that the solvent extraction process offers the greater promise for successful development.

Senator BARTLETT. Do you believe that notwithstanding further experimentation, more work, additional research ought to be made along the biological lines?

Dr. DUDLEY. This would certainly be desirable; yes.

Senator BARTLETT. This would be another reason, perhaps, for more than one plant?

Dr. DUDLEY. Correct.

Senator BARTLETT. Tell us, if you will—I know nothing of the subject at all—about what you obtain from seaweed.

Dr. DUDLEY. The substance is technically known as carrageenan. This is a polysaccharide that is used in a wide variety of food uses. In such products as toothpaste, gelatines, soups, ice cream, and almost ad infinitum.

Senator BARTLETT. What does it do to or for toothpaste?

Dr. DUDLEY. It adds to viscosity. It increases the thickness of the toothpaste.

Senator BARTLETT. Is there a ready market for this?

Dr. DUDLEY. This was a market that was developed over the years.

Senator BARTLETT. Are there several companies in the United States engaged in this?

Dr. DUDLEY. There are in the particular variety of extractives that we produce—there are only two producers. There are other extractors of seaweeds.

Senator BARTLETT. Is the supply of seaweed adequate, or do you have to search far and wide for it?

Dr. DUDLEY. The major part of our raw material comes from off the New England coast and through the Maritime Provinces. However, we are harvesting all over the world, and are continually looking for new sources off the coast of South America, through the South Pacific, and so forth.

Senator BARTLETT. You can use more than you have?

Dr. DUDLEY. Yes; we would like to develop new sources for some of the new products that we have been developing; yes.

Senator BARTLETT. I infer that your views are in harmony with those of the Bureau of Commercial Fisheries, that a plant of about 50 tons capacity per day would be the minimum that ought to be built.

Dr. DUDLEY. Yes. This is 50 tons of raw fish, of course.

Senator BARTLETT. Yes.

Would you have any comment to make on the statement that appeared in this fishing leaflet that there ought to be readily available a supply of fish which would allow the plant to operate 250 days a year, if it is going to be an economical operation?

Dr. DUDLEY. If it is to be an economical operation; yes. This course would not be necessary for experimental purposes.

Senator BARTLETT. No. But a minimum of 250 days would be required if someone is going to make money from the process.

Dr. DUDLEY. Yes. Normal practice, in commercial operations of this type, would be to operate either a 5-, 6-, or 7-day week.

Senator BARTLETT. What fish off the New England coast could be employed in this process?

Dr. DUDLEY. Well, the hake and hake-like fish certainly. I understand they are in abundance off the New England coast.

Senator BARTLETT. In ample supply?

Dr. DUDLEY. Yes.

Senator BARTLETT. Is it your personal conclusion that this can be produced economically and that worldwide markets can be developed?

Dr. DUDLEY. I would say the economic factors appears favorable, but I don't think it will be possible to accurately determine them until a larger plant has been built. This has been our experience, as I mentioned, in connection with our own development of oil seed proteins. Here the scale of our pilot operations was approximately the same as those at Beltsville. And the plant that we scaled up to is approximately the same size as this 50-ton-per-day fish plant that the Bureau of Commercial Fisheries has recommended.

Senator BARTLETT. The members of the committee have been told, and I would like your comment on this, Dr. Dudley, that if a test plant or plants is or are built and what has been discovered to date is verified, that there is ample supply of capital ready to move into this field. Would you believe that to be correct?

Dr. DUDLEY. I think this depends on how you define ample supply.

I think if the product finds acceptance in sophisticated foods in this country, I think there would be very little question but what private industry would provide the capital funds that would be needed for the installation of the necessary plant installations.

If it is a matter of feeding the underprivileged nations, then I am not so sure that private industry would be so ready to invest capital funds.

Senator BARTLETT. Why?

Dr. DUDLEY. The profit motive.

Senator BARTLETT. I beg your pardon.

Dr. DUDLEY. Because of the profit motive, the lack of incentive from the profit motive standpoint.

Senator BARTLETT. Well, I suppose initially at any rate most of the product would be purchased by the Government for the food for peace program. Would industry feel that this was too chancy?

Dr. DUDLEY. No. If industry were assured of a satisfactory profit, I am sure there would be no problem.

Senator BARTLETT. The money is there, ready, available, providing everything else is equal.

Dr. DUDLEY. Yes. And there is already evidence of that. Quaker Oats, for example, has already invested substantial funds in the introduction of carrageenin into Latin America.

Senator BARTLETT. Mr. Foster?

Mr. FOSTER. How far out do you go to get seaweed on the Atlantic coast. How far out to sea do you go to get this?

Dr. DUDLEY. We do not go out into deep water. The seaweed that we harvest grows to depths of I would say a maximum of about 20 feet.

Mr. FOSTER. The senior Senator from Alaska refrained from pressing you on the question of whether or not we have any seaweed resources in Alaska. But I would think he would like to carry this last step through.

Have you surveyed the Alaska coast on this?

Dr. DUDLEY. Yes, we have, and unfortunately there are no red seaweeds we know of off the Alaska coast. This is the variety we need in the raw material. There is plenty of kelp, from which algin is made, but this is not a product of ours.

Senator BARTLETT. I am informed there is a vote, I have no further questions, so I thank you gentlemen.

The committee will be in recess until 10 o'clock in the morning.

(Whereupon, at 12:25 p.m., the committee was recessed, to reconvene at 10 a.m., on Tuesday, May 17, 1966.)

FISH PROTEIN CONCENTRATE

TUESDAY, MAY 17, 1966

U.S. SENATE,
COMMITTEE ON COMMERCE,
Washington, D.C.

The committee met at 10 a.m. in room 5110, New Senate Office Building, Hon. E. L. Bartlett presiding.

Senator BARTLETT. The committee will be in order to continue hearings on S. 2720.

The first witness this morning is J. Steele Culbertson, director of the National Fish Meal & Oil Association. Mr. Culbertson.

STATEMENT OF J. STEELE CULBERTSON, DIRECTOR, NATIONAL FISH MEAL & OIL ASSOCIATION, DIVISION OF NATIONAL FISHERIES INSTITUTE

Senator BARTLETT. You may proceed at your pleasure, Mr. Culbertson.

Mr. CULBERTSON. I have a prepared statement to read, if I may, Senator.

Senator BARTLETT. You may.

Mr. CULBERTSON. I am J. Steele Culbertson, director of the National Fish Meal & Oil Association, a division of National Fisheries Institute. My appearance here today is solely on behalf of the members of this association who are engaged in commercial fishing and in the manufacture of fish meal, fish oil, and fish solubles. Their operations extend along the coast from the southern New England States to Sabine Pass, Tex., and account for 80 to 90 percent of the total U.S. production of these products.

The raw material used for this purpose is derived primarily from menhaden, which is a member of the herring family and the most abundant species harvested by U.S. fishermen. In some years menhaden accounts for over 40 percent, on a volume basis, of the total landing of all commercial species, including the shellfish, that are caught and landed in the United States. The record year, according to U.S. fisheries statistics, was in 1961 when menhaden landings exceeded 2.3 billion pounds.

In order to harvest and process this enormous fishery resource the members of the National Fish Meal & Oil Association own and operate 30 large manufacturing plants on both the Atlantic and gulf coasts, from 500 to 600 fishing vessels, and 60 aircraft having a total value in excess of $100 million. People engaged in the industry, including fishermen and shore crews, number over 6,000 and many more are employed

in the allied industries and businesses such as shipyards, plant and machinery manufacturers, net and twine manufacturers, fuel companies, transportation companies, and many others.

My reason for giving you this background information about our industry is in order that you may better appreciate the size and importance of the menhaden fishing industry and resource and the potential both have in the future of FPC as well as our interest in promoting its development and use.

Because our industry group has been in forefront the past 4 to 5 years in promoting the development of FPC it seems appropriate to briefly review some of the activities that have been significant in this undertaking.

First, in order to show you the real interest our group had in FPC and the faith they had in its future development, I will quote from our bulletin No. 153–p, dated February 16, 1962, that was sent to our members giving a report on a joint meeting of the executive committees of the industrial products division of National Fisheries Institute and the Virginia Fishermen's Association. It reads as follows:

> Last Monday afternoon, February 12, 1962, at the annual meeting of the Virginia Fishermens Association Mr. McKernan, Director of the Bureau of Commerical Fisheries and I were called in to attend the Executive Session of the Menhaden operators.
>
> The purpose in inviting us to the meeting was (1) to discuss the standard of identity for fish protein concentrate approved by the Food and Drug Administration and published in the January 25, 1962, issue of the Federal Register which specified the use of fully dressed and eviscerated fish, (2) ascertain what assistance the Bureau of Commerical Fisheries is prepared to offer in the preparation of suitable letters of protest to the Food and Drug Administration on this standard of identity in a effort to get Food and Drug to hold hearings on the question of using whole fish and (3) once such a hearing is announced, what role the Bureau of Commercial Fisheries would have in the hearing.
>
> Following a full discussion of the subject, it was the consensus of all present that industry should vigorously oppose the standard of identity just issued by the Food and Drug Administration and that we should petition for a hearing and do everything possible to get the Food and Drug Administration to agree to a hearing and a standard of identity utilizing whole fish.
>
> In order to pursue this matter, a committee was empowered to levy and collect assessments up to $15 thousand and make decisions regarding the handling of the case on behalf of the Virginia Fishermens Association and the Industrial Products Division of National Fisheries Institute. The committee selected was composed of Dr. I. William Lane, J. Howard Smith, Inc., Chairman; Jack T. Styron, Louisiana Menhaden Company; W. C. Lunsford, Reedville Oil and Guano Company; H. R. Humphries, Standard Products Company, Inc.; and J. Steele Culbertson, Director, Industrial Products Division. For those of you who were not present I might say that all who were attached a great deal of importance to fish protein concentrate and the value that this product, if approved for human use, will be to the future of the industry.
>
> The first order of business will be to prepare and send Food and Drug appropriate letters to protest before the February 25, 1962, deadline against the standard published in the January 25th issue of the Federal Register and instead ask for a standard of identity utilizing whole fish and for a public hearing upon this matter in order that a fair case may be developed and presented.

Pursuant to the action taken by the executive committee a document was prepared and submitted to Food and Drug Administration opposing the standard of identity issued in the January 25 edition of the Federal Register which specified the use of fully dressed fish. The following is a brief quote from the objection filed:

> Each of the members of the Industrial Products Division of National Fisheries Institutes Inc., and of the Virginia Fishermens Association, will be adversely

affected if the standard as promulgated is placed into effect. This is by virtue of the fact that each is actually or potentially a manufacturer of the food entity purported to be identified by the standard and the standard falls short of properly defining and standardizing the product. Cumulatively it is estimated that the members of these Associations would manufacture approximately 70 to 80 percent of the product sought to be defined by the standard of identity. At the present time these same members produce from 80 to 90 percent of the fish meal now manufactured in the United States.

During the next 2 or 3 months the committee mentioned above on fish protein concentrate, together with their attorney and members of the Bureau of Commercial Fisheries, held a number of meetings in Washington, D.C., to make preparation for a hearing that was set set by Food and Drug Administration for June 12, 1962, on the proposed use of whole fish for the manufacture of fish protein concentrate for human consumption. In the same announcement Food and Drug also announced that the order establishing a standard of identity for fish protein concentrate utilizing fully dressed and eviscerated fish, published in the Federal Register of January 25, 1962, is stayed in its entirely.

Finally after a very careful study and analysis by our committee working in conjunction with our attorney and the BCF it was decided that processes were not yet perfected for the manufacture of fish protein concentrate and it was the belief we were confronted with an almost impossible problem in attempting to convince Food and Drug to issue a standard of identity for FPC manufactured from whole fish when we did not really have a suitable process and perhaps not a suitable product.

Upon reaching this determination our joint industry-Government committee decided to refer the matter to the Secretary of the Interior and asked if he would use the facilities of his good office and get the National Academy of Science to initiate a study by an appropriate group under their supervision on the product and the processes. Accordingly on May 31 the Secretary of the Interior sent a letter to Dr. Bronk, president, National Academy of Sciences, requesting this action and, as you all know, these studies have been made and favorable findings and reports rendered.

Using a copy of the letter of the Secretary of Interior to the National Academy of Sciences, we then had our attorney write to the Food and Drug Administration and request indefinite postponement of the hearing on the proposed standard of identity for FPC made from whole fish. Accordingly, we were notified by FDA that the hearing was indefinitely postponed without prejudice.

Now, 4 years later and with the work that has been done in the meantime by the Bureau of Commercial Fisheries and by members of our industry on the development of a suitable process and product for FPC it seems that we are on the threshold of being able to commence the commercial manufacture and use of this product just as soon as approval is given by the Food and Drug Administration. Although we have made a long stride in this direction, we feel there is still need for further support by Government to assist industry in the final development of this product.

Accordingly we wish to offer our wholehearted support for approval and passage of S. 2720. In this connection it is our belief that

menhaden, the most abundant U.S. species harvested, is highly suitable for the manufacture of FPC and that one of the plants that would be authorized by the bill be established on the Atlantic and one on the gulf for the use of this species.

Thank you.

Senator BARTLETT. All right, Mr. Culbertson, we will recall you for questioning in a few minutes. In the meantime we will hear from Senator Kennedy.

STATEMENT OF HON. EDWARD M. KENNEDY, A U.S. SENATOR FROM THE COMMONWEALTH OF MASSACHUSETTS

Senator KENNEDY. Mr. Chairman, I appreciate the opportunity to appear here this morning in support of S. 2720, a bill which I was pleased to cosponsor. I especially want to commend the eminent chairman of this committee, Senator Magnuson, and you, Mr. Distinguished Chairman, the Senator from Alaska, Senator Bartlett, who have led the Senate in developing our great marine resources, for bringing this important proposal before the Congress.

All of us here are aware of the recent dramatic advances made in the processing of fish protein concentrate, and of the long struggle to gain FDA approval of the chemical process developed by the Bureau of Commercial Fisheries in collaboration with the National Academy of Sciences.

We now impatiently await that final determination—approval by the FDA of Interior's petition to permit commercial production and domestic consumption of FPC as a food additive is really a prerequisite to launching the accelerated program of research and development which is necessary to realize FPC's incredible potential as a source of food.

There can be no question of the need for expanding the world food supply. It is enough to note that almost two-thirds of the world's inhabitants are either chronically hungry or consistently undernourished. Half the children born in the world each year die before the age of 5—mainly because of malnutrition, which is usually as a result of severe protein deficiencies.

FPC is designed to meet this worldwide need for protein. It is a food supplement which contains a high amount of high quality animal protein in a form which is safe, inexpensive, easy to transport, and palatable. And the potential supply of FPC is enormous.

It is estimated that man obtains only 1 percent of his food from the sea, yet our oceans cover three-fourths of the earth's surface, and produces about 400 million tons of animal protein each year. Unfortunately, only about 10 million tons are harvested annually.

If the United States will take the lead in exploiting these untapped food resources through the commercial development of FPC; this Nation could make a contribution of great dimensions to mankind.

As Don McKernan, Director of the Bureau of Commercial Fisheries, has observed, the unharvested fish in the United States coastal waters alone could, in the form of FPC, provide sufficient protein to balance the diet of 1 billion people for 300 days at a cost of about half a cent per person per day. If it were available, we

could use it domestically in our war on poverty. We could also export it in substantial quantities under our food-for-freedom program, and provide the know-how to help developing countries exploit their own fish food resources.

This is why I consider passage of this bill of such great significance. The bill directs the Secretary of the Interior to promote research by public and private agencies to determine the best and most economical process for commercial production of FPC, and authorizes the Secretary to provide for construction of not more than five experimental and demonstration plants.

Enactment of this bill would commit the United States as a matter of national policy to such development; and it would provide an opportunity both to determine the commercial feasibility of producing FPC and to study how FPC can be incorporated into the diet of developing countries and used right here in the United States.

The experimental plants established under this legislation could be used to determine what processing conditions would be economical in large-scale industrial operation, what the characteristics of FPC will be when packed and stored under industrial conditions, and what uses can be made of the different processing methods which are available to produce FPC.

With respect to this latter point, I am aware that some people have suggested that there is at the present time only a need for authority in the legislation to construct one, not five fish protein concentrate plants.

I would like to make my position in respect to this matter quite clear. I think it is, in fact, essential that the Secretary have broad authority permitting him to construct or contract for the construction of more than one plant.

Mr. McKernan has stated that there are a number of different processes which will require substantial research before the economic feasibility of any process has been proven. He pointed out in his testimony before the committee in Aberdeen that it is unclear which process will be the best.

It is also generally recognized that additional research will have to be accomplished not only on hake and other lean fish, but also on the more fatty fishes such as menhaden, anchovy, and herring.

In addition to the present process involving isopropyl alcohol, the Department also has under consideration other chemical, biological, and physical processing methods which must be developed further.

If developments are favorable, it will be necessary in the next few years to construct larger experimental plants for the further development of these processes.

I believe the Secretary of the Interior should be given authority to construct additional plants when and where needed to determine new processing methods and to experiment with all commercially significant stocks of fish.

It is argued, by those who favor authorizing only one plant, that when and if the need for further authorization is needed the Bureau can return to the Congress. I fail to understand this position. It denies flexibility. It wastes time. And it seems pointless to authorize only one plant when everyone admits that more than one will be needed, and when comparatively speaking, so little money is involved.

64-610—66——12

Our farm subsidies each year amount to billions of dollars. Here we seek several millions of dollars to pursue a scientific breakthrough of tremendous magnitude. Restricting the authorizations as suggested would indeed be an unjustified and false economy.

Furthermore, I consider it extremely important that research and development of FPC proceed on both the Atlantic and Pacific coasts, in part to insure maximum exposure to the variety of fishing conditions and fish species which must be considered, and also to stimulate interest and participation of private industry wherever commercial exploitation if feasible.

Thus, for example, the New England waters east and southeast of Cape Cod are rich in red hake and whiting, just as are the waters of the Pacific Northwest. The estimated New England sustainable annual yield of whiting is estimated at 500 million pounds and red hake at 300 million pounds. Indeed, all the fish used by the Bureau in their experimental FPC programs came from New England waters.

The fishing industry of New England traditionally has made a major contribution to the economic life of the area. Today it has the fishing fleets and equipment, the excellent hake ports of Boston, Gloucester, New Bedford, and Point Judith, and the great centers of marine research necessary to become the center of the exciting new industry which commercial production of FPC will hopefully become.

But these hopes will remain just that without Government encouragement and support. I have spoken with representatives of several large industrial corporations who are interested in FPC. They see quite clearly its theoretical potential, but they are reluctant to invest the necessary funds until research and development of FPC moves further along.

It is up to the Government to speed up this process, for time is of the essence and the toll in human misery caused by malnutrition continues to grow each day. By 1980, just to meet expanding food needs created by population growth, additional investment in food resources of an estimated $150 billion will be required.

The Government must harness the great resources of private industry by contracting with industry to undertake economic feasibility studies and research into marketing and distribution methods. We must determine the range of new products as well as the adaptability of FPC to various food forms. We must establish the degree of market and consumer acceptance of FPC, as well as further perfecting the process itself. In short, we must strive to do all we can to translate that theoretical potential into a realistic business opportunity.

Mr. Chairman, I would like not only to urge the prompt passage of this legislation, which is so important to achieving the objective I have just mentioned, but also to suggest two constructive amendments which I believe are consistent with the purposes of the legislation.

The first amendment would permit and encourage the participation of State, local, and private institutions and agencies in the proposed expanded fish protein concentrate program. This provision is similar to that found in the legislation authorizing the construction of five experimental plants in the saline water program.

I refer specifically to section 3 of Public Law 85–883 enacted September 2, 1958, and ask that a copy of that law be made a part of the record. Since the provision has proven to be very helpful in encouraging a broad public participation in the saline water program, I believe it should be incorporated in the pending legislation.

The second amendment that I would suggest is one that would specifically give to the Secretary of the Interior authority to provide grants to public and private institutions to promote and encourage basic research in fish protein concentrate.

This amendment is also patterned after the approach used in the saline water program. Under the saline water program the Secretary of the Interior through the Office of Saline Water has been able to encourage and stimulate basic research needed to develop new processes.

In my opinion the Secretary could use similar authority in the proposed program to assist private and public initiative in developing new fish protein concentrate processes.

Mr. Chairman, in closing I would like to say again how important I consider the work that you have done in this area. On March 1 of this year I spoke on the Senate floor on the subject of FPC. I pointed out then that the research done so far on FPC has only opened the door to the much greater opportunities which lie in its future development. If we seize these opportunities it will be because of your foresight and pioneering efforts which led the way.

Senator BARTLETT. Thank you very much, Senator Kennedy. Pursuant to your request, Public Law 85–883 will be made a part of the record.

(Public Law 85–883 follows:)

Public Law 85–883

85th Congress, S. J. Res. 135

September 2, 1958

JOINT RESOLUTION Providing for the construction of demonstration plants for the production, from saline or brackish waters, of water suitable for agricultural, industrial, municipal, and other beneficial consumptive uses.

Whereas official Government reports show unmistakably that the United States population is multiplying at a rate which by 1980 will triple the demand for supplies of fresh water, which if not available will adversely affect the national defense by jeopardizing the economic welfare and general well-being of vast segments of the population of the United States, as well as the population of some of our Territorial possessions; and

Whereas many cities, towns, and rural areas are already confronted by shortages of potable water that imperil health; and

Whereas the expanding population, industry, and agriculture of the United States are becoming increasingly dependent upon an assured augmented supply of fresh water while the future welfare and national defense of the United States rest upon increased sources of fresh water; and

Whereas research by governmental agencies, educational institutions, and private industry has brought about the evolution, on a limited scale, of methods of desalting sea water and the treatment of brackish water which give promise of ultimate economical results; and

Whereas the United States Government has the responsibility, along with safeguarding the national defense, and protecting the health, welfare, and economic stability of the country, to transform these experiments into production tests on a scale not possible of achievement otherwise; and

Whereas the Congress recognized its responsibility in this field by the enactment in 1952 of the Saline Water Act (66 Stat. 328), reaffirmed its position by the amendments to such Act in 1955 (69 Stat. 198); and the legislative history of such Acts reveals that the Congress recognized even then that the time had arrived for tackling the problem more realistically and effectively, but unfortunately the program was limited to such an extent that concrete results are not possible of attainment under the provisions of existing legislation; and

Whereas the Congress now finds it is in the national interest to demonstrate, with the least possible delay, in actual production tests the several optimum aspects of the construction, operation, and maintenance of sea water conversion and brackish water treatment plants: Now, therefore, be it

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) the Secretary of the Interior shall, pursuant to the provisions of the Act of July 3, 1952, as amended (42 U.S.C. 1951–1958), and in accordance with this joint resolution, provide for the construction, operation, and maintenance of not less than five demonstration plants for the production, from sea water or brackish water, of water suitable for agricultural, industrial, municipal, and other beneficial consumptive uses. Such plants shall be designed to demonstrate the reliability, engineering, operating, and economic potentials of the sea or brackish water conversion processes which the Secretary shall select from among the most promising of the presently known processes, and each plant shall demonstrate a different process. A decision with respect to the process to be utilized in the first of these five plants shall be made by the Secretary within six months after the date of approval of this joint resolution and decisions with respect to the processes to be utilized in the other plants shall follow at intervals of not more than three months. Each such decision shall be reported promptly to the Congress and the construction of the plants shall proceed as rapidly as is possible.

(b) The construction of the demonstration plants referred to above shall be subject to the following conditions:

(1) Not less than three plants shall be designed for the conversion of sea water, and eash of two plants so designed shall have a capacity of not less than one million gallons per day;

(2) Not less than two plants shall be designed for the treatment of brackish water, and at least one of the plants so designed shall have a capacity of not less than two hundred and fifty thousand gallons per day; and

(3) Such plants shall be located in the following geographical areas with a view to demonstrating optimum utility from the standpoint of reliable operation, maintenance, and economic potential—

(A) At least one plant which is designed for the conversion of sea water shall be located on the west coast of the United States, at least one such plant shall be located on the east coast thereof, and at least one such plant shall be located on the gulf coast thereof; and

(B) at least one plant which is designed for the treatment of brackish water shall be located in the area generally described as the Northern Great Plains and at least one such plant shall be located in the arid areas of the Southwest.

(c) As used in this joint resolution, the term "demonstration plant" means a plant of sufficient size and capacity to establish on a day-to-day operating basis the optimum attainable reliability, engineering, operating, and economic potential of the particular sea water conversion process or the brackish water treatment process selected by the Secretary of the Interior for utilization in such plant.

SEC. 2. The Secretary of the Interior shall enter into a contract or contracts for the construction of the demonstration plants referred to in the preceding section, and the Secretary shall enter into a separate contract or contracts for the operation and maintenance of such plants. Any such operation and maintenance contract shall provide for the compilation by the contractor of complete records with respect to the operation, maintenance, and engineering of the plant or plants specified in the contract. The records so compiled shall be made available to the public by the Secretary at periodic and resonable intervals with a view to demonstrating the most feasible existing processes for desalting sea water and treating brackish water. Access by the public to the demonstration plants herein provided for shall be assured during all phases of construction and operation subject to such reasonable restrictions as to time and place as the Secretary of the Interior may require or approve.

SEC. 3. The Secretary is authorized to accept financial and other assistance from any State or public agency in connection with studies, surveys, location, construction, operation, or other work relating to saline or brackish water conversion problems and facilities for such conversion, and to enter into contracts with respect to such assistance, which contracts shall detail the purposes for which the assistance is contributed. Any funds so contributed shall be available for expenditure by the Secretary in like manner as if they had been specifically appropriated for purposes for which they are contributed, and any funds not expended for these purposes shall be returned to the State or public agency from which they were received.

SEC. 4. The authority of the Secretary of the Interior under this joint resolution to construct, operate, and maintain demonstration plants shall terminate upon the expiration of seven years after the date on which this joint resolution is approved. Upon the expiration of such seven-year period the Secretary shall proceed as promptly as practicable to dispose of any plants so constructed by sale to the highest bidder, or as may otherwise be directed by Act of Congress. Upon such sale, there shall be returned to any State or public agency which has contributed financial assistance under section 3 of this Act a proper share of the net proceeds of the sale.

SEC. 5. The powers conferred on the Secretary of the Interior by this joint resolution shall be in addition to and not in derogation of the authority conferred on the Secretary by the Act of July 3, 1952, as amended (42 U. S. C. 1951–1958). The provisions of such Act, except as otherwise provided in this joint resolution, shall be applicable in the administration of this joint resolution.

SEC. 6. When appropriations have been made for the construction or operation and maintenance of any demonstration plant under this joint resolution, the Secretary may, in connection with such construction or operation and maintenance, enter into contracts for construction, for materials and supplies, and for miscellaneous services, which contracts may cover such periods of time as he shall consider necessary but under which the liability of the United States shall be contingent upon appropriations being available therefor. Unobligated appropriations heretofore made to carry out the Act of July 3, 1952 (66 Stat. 328), as amended (42 U. S. C. 1951 and following) shall be available for administrative and technical services, including travel expenses and the procurement of the services of experts, consultants, and organizations thereof in accordance with section 15 of the Act of August 2, 1946 (60 Stat. 806), as amended (5 U. S. C. 55a), in connection with carrying out the provisions of this joint resolution.

SEC 7. There are hereby authorized to be appropriated such sums, not in excess of $10,000,000, as may be necessary to provide for the construction of the demonstration plants referred to in this joint resolution, together with such additional sums as may be necessary for the operation and maintenance of such plants, and the administration of the program authorized by this resolution.

Approved September 2, 1958.

Senator BARTLETT. I ask you to turn to the first page of your statement. I am wondering if there isn't a typographical error. The paragraph reads:

> It is estimated that man obtains only one percent of his food from the sea, yet our oceans cover three-fourths of the earth's surface and produce about 400 million tons of animal protein each year. Unfortunately only about 10 million tons are harvested annually.

I would assume you intended to say "and can produce about 400 million tons."

Senator KENNEDY. That is exactly right. I was at that point—I think it could be read that way, can produce 400 million tons of animal protein, but nonetheless, I think it could be read does produce, or within the sea.

Obviously we don't realize it, but it is produced within the sea, but unharvested.

Senator BARTLETT. Oh, I see, yes.

When you said that by 1980, just to meet expanding food needs created by population growth, additional investment in food resources

of an estimated $150 billion will be required, you gave, in my opinion, a dramatic reason why the comparatively small expenditure which would be required by this bill is justified.

I want to say, Senator Kennedy, that you have made the most eloquent and logical statement yet presented to the committee as to why there should not be a restriction to one plant, why there should be a series of plants dedicated to searching out different processes which might be employed in the production of fish protein concentrate, and your argument to me was very compelling.

Further, even if we pass this authorization will for five experimental plants, we all know that if that total number is not justified, the Appropriations Committees will not appropriate for them, so there is a backstop here in any case.

Senator KENNEDY. I certainly agree with the observation made by the Senator from Alaska. I think we can benefit from the experience of the saline water program projects, where there were a variety of different alternative approaches made on this, and unquestionably, because this was the attitude that was assumed by the Congress and the Executive, I think that we certainly moved in that along toward the conversion possibilities in a much more dramatic and speedy way than if we had just selected any one of the suggestions which had been made.

I think the same logic flows to this argument here. And I think as this committee has pointed out, and others have testified, it is a very modest kind of authorization which is being made.

It certainly seems, if we are serious about the program, in achieving the objectives which have been mentioned by the President and many others who have been concerned about this, it seems to me we are proceeding in a prudent and reasonable way by these alternative routes.

I know this committee will give a great deal of attention to certainly the numbers which have been suggested. I am heartened by the attitude which is assumed by the Senator from Alaska, as well as by the chairman of this committee, in looking at this multiple approach.

Senator BARTLETT. The suggestion you make that this is on all fours with the water program is to my way of thinking exactly correct. Their plants were deliberately located at different places, using different processes, and time after time, yesterday even, the committee has been told that the process which has been developed at Beltsville, and which seems so successful, may not be the only one or may not be the best one. Many other processes remain to be explored and obviously can be unless we have a sufficient number of plants.

Senator KENNEDY. I think that is true. I think the fact we are really developing this for mankind as well, I think we are going to find it, particularly in the saline water, we are going to find different techniques that might be adaptable for different countries and nations and regions, and I think that we are really making extraordinary contributions to mankind as well. And I think that same logic applies very clearly and dramatically to this.

I mentioned in the latter part of my testimony those two amendments. As this committee knows, in the saline water program there are two States, New Mexico and California, that are making direct contributions, the States themselves, to the efforts for this development in the saline field.

The purpose of my amendment is to try to arouse greater participation by the States and perhaps local municipalities for the developing of programs and industries in their areas. It gives the opportunity for States and local communities to participate, which I think is a worthwhile consideration.

Senator BARTLETT. You may be assured the committee will give serious consideration to your proposal.

Senator KENNEDY. I think the other deals with permitting the Secretary of the Interior to devote funds to research and development. I think perhaps the current legislation could be read in such a way as to feel he already has that power. I would certainly read it this way.

But I do feel it is of sufficient importance to consider permitting the Secretary to consider research, further research and development in this field, to write that in legislative form. I think that language is in the Public Law 82–448, section 2(d), and I think it might be a matter which the committee in its deliberations might consider.

Senator BARTLETT. We will give it most serious consideration.

I want to say, before you leave the stand, Senator, that I assume that when an overwhelming majority of Massachusetts voters sent you here to the Senate they did so for a variety of reasons. From my own perhaps parochial standpoint, I am happy they did, because of the leadership and help you have provided all of us since your arrival in trying to promote and develop the commercial fishery of the United States. You have been of tremendous assistance, and I for one appreciate it deeply.

Senator KENNEDY. I appreciate your comments. I think that the people of Massachusetts and New England generally, as well as the members of this committee and the distinguished chairman, Senator Magnuson and yourself, represent States which are many thousands of miles away from the New England fishing areas, but nonetheless, those interests are always carefully protected and represented by the distinguished chairman and yourself, and we are extremely fortunate, those who are interested in the sea, to have these distinguished members representing their interests.

Senator BARTLETT. Thank you very much.

Mr. Culbertson, will you return to the stand, please?

Senator BARTLETT. Will you please tell us something about menhaden? What is its geographic area in which it lives?

Mr. CULBERTSON. Primarily from the Southern New England States all of the way down the Atlantic coast, on down to Texas, is where they are presently being harvested by U.S. fishermen.

Senator BARTLETT. How far south of New England?

Mr. CULBERTSON. It varies from year to year, Senator. It wasn't too many years ago there was quite a catch made in the New England States.

More recently, however, the catch north of New York—New York is about as far as any great abundance has been taken in recent years. In the early days, the menhaden fishery had its beginning in the New England States.

Senator BARTLETT. Does the menhaden spend its entire life at sea?

Mr. CULBERTSON. Yes.

Senator BARTLETT. How long does it live if permitted to do so?

Mr. CULBERTSON. The year classes that are harvested vary from about 1 up to as much as 6 or 7 years I believe.

Senator BARTLETT. How big a fish is this on the average?

Mr. CULBERTSON. On the average, probably about 12 inches, perhaps a little less. Less than a half pound, or three-quarters of a pound.

Senator BARTLETT. How much was the weight?

Mr. CULBERTSON. Probably a half a pound.

Senator BARTLETT. This is a fatty fish, is it not?

Mr. CULBERTSON. Very fatty and oily, in that respect about like a herring.

Senator BARTLETT. No work, or very little work, has been done, as I understand it, to reduce a fatty fish to a fish protein concentrate, correct?

Mr. CULBERTSON. I cannot answer that. I think there has been some work done on that. I am pretty sure. How much, I am not prepared to say.

Senator BARTLETT. In any case not by the Bureau of Commercial Fisheries in its experiments in Beltsville?

Mr. CULBERTSON. They have been doing some work on it, yes, sir.

Senator BARTLETT. On menhaden?

Mr. CULBERTSON. Yes, sir.

Senator BARTLETT. But they haven't arrived at a process yet, in respect to fatty fish, which they are ready to present to the Food and Drug Administration.

Mr. CULBERTSON. That is correct.

Senator BARTLETT. That is one reason why you see the need for this bill and the construction of an adequate number of plants, so that different processes may be sought in respect to different kinds of fish?

Mr. CULBERTSON. That is correct. We feel also that because this is our most abundant species that it does offer the possibility from the supply standpoint. Others that we think of may develop in sufficient quantity, but may not too.

Senator BARTLETT. Let us assume a process is developed which will find that menhaden is suitable for protein concentrate. And let us assume that these Government plants are built and the economics are verified. Is it your opinion that those in the menhaden industry would then be ready to embark upon private ventures?

Mr. CULBERTSON. I am quite sure they would, Senator. A little quick arithmetic would show up the value of the menhaden, if reduced to FPC, would be worth approximately $100 million annually.

Senator BARTLETT. $100 million.

Mr. Foster?

Mr. FOSTER. No questions. Thank you.

Senator BARTLETT. Thank you, Mr. Culbertson.

The next witness is Mr. Jacob J. Dykstra, president, Point Judith Fishermen's Cooperative Association, Point Judith, R.I.

STATEMENT OF JACOB J. DYKSTRA, PRESIDENT, POINT JUDITH FISHERMEN'S COOPERATIVE ASSOCIATION, INC., POINT JUDITH, R.I.

Mr. DYKSTRA. I wish to thank you, Senator, for the opportunity of appearing here today and for the attention you are focusing on this matter of FPC.

The organization which I represent, the Point Judith Fishermen's Cooperative Association of Point Judith, R.I., consists of 135 member

fishermen owning and operating 45 medium and small size draggers out of the port. We pack or process all of the food and industrial fish landed at Point Judith. A summary attached to this statement shows that this fleet has a record of continuous production of trash fish, mostly red hake, for over 15 years, that is unequaled by any port in the United States.

The main concern of our organization with the this type of fish is the expansion and upgrading of the market to insure a continuous outlet for available production at the best possible ex-vessel price. The current use of the bulk of industrial fish for fish meal and fish solubles constitutes an underutilization because—

1. The processes in use do not recover the maximum available protein from the raw material.
2. The products produced are not used directly for human consumption.
3. The products produced do not store well under all conditions over long periods of time.

Fish protein concentrate has been demonstrated to have all of the desirable characteristics not present in currently widely produced products.

A number of separate and uncoordinated efforts have been partially successful in exploring the potential of this type of product, but have failed to develop to major commercial proportions for a number of reasons, some of which are—

1. Reluctance of Government agencies to recognize the product as acceptable human food.
2. Engineering and equipment have not been adequately applied on a production level due to limited funds invested by industry and Government.
3. Quality control and adequate production standards have not always been established and enforced.
4. Market development, despite the desperate need for and proven value to mankind of fish protein concentrate, is a massive and complicated undertaking if full potential is to be realized.

What is required is a coordinated and sustained effort to promote practicable and economic production of this product by industry. This cannot be accomplished by a piecemeal attack on one or another of the difficulties to be overcome.

The Bureau of Commercial Fisheries of the Fish and Wildlife Service has recently conducted extensive and commendable experiments in pilot plant production of fish protein concentrate. The efforts already made should be expanded and carried forward into commercial production as provided in S. 2720. However, simultaneously, every phase of development from extracting the fish from the ocean to presentation to the consmer must be pursued. Only a broad approach such as this will insure an ultimately successful commercial product.

Our recommendations for provisions of S. 2720 to be retained, emphasized, or added follows:

1. That the five plants provided for in section 2(a) are an absolute minimum number of plants to adequately test and develop the best methods and equipment for commercial production.

2. That the plants be erected and operated by private industry under Federal Government contract, supervision, and subsidy but be wholly supported and controlled by private industry as soon as practicable.

3. That the plants be located and developed to use as raw material all types of fish available as the only economically feasible way to realize full potential.

4. That specific provisions for efficient harvesting and handling of fish before processing be included.

5. That specific provisions for market development be included.

We heartily endorse S. 2720 and desire its enactment into law as speedily as this can be accomplished.

Thank you for the opportunity of appearing before this committee today.

Senator BARTLETT. The committee is grateful to you for your endorsement of the bill and the reasons for its enactment which you explained.

I have no questions. Thank you very much.

(The attachment to the prepared text follows:)

POINT JUDITH FISHERMEN'S COOPERATIVE ASSOCIATION, INC.

Industrial fish landings

	Pounds		*Pounds*
1951	20, 857, 373	1959	90, 615, 265
1952	33, 567, 879	1960	39, 803, 785
1953	49, 939, 117	1961	56, 739, 545
1954	69, 689, 782	1962	50, 241, 577
1955	83, 237, 300	1963	32, 915, 780
1956	110, 173, 250	1964	33, 441, 062
1957	112, 765, 100	1965	28, 800, 635
1958	87, 788, 330		

Senator BARTLETT. Dr. Thomas L. Meade.

STATEMENT OF DR. THOMAS L. MEADE, J. HOWARD SMITH, INC., PORT MONMOUTH, N.J.

Dr. MEADE. Mr. Chairman, I have a prepared statement, if I may read it.

Senator BARTLETT. You may.

Dr. MEADE. Mr. Chairman, I am Thomas Meade, Director of R. & D. for J. Howard Smith, Inc.

It is generally agreed that the major source of raw material for the production of fish protein concentrate will be underutilized and non-utilized species of fish present in our coastal waters and that species from inland waters may also eventually contribute. The potential for currently unfished stocks has been estimated (1) at 3,089,000 tons annually. Of this total 68 percent may be classified as clupeid fishes while red and silver hake which are representative of the Merluzza family and the subject of intensive research represent only 8 percent, providing the Pacific stocks are comparable to those in the Atlantic.

Looking at the overall resource more realistically we can consider what from an economic standpoint, might be regarded as under-

utilized species, that are used by the fish reduction industry in the manufacture of fish meal, solubles and oil. The 1965 menhaden landings although considerably smaller than in years past amounted to 819,200 tons. This one species accounted for 70 percent of all the fish and fish byproducts used in the reduction industry. Menhaden landings at ports on the Gulf of Mexico amounted to 510,000 tons. These landings when considered in conjunction with a projected additional 2.25 million tons (1) of clupeid fishes that could be harvested annually clearly illustrates that the Gulf of Mexico has the greatest known potential, in terms of raw material for fish protein concentrate production, of any area along our coasts.

It should be recognized that the presence of fish meets only one of the requirements for a successful fishery. The ability to catch and land fish in adequate quantities over extended periods is essential for an industrial fishery and can be considered as equally essential for the economical production of fish protein concentrate. Although I have emphasized the potential for clupeid fishes such as herring, sardines, and menhaden, I do not wish to detract from the importance of other species. The degree of development of any fishery is almost directly proportional to the economic return. Many species of fish are not utilized simply because they have not gained general acceptance in the edible field and cannot be harvested in sufficient quantity at a price that would permit their use by the reduction industry. It is hoped that end product upgrading, that is the production of fish protein concentrate instead of fish meal, will provide the economic base that will enable the full development of marginal and nonexploited fisheries.

In any consideration of fish protein concentrate production we should recognize that the fish used for this purpose must be handled under conditions of sanitation approximating those of the food fish industry. This applies equally to fishing and processing operations. This feature more than anything else sets the fishmeal industry of today apart from the fish protein concentrate industry of tomorrow. With the realization that the transition was only a function of time the industrial fishing industry is rapidly modernizing its fleet. In our own operations involving more than 80 major vessels in the active fleet we are successfully employing refrigeration to extend the range of the vessels. Not only has the range been extended but the duration of the trip is no longer limited because of the danger of spoilage. These advances have not only given us the capability of landing high quality fish at any port but also resulted in more efficient operations by eliminating the time and expense involved in daily landings.

Research on fish protein concentrate production has been carried out in most major fishing countries for the last 20 years. The scientific and patent literature provide ample evidence as to the success of these efforts. Most processes that have been carried from the pilot level to limited production are based on the use of hygenically produced fish meal as a basic raw material for the production of fish protein concentrate. This, of course, is a realistic approach and takes into consideration the perishable nature of fish and the desirability of working with a stable intermediate. Processes and products em-

bracing this principle have been approved by a number of foreign governments.

It is a paradox that native populations in some of the major fish meal producing countries are suffering from protein malnutrition. This is not because they lack the raw material for the production of protein rich foods or the industrial technology but is rooted in economic and sociological problems. It is precisely these problems that have deterred large scale commercial production of fish protein concentrate in many countries.

Fish protein concentrate is not new in this country. Our firm and its affiliate, Smith Research & Development Co., Inc., have been actively engaged in research in this area for more than 15 years. The patent literature indicates that some of our large food companies have also been active for a considerable time. Processes resulting from this work are capable of producing high quality fish protein concentrate that meet the standards established by some foreign government and those proposed by agencies of the United Nations. In our case a factory with 15,000 tons annual capacity was built and has been in operation for 3 years.

The status and acceptability of protein products made from whole fish was the subject of controversy between industry and the Food and Drug Administration which was settled when the FDA issued a modified definition and standard of identity on January 25, 1962, which did not permit the use of whole fish in the manufacture of fish protein concentrate. As a result of this action research by industry was largely curtailed and the task of exploring new approaches, development of technology and coordination of scientific disciplines was undertaken by the Bureau of Commercial Fisheries. The success of the Bureau in this endeavor clearly illustrates the necessity for close cooperation between Government and industry in vital areas.

Gaining acceptance for the use of whole fish for the production of FPC should provide the signal, for industry to resume active development. However, in view of past experience and present restriction relative to species and processes a period of close cooperation between Government and industry is necessary in order to obtain broader approval with respect to fish that can be used and approval of alternate processes and products.

We recognize that, although the Bureau has successfully produced fish protein concentrate from red hake and petitioned the FDA for approval of the product and process, a great deal of data needs to be developed in order to insure a successful commercial operation. The demonstration pilot plant of the Bureau is well suited for the conduct of basic studies with other fish and the investigation of alternate processes but lacks the equipment and capacity for developing the basic engineering data necessary to scale up approved processes or to provide adequate quantities of fish protein concentrate for large scale market development and testing. This requirement can best be met in a pilot plant or limited production facility designed with these particular objectives in mind. The need for additional pilot facilities will arise as basic developments progress.

The importance of close Government-industry cooperation during the development phase is essential in order to assure rapid progress.

From a marketing standpoint primary emphasis will initially be placed on developing overseas markets through close cooperation with United States and United Nations agencies. This phase requires development in much the same manner as the engineering phase.

It is hoped that as experience is gained in the production, marketing and use of fish protein concentrate that sufficient data will be developed to enable the lifting of any restrictions on its use. Obviously for economic reasons it is desirable to have a broad market, however, we also should recognize that this product can become an important contributor in our "Food for Peace program" and as such must be evaluated differently.

From this statement, which has been somewhat rambling, I hope that you will sense the urgency of moving forward as rapidly as possible, while at the same time avoiding some of our past mistakes. An intermediate step, in the form of pilot operations, will provide maximum assurance of a successful transition from FDA approval to commercial production.

In concluding, I would like to state that our firm favors S. 2720.

Thank you.

Senator BARTLETT. Thank you very much, Dr. Meade. Your statement was quite the contrary of rambling. It was very cohesive.

Did you say J. Howard Smith built a 15,000-ton plant?

Dr. MEADE. We do have a 15,000-ton plant in operation at the present time.

Senator BARTLETT. It is producing now?

Dr. MEADE. It is producing a fish protein concentrate product. However, it is not one that would be approved by the FDA under their current definitions and therefore the product is relegated to the feed industry.

Senator BARTLETT. Did you say that there is a production abroad of fish protein concentrate now?

Dr. MEADE. Yes, there are facilities for the production of fish protein concentrate in Morocco, South Africa, Chile, and Peru.

Senator BARTLETT. Is it being product there in some volume?

Dr. MEADE. The production in South Africa has reached a volume of approximately 1,000 tons per year. The potential for production in Morocco is much higher than that, but the sale of the product in Morocco has been the problem. They have not been able to sell it at a price that would justify operation.

Senator BARTLETT. How about the South American countries?

Dr. MEADE. The South American operations are on a limited pilot basis.

Senator BARTLETT. They make this from whole fish?

Dr MEADE. Yes. It is my understanding that the Moroccan operation is capable of making it either from whole fish or eviscerated fish.

Senator BARTLETT. And their governments have approved?

Dr. MEADE. Yes, they have.

Senator BARTLETT. Do you think there is a very considerable potential insofar as United States is concerned, if we can get this moving?

Dr. MEADE. There is no question about the potential.

Senator BARTLETT. Thank you very much, Dr. Meade.

Senator BARTLETT. The next witness is Dr. Parfentjev.

STATEMENT OF DR. I. A. PARFENTJEV, FELLOW OF THE NEW YORK ACADEMY OF SCIENCE, PARK-SHERATON HOTEL, NEW YORK, N.Y.

Senator BARTLETT. We are glad to have you here, Doctor.

Dr. PARFENTJEV. Thank you, sir. I am not representing any industry, organization or group, Senator Bartlett, but I am speaking entirely as an individual with many years of research and practical experience in the preparation of fish protein concentrate. I have been working on this subject for more than 20 years. I received my doctor of science degree in biology at the University of Berlin. In this country I have been on the faculty of Washington University in St. Louis, Duke University, and the Yale University Medical School.

Also I have been connected with two fisheries, one fishery in Florida and another fishery in Massachusetts. In Massachusetts, as a matter of fact, I worked with two fisheries, Gorton Pew Co. and Dehydrating Process Co.

Today I am speaking entirely as an independent, and I would like to say a few words about my long years of experience in this field.

My method, "Fish Protein and Mineral Products," patented in June 1950 (2,512,375), has been applied for a number of years by fisheries in Gloucester, Mass., for the manufacture of a chicken feed additive.

I am a fellow of the New York Academy of Science; am at present engaged in private research, including research in fish protein for human consumption; and reside at the Park-Sheraton Hotel, 870 Seventh Avenue, New York, N.Y.

Mr. Chairman, there is no doubt that high quality protein may be extracted from fish. There remains one or two points that need to be investigated further. First, what fish resources may be used to make the final product not only economical, safe, and beneficial for human consumption, but also sufficiently palatable so that people who need it can be induced to eat it, and two, the method of extraction to be used in order that the final product may not only be economical, safe, beneficial, and palatable, but also stable, so that it may be transported long distances and stored in hot climates without refrigeration, without the danger of spoilization.

Today the main sources of protein for fish protein concentrate is coming from the trash fish. You know, trash fishing they call fishing of nonedible fish that they deliver to the shore without ice. And I consider such products will be unsafe for human consumption and should be forbidden to use it for this purpose.

Senator BARTLETT. What kind of fish would that be, Doctor?

Dr. PARFENTJEV. It is a whole number of fishes that are not edible.

Senator BARTLETT. Would you name some?

Dr. PARFENTJEV. I am sorry, I cannot name them.

Now the most important source of fish protein concentrate in my mind is the carcasses that are left after filleting the fish for market. These carcasses are available in tremendous amount in the fisheries and they are in very good condition, because they are brought to shore in perfectly fresh condition and every trawler that comes in is examined for freshness of fish. At the same time this is the most eco-

nomical method, because this fish is for "edible purposes" and the fishermen are instructed to remove the fillets and sell them as fillets, so additional income from making fish protein concentrate from the fish carcasses would be a very great incentive for fishermen.

Our experience in Gloucester demonstrated that fish protein concentrate prepared from fish carcasses is better than the fish fillets even, not only that made from whole fish, because it yielded much more protein and vitamins. The concentrate extracted from the carcasses of fish is rich with vitamins. For instance, nicotinic acid is present in many such fish, about 200 gamma per 1 gram of protein. Chemical analyses of fish protein concentrate that I prepared were performed in several laboratories, Wisconsin Alumni, Ralston Purina Co., National Oil Products Co., American Home Products, Lederle Laboratory, and others. They all find that this product that they are preparing from fish carcasses is very rich in protein and very rich in vitamins and also very safe for human consumption.

Even in more recent experiments, I prepared extract from this method and injected it into animals by injection and I did not find any injurious effect for long periods of time.

I will briefly mention some points that may be of interest to you. For instance, the reports from the research laboratories of the Gorton Pew Fisheries. They found that the gross protein value of a fish product prepared with acidulated water was 164, compared to 135 of regular fishmeal. Furthermore, they reported that the level of the protein factor, which we call today Vitamin B_{12}, was higher than in regular fishmeal.

Also, with permission of you, Mr. Chairman, I would like to refer to a letter I received from Peru, from Mr. Chienda, Technical Director of Public Nutrition of Peru.

He wrote to me in November 1964.

It is my pleasure to write you at the request of the President of the Republic, Fernando Belaunde Terry, who has especial interest in the suggestions communicated in your letter.

Apparently he referred to my suggestion to make a protein concentrate for human nutrition. He said before they had been using it just for chicken feed. He said that today they have developed so far this product that they can use it for lunches for school children.

In a second letter he sent to me a detailed analysis of their fish flour and from this analysis I think they have very much advanced the preparation of fishmeal and I would be glad if the committee so desires to give this analysis to you for an exhibit, because there are lots of figures, and it indicates that in Peru they are well-advanced with this product for human nutrition.

I have another letter written to me in 1944 from one of the largest companies who prepared chicken feed from fish carcasses, and there is a very interesting thing, they find it is very useful for them. For instance, Mr. Ryan, who was the president of this company, says that he finds my method of preparation of fishmeal for chicken feed is the most practical and useful for this purpose.

I wish to mention also that in 1950 I patented this method and it has been used in Gloucester fishery for a number of years since that time.

I don't want to stress the importance of my method, Mr. Chairman.

I just wanted to give information about it and to let other people judge the practicality of it.

As I have already mentioned, this method is very economical, because it does not require special fishing. It can be used on the fish brought in for human food. But it has some certain advantages that I mentioned. It is more nutritious, more simple a method that does not require a complicated installment.

One of the advantages of this method consists in the fact that I am using acid for preparation, and this method makes the product very stable, because bacteria can not proliferate in acid conditions. Many bacteria stop multiplication in acid conditions. That is another advantage of this method.

And if it sent abroad, we have to consider that we are going to send material in most cases to underdeveloped countries, starving people that need more nutrition, and in these countries unsanitary conditions prevail and there are no refrigeration systems. And if the material sent is slightly acid, that would prevent by itself this material from spoiling. Because it is very dangerous to deal with primitive countries. Even if you send it from here a stable product, you cannot be sure that they would not contaminate it and spoil it which may lead to poisoning of the people.

This acid treatment it seems to me is a very practical procedure and will make the product very safe for distribution.

Also it is very inexpensive compared to the other methods which have been applied for preparing fish meal up to now, and may be applied for human nutrition. Complete hydrolysis of fish with strong acid or enzymes—you can liquefy the fish and this liquid fish is much less nutritious than intact fish that I have prepared with slight acidification. This slight acidification, around 4, is not noticeable in human taste. So it will be no objection of this whatsoever. But some people have been using this completely liquefied fish, but I don't see any purpose or advantages to it.

Also I don't see any advantages to make alcohol extraction, because what do they extract? The lipids. But lipids are not poisonous things, it is a very useful thing. And besides, lipids contain vitamin A and that is one of the most important nutritious factors. But by using the alcohol method, it certainly would complicate very much this production of protein concentrate, will make it much more expensive.

So in my method I just simply treat the fish by acidified water and I am not using alcohol.

Thank you very much.

(The complete prepared statement of Dr. Parfentjev follows:)

STATEMENT BY DR. I. A. PARFENTJEV

Mr. Chairman, I have here a short statement I should like to read. My name is Ivan A. Parfentjev. I consider it a great privilege to testify before this distinguished committee of the Congress of the United States on the subject of Fish Protein Concentrate with its vast potential for preventing the starvation of so many millions of human beings.

I am not representing any industry, organization or group, Mr. Chairman, but am speaking entirely as an individual with many years of research and practical experience in the preparation of fish protein concentrate. I received my Doctor

of Science degree in biology at the University of Moscow in 1917, and, later, did graduate work at the University of Berlin. In this country I have been on the faculty of Washington University in St. Louis, Duke University, and the Yale University Medical School; and I have engaged in the preparation of fish meal in the fisheries of Florida and Massachusetts. My method, "Fish Protein and Mineral Products," patented in June 1950 (2,512,375), has been applied for a number of years by fisheries in Gloucester, Massachusetts, for the manufacture of a chicken feed additive. I am a fellow of the New York Academy of Science; am at present engaged in private research, including research in fish protein for human consumption; and reside at the Park Sheraton Hotel, 870 Seventh Avenue, New York, New York.

As this Committee is, I am sure, very well aware, Mr. Chairman, research in fish protein has been carried on for a long, long time. Most excellent work has been done in laboratories under the sponsorship of commercial fisheries, universities, and the U.S. Department of Interior. There is no question but that high quality protein may be extracted from fish. The problems remaining which are so comprehensively and well covered in Section 2 of S. 2720 are principally problems of 1) what fish resources may be used to make the final product not only economical, safe and beneficial for human consumption, but also sufficiently palatable so that people who need it can be induced to eat it, and 2) the method of extraction to be used in order that the final product may not only be economical, safe, beneficial and palatable, but also stable, so that it may be transported long distances and stored in hot climates without refrigeration, without the danger of spoilization.

It is precisely in regard to these two problems, Mr. Chairman, that I feel my experience may be of some small assistance.

FISH RESOURCES

There are today two main sources of raw material used in the preparation of fish meal as a protein additive for chicken feed. One is so-called "trash fishing", the other is the use of fish carcasses left after the filleting of fish for the market.

Trash fishing consists mainly of non-edible fish delivered to the shore without ice. The use of this material for the preparation of fish protein concentrate would be unsafe for human consumption and should be forbidden by law.

The use of fish carcasses is another story, often misunderstood by the layman.

In our experience in Gloucester, Massachusetts—and the Dehydrating Process Company has been using my method for the last 25 years—the use of fish carcasses left after the filleting of fresh fish, available in large quantities in fisheries as a waste product, is not only a most practical source of raw material, but the carcasses yield a higher quality and quantity of both protein and vitamins than the admittedly more valuable fresh fillets. In addition, tests have shown that fish meal made from these carcasses—at least fish meal prepared by my method—is perfectly safe for human consumption.

Chemical analyses of fish protein concentrate that I prepared were performed in several laboratories: Wisconsin Alumni, Ralston Purina Company, National Oil Products Company, American Home Products, etc. Reports received indicated high protein and high vitamin content. Among vitamins, a particularly high value of nicotinic acid was reported, in certain samples up to 200 gamma per 1 gm. of protein.

Of particular interest is a report from the research laboratories of the Gorton Pew Fisheries. They found that the gross protein value of a fish product prepared with acidulated water was 164, compared to 135 of regular fish meal. Further they reported that the level of the protein factor (what we call today Vitamin B_{12}) was higher than in regular fish meal (*Exhibit A*).

With your permission, Mr. Chairman, I will read a brief letter I received from Mr. Chienda, Technical Director of Public Nutrition of Peru, indicating use of fish flour in human consumption (*Exhibit B*).

In a second letter Mr. Chienda sent me a detailed analysis of their fish flour which gives the impression that is of good quality and that they are well advanced in its manufacture.

I would also like to read from a letter from John Ryan, President of Dehydrating Process Company, Boston, Massachusetts (*Exhibit C*).

Parenthetically, I might say that although for the most part the analyses I refer to were made by private commercial companies for their own use, and I,

therefore, have no right to make them public, it would be possible for me to offer for the record, should the Committee so desire, the report of the Gorton-Pew Fisheries Company Ltd., Gloucester, Massachusetts.

METHODS OF EXTRACTION OF FISH PROTEIN

The method of preparing fish protein concentrate should be simple, efficient and inexpensive. Such a method should satisfy the requirements of nutrition, taste, as well as shipment and storage. The last two requirements are of particular significance in the shipment of fish protein concentrate abroad to undeveloped countries, where unsanitary conditions prevail and there is little refrigeration. It would indeed spell tragedy if, after going through these hearings and the anticipated additional research and experimentation, we sent starving people tons of fish meal which could spoil and give them food poisoning.

Believe me, Mr. Chairman, I am not here to promote my own method above all others. I would merely like to indicate that in my experience and experimentation, moderate acidification preserves the high quality of the protein and increases stability and appreciably reduces the odor of fish protein concentrate. Complete hydrolysis of fish with a strong acid or enzymes, favored by some researchers is less nutritious, and the use of alcohol for the extraction of lipids from fish, favored by other researchers, both costly and unnecessary, are not used in my process.

I heartily recommend the passage of S. 2720 as it stands, without change. The ingenious vision of President Johnson, Secretary Udall and this Committee may well change the course of World History.

Thank you, Mr. Chairman.

EXHIBIT A

GORTON-PEW FISHERIES CO., LTD.,
Gloucester, Mass., February 13, 1948.

Mr. I. A. PARFENTJEV,
Pearl River, N.Y.

DEAR MR. PARFENTJEV: We have received a report from our Biological Laboratory on the fish meal prepared under your direction last August. The report is summarized as follows:

"GROSS PROTEIN VALUE

"A biological assay of red fish meal processed at the Chemical Laboratory indicated a gross protein value of 164 as compared to 135 for red fish meal manufactured at our fish meal plant.

"ANIMAL PROTEIN FACTOR

"A preliminary test indicates that the red fish meal processed at the Chemical Laboratory contains more of the animal protein factor than meal manufactured at our fish meal plant."

The test animals were chicks.

Very truly yours,

EARL P. MCFEE, *Chief Chemist.*

EXHIBIT B

MINISTERIO DE SALUD PUBLICA Y ASISTENCIA SOCIAL,
Lima, November 19, 1964.

Oficio No. 236–D.T.A.
Mister IVÁN PARFENTJER,
New York, N.Y.

DEAR SIR: It is my pleasure to write you at the request of the President of the Republic, Fernando Belaúnde Terry, who has especial interest in the suggestions communicated in your letter. I should also like to inform you that in Perú, important efforts to prevent children's malnutrition are in process, since those industries dedicated to producing protein concentrates in order to improve nutritión have been issued legal regulations which liberate them of taxes and mortgages.

At present, fishmeal is been produced for human consumptión, and is given to school-age children. Within a short period, private industry will manufac-

ture a protein concentrate of cotton seed, quínua (a peruvian cereal with 12% protein of high biological value) and vitamin supplements, of biological form and value similar to the Incaparina, which is a success in Central América.

I am enclosing a pamphlet, "Facing Malnutrition", in which there is a brief description of the activities performed by my Department in this field, letting it be understood that all the aspects of productions, promotion, and commercialization of foods is a function of my country's Ministry of Agriculture.

My Department (Dirección Técnica de Alimentación del Ministério de Salud Pública y Asistencia Social) acts in the technical and normative aspects of the activities of nutrition, directing and promoting the employment of high-value food.

I would like to have the opportunity to have a personal interview with you, and I hope this occasion will present itself.

Very sincerely yours,

LUIS BERNALES CHIENDA,
Director, Technico de Alimentacion.

EXHIBIT C

DEHYDRATING PROCESS CO.,
Boston, Mass., January 31, 1944.

Dr. IVAN PARSENTJEV,
Pearl River, N.Y.

DEAR DR. PARSENTJEV: I regret very much that I was unable to give you more time on Saturday.

Mr. Wilson tells me that you are contemplating starting a Pilot Plant on the Atlantic Coast. Boston or Gloucester would, of course, be the best location. You would be close to the source of supply. Boston, in a normal year, should have about 300 million lbs. of all kinds of Fish landed here. Gloucester, about 150–200 million lbs.

In Boston at least two-thirds of the catch would be Cod and Haddock; assume this fish will average about 4 lbs. in weight. As Cod and Haddock are gutted at sea, this is thrown overboard, except a very small portion of the livers, which are now saved. As you know, Cod or Haddock will have close to about ¾ lb. of entrails, more when the roe is full. Therefore, 40 to 50 million pounds of Fish entrails are thrown overboard every year.

I have viewed this problem over the years, and I have never seen a solution to it until last Saturday. I would like to work with you on it, as I believe we are in closer contact with the raw material that your process needs, than any other concern in the fish business.

Yours very truly,

JOHN RYAN, *President.*

Senator BARTLETT. Thank you, Doctor. Has your product ever been presented to the Food and Drug Administration?

Dr. PARFENTJEV. No, I never presented it. But I brought these cookies, Senator Bartlett, for your examination, if you or the other Senators who participate in this meeting wish to try it.

Senator BARTLETT. I will be glad to have a sample.

Dr. PARFENTJEV. The fish protein concentrate that was used in these crackers I tested, in my animal method of injection, and they survived it, and they are in very good shape.

Senator BARTLETT. Have you ever talked with the Bureau of Commercial Fisheries people about your method?

Dr. PARFENTJEV. I spoke with people in the Bureau, Department of Interior, yes. I did speak with them. But I just bring these crackers for you, if you wish to see them. They have a very appetizing smell, I can assure you.

Senator BARTLETT. Thank you very much. I will be possessed of terrific energy tomorrow.

Dr. PARFENTJEV. Yes. They contain 10 percent of fish protein concentrate, dried.

Senator BARTLETT. Ten percent?

Dr. PARFENTJEV. That means 10 times more than is in fish fillets, because fillets are not more than 20 or 30 percent of protein.

If you ask me, in my judgment, you will enjoy these.

Senator BARTLETT. Thank you. It seems to me, Doctor, your testimony is of unusual value. It gave me, for one, information that I didn't have before. Here you have been engaged in this activity for a good many years, and you have a method which you think is far superior to that which has been employed at Beltsville, by the Bureau of Commercial Fisheries. Everything you say convinces me all the more that we mustn't rely upon one method of extracting protein concentrate from fish, but we must explore all that are available and that certainly would include yours.

I am glad you came before the committee. I am glad you testified. Thank you very much.

Dr. PARFENTJEV. Thank you.

Senator BARTLETT. The next witness will be William R. Reagan.

STATEMENT OF WILLIAM R. REAGAN, AVCO CORP., NEW YORK, N.Y.

Mr. REAGAN. Thank you, Mr. Chairman.

On behalf of Avco Corp., may I express our sincere thanks for your invitation to appear before this committee and to discuss with you our investigation of fish protein concentrate.

There is currently a great amount of interest attendant upon the "hydrospace" or "inner-space" sciences. Although there is a good deal of speculation as to when man will be able to best utilize all the potentials of our oceans, I believe there is general agreement that the sea is, in fact, our last great frontier; and that it is within man's capability to harness its energies, extract its resources, improve its potential for transportation and habitation, and ultimately maximize our control over that hitherto generally unknown and alien environment which covers most of our planet.

Our extensive investigation of fish protein concentrate was motivated by a basic Avco Corp. operating philosophy that a large and highly diversified corporate entity must, in order to insure healthy growth, investigate and evaluate new economic areas which indicate strong potential.

For several years, Avco has carried on basic research and advanced development in the marine technology and ocean engineering fields. We are not active in the fishing business as such, nor are we engaged in the manufacture, processing, or distribution of food.

It became quite evident to us, from the very beginning, that FPC could have long-term effects which would transcend the realm of economics. Humanitarian considerations, foreign aid, the world starvation problem, and many other factors of national and international significance became an integral part of our study.

Our investigation began on the basis of two or three generally known facts: Protein malnutrition is a primary cause of starvation

and disease. There is an abundance of animal protein generated yearly in the oceans of the world. Yet, the annual yields of the sea are far below their potential.

Further, most of the ocean's protein yield is consumed, either by animals or people, in those parts of the world where protein malnutrition is not a major problem.

I would at this time like to pay compliments to the people in the Bureau of Commercial Fisheries. From the beginning of our investigation, it was necessary we be in constant contact with them. Mr. McKernan, Dr. Pariser, Dr. Knobl, Dr. Hamerle, and Mr. Butler. They are as fine and dedicated a group of Government servants as we have ever met.

FPC and its ultimate end is, however, a many faceted problem. What is it? How is it manufactured? Where does the raw material come from? Who supplies it? Who uses it? How many different end products are possible? What role will the Government play? What role will industry play? What is the market? Can the people who need it afford it? What are the best locations for plants in the United States? Abroad? What is the nutritive value? What are the economics for its production? How will it be distributed? These, and countless other questions presented themselves. We have answered many of these questions. We have made what we consider to be reasonable estimates in some areas. There are many, many questions, however, to which the answers are just not known.

There seemed to be a need for FPC to be examined within the entire context of the world population and food crises. Relationships had to be drawn between this product or products and the general state of the fishing industry in this country and in others. And, of course, it was absolutely necessary to become familiar with the technological state of product development.

Our investigation then could be divided into two general areas: first, an investigation of the specifics; that is, the processes, the market, the fishing industry, the basic raw material, and so forth. And second, a parallel effort was pursued which would constantly take the data obtained from the investigative phase and attempt to create a composite picture of FPC within the framework of the U.S. economy, its foreign and domestic programs, and the relationship of all these factors to the future.

Mr. Chairman, I would like, at this time, to make a very basic and essential assumption. Let us assume, for our purposes, that FPC will be accepted and approved by the Food and Drug Administration. For, if the product is not going to be available for human consumption, then any considerations we might have in regard to its future must necessarily be hypothetical.

I am sure that you are fully familiar with all the historical objections to FPC and have already heard ample testimony to refute the "esthetic" arguments. It is sufficient to say that these esthetic objections seem most untenable when examined under the light of reason and scientific scrutiny.

I would like to consider three specific aspects of FPC:

1. The product and source of raw material.
2. The potential market.

3. Questions and comments.

It is not my intention to delve at length into the technicalities of each of these areas, but rather, to present to you some of the basic data which we have gathered. By examining these three areas, we can make some reasonable observations concerning FPC and its future.

I. THE PRODUCT AND SOURCE OF RAW MATERIAL

In the generic sense, fish protein concentrate can be any product, derived from fish, which has a higher concentration of protein per pound than the original raw material from which it came; namely, the fish. As you know, there are three basic ways to obtain fish protein concentrate: chemically, biologically, and physically. I am sure Dr. Pariser and Mr. McKernan have provided detailed information on this subject. Parenthetically, there has been a good deal of controversy over the what, why, and wherefore of the Secretary's petition. In our opinion, the facts are very clear. They are—

1. Previous FPC petitions have been rejected consistently by the Food and Drug Administration.
2. The Bureau of Commercial Fisheries, under the aegis of Secretary Udall, set about to develop a product which would be acceptable to FDA.
3. The approval of this product seems imminent.
4. Therefore, again assuming approval, the Bureau of Commercial Fisheries has succeeded in its attempt to have whole, processed fish accepted for human consumption.

I emphasize these points, Mr. Chairman, because we feel they are most important to our clear understanding of the Government's involvement. We have never received any indication that the Bureau of Commercial Fisheries intended to get into the fish-processing business or wanted to be competitive with industry. On the contrary, I believe their primary objective was to penetrate the "whole fish" barrier. From here, it is hoped that numerous processes will be found acceptable by FDA and that FPC will be available in many forms. After this, any product which meets the chemical and toxicological standards of the Food and Drug Administration should be acceptable.

However, at this juncture, I suggest it advisable to look at the present product which is under consideration. It is, as you know, produced by a chemical process in which the solvent used is isopropyl alcohol. The end product is essentially colorless, tasteless, odorless, and of high protein value. It is important to note that the species of fish used by the Bureau in the development of this product, hake, is available in abundance off the coast of New England and the Pacific Northwest. This species, alone, can probably provide an annual sustainable yield in excess of 700 million pounds in each of these areas. As other chemical processes are approved and other species found to be acceptable as basic raw material, I am of the opinion that every coastal section of our country will be able to use the various regional species contiguous to their shores.

Consequently, our first recommendation to this committee, would be to suggest that Congress continue to provide the Department of the

Interior with the necessary and ample funds to seek quickly approval of species other than hake—or merluccius—as acceptable raw material for chemically extracted FPC.

I have intentionally restricted my comments to chemically extrated FPC for two reasons. First, it is a product which now exists; and secondly, since it is easily mixed with many other basic foods, its near-term importance is both reasonable and feasible. Both the biological and physical processes will have their place in the future and I will offer comments on this subject shortly.

II. THE MARKET

It is necessary in discussing "The Market" to define this term in relation to the most general concept of FPC and then I suggest that we make a very clear distinction between two different markets which involve FPC.

In the general sense, the market for FPC encompasses in our opinion those countries, areas, or individuals who would or should consume fish protein concentrate products in any form whatsoever.

For the purpose of this discussion, I would divide this market into two separate and distinct areas.

I suggest that one market contains all of those individuals in the United States and other countries who suffer from protein malnutrition. This is a market of need.

I suggest that the second market be defined as that portion of the world's population which might consume FPC for reasons other than the fulfillment and sustenance of minimal nutritional requirements. In other words, this market includes all of those individuals who don't need a protein supplement in their present diet in order to stay alive and/or healthy. Let us refer to this as the "choice" market.

We now have defined two market groups—the former the hungry, or those with a need; the latter the healthy, or those with a choice.

It might be well to point out here that the biological process currently under development by the Bureau of Commercial Fisheries seems to show great promise for the "choice" market. It has special appeal from the taste point of view because the end product of an enzymatic or biological process can be tailored to many different tastes while retaining its basic nutritional value. There is no reason to doubt that this type of FPC will also have great appeal to the "need" market.

Very little conclusive data is available on the physical processes and it seems reasonable to assume that product development in this area will most probably lag behind that of the biological processes.

Since the only type of product which might be reasonably available, in the near term, for general consumption seems to be the powdery chemically extracted type which I am sure you have all seen if not eaten, I will restrict the rest of my comments to this type of FPC. I would like, however, to reemphasize two points at this time.

1. I am speaking of any product which has essentially the same protein and physical characteristics as the Bureau's product and is found acceptable by FDA. This is regardless of by whom the product is developed, whether it be a commercial company or the Government.

2. I discard considerations of the biological and physical processes from further discussion in this market section only because the state of the art lags behind that of the chemically oriented approach; and hence the marketability of these products is further downstream. I do not in any way mean to detract from their ultimate potential or significance.

The presently developed FPC product has, in my opinion, the nutritional qualities to provide the hungry people of the world with the necessary protein to sustain good health. The basic raw material from which FPC can be extracted is more than ample. Moreover, fish protein concentrate appears quite attractive as a supplement to food already being consumed in the "choice" market. Because it is essentially tasteless, colorless, and odorless, it could be added to any number of products which presently have little protein content. Promotional possibilities for this type of food are self-evident.

In regard to the "need" market, the National Academy of Sciences has developed an excellent plan to conduct feasibility studies in Peru, Chile, Bolivia, Uganda, Thailand, and India. The Academy would use FPC produced by the first pilot plant or plants.

In this regard, Mr. Chairman, we offer our second recommendation; that this committee recommend that this study begin as soon as the FPC is available and that the necessary funding for its proper execution be provided.

Although, for a number of reasons, it has always been rather difficult to introduce new foods into a culture, we are inclined to be optimistic in regard to FPC acceptance. Since it would be used essentially as a supplement to basic bulk food, the problem of a new taste should not be a detrimental factor toward acceptance.

Summarizing the market situation, there is no doubt in my mind that FPC can be a major factor in the alleviation of the world malnutrition problem. But identifying and developing a solution to a problem is one thing—making it work is another.

III. QUESTIONS AND COMMENTS

I suggest that the most important question which we might ask at this time is: What happens to FPC should the FDA approve Secretary Udall's petition?

In order to have the right things happen, there must be a plan. And logically, before a plan can be drawn up, there must be a goal. Members of this committee and other members of Congress have in fact established a goal and offered plans—in the form of legislation. This legislation, hopefully, will bring about the availability of FPC in small quantities. This will be accomplished by the construction of one or more pilot plants sponsored by the Department of the Interior. Now, what happens after that is a most serious and complicated consideration, made even more difficult by the fact of time—for time is truly of the essence.

Voluminous statistics exist on the relationship between the population increase and the world food crisis. Consider that the population of the world will double by the year 2000—less than 34 years from today. In less than half that time—by the year 1980—it is anticipated

that the world population will increase by 1.2 billion, and that 85 percent of that increase will be in the underdeveloped countries.

Less than a year ago, a short, conclusive statement was issued by the participants in a national seminar on U.S. food policy in relation to world needs. This seminar was cochaired by Dr. Roger Revelle, Director of the Center for Population Studies of Harvard, and the Honorable Richard W. Reuter, then the Special Assistant to the President and Director of food for peace. I believe this statement defines a positive goal for FPC. If I may quote it, Mr. Chairman. This was said by the way in regard to the underdeveloped countries.

> The chain of economic-industrial development which raises purchasing power and permits consumers to buy more and better food—which in turn stimulates increased food production—is time consuming. It cannot markedly lift the low nutritional levels during the next 15–20 years, even if population trends are moderated. This fact means that in addition to the usual efforts to step up production of grains and livestock products through better farming practices, better seeds, more fertilizer, more efficient feeds, etc.—the usual elements in agricultural development programs—we need an additional food program which concentrates in making readily available high protein foods to meet nutritional requirements of the next 10–15 years during which local production will hopefully have been noticeably increased. Thus the efforts to raise food production should be accompanied by even more intensive effort at promoting the processing and distributing of high protein foods, particularly from sources other than livestock. Such foods probably will remain in short supply for a long time to come.

This short supply need not exist if FPC development and production programs are vigorously pursued. Will U.S. industry immediately rise to this challenge?

In my opinion, it would be imprudent to predict that large industry alone will quickly manufacture great quantities of this product to be consumed by the underdeveloped nations. The economics involved are simply too vague at this time. The motivation, in short, is not there. It is probable that our domestic food companies will show great interest in this type of product—I understand most of the major food companies have already visited the College Park Laboratory—and might well create a demand for FPC to be used as a supplement to their food products for the "choice" market. It is difficult at this time, however, to translate this interest into the wherewithal to satisfy the "need" market.

I would not attempt to define "industry's position"; first, because the general term "industry" covers such a large segment of our economy, and, secondly, because I feel it is impossible for any one man or company to speak for all of industry. Rather, I would like to point out that, as a result of our research, the following questions seem to us important; and their resolution or partial resolution can, perhaps, open the way for greater progress.

Question 1: In regard to the basic raw material for FPC, will the Food and Drug Administration require that the "industrial" fish used be preserved in a manner similar to the preservation of food grade fish?

Comment: If there are strict requirements that the "industrial" fish used be preserved, either by icing or other suitable means, in a manner similar to fish which are presently caught for human consumption, then this requirement could affect the cost of the raw mate-

rial. It is well to remember that since it takes approximately 6 pounds of raw material to produce 1 pound of FPC, a 1-cent per pound increase of raw material cost automatically increases the material cost of the end product by 6 cents per pound. This does not include the actual costs of processing.

Question 2: Will it be necessary to develop fishing techniques and equipment to make the harvesting of industrial fish economically attractive in the face of the inherently higher priced food fish market?

Comment: In regard to the pilot plant supply, there seems to be no immediate supply problem. The proposed pilot plants would use about 25 to 30 million pounds of fish per year. In this regard, we are from New England ourselves and we have been to the four major fishing ports in New England, Gloucester, Boston, Point Judith, and New Bedford, and there seems to be no difficulty at all in getting this amount of fish for the pilot plants. The prospect of a fixed guaranteed quantity and price has great appeal to the fishing interests, and I am of the opinion that at least for the pilot plant stage, the raw material will be able to be purchased at a reasonable price at any one of the major ports in New England or the Northwest. However, should the demand for fish suddenly increase, it is difficult to forecast the economic outcome. It is hoped that new techniques for mass volume production, both at sea and ashore, will enhance the prospects of industrial fishing.

As it stands now, FPC is in itself not the cure-all to the ills of the U.S. fishing industry.

Question 3: What will the actual plant operational costs be?

Comment: The Bureau of Commercial Fisheries has done an excellent job, in its summary report published last month, in estimating the costs of pilot plant operation. Nonetheless, unanticipated chemical engineering problems may arise in certain areas, such as solvent recovery, which could increase processing costs. On the other hand, the recovery of byproducts might well more than offset these costs. The answers will not be known until the first pilot plant is operating. At that time, it should be much easier to make a reasonable forecast concerning the economics of a large-scale production facility.

Question 4: Should plants be built abroad?

Comment: It seems logical that underdeveloped countries, with abundant supplies of fish in native waters, would be ideal locations for FPC plants. The abundance of fish does not necessarily solve the problem. In India, for instance, the fishing fleets are all pretty much oriented toward small, local markets, none of which seem capable of handling an FPC plant of effective size. Moreover, past attempts to move the basic raw material over land to a central processing center have proved economically unfeasible. Although there may be underdeveloped countries capable of successfully sustaining their own means of production, it is generally true that a country which is underdeveloped usually lacks the technical capability to embark on a venture which has a substantial number of fairly sophisticated economical, technological, and logistical implications.

Question 5: If the Federal Government is a major buyer of FPC, how will it be bought, and by whom?

Comment: I am sure, Mr. Chairman, that this committee is in a much better position to answer this question than I. My reason for

raising it, however, is that at the present time lack of a definite policy in this regard may contribute to some extent to the lack of full-scale industry interest and participation in FPC-oriented activity. It is my understanding that the food-for-freedom legislation provides for the purchase of highly nutritious supplements for the basic commodities. It would seem that FPC should qualify in this category.

Question 6: Is this product in competition with agricultural products?

Comment: The answer is "no." FPC is primarily a supplement to be used in small quantities with agricultural products which lack a full "protein profile." It has been reported that friction might arise between those people concerned with the effectiveness of FPC and its excellent amino-acid content, and other individuals who are developing better nutritive products from agricultural material. However, there seems to us to be great accord among most research scientists in this field. The consensus is that this is not an "either-or" situation, but rather that there is a great requirement for all types of new and effective sources of protein.

Question 7: What is the Government's long-term role?

Comment: I offer this final question for consideration, Mr. Chairman, because it is our considered opinion that if the full potential of FPC is realized, it will become a major worldwide source of protein, and many branches of the executive department would have a keen interest in its use, effectiveness, and implications. If FPC is to be an integral part of our answer to the world starvation problem, I then suggest consideration of the long-term involvement of the following departments of Government with respect to the communication, policy, coordination, and implementation aspects of this program.

A. The State Department—has direct aegis over the food for peace and AID programs, as well as the responsibility for weighing the effects of the food crisis in relation to our foreign policy.

B. The Defense Department—has the responsibility of defending our national interest and our allies throughout the world. Since the prospects of a serious famine, which may well threaten India, China, and Pakistan in the early 1970's, loom on the horizon, DOD's interest is clearly evident. Starving men have historically, shown little respect for international boundaries.

C. The Department of Health, Education, and Welfare—with great responsibility for major Government domestic food programs could have a very major influence in the use of FPC as part of a program to alleviate hunger at home.

D. The Department of Agriculture's iuvolvement is self-evident.

E. The Department of the Interior—the answer is obvious.

It seems clear that all of these departments have a vital concern and interest in any major breakthrough which might affect the world food crisis.

Since it is evident that each of these departments, because of its specifically defined area of responsibility, is interested in different aspects and ramifications of the problem, it would seem desirable that the best possible lines of communication exist, perhaps at the Assistant Secretary level, among these departments and between the executive branch and the Congress.

Finally, Mr. Chairman, I would urge speedy passage of S. 2720. I am sure that with constructive legislation, understanding, and communications, fish protein concentrate can be brought to its full potential by our country.

Thank you.

Senator BARTLETT. Thank you, Mr. Reagan, for a truly excellent statement. You have posed some questions that are pertinent and will obviously have to be answered.

I have only one question I would like to ask you. On page 17 you said at the top of the page:

> It has been reported that friction might arise between those people concerned with the effectiveness of FPC and its excellent amino acid content, and other individuals who are developing better nutritive products from agricultural material.

My question is this: Is it better than FPC, is it better than has been derived from agricultural products heretofore?

Mr. REAGAN. FPC has a fine cross section of the eight essential amino acids, Mr. Chairman, which are necessary for full nutrition, amino acids all of which must be synthesized together. There have been products developed at University of Indiana, lysine is one form of amino acid, they have it up to 40 percent, a major breakthrough.

The soybean industry has done a good deal of research. To the best of my knowledge there is no product which seems to compare economically with FPC, which has as fine a cross section of the essential amino acids as FPC, or MPC has.

Many of these products have many different advantages to offer and each of them have separate amino acid contents which in themselves are good. We have been told that there are agricultural products that are equal to FPC, but we have not seen any, and we haven't seen any yet that seem to have as good a cross section of protein as FPC has.

Senator BARTLETT. In any case, your statement made it very clear that you do not see any need for controversy between the two.

Mr. REAGAN. Absolutely, sir. But there have been a number of editorials lately. There was one in Minnesota last week, which I read, that indicated this was a new problem for the farmers, that this would be a new competitive product. We don't see it as such at all. Because FPC is a supplement, it can supplement the farm products.

Senator BARTLETT. I agree with you wholeheartedly.

Mr. Foster, do you have any questions?

Mr. FOSTER. No, Mr. Chairman.

Senator BARTLETT. Thank you very much for a very good statement.

Mr. Walter D. Thomas.

STATEMENT OF WALTER D. THOMAS, WASHINGTON REPRESENTATIVE OF FMC CORP.

Mr. THOMAS. Thank you, Mr. Chairman, for allowing us to present a brief statement today. Before reading my remarks, I would like to state by way of background that at FMC Corp., formerly, Food Machinery & Chemical Corp., we have for over 35 years been a major supplier of food processing equipment, both in the United States and throughout the world.

Not only have we supplied this machinery, we have done a great deal of work in developing food processes. And we have done this not only for ourselves, but for food processors, and for the U.S. Government, for example. So we have a long-time experience with this general field.

We followed closely the work that the Bureau of Commercial Fisheries has done; we are enthused about it. We feel it can be the opening shot in something of tremendous value to mankind in feeding peoples throughout the coming years as the need gets so much more severe.

Senator BARTLETT. Where is your home office?

Mr. THOMAS. San Jose, Calif. And in neighboring Santa Clara, Calif., we have our laboratories, Central Engineering Laboratories, which have followed this work of the Bureau of Commercial Fisheries and where we do our own food processing development.

The population explosion requires all the world's food resources to be used, and the United States, in its own interest, must lead in the development of new food sources. A relatively untapped source is the ocean, which constantly generates vast amounts of protein. This foodstuff in the ocean is scattered, it is perishable, and much of it is in forms of fish not presently eaten.

The large scale manufacture of Marine Protein Concentrate promises to make much greater quantities of the ocean's protein resources directly available to man by converting fish to a nonperishable, easy to ship and distribute form which is nutritious and compatible with present foods. We expect the development work being done by the Bureau of Commercial Fisheries to result in a large new food industry furnishing new sustenance to undernourished people and new markets to fishermen and food processors. Therefore, our company is now working to develop efficient processing equipment for making MPC, and we visualize a substantial long range market for it.

FMC Corp. recommends the passage of S. 2720 as a means to accelerate the time when commercial manufacture of MPC will take place.

We wish also to take this opportunity to commend the Bureau of Commercial Fisheries for its work in developing and promoting MPC and to urge that this good work continue in order to extend the present process of solvent extraction to other species of fish besides hake, and also to develop other, less costly processes for making MPC.

Research and development by a Government agency, as performed by the Bureau of Commercial Fisheries in developing MPC, does an important service. The markets for MPC will be difficult to develop, despite the obvious need for the product; establishing its wholesomeness and petitioning the Food and Drug Administration for clearance are extremely formidable tasks; and even to begin with, selecting a process scheme and developing enough details to make a pilot scale effort is a big job. While private industry could conceivably do this work, the long-term nature of the task and the need for large expenditures, both to get the product approved and to carry out the sociopolitical campaign to get the product accepted by consumers in underdeveloped countries where the big markets are, makes undertaking the whole development effort a dubious venture for any corporate management. In fact, this project is an example of how Government and industry can supplement each other's work; Government laboratories are in a position to do basic work of a long range nature, even

though the risks are great, if the project has sufficient potential for public benefit; while industry is highly skilled in the means of economical production and distribution of products for which reasonable demand exists.

We believe that authorization of these demonstration plants will enable the market for MPC to be established so that private industry can use its enormous productive capacity to provide mankind with this desperately needed protein.

Senator BARTLETT. Thank you, Mr. Thomas. You have given some excellent reasons as to why the initial effort should be under the direction of the Government, with industry to follow on a larger scale.

Mr. THOMAS. Right sir.

Senator BARTLETT. Thank you very much.

Mr. Richard Whittington, please.

STATEMENT OF RICHARD WHITTINGTON, BELLAIRE, TEX.

Mr. WHITTINGTON. My name is Richard Whittington, I am a marketing analyst and I have been a consultant to the Institute of Nutrition of Central America and Panama, a contractor, with special reference to Guatemala and Mexico.

I have also worked in Kenya with only reference to protein malnutrition.

I am presently consultant to Hugo Cervantes, the Governor of the State of Baja California, Republic of Mexico, which has 20 million Mexicans living in families that earn less than $120 a year and at the same time there are between a half million to 1 million tons of anchovies available off the west coast waters of Baja California, according to Scripps Institute of Oceanography.

I have prepared or correlated a report which I would be glad to send to you, Senator, and Senator Magnuson——

Senator BARTLETT. We would be glad to receive it.

Mr. WHITTINGTON (continuing). Which is a copy of what I prepared for Dr. Cervantes.

These are pictures of three Guatemalan children. They look like three different children, but they are three pictures of the same child, suffering from protein malnutrition, who has been treated correctly with proper diet. One after about 3 weeks and one after about 6 months. The sturdiest child on the right, completely recovered from kwashiorkor, which is the medical term for protein malnutrition.

I also show you pictures of some African children suffering from the same disease. Also a picture of Dr. Moises Behar, the director of the Institute of Nutrition of Central America and in Guatemala, for your examination.

The Institution of Nutrition of Central America and Guatemala is part of the World Health Organization, the Western Hemisphere Branch is the Panama Sanitary Bureau.

We have an office of this in El Paso, Tex., and we have been working in the Rio Grande Valley and in Mexico, and are continuing our studies of protein malnutrition.

As a Texan it grieves me to admit we have protein malnutrition in our State borders to a severe extent along the river. I would like to also offer for your consideration either now or at a future date an

official movie of the Ministry of Health of the Republic of Guatemala, produced in cooperation with the Institute of Nutrition of Central America and Panama, under the direction of Dr. Behar.

Senator BARTLETT. We would like to see that, but of course we can't right now. How long will you be in town?

Mr. WHITTINGTON. I will be here as long as you require. Today or tomorrow or some other date. I cite these two examples, Senator Bartlett, in support of my contention that Mexico is a very progressive country in terms of FPC. We have the private sector, and we have the government sector. We have the scientific sector, and the government, all in unified accord to the merits of FPC.

I therefore submit that we ought to take note, to take heed of our neighbors to the south. At the same time, we have got to realize that the businessmen of the United States in the soybean, spray dried milk process industry, flour milling, and baking, have felt their economic welfare has been threatened by the competition of a new product which would be called FPC.

I suggest that they reexamine their economic positions, and take close heed of the tremendous market potential, both in United States and abroad, for this new product and see that far from being competitive, the world needs all of the protein they can get from animal, vegetable sources, whether it is from United States or otherwise.

Thank you very much, sir. I would be glad to answer any questions you have.

Senator BARTLETT. Thank you.

Mr. Gordon D. Zealand.

STATEMENT OF GORDON D. ZEALAND, EXECUTIVE DIRECTOR, INDUSTRIAL DEVELOPMENT COMMISSION, CARTERET COUNTY, N.C.

Mr. ZEALAND. Mr. Chairman, gentlemen, I am Gordon D. Zealand, executive director of the Carteret County, N.C., Industrial Development Commission. This county embraces Beaufort and Morehead City, N.C., locations of five menhaden processing plants.

I would like the privilege of submitting our request for your consideration of Carteret County as one of the locations for a pilot operation to produce fish protein concentrate, and request your consideration and evaluation of the following facts:

This county is classified by the Labor Department as an area of persistent and chronic unemployment, and is eligible under the Economic Development Administration for priorities pertaining to economic and industrial activities.

According to statistics prepared by the Department of Interior, U.S. Wildlife Service, Carteret County has landed 76 percent of the total menhaden in North Carolina. Furthermore, our area accounts for approximately 12 percent of the entire menhaden landings of the Middle Atlantic, Chesapeake, South Atlantic, and gulf coast areas as substantiated on the attached tabulation.

We have adequate land and facilities available for such a pilot operation as has been proposed, and will lend all support and cooperation possible.

It may be further noted that within our county, we have the Duke University Marine Laboratory, the University of North Carolina Institute of Fisheries, North Carolina Commercial Fisheries, and the Radiobiological and Biological Laboratories of the Fish and Wildlife Service, Department of Interior. I am sure that these five offices would be in a position to lend substantial help in research if this pilot operation is located in Carteret County.

Also, in the months of May through December, we have very many fish available that are of little fat content. In addition, we are not to distant from the fishing ground to assure the fresh delivery of the menhaden to the pilot plant to provide the epitome of perfection in operation.

Thank you very much.

(The aforementioned tabulations follows:)

Menhaden landings

	Carteret Co. (pounds)	North Carolina (pounds)	Percent	North Carolina, value
1961	169, 875, 170	221, 555, 339	76. 7	$2, 415, 000
1962	90, 903, 523	122, 898, 052	74. 0	1, 364, 000
1963	161, 097, 225	190, 213, 882	84. 7	2, 111, 055
1964	119, 863, 380	172, 991, 671	69. 3	2, 109, 000
1965	124, 465, 010	156, 340, 864	79. 6	2, 031, 000
Total	663, 204, 308	863, 999, 808	76. 0	10, 030, 055

Area	1961	Percent	1962	Percent	1963	Percent	1964	Percent	1965	Percent
	1,000 pounds		*1,000 pounds*		*1,000 pounds*		*1,000 pounds*		*1,000 pounds*	
Middle Atlantic	715, 049	32	782, 487	33	372, 851	21	139, 258	9	144, 741	9
Chesapeake	298, 679	13	327, 910	14	259, 015	14	336, 414	21	285, 997	17
South Atlantic	254, 505	11	157, 169	7	215, 886	12	190, 146	12	188, 002	11
Gulf	1, 020, 433	44	1, 056, 625	45	967, 693	53	904, 141	57	1, 019, 656	62
New England	26, 011	1	23, 753	1	353	------	6	------	0	------
Total	2, 314, 677	------	2, 347, 944	------	1, 815, 798	------	1, 569, 965	------	1, 638, 396	------

Senator BARTLETT. Thank you. I think it is well you provided this statement for the record, urging the location of the plant in your county. I would assume that determination as to the locations will be made not by the committee, not by the Congress, but by the Department of Interior.

However, as I said, it is well that your case is presented in the written record for consultation with the Department of Interior.

On the basis of being a Senator from the State of Alaska, I should note here that during these 2 days of hearings there have been several suggestions as to where plants should be located. Congressman Clausen of California urged yesterday that one be in his district, which he said, as I recall, has 400 miles of coastline.

I haven't said, nor do I propose to say a word concerning Alaska, which has over 30,000 miles of coastline.

Thank you very much.

Mr. ZEALAND. Thank you, sir.

Senator BARTLETT. Edward V. Linson.

STATEMENT OF EDWARD V. LINSON, ASBURY PARK, N.J.; ACCOMPANIED BY GERALD MILLER, EXECUTIVE DIRECTOR, MEALS FOR MILLIONS FOUNDATION

Mr. LINSON. Mr. Chairman, I would like to introduce myself. I am Edward Linson, an individual. I am not identified with any commercial enterprise, nor with any Government agency. With your permission I would like to make a few remarks.

Senator BARTLETT. This makes you exceptionally pure.

Mr. LINSON. Mr. Chairman, over a period of more than eight and a half years and entirely on my own, I have pursued an active interest in the merit, need, and production of marine protein concentrate and I appreciate the opportunity to express my views on this important subject before this committee.

The world food crisis has been given so much publicity by many eminent authorities and is so well known to Members of our Congress that I would not presume to belabor the subject. Nevertheless, I would like to refer to one figure amongst others which was released by Secretary Freeman following a comprehensive survey of the world food deficits for 1962.

In view of the large increase in world population since then, we may feel assured that those deficits have enlarged and become more serious. There may be more recent estimates through official sources but, if so, I do not have them.

However, using the 1962 figures we find that the deficit—besides wheat, cereal, grains, rice, beans and other carbohydrate foods—include a deficiency of animal/marine protein in terms of nonfat milk solids of 1,800,000 metric tons.

Since nonfat milk solids carry about 32 percent protein, this deficiency would amount to 1,270 million pounds of animal/marine protein.

To make up any such deficiency in terms of animal or poultry units would involve a considerable time factor and a fantastic number of animal and/or poultry units even if pasturage and/or feed supplies were available without diverting such feed supplies from human consumption channels, neither of which would be the case.

It has been repeatedly emphasized by competent authorities that the only practicable answer is a more intensive harvesting of the seas and especially the utilization of fish which are in abundance but which, at present, are not being taken because they have no market.

Fresh raw fish, properly processed under sanitary and hygienic conditions can be utilized in the form of an additive to wheat flour, corn meal, cereals such as farina and many other carbohydrate foods within hours of the time the fish are landed and made subject to processing.

Moreover, the protein—if not damaged in processing—is of the highest quality complete in all the essential amino acids which are the building blocks for protein. The nutritive values of the minerals in a properly prepared MPC are an important bonus.

Doctors Johnson, Metta, and Schendel of the University of Illinois found that MPC has a higher protein efficiency rating than nonfat milk or beef, thus bespeaking its superior quality.

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Doctor Norris and associates at Cornell University equated relative values in PER—that is protein efficiency rating—based on casein at 100, as follows:

Fish protein at a high of 111, nonfat milk at 100, which follows, because casein is milk protein, meat at 91, soybean flower at 89.

It should be noted that MPC contains upward of 75 percent protein. Therefore 1 pound of MPC would be equivalent to 5 or 5½ pounds of prime beefsteak or some 2 to 2½ pounds nonfat milk solids. This makes possible very considerable economies in handling, transportation and storage.

I will not attempt to comment on the beneficial effects the large-scale production of an acceptable MCP made from edible fish which are now unmarketable will have on the American fishing industry as they should be self-evident. However, I do want to point out that MPC would be, by far, the lowest cost edible protein on a par unit basis than that from any other source whether animal or vegetable. It seems to me that these two factors—highest quality and lowest cost—are worthy of special consideration.

You are probably well aware that one of the first recommendations made by Food and Agricultural Organization after the establishment of United Nations some 20 years ago was for the production of what was then called fish flour. Subsequently, to distinguish it from fishmeal it was referred to as fish protein concentrate. Now we recognize it as marine protein concentrate.

Many commercial concerns and several governmental agencies, both in this country and abroad, were immediately interested. Much proliminary work was done by private interests in the United States, Canada, Sweden, and elsewhere and, with government assistance, in Morocco and South Africa.

UNICEF, now known as the United Nations Children's Fund, built a project plant at Quintero, Chile, and donated it to the Chilean Government.

None of these early plants was effective in producing either an acceptable or economical product. The problem of producing a high quality and acceptable MPC from certain species of edible fish which are termed unsalable, such as sardines, pilchards, anchovies, and other oil-bearing fish was found to be much more difficult than was first realized.

It happens that I was directly concerned and involved in the transition in the use of fish from fertilizer to a suitable quality fishmeal for animal and poultry feeding. At that time there were many problems such as cooking procedures, temperature controls, rancidity, and other problems which we had to learn to overcome. A very similar condition now prevails in our effort to convert edible food fish from a feedstuff to a foodstuff.

From my own resources I have personally expended much time and effort and many thousands of dollars in research, experiment, and development with many, many discouragements. Eventually, I did achieve a breakthrough and, on a commercial scale level, did produce an MPC which was highly evaluated by the Bureau of Commercial Fisheries and which was clinically used on babies and children with dramatically effective results.

While a similar product might qualify as acceptable, I would be the first to acknowledge that there is need for considerable improvement, but I can no longer pursue this work on my own, nor have I found others disposed to expend their resources in this field.

At this point, Mr. Chairman, I would like to add a comment. At yesterday's hearing Representative Keith mentioned that Dr. Graham had used viobin fish flour in his clinical work, which is correct. But he neglected to mention that Dr. Graham also used fish flour from other sources, such as the plant at Quintero, a small plant at Suyo in Peru, and our own. During this work with fish protein concentrate, over a period of 2 or 3 years, Dr. Graham found a variance in results with FPC, from the same source. After exhaustive tests he learned the principal cause of these variations was directly traceable to the solvent used for defatting. This indicates the need for further research in this particular field.

The work which has been done at College Park is to be most highly commended and their results have added enormously to the technology of the problem. But the work is not done and there are many additional problems with which to deal.

The provisions of this bill which envisages contract research will bring the combined experience of the Bureau of Commercial Fisheries and many industrial firms to bear on these problems, thus utilizing to the utmost the combined talents of industrial and Government research groups.

With the encouragement, incentive and support provided by S. 2720, it is my opinion that it will be a most effective means of supplementing and furthering the work already done by the very capable staff at College Park and keep America in the forefront in this field of such tremendous potential importance.

Mr. Chairman, I most earnestly endorse the intentions and purposes of this bill.

Senator BARTLETT. Mr. Linson, the committee is grateful to you for your appearance. You have made a real contribution. You have made one false assumption, too, when you implied that all of us are aware that one of the first recommendations made by FAO, after establishment of the United Nations, was for the production of fish flour. I for one didn't know that. I think that is tremendously interesting.

Mr. LINSON. Yes. They were the ones that suggested the idea in the first place.

Senator BARTLETT. This is news to me and I think it is of significance in consideration of this very bill.

Mr. LINSON. Well, I aim to be helpful, Senator, if I can contribute anything at all.

Senator BARTLETT. You are to be commended and I do commend you for the effort you have devoted to this, the money that you invested, without any hope of reward, and I think you have been most public spirited and I want to thank you on behalf of everyone who is interested in this.

Mr. LINSON. Thank you very much, sir.

Now, with your permission, I would like to add another comment. Dr. Schneider of the Bureau of Commercial Fisheries recently brought up what I thought was a very timely and pertinent question. The

question was if and when we reach the point of a large scale production of marine protein concentrate, what are we going to do with the stuff? And again with your permission, I would like to introduce Mr. Gerald Miller, who is the executive director of the Meals for Millions Foundation. The foundation has distributed more than 70 million meals or meal supplements in 127 needy countries through 200 or more volunteer agencies around the world, and I thought while we are concerned essentially with the production of marine protein concentrate, I thought it would tie in very well to know how, where and when we are going to be able to distribute this. And I thought perhaps you would like to ask Mr. Miller some questions about the utilization, once we have it.

Senator BARTLETT. I certainly would.

Before that I will ask Mr. Miller if he cares to make a direct statement. We have here of course the letter that you wrote from Santa Monica on May 10. It might be you would care to read that letter. Do you have a copy with you?

Mr. MILLER. I don't have one with me, Mr. Chairman.

Senator BARTLETT. I will brief it by saying that you wrote me on May 10 saying that Meals for Millions Foundation is greatly encouraged by the introduction of S. 2720, that the foundation has long been concerned about the protein deficit in the developing countries throughout the world, and you expressed a belief that this bill represents a great step forward in combating protein deficiencies.

You went on to say 20 years ago the foundation was confronted with the problem, a similar problem, as you described it, of introducing a vegetable protein concentrate on a worldwide basis.

I quote now from your letter:

> Over the past twenty years we have distributed approximately 14 million pounds of a vegetable protein concentrate based on either soy or peanuts which we gave the name multipurpose food. The value of vegetable proteins is now fairly well established as a result of this, and many other similar efforts.

Continuing to quote from your letter:

> We would like to offer our assistance, by formulating various consumer products with fish protein in our experimental plant in Santa Monica, as well as to carry out programs for acceptability and clinical testing on a large scale basis, in a number of countries overseas. At the same time we could also be helpful in distributing such projects on a worldwide basis through our established distribution system to hospitals, orphanages, and other institutions, as well as missions of all denominations.

Concluding you say:

> I would welcome your comments on these suggestions.

My comments are to the effect that I think this would be highly helpful in arriving at a market for fish protein concentrate. Of course that has been one of the great concerns, after an acceptable product is available, what do you do with it.

Well, we have certain ideas on that subject of course, ideas which we think are practical and will be effective. But I should think that through the agency of an established foundation, such as that of which you are executive director, this process of distributing the protein concentrate derived from fish would be accelerated and would be greatly assisted.

I am sure the Department of the Interior, and I know this committee, would be greatly pleased to have whatever cooperation you may be able to and may care to extend.

How long has your foundation been in existence?

Mr. MILLER. We have been in existence about 20 years, Mr. Chairman.

Senator BARTLETT. And the foundation is dedicated principally to the distribution of needed foods in underdeveloped an undeveloped countries?

Mr. MILLER. Not principally. It is devoted principally to the alleviation of hunger and malnutrition in the underdeveloped countries, but it does it not only by the distribution of food, but this food which is distributed is used for demonstration purposes, and our basic approach is to determine how we can develop private initiative within these countries so they can produce it themselves.

In terms of the marine protein concentrate, we believe that the pilot stage, which we are now conceiving in Senate bill 2720, would only be the first step in beginning to develop protein resources from marine resources within these countries.

If we are going to have effect in an ultimate sense, we have to develop this initiative in the countries themselves.

Senator BARTLETT. I agree with you.

Does Meals for Millions Foundation depend upon voluntary contributions for its support?

Mr. MILLER. Yes; entirely. Our contributions come from individuals as well as from certain industries.

Senator BARTLETT. Well, I think this could be very meaningful, Mr. Miller, in the long-term aspects of the problem that confronts us. I am going to place your letter in the record, together with a copy of the attachment which is entitled "Pilot Protein Production and Feeding Program for a Selected Region in Chile."

I think this will be helpful.

(The letter and proposal follow:)

MEALS FOR MILLIONS FOUNDATION,
Santa Monica, Calif., May 10, 1966.

Senator E. L. BARTLETT,
U.S. Senate, Washington, D.C.

DEAR SENATOR BARTLETT: We are much encouraged by the introduction of bill S. 2720 which you and Senator Magnuson have co-sponsored to encourage the production of marine protein concentrate. We have long been concerned about the protein deficit in the developing countries throughout the world, and we believe that this bill represents a great step forward toward combating one of the world's greatest problems.

While the pilot plant proposed in the bill will produce about 3,000 tons of MPC in the next two years, we have received little information about what is to be done with the plant production and how such will be distributed to maximum effect. It is obvious that the offtake is designed for large-scale human nutrition studies throughout the world, but no indication is given as to how this might be accomplished.

Some 20 years ago we were faced with a similar problem of introducing a vegetable protein concentrate on a world-wide basis. Over the past 20 years, we have distributed approximately 14 million pounds of a vegetable protein concentrate based on either soy or peanuts, which we gave the name "multi-purpose food (MPF)". The value of vegetable proteins is now fairly well established as the result of this and many other similar efforts.

We would like to offer our assistance by formulating various consumer products with fish protein in our experimental plant in Santa Monica as well as to carry

out programs for acceptability and clinical testing on a large-scale basis in a number of countries overseas. At the same time we could also be helpful in distributing such products on a world-wide basis through our established distribution system to hospitals, orphanages, and other institutions as well as missions of all denominations. I am enclosing for your information a proposal we have for a program to feed 20,000 pre-school children in Northeast Brazil as well as a similar project for industrializing a protein processing plant in Talca, Chile. While these are both based upon control studies and ultimate manufacture of vegetable proteins, they could just as heasily be adapted to marine protein programs for these and other countries.

I would welcome your comments on these suggestions, and I plan to be in Washington for the hearings on May 16 and 17.

Sincerely yours,

GERALD J. MILLER, *Executive Director.*

TENTATIVE PROPOSAL—PILOT PROTEIN SUPPLEMENTATION PROGRAM FOR CHILDREN ONE TO SIX YEARS IN THE CARIRI REGION OF NORTHEAST BRAZIL

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SCOPE

1.1 *Summary.* The subject proposal is for a mass supplementary protein feeding program covering a five-year period for the pre-school population in the Cariri Region of Northeast Brazil. Provision is made to carry on sufficient testing to provide a scientific basis for evaluating immediate and long-term effects on growth, health and possibly relevant psychological factors of the child population resulting from mass feeding of a protein supplement fortified with essential vitamins and minerals. The program is also intended as a pilot operation in mass feeding of infants using locally produced, low-cost protein foods which could be adapted and repeated throughout Northeast Brazil and other underdeveloped areas where malnutrition is endemic. Although many nutrition programs have been carried out elsewhere few, if any, have combined the experimental work of supplementary feeding on a mass basis for a complete population of one to six year olds, with the local production of the food. Thus the practical problems of mass production and distribution on a local scale are com-

bined with experimentation and research on the effects of such food on a mass population. From its practical side, the program may be expected to stimulate widespread interest in other hinterland areas, where protein malnutrition is usually most severe, in emulating the local production and distribution of high protein food supplements. From the research side additional valuable and reliable data will be obtained and analyzed relative to immediate effects on infants and the longer term effects on their health and growth as they approach adolescence.

1.2 *Location.* "Project Brazil" is an on-going program located in the Cariri Region of the State of Ceara aimed at the economic development of the region. The proposed supplementation program would be carried out in the same area, specifically concentrated in the hinterland towns of Carto, Juazeiro do Norte and Barbalha which, being almost contiguous to each other, form a triangle about 15 km. on a side in the commercial center of the region. They are towns typical of the interior with a relatively tight, somewhat urban core, surrounded by the huts of people in the lowest economic strata and merging into a strictly rural environment. This particular tri-city area is peculiarly suitable for the proposed program because the attention of the entire nation has been drawn there owning to the publicity given to "Project Brazil" in the press and in government circles. For this reason, as well as for the special merits of the applied nutritional program, it may be anticipated that special nation-wide interest will focus on the undertaking.

1.3 *Size of Program.* The tri-city area has a total population of approximately 120,000 people. The population of 1 through 6 year olds, estimated at 15% of the total, comes to 18,000,[1] These would be distributed among the above mentioned towns about as follows:

	Total population	Test population (1 to 6 years)
Crato	45,000	6,750
Juazeiro do Norte	60,000	9,000
Barbalha	15,000	2,250

The program would undertake to feed as many of the children in age bracket, 1 through 6, as mechanically and technically possible. This selection would facilitate direct biostatistical comparison of the tri-city area of the Cariri with other more or less similar areas in other parts of Northeast Brazil.

1.4 *Costs.* As indicated in Section 3 on the Budget, the operations in Brazil will be carried out primarily by Brazilian nationals with the necessary technical back up and organizational start up assistance by a small permanent group of personnel in the United States, who will have access to intellectual, technical and experimental resources at both the University and the Meals for Millions Foundation (MFM).

1.4–1 *Sources of Funds.* The MFM Foundation will undertake to support to a substantial extent the dollar expenses of the program by making direct dollar grants to the program, by providing experienced personnel for various phases of the work, and by providing certain experimental and laboratory facilities in the new experimental protein processsing plant and laboratory, now under construction near UCLA. Therefore the largest demand for funds from AID will be for expenditures in soft currencies.

1.4–2. *Cruzeiro Costs for Brazilian Personnel and Office Expenses.* Among Brazilian personnel there will be 7 on the permanent professional staff, about 30 on the semi-professional level and 25 on the non-professional level. The direct payroll cost for this personnel is estimated at cruzeiros equivalent to $83,000 per annum. Office space, office supplies, salary expenses and other miscellaneous expenses will raise this to about $100,000 annually.

1.4–3. *Cruzeiro and Dollar Costs for Laboratories, Clinics and Equipment.* Laboratory equipment is estimated to cost about $18,000.00. The equipment for

[1] Processes and Problems of Industrialization in Underdeveloped Countries. Page 17. The figure of 15% is derived from 57% in age group 15–64, leaving approximately 42% in 0–15.

the central clinic in Crato and the two subsidiary clinics in Juazeiro and Barbalha or other specialized equipment are estimated to be about $6,000.00.

Of the total amount, about 75% or $18,000.00 is estimated to be available nationally for cruzeiros, the remainder requiring dollar expenditures. The proper preparation of space, such as tilling, installing proper plumbing and lighting, etc., is estimated at $10,000.00 in cruzeiros. Thus, this cost which will be a one-time expenditure, will approximate $28,000.00 in cruzeiros and $6,000.00 in dollars.[2]

1.4–4. *Cruzeiro Costs for Associated Research Program.* The research program will be tied in with the University of Ceara as well as with UCLA. It is envisioned that two research fellows, either post doctoral or working on doctoral dissertations, one Brazilian who might later become permanently attached to University of Ceara faculty, and the other from UCLA would be in residence at the program site. This implies that one Brazilian nutrition researcher would be working and studying in U.S. at UCLA at a cost including transportation of $6,000.00 in U.S. dollars; one Brazilian researcher working in Cariri at a cost of $5,000.00 in cruzeiros; and one UCLA research fellow working in Cariri at a cost of $3,750.00 in dollars and $1,825.00 in cruzeiros. To the personnel costs should be added about $5,000.00 in special research equipment costs, comprised of $3,750.00 in cruzeiros and $1,750.00 in dollars. The total costs for the research fellow program would amount to $10,575.00 in cruzeiros and $11,500.00 in dollars.

1.4–5 *Cruzeiro Cost of Protein Supplement.* The cost per child per day is calculated as $0.00925; that is, less than one cent per day. The annual cost will be, for 365 days per year, $60,500.00 in cruzeiro funds. This includes soluble soy flour, sugar, flavoring and vitamin-mineral fortifiers.

1.4–6. *Cruzeiro Cost of Distribution Equipment.* One 2½ ton truck will be required with an appropriate tank for gross distribution, about 20 hand propelled carts, as well as drinking cups and other small miscellaneous equipment. The cost of this equipment is estimated to be $13,000.00 in equivalent cruzeiro funds.

1.4–7 *Total Cruzeiro Costs.* The foregoing estimates amount to a cruzeiro funds requirement equivalent to $154,825.00 annually plus $31,000.00 in nonrecurring costs for the first year. These are presumed to derive from PL 480 funds in Brazil. For the five years over which the program is planned, the total cost comes to $805,125.00, in cruzeiros.

1.4–8 *Dollar Costs.* The total dollar costs are estimated to be $131,000.00 for the first year, and $125,000.00 per year thereafter. The annual load for AID would be $59,600.00 and for MFM Foundation $65,400.00. However, AID would expend an additional $6,000.00 in nonrecurring costs the first year. These costs are distributed among technical support personnel who will set up the program in the Cariri; train Brazilian personnel to take over the operation of the program; and who will maintain control and provide periodic evaluation.

1.5 *Participation by the Meals for Millions Foundation.* The program calls for MFM to accept joint responsibility with UCLA for policy making and overall program direction and to accept specific responsibilities for the following costs associated with implementing and directing the program:

a. Provide the Program Director, paying his salary and overhead.

b. Provide a technical short-term consulting staff to be comprised of six consultants and to pay their state side salaries and overhead both when serving in the U.S. and in Brazil, but not paying their overseas salaries, per diem, or travel.

c. Provide two technicians at 30% time for food formulation and testing and for developing and improving food processing techniques, paying their salaries and overhead costs.

d. Provide an administrator 50% time and full time secretarial support, paying their salaries and other costs.

1.6 *Participation by UCLA.* The program calls for UCLA to provide the chief investigators for the program—one from the School of Public Health and one from the Department of Engineering. These same UCLA staff members will serve on the Policy Committee jointly with designees of MFM.

1.7 *Participation by AID.* At its discretion AID may designate a representative to serve on the Policy Committee.

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[2] Manual for Nutrition Surveys—Interdepartmental Committee on Nutrition for National Defense, May 1957. Note cost estimates are corrected to current in Brazil by applying a 50% correction factor.

1.7.1 The program budget calls for AID to pay all cruzeiro costs indicated in Section 1.4–7 above and the following dollar costs:

a. Salaries and overhead at 15% time for the two chief investigators to be provided by UCLA.

b. Travel, per diem, related expenses and salaries for overseas work of the consulting staff but not overhead, which will be absorbed by MFM.

c. Expenses for the Brazilian research fellow when studying in the USA.

d. Dollar expenses for the UCLA research fellow while in Brazil.

e. Dollar costs for laboratory equipment not available in Brazil on cruzeiro funds.

2. PURPOSES OF THE PROGRAM

2.1 To set up and conduct a pilot operation consisting of a daily feeding program of supplementary protein for all the children of the pre-school age in a given area.

2.2 To compare the growth and health of children who are being fed with supplementary protein with that of children in other parts of the State of Ceara, for example, in the favelos of Fortaleza, in the town of Sobral and in other states of the Northeast who consume only the customary diet of the area.

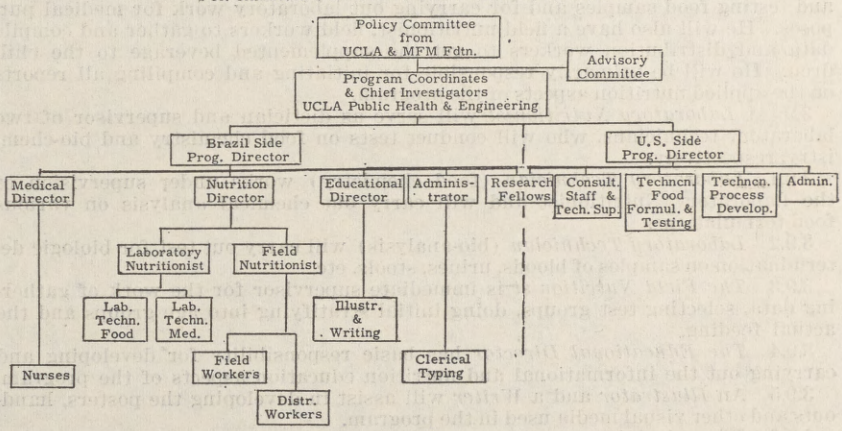
2.3 To demonstrate the efficacy and potential of cheap protein supplements to the population of the tri-city area, thereby encouraging them to extend the use of such supplement by adding it to the daily diet of the whole family.

2.4 To demonstrate to Brazilian health authorities the possibilities and desirability of introducing high protein supplements on a mass basis within a community.

2.5 To demonstrate the possibilities and feasibility of locally growing, processing, and marketing a high protein supplement under auspices of small private enterprise.

2.6 To "debug" the program before formalizing it for adaptation and use elsewhere in Brazil and in other parts of the world where protein malnutrition is a serious problem.

ORGANIZATION CHART: PILOT PROTEIN SUPPLEMENTATION PROGRAM
FOR CHILDREN 1 THROUGH 6 YEARS - NORTHEAST BRAZIL



3. ORGANIZATION

General

The organizational structure and relationships can be seen graphically in the attached functional chart. The basic program organization is divisible into two part, the Brazilian side, whose costs can be met in cruzeiros, and the U.S. side, which requires dollar expenditures.

3.1 *The Policy Committee* will consist of six representatives from UCLA and MFM Foundation who will have competence in the major program efforts, such as Medicine, Nutrition, Education and Administration. Its functions will be to effect policy guidance and general program evaluation.

3.2 *An Advisory Committee* consisting of experts in the various related fields will provide the professional and technical depth needed to give program guidance.

3.3 *Two Program Coordinators from UCLA* will serve as chief investigators and will assure that results are coordinated with other on-going University programs, such as "Project Brazil."

Operational Level (U.S. side).

3.4 *The Program Director* from the U.S. side will be charged with execution of the program and general supervision of its operation. Working with the help of a small administrative staff of one or two persons and short-term consultants, he will facilitate and supervise the work of the Brazilian counterpart who will be field director. He will also have at his disposal the facilities of the Meals for Millions experimental plant and laboratories for formulating and testing of supplemental mixtures and for developing appropriate food processing techniques suitable for adaptation in the Cariri.

3.5 *Research Fellows*: An exchange program will be set up using Brazilian and U.S. college graduate students doing related field work in conjunction with the project. Study will be for a period of about one year and will include an intensified orientation period at the MFM experimental plant and laboratory.

(Brazilian side).

3.6 *The Brazilian Program Director* will be the counterpart of the U.S. Director and will work under his immediate supervision. The Brazil Program Director has responsibility for supervising the entire field operation. His staff will consist of various technical program directors and an administrator. He will also be assisted in carrying out his job by short-term consultants in various specialities as well as through visits of U.S. program counterparts who will assist in initiating the various program elements and will make periodic visits to evaluate its progress and effectiveness.

3.7 *The Medical Director* with the help of two nurses will carry out examinations of the test group and make initial and subsequent medical evaluation and provide general clinical supervision, as appropriate. He will be in charge of the clinics. (One central clinic and two subsidiary clinical facilities).

3.8 *The Nutrition Director* is concerned with implementation of the controlled feeding program. He will be assisted by laboratory staff for analyzing and testing food samples and for carrying out laboratory work for medical purposes. He will also have a field nutritionist, field workers to gather and compile data and distribution workers to get the supplemented beverage to the children. He will be primarily responsible for initiating and compiling all reports on the applied nutrition aspects of the program.

3.9 *A Laboratory Nutritionist* will serve as dietician and supervisor of two laboratory technicians, who will conduct tests on food chemistry and bio-chemistry, respectively.

3.9.1 *Laboratory Technician* (food chemistry) works under supervision of the Laboratory Nutritionist and will carry out chemical analysis on various food formulations.

3.9.2 *Laboratory Technician* (bio-analysis) will carry out test for biologic determination on samples of bloods, urines, stools, etc.

3.9.3 *The Field Nutritionist* is immediate supervisor for the work of gathering data, selecting test groups, doing initial stratifying into age groups and the actual feeding.

3.9.4 *The Educational Director* has basic responsibility for developing and carrying out the informational and nutrition education aspects of the program.

3.9.5 An *Illustrator* and a *Writer* will assist in developing the posters, handouts and other visual media used in the program.

3.9.6 *The Administrator* will work under supervision of the Program Director and will carry out all administrative record keeping and housekeeping duties and be responsible for all expenditures such as payroll, expenses, clinical supplies, etc. He will cause proper accounts to be maintained and present a monthly financial statement.

3.9.7 *Nurses, Field Workers, Distribution Workers* and *Clinical Staff* will be employed and perform duties relative to their respective departments, as required.

3.9.8 *Research Fellowship Program* will be under the direction of the Program Directors who coordinate closely with the University of Ceara and UCLA, as appropriate.

BUDGET: PILOT PROTEIN SUPPLIMENTATION PROGRAM
CHILDREN 1 thru 6 YEARS - N.E. BRAZIL

	Meals For Millions			AID				AID-Cruzeiros		
	Salaries	Overhead	Materials	Salaries	Overhead	Travel	Equipment	Salaries	Expenses	Equipment & Materials
Program Director	$15,000	$ 5,250	$.	$	$	$	$	$	$	$
Chief Investigators 2 Professors 15%				6,750						
Consultants 6 in U.S.	9,000	3,150	228							
Consultants 6 in Brazil		14,490		41,400						
Technician - Food Formulat. & Test.	3,000	1,050								
Technician - Process Development	3,000	1,050								
Administrator 30% X 8400	2,520	882								
Secretary	5,000	1,750								
Research Fellows 3				6,000	3,600	1,850		5,000	1,825	
Laboratory Equip. non-recurring							6,000			18,000
Food										60,000
Brazil Payroll								83,000		
Special Research Equip.										5,000
Distrib. Equip. non-recurring										13,000
Total - 1st year	$37,520	$27,622	$ 228	$54,150	$3,600	$1,850	$6,000	$88,000	$ 1,825	$96,000
Less non-recurring							6,000			31,000
Annual budget 2nd thru 5th yrs.	$37,500	$27,622	$ 228	$54,150	$3,600	$1,850		$88,000	$ 1,825	$65,000
Total 5 Year Budget	$187,600	$138,110	$ 1,140	$270,750	$18,000	$9,250	$6,000	$440,000	$ 9,125	$356,000
Total 1st year		65,370			65,600				185,825	
each additional year		65,370			59,600				154,825	
5 year program		326,850			304,000				805,125	

Budget—Annual payroll: Brazil side

[In dollar equivalent of cruzeiros]

Brazil payroll costs	Per person	Total annual
1 program director	$6, 000	$6, 000
1 medical director (M.D.)	6, 000	6, 000
1 nutrition director	4, 000	4, 000
1 educational director	4, 000	4, 000
1 laboratory nutritionist (biochemist)	3, 000	3, 000
1 field nutritionist	3, 000	3, 000
1 project administrator	3, 000	3, 000
1 laboratory technician, food chemistry	2, 500	2, 500
1 laboratory technician, bioanalysis	2, 500	2, 500
4 nurses	1, 500	6, 000
20 social workers (secondary school level of training)	1, 000	20, 000
20 distribution workers	700	14, 000
4 clerical workers	1, 000	4, 000
2 writers and illustrators	2, 500	5, 000
Total		83, 000

5. MECHANICS OF DISTRIBUTION

5.1 *Quantity per Child:* At least two studies of metabolic patterns [3] indicate that children retain nitrogen and grow normally on protein intakes comparable to the theoretical requirement as presented by Hegsted, et al (1946). If these requirements are increased by 50%, then the recommended requirement remains constant at 21 grams of high biological value protein daily for ages 1 to 6 years. Presumably the effects of increasing body weight and size is just offset by the decreasing demand to maintain growth. On the other hand the Recommended Daily Dietary Allowance of the Food and Nutrition Board, National Research Council (1953) indicates an approximate linear relationship between ages 1 to 6 with 35 grams at 1 year and about 55 grams at 6 years. Thus the protein requirement indicated in the latter source is about 2 times the former source.

[3] Symposium on Metabolic Patterns, 1960 ; and Bartlett, 1926.

Because of the lack of precise agreement as to the quantities of protein needed and recognizing that the biological value of the protein may have been assumed at a higher value in the first recommendation, whereas the latter may have provided a safety factor to take account of varying qualities of protein in the normal diet, we will set the desired supplement at 33% of the recommended daily allowance of the Food and Nutrition Board at 1 year of age (35 grams, or 12 grams daily.) This supplement will be held constant on the basis that as the child grows older he is likely to ingest a greater variety of foods, thus reducing the size of the required supplement. At the age of 6 years, using the Food and Nutrition Board recommendation of 55 grams, the 12 grams daily would constitute about 22%. Relative to the first recommendations based on protein of high biological value this amount would equal roughly one half.

5.2 *Quantity per Serving:* Soy flour as normally produced is approximately 50% protein. With the exception of methionine it is well balanced in essential amino acids. If it is fortified properly with essential vitamins and minerals which are specifically lacking in the area and with additions of methionine, it has a high biological value. Therefore rations per child of 24 grams of soy flour per day would provide the supplementary amount of 12 grams of proteins. In order to facilitate better utilization of the 24 gram ration it would be divided into two 12 gram servings, one in the forenoon and one in the afternoon.

5.3 *Details of Distribution:* To insure inclusion of all children in the prescribed age bracket, 1 to 6 years, hand propelled carts, appropriately decorated and equipped with musical bells after the fashion of "good humor" wagons, would dispense the protein supplement in liquid form, cooled slightly, sweetened and flavored to suit the taste of the local children. A distributor with his cart would follow a prescribed route in a specified time schedule. At each stop, the children of that immediate neighborhood would queque up to receive their allotment.

5.4 *First Level of Distribution and Control:* The beverage distributors would carry reusable, factory-washed cups, enough for each child on his route in the specified age bracket. These cups would be of aluminum and anodized in a distinctive color pattern. This uniqueness would avoid the possibility of obtaining additional cups from local stores and would discourage using them for other purposes. In addition each week every mother would receive an allotment of tickets, one for each serving. Each child would present his ticket and receive a filled cup which he would return when empty. The tickets would be coded so that consumption records could be maintained. Irregularities could be caught by the appropriate field worker and straightened out.

5.5 *Manpower and Equipment Needed for Distribution at Point of Consumption:* It is estimated that the distributor could serve about 6 children per minute. At an average corner it is assumed that children up to the mid block in each of the four directions would respond to the signal. This would amount to approximately 100 families. Assuming 2 children in this age bracket in the average per family, each stop would draw about 200 children. The service would require 35 minutes. About 5 minutes is needed to move to the next location. Allowing 20 minutes of set-up time at the start and 20 minutes to clean up the cart and prepare for the next cycle, it follows that in each 4-hour period the distributor could serve about 1,000 children. For 18,000 children, served twice daily, approximately 20 distributors and carts are needed.

5.6 *Approximate Formula:* The exact formula will be worked out in the MFM laboratory and tested experimentally. For present purposes assume the formula per serving to consist of 12 grams of soluble soy flour with an appropriate amount of sugar (about 8 grams) and flavoring to provide consumption motivation, dissolved or suspended in 80 cc. of water.

5.7 *Size and Weight of Distribution Carts:* To provide for each cycle of servings the cart requires a capacity of 80 litres. If it is 40 cm. deep, it will be 40 cm. by 50 cm. inside dimensions. The weight of the liquid will be about 100 kg. It is estimated that the total weight of the cart loaded would be about 150 kg. including provision for ice.

5.8 *Mechanics of Secondary Level of Distribution:* The total liquid to be distributed per cycle will be about 1600 litres or approximately 2 metric tons. A tank truck of relatively small size will leave the factory and unload the necessary amounts in secondary storage tanks at each of the 3 distribution centers in one round trip. The distributors will fill up from their tanks and proceed to their routes at the appointed times.

6. FIELD CONTROL

6.1 *Field Workers:* Twenty women field workers are proposed for carrying out the field work. The duties of a field worker would be the following:

6.1–1 Periodic visitation to each family with children in the program age bracket in the specific assigned area of the tri-city assigned to her.

6.1–2 Surveillance of the distribution activity in assigned area.

6.1–3 Checking up on the consumption of the supplementary protein food.

6.1–4 Observing any unusual signs of illness among the children in her jurisdiction.

6.1–5 Distributing the weekly rations of tickets to the mothers.

6.1–6 Preparing weekly routine reports.

6.1–7 Preparing quarterly general reports.

6.1–8 Assuming general responsibility for the proper functioning of the program in assigned area.

6.2 *Periodic Visitation to the Homes:* It is estimated that approximately 10,000 families will be involved. It is assumed that half of each working day will be taken up with home visitation and direct contacts with the mothers. During a visit a two-way exchange would take place. From the field worker to the mother would be an educational process utilizing materials and methods worked out jointly by the Nutritional Director and the Educational Director. From the mother and by observing the children, the field worker would obtain information as required by the Public Health Director and Medical Director.

6.2–1 The field workers will perform their social work and nutritional observations under the direct supervision of the Nutrition Director.

6.2–2 The field workers will perform their educational duties under instructions issued by the Educational Director by methods consistent with other aspects of field work as established by and with educational materials prepared by that Director.

6.2–3 Each field worker will have approximately 500 families within the area of her jurisdiction. She can visit each family on a 3-month cycle at a rate of 8 families per day, thus covering all children assigned to her in each quarterly report. It is assumed that each morning could be devoted to family visitations, the afternoons being available for other assigned work.

6.2–4 During the morning visitations the field worker will have an opportunity to observe the distribution of the protein supplement to the children in her area. She will look for any irregularities in the procedures. At random intervals during the afternoon distribution as set by the Nutrition Director, she should make spot checks in greater detail with findings noted on official forms. She will pay special attention to the completeness with which the children consumed the food and attempt to determine reasons by consultation with mothers when failures to consume food occurs.

7. NUTRITIONAL CONTROLS AND SUPERVISION

7.1 *Staff.* The staff for the nutritional activity will consist of a Nutrition Director who will have immediate responsibility for the combining of the data and preparation of all reports on the nutrition aspects of the program. He will be assisted by a laboratory nutritionist for tests in experimental work who will have the services of two Laboratory Technicians, one working with food chemistry and the other doing bio-analyses on bloods, urines, stools, etc. The field projects will be under control of a Field Nutritionist who will supervise the work of gathering data, selecting test groups and doing initial stratification. Field nutrition workers will carry out the feeding program and the gathering of basic data.

7.2 *Procedures.* In cooperation with the Medical Supervisor, who will do the examinations, the child population will be stratified into 5 different age groups and into 3 levels of income which are middle class, "high poor," and "low poor." Therefore about 15 stratifications with about 40 children in each group will make a total test group of about 600 children. Section 9 describes the periodic examination and sampling of the groups.

7.3 *Record Control.* A recording routine will be devised for field workers consisting of standardized check-off lists and observation sheets. Ticket books containing sheets will be distributed by nutrition workers weekly for children to obtain the supplemented beverage. Particular care will be taken and separate

codification made for the sample group. A summary of the results will be made weekly by the Field Nutritionist. Routine correlations will be made by the Nutrition Director and Medical Director between the nutritional observations and the results of medical examinations.

7.4 *Food Quality Control.* A continuous control will be maintained on the production of the food supplement. This will be carried out at the laboratory through random field sampling of the product and by running a continuous quality control sample on the production.

8. COMMUNITY EDUCATIONAL SUPERVISION

8.1 *Staff.* The Brazilian Educational Director will have basic responsibility for developing and carrying out the nutrition education aspects of the program. This operation will be set up initially and supervised periodically by outside consultant assistance from the United States. The Educational Director will be asisted by writers and illustrators who will develop the primary visual educational material, such as posters, pictures, pamphlets, etc.

8.2 *Testing of Educational Materials and Techniques.* All educational material will be carefully developed and tested for its effect before put into use. The techniques to be developed will be related to the particular town or village population affected by the program.

8.3 *Basic Philosophy.* The basic philosophy will be predicated upon the assumption that "the way to a child's stomach is through the mind of the mother with the recognition that the way to the mind of the mother is often blocked by the mind of the grandmother." Every attempt will be made to use educational techniques which will anticipate the way in which the mothers or other local townspeople are actually thinking and believing.

8.4 *Approach to Children.* The basic approach to the children will be to present a tasty, attractive, high protein beverage anticipating their psychological-emotional reactions. It is a methodology amply validated by soft drink preferences throughout the world and the successes of the "Good Humor man" approach in the United States and Latin American cities. The educational effort will take advantage of the quasi-social event when the distributor of the protein beverage goes through his territory, ringing his bell for the children to queue up with their tickets for their tasty beverage. They will be taught by various means that the beverage is not only tasty but will make them "big and strong."

8.5 *Other Media.* Radio spots will be used throughout the areas emphasizing the esthetic and nutritional value of consuming the food. The broadcast will be designed to appeal primarily to parents, particularly the mothers. Educational films will be shown at public gathering places on a regular schedule which will be both entertaining and designed to get across the basic nutritional education.

9. MEDICAL SUPERVISION

9.1 *Staff.* Medical supervision will be carried out by a physician who will serve as Medical Director with the help of two nurses and will carry out initial and periodic medical examinations on the test group.

9.2 *Medical Examinations of Test Group.* Medical Director will work with the Nutrition Director in stratifying the sample of the test group by age and levels of income. Regular examinations on these will be carried out four times a year. A cycle of 10 children will be examined daily based upon 60 working days in a 3-month period. Thus, 600 children will be sampled in 15 stratifications during a year's time.

9.3 *Random Sampling Non-Test Group.* In addition to test group sampling, random samples will be made daily from children other than the test group. In this manner, 3 random samples will be examined daily for the 250 working days in the year. This will give a random sample of 750 children to be compared with the 600 children in the test group sample.

9.4 *Results of 5-Year Observation Period.* Using the sampling manner described above, a large base will be established for making a 5-year growth observation. The unique aspect of this is that height and weight data can be measured and compared for children age 1 year who have been fed a nutritional supplement with children ages 2 to 5 years who have received the supplement for the same period of time. By the end of the 5th year we will have the comparative study of growth factors for children who have received the nutri-

tional supplement for a full 5 years as against the results obtained in those receiving the supplement for durations varying from 1 to 4 years. In other words, the results of supplemental feeding for a sustained period can be compared with those recipients of varying ages receiving the same supplementation for varying periods of time.

10. PROGRAM COORDINATION AND EVALUATION

Will be carried out on a continuing basis by visiting consultants with specialized interest in the various program activities, by the small permanent staff group in the U.S. who will maintain constant contact and compile reports, and by the chief investigators who will serve as program coordinators. These consultants will not only assist in setting up the program, but will facilitate its operation through their respective Brazilian counterpart. On subsequent visits, two a year are planned, they will evaluate particular aspects of the program and advise on its future development. Periodic evaluation reports comprehending all of the various field reports will be written and reviewed by the Policy Committee and Advisory Committee, as appropriate.

11. TECHNICAL EDUCATION PROGRAM

The program has as one of its basic objectives the training of a prepared local manpower source competent in the various technical skills and professional and managerial disciplines. This will be accomplished through on-the-job training techniques in which local Brazilian counterparts, after an initial period of preparation, will assume program responsibility under the guidance of a specialized consultant counterpart from the U.S. In addition Brazilian research fellows will be trained in the U.S. at UCLA and the MFM experimental plant and laboratory to return to their country and as faculty establish a development training program at the University of Ceara, an important focal point in Brazil's Northeast. Others will be prepared as technicians, field workers and program directors who can be used elsewhere in Brazil in similar development schemes.

11.1 *Elimination of Outside Aid.* At the expiration of U.S. participation in the program, sufficient local competence will be available to obviate the need for outside aid.

11.2 *Strengthening of Faculty, University of Ceara.* During the duration of the program, visiting consultants will also visit the University of Ceara and help establish it as an educational focal point of development programs in Northeast Brazil. Graduate fellows will be trained in this country to return as faculty at that University. As the program progresses and its curriculum is developed, local scholarships will be given for study and research at that University so that its training program becomes well established and self-sufficient.

12. PREPARATION OF REPORTS (DESIGN OF EXPERIMENTAL PART OF PROGRAM)

All reporting forms will be developed before actual work begins. Blank check-off forms will be worked up and printed beforehand. Standard formats for charts and tabular information will be used in daily and periodic reporting. The day-to-day routine will be outlined and controlled through such check lists and summarized through the reporting method. The periodic reports and check lists will then serve as a basis for evaluation and the final report. In this manner progress reports will be designed at the beginning by establishing all the necessary "bench marks." Such procedure will from time to time be redesigned to provide for more effective evaluation.

A tentative proposal on the above project was made in June of 1965, as a basic plan of operation for the experimental part of the pilot feeding program.

The tentative proposal was reviewed by various officials of the U. S. Public Health Service; National Institutes of Health; as well as the Department of State, Agency for International Development. As a result of the comments and observations made by these, we have been able to prepare the following supplement, which attempts to give further explanation to various aspects of the program as well as to answer specific questions which were raised. It is anticipated that these and other modifications will be incorporated into the new proposal.

1. Why is only one product discussed in the proposal (i.e., only one form of the protein supplement)?

Limitations imposed by traditional food habits

a. We recognize that foods must be formulated to suit the traditional tastes of the population or of a sector of the population. This imposes limitations (or constraints) on the choice of formulations among the many which might be considered.

Reliable measurements

b. Of the limited group of formulations suited to the tastes and mores of this social group, we preferred those that would facilitate reliable measurements on a substantial population.

Acceptable results

c. Only if the measurements are reliable will the results be accepted and have the desired influence on a world-wide scale.

Advantages of a beverage

d. A beverage, sweetened and flavored, can compete favorably with the well-known soft drinks which are popular in the most remote areas throughout the world. It can compete on the basis of sweetness, variety of flavors, coolness, ease of consumption, and the natural preference for liquids over solids in the warmer climates because of the higher refreshment value.

Selection of the beverage form

e. For the above reasons and because of its particular suitability for the vulnerable age group at whom the proposal is directed, the formulation described in the proposal was selected as the primary product form. However, it is also intended to experiment with a wide spectrum of product forms which would have consumer appeal to various sectors of the population, rural and urban, at various age levels, and different economic strata. We are currently carrying out programs or actively supporting programs in which varied forms of consumer products are used such as noodles, bread, cookies, gruels, packaged soups, artificial hamburger, milk substitutes, infant foods, etc. These are based on vegetable proteins from soy, peanuts, bengalgram, coconut meal, sesame and cottonseed.

2. Why is only one method of distribution described?

Method commonly known in area

a. We recognize that many schemes could be devised to distribute the product. However, the schemes of distribution must be adapted to and be consistent with the customs and habits of the society. Distribution of water and milk, such as there is, has universally and through the ages been distributed by peddlers using hand drawn carts or donkeys. In the specific towns of Crato, Juazeiro and Barbalha, the region contemplated in the proposal, one finds many peddlers with their carts distributing popsicles, soft drinks and confections as well as other goods. Milk and water is distributed house-to-house by similar vendors. The same can be found in virtually any Latin American town from the smallest to the largest.

Method enabling control

b. The proposed method of distribution enables tight control over the experimental conditions while being consistent with the customs of the subject society. As indicated in the foregoing, the reliability and creditability of the measurements are important if the results are to be accepted and implemented elsewhere.

Direct access to target age group

c. The pre-school age group is at the same time the most vulnerable to protein malnutrition and the most difficult to reach in any supplementation program. This method of distribution was selected because it appears to be the most direct and foolproof way to reach the subject age group. While the proposal described only the distribution for the experimental part of the program, it is intended to use this as a basis for an educational program and as a platform for developing full-scale marketing and distribution in a commercial sense.

3. How will the product be put on a commercial basis?

Pre-planned, tied-in with related industrial and market development

a. As a part of the ongoing small industry development program in the Cariri region, the company, IMOCASA, was established in Crato under local private ownership and control. IMOCASA is about a $400,000 enterprise engaged in storing and milling corn and producing a complete line of packaged consumer products with animal feeds and corn oil as by-products. In the early stages of planning this company, feasibility studies were made to determine whether the production of Multi-Purpose Food should be included in its product line. The answer was affirmative if a market of sufficient size could be developed. It was foreseen that the market would not need to be overly large to be reasonably profitable. For example, production of one ton per day of a high protein supplement from vegetable sources selling at prices below American prices would be at or above the breakeven point.

The possibility of producing the high protein product was kept in mind in planning the layout and in selecting equipment. For this reason, with a small amount of additional equipment, IMOCASA can begin the production of the protein supplement. As a part of the general program their key personnel were trained in the United States, and there was an opportunity, both in Brazil and in the United States, to give them orientation relative to producing this product. While some production difficulties are almost inevitable even under the best of circumstances, we believe that with the investments already made by us and by Brazilian private interests (Imocasa) in preparing for the production of this product that such difficulties will be minimal.

Utilization of indigenous raw materials

b. Concurrently with planning the production facility, the question of raw materials was considered. An extensive study was made by one of the technical staff of the Foundation stationed at the University of Ceara, of utilizing cottonseed meal and comparing with soy on the basis of social and biological acceptability and economic suitability. It appeared that soy would be preferable. A recent Harvard Business School study corroborates the economic advantages of soy. They list per pound of useable protein the following:

Soy flour	0.11
Fish meal	.14
Cottonseed flour	.20
Wheat	.30
Nonfat dry milk	.60

The Foundation then sent seed varieties for test plantings in the region. The owners of the largest farm in the region (who are modest stock holders in Imocasa) undertook to plant the seed and obtained excellent yields. As no viable market for soy exists at the present time in the region, they have continued on an experimental basis only. However, they and other farmer stockholders are willing to plant sufficient soy for Imocasa's production needs.

Possibility of preliminary soy grit importation

c. Citing the *Soybean Digest*, November 1965, (USDA Reports), Brazil's current crop of soybeans is estimated at 16.6 million bushels which is a record production and 50% above last year's outturn. Therefore domestic sources of soy are available to meet Imocasa's needs until local production is realized. It is also *possible to use soy grits* from the United States if this is a convenient way of meeting some of the major costs of the program. However, the importation of soy or soy grits should be such as *to complement* local production rather than discourage it.

Consumer acceptance

d. In our studies in this region previously cited, the acceptability of the product was easily demonstrated to be good. A major item of food is toasted Manioca flour (cassava) and is eaten by all members of the family. It is served at the table and is placed in heaping quantities over vegetables, rice, beans and in soups. This food is primarily starch and fiber and while it adds to the calorie content of the meal, it provides essentially no other nutrients. Soy-based multi-purpose food (MPF) which was used in these tests was easily substituted for the manioca flour with a high degree of acceptability. This is one form of the product

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which would present little consumer resistance. Other forms in which this supplement could be used although not yet market tested in this particular region, are macaroni, spaghetti and other pasta products, beverages, powdered soups, cookies, all of which have been tried in other areas of Brazil and in other Latin American countries. (The Foundation has had similar experiences in Far and Middle Eastern countries). Pastas are popular in the Cariri. Therefore a line of pasta products fortified with as much as 25% soy, enriched with vitamins and minerals suited to the region, is considered as a good candidate for early commercial production. Other products can be added as the market develops.

Market development

e. It is not intended to imply from the foregoing that market development is easy. Indeed it is the most critical and difficult factor. This is so because the ultimate consumer does not perceive the actual need for the product. If, for example, we were to present to a typical person of the Cariri a choice between multi-purpose food and manioca flour, we might convince him that the taste of the two was quite similar and that either one could be eaten as a topping on other foods. He would then want to know why he should change and, moreover, upon learning that the price was higher he would be even less inclined to change. The idea of nutritional values in terms of proteins is too abstract. It is meaningless to him until he has been subjected to an intensive educational program or what we more popularly know as advertising. For the educational program to be meaningful the product must be readily available through the normal channels of distribution; and for it to be effective the educational program must reach virtually every family. The proposed program has considered both of these factors. Almost every family in the region has at least one child of pre-school age. Therefore nearly every family feels the impact of the feeding activities and becomes accessible to the educational side of the program. For this reason we have stressed the importance of the educational function in the proposal. We believe that the combination of demonstration and education will create an awareness of and interest in the products and will eventually provide the basis for a strong market.

The price of achieving a self-sustaining production and market for high protein fortified foods is the cost of a demonstration program reinforced by a massive educational effort. The price may seem high, but it is far less than the cost of the continuing burden of relief measures.

4. How will the University of Ceara be strengthened in nutrition and food technology?

This program will provide a training ground for faculty, other staff members and students of the University of Ceara. The proposal contains an organization chart indicating the preponderance of Brazilian personnel who would be associated with the University of Ceara. It is proposed that top level guidance be provided by staff and consultants of Meals for Millions Foundation. It is further proposed that research and academic back-up be provided by relevant faculty or departments at UCLA. This is particularly appropriate because UCLA has now had a long and varied experience of cooperation with the University of Ceara and there are many personal bridges of friendship between the two institutions.

Relative to strengthening the University of Ceara in the specific aspect of food technology involved in producing, formulating and testing high protein food supplements, the Meals for Millions Foundation will have available its experimental plant and teaching facility for training university staff.

Mr. LINSON. Mr. Chairman, may I make a further comment?

Senator BARTLETT. Surely.

Mr. LINSON. At yesterday's hearing there was testimony offered the committee about the cost of an experimental plant. I have built a fish reduction plant. I have operated a fish reduction plant. I have had practical experience at firsthand. The suggestion that $2 million is required for an experimental plant in my own opinion is definitely out of line.

I have examined carefully the figures prepared, the estimates prepared at College Park by the Bureau of Commercial Fisheries. I

just want to say that I consider them entirely realistic, if anything I would say that they are inclined to be a little bit on the liberal side.

If an experimental plant for our purposes can't be built within an overall cost of $1 million, we better abandon the whole idea.

Senator BARTLETT. This is good news.

Mr. LINSON. I have great respect for the people at College Park, and as I say, I considered their figures quite realistic.

Senator BARTLETT. Thank you.

Mr. LINSON. Thank you, sir.

Senator BARTLETT. Now we will go back to the start and asked the reporter to place a copy of S. 2720 in the record at the outset of the hearings. Likewise, a report from the Department of the Interior endorsing the legislation, but urging one plant instead of the proposed five.

We now have a report from Dr. Hornig, Director of the Office of Science and Technology, in the Executive Office of the President, favoring the legislation. That will be placed in the record.

Here is a letter from the Public Utilities Commission of the city and county of San Francisco, signed by James K. Carr, general manager of public utilities, directed to Chairman Magnuson, endorsing the bill.

All of these will go into the record.

There arrived from Juneau, Alaska this morning a telegram from Governor William A. Egan, strongly supporting the passage of S. 2720.

And here is a statement from the General Foods Corp. supporting the bill.

We have a letter from Viobin Corp. which will be placed in the record.

A resolution from the city of Seward, Alaska, favorable, and they don't even ask that the plant be located there.

Another one from the Sport Fishing Institute to Chairman Magnuson. That will be placed in the record.

(The following was received to be made a part of the hearing record:)

STATEMENT OF GENERAL FOODS CORPORATION RESEARCH CENTER, TARRYTOWN, N.Y., ON SENATE BILL S. 2720

General Foods Corporation supports the objectives of S. 2720: to authorize the Secretary of Interior to develop, through use of experimental and demonstration plants, practicable and economic means of production of fish protein concentrate for human consumption.

We believe that some minor amendments, which are included in this statement, will help eliminate any possibilities of ambiguity regarding the purposes of this bill.

Enactment of this proposal into law will be a major step forward in the struggle to establish and maintain adequate nutrition for the rapidly expanding world population—a struggle in which our nation is already taking a leading role. This proposed legislation provides for a realistic cooperation between government and private industry; this is a combination which many times has demonstrated its effectiveness as an efficient and economic method of achieving long-range humanitarian objectives.

We support this proposal for three major reasons:

First—General Foods Corporation, as one of the nation's leading food companies, has a major interest in world nutrition and health. We presently are cooperating with a number of governmental agencies seeking ways and means

to feed the rapidly expanding world population. We are actively supporting the Food For Peace Program. Our president is a member of the National Advisory Commission on Food and Fiber. For a number of years, General Foods has actively participated in the Food Protection Committee of the National Academy of Science. This Committee's objective is to evaluate food technologies as they relate to public health.

We assist in the development of United State Department of Agriculture research programs by serving on the Utilization Research and Development Advisory Committee. We are presently engaged in research under contract with the National Institutes of Health on problems related to public health. We very actively support such non-governmental bodies as The Nutrition Foundation and The Institute of Nutrition Science and have made substantial contributions to several university nutrition study programs.

Second—we are engaged in an intensive research and developent program of our own. Our scientists are continually searching for new and different food supplies—for new sources of nutrition—for ways to supplement our existing food sources—for methods to help increase our own limited capacity to support a growing world population. This effort is compatible with out corporate goal: to furnish people with the best nutrition at the lowest price possible and a fair return to our stockholders. But at the same time this effort reflects our sense of responsibility to aid in the solution of pressing human problems.

Third—we possess a considerable body of technical information in the area of fish protein concentrate. We will be pleased to share this information with the Secretary of the Interior to help achieve the objectives of this proposed legislation.

As we interpret the bill, it would permit the Secretary of Interior to make a major advance in supplying an additional source of a highly nutritious and stable protein concentrate. The need for additional protein sources is well established.

The presently available supply of both vegetable and animal protein, as well as correlations of this supply against future needs and future availability, has been carefully documented by a number of skilled investigators from governmental agencies, educational institutions, and private industry. We have listed some of them in the Appendix to this statement.

The Bureau of Commercial Fisheries of the U.S. Department of Interior (in its Oceanography Program presentation to the Interagency Committee on Oceanography, Washington, D.C., Sept. 24, 1965) estimated the potential annual world fish supply to be as much as 500-million tons. This could yield annually nearly 100-million tons of fish protein concentrate (converted on a fresh-fish to fish-protein-concentrate ratio of 5 to 1). These 100-million tons of fish protein concentrate would provide a world population of 50-billion people with a generous one-half supply of the daily protein requirements of each person.

At the present time, there exists a number of laboratory processes for reducing whole fish to fish-protein concentrate suitable as human food. However, there is not available yet a process which has been proven on even a pilot plant scale. There is just *no* process which now could be used to design and construct a commercial plant which could produce substantial quantities of edible fish-protein concentrate.

This proposed legislation would provide experimental and demonstration production facilities. These steps are necessary before our modern technology can successfully start converting the sea's abundant supply of protein into food to nourish starving people around the globe.

In its present form this bill provides for disseminating information obtained from the first large-scale pilot production plant to private industry. In the final analysis, it will be private industry which can most efficiently produce and distribute this new food source to the people.

The experience and information obtained from the pilot plant proposed in this bill can then be used to:

1. Provide fish-protein concentrate which various governmental agencies can test for acceptability in those countries suffering from protein malnutrition.
2. Help develop the engineering data needed to plan and build a large-scale commercial production facility, and
3. Provide enough concentrate for further research and development by private industry.

Without detracting from the primary objectives of this proposed legislation, we would suggest minor amendments in the text. These are offered only to make certain that no ambiguity exists with respect to its purpose.

We suggest that the present language would permit the construction of yet another "fish meal" facility—fish meal being presently manufactured in large quantities for industrial uses—animal feeds, fertilizers, etc. We would propose adding to the enacting clause, at line 2 of page 2 of the text, the phrase "acceptable under existing legislation for human consumption."

We would propose to amend Sec 2. (a) by inserting after the phrase ". . . for the production of . . ." at line 6 of page 2 of the text, the word "such" and adding to the second sentence of this Sec. 2. (a) at line 10 of page 2, the phrase "acceptable under existing legislation for human consumption."

Engineers experienced in pilot plant construction have estimated that Sec. 3. of this proposed bill would provide sufficient funds for one such plant as described elsewhere, including: a typical waterfront location, special foundation construction, the special materials required in any facility preparing human food products, and the flexibility of operation and instrumentation called for in a development project of this type.

It is hoped that the Secretary of the Interior would complete the first of the plants authorized in this proposed bill before starting any additional facilities.

In summary: General Foods Corporation supports the objectives of S. 2720 and urges that it be favorably reported out of the Committee on Commerce with the minor amendments proposed.

APPENDIX

"Proteins, Their Chemistry and Politics" by Dr. A. M. Altschul, Basic Books, Inc., 1965, discusses on pages 179–207 the world protein food problem.

Proceedings of the Symposium on Proteins, American Chemical Society Annual Meetings, Atlantic City, September 11–14, 1965, give extensive information on the impending world protein food shortage and its implications.

"The State of Food and Agriculture 1961" by Food and Agriculture Organization of the United Nations, Rome 1961, presents a detailed presentation of world food supplies.

Committee on Agriculture, House of Representatives, Eighty-Ninth Congress, Second Session, February 14–18, 1966, testimony published in "Committee Print" March 23, 1966, highlights the seriousness of the growing world food shortage in the face of the rapidly increasing world population.

STATEMENT OF W. G. SALETIC, PRESIDENT, CONGRESS OF AMERICAN FISHERMEN, ABERDEEN, WASH.

My name is W. G. Saletic. I am president of the Congress of American Fishermen, an organization composed of some twenty fishermen's associations, unions and marketing cooperative. The Congress of American Fishermen was formed just over a year ago to further the protection and advancement of the American fisherman and his industry. I would like to speak about both today—"protection and advancement."

First of all, may I say that the Congress of American Fishermen is continuously appreciative of the excellent efforts made by Senator Warren G. Magnuson and the Senate Commerce Committee in furthering the cause of the American fishermen. Few national government leaders have had the foresight to recognize the value of the American fishery resource or the importance of strengthening America's ability to harvest. The understanding and support in this regard by the Commerce Committee chairman has been singular.

The hearing today concerns S. 2720 which provides for the construction of up to five experimental Fish Protein Concentrate plants and authorizes an appropriation of up to $5 million for that purpose. We are totally in support of this concept, and though our competence may not extend to the realm of experienced judgment as to the method outlined in the proposed legislation, we wish to be on record favoring any program which will hasten the day when adequate processing facilities for Fish Protein Concentrate will be available, not only so that we can begin utilizing the latent coastal fishery resources, but to enable the United States to better fulfill its world commitments to the hungry. We believe this legislation to be in the broad national interest.

Before discussing the processing needs, I would like to touch briefly on the position of the Congress of American Fishermen in regard to other facet of

CAF purpose, "protection" of the American resource. Regardless of the extent of processing facilities or harvesting techniques, we must have a substantial resource upon which to base these new fisheries.

Though the present Pacific Coast operations offshore by the Japanese and the Soviet Union are not including the Pacific Hake, we have very reason to believe that these nations covet this vast virgin resource and with the kind and quantity of operation which they employ, it appears as a very real threat. Last week in Seattle, some eighteen directors of the Congress of American Fishermen attended a one day emergency session to discuss some direction and course of action in light of the present foreign encroachment. In attendance, in addition, were two representatives of the Atlantic fishermen's associations, and I am pleased to report that they thoroughly concur in the course of action taken by C.A.F.

The Directors of the Congress of American Fishermen, realizing that the question of the Territorial Sea and Fishery Zones is now being well considered as separate in the question of Law of the Sea, feel that broad jurisdiction no longer presents a threat to the security of the United States as previously espoused by the U.S. Defense Department. It is our feeling, therefore, that the United States can now regard its rich coastal fishery resources in the light of what is best for their utilization and long-range conservation.

The CAF, therefore, has taken a position requesting the immediate establishment of a 200 mile fishery zone or the extent of the Continental Shelf, whichever is greater. Allowances are made for inclusion of the necessary Abstention Principle for protection of the anadromous resources, particularly North Pacfic salmon. Reference is also made to consideration of historic rights at historic levels and the appreciation of existing treaty agreements.

We recognize that the hearing today is not on the subject of jurisdiction and that this subject may be more properly presented at the hearings on Senator Bartlett's Twelve Mile Limit Bill scheduled next month in Washington, D.C., but we felt that protection of the Pacific Hake resource is an integral part of the program we are discussing here today, and wish that this short statement be included in the record. I also have with me copies of two resolutions adopted by CAF at last week's meeting; one commending the Commerce Committee Chairman for his far sighted three point action program annuonced just a week ago, and the second outlining CAF's 200-mile limit proposal. We would bow to the wishes and discretion of the Chairman as to whether they would be properly submitted for the Record at this time or provided to the Committee as information documents.

May I express the appreciation of the Congress of American Fishermen for the sacrifice on the part of the Senator in holding his hearing here in Aberdeen, thus allowing many more citizens to testify than would have been able to at the Washington hearings early next month.

In closing, may I say that it is our belief that had other representatives in the Congress had the wisdom and foresight of the Commerce Chairman and followed his leadership three years ago in the call for world Fisheries Conference, we would be in a far better position today to meet the present Soviet challenge to our resource.

Thank you.

PUBLIC UTILITIES COMMISSION,
City and County of San Francisco, May 13, 1966.

Hon. WARREN G. MAGNUSON,
U.S. Senate, Washington, D.C.

DEAR SENATOR MAGNUSON: Thank you for your letter of April 26 inviting me to comment at the hearings of Senate Bill 2720, which would authorize further research and development of Marine Protein Concentrate as a food additive.

Although I cannot be present at the hearings, I shall appreciate your making the enclosed statement a part of your Committee's record.

From our many discussions on this subject in the past, I believe you are aware of my strong conviction that this program is of tremendous significance to the people of the United States and to the world.

My congratulations to you and Senator Bartlett for your most successful efforts and progress in this endeavor.

Sincerely yours,

JAMES K. CARR,
General Manager of Public Utilities.

STATEMENT BY JAMES K. CARR, GENERAL MANAGER OF PUBLIC UTILITIES,[1] CITY AND COUNTY OF SAN FRANCISCO

Mr. Chairman and Members of the Committee: Your invitation to comment on Senate Bill 2720 is deeply appreciated. In early 1961 I was made aware of the enormous potential of marine protein concentrate for alleviating the undernutrition and malnutrition that affects two-thirds of the population of the world. Although the United States does not suffer a deficiency in animal protein in comparison to other nations of the world, nevertheless, there are a number of people in the United States who can benefit on a dietary basis from the development of a marine protein concentrate. In addition, as you know, the full utilization of the fishery resources can be a boon, not only to the fishermen themselves but to the processors.

In the very first week of the administration of the late President John F. Kennedy, Secretary Udall and I were alerted as to the possibilities of marine protein concentrate by the scientists of the Technological Laboratory of the Bureau of Commercial Fisheries at College Park, Maryland, and by the Director of the Bureau of Commercial Fisheries, Donald L. McKernan.

With the assistance of certain members of this committee and other members of the Congress, the necessary appropriations were made to begin what has now proved to be one of the most important research activities of the Department of the Interior.

It has been amply demonstrated that the marine protein concentrate can supply the amounts and the proportions of those critical amino acids that make up protein which are essential to the maintenance and growth of the human body. The experiments that have been conducted over the past few years by the Technological Laboratory of the Bureau of Commercial Fisheries at College Park have shown that foods which contain non-animal proteins need only to be supplemented with small quantities of animal protein to effect tremendous improvements in the quality of the food. It is as a food additive that MPC offers its greatest potential.

The claims of the dietary value of the product are supported not only by the scientists of the Department of the Interior but also by the Advisory Committee on Food and Nutrition of the National Academy of Scientists of the National Research Council.

I am particularly pleased with the proposal as outlined by Senate Bill 2720 which would set up demonstration plants to prove a practicable and economical means for the production of marine protein concentrate. It is the next logical step in the program. Senators Bartlett and Magnuson and the other Congressmen who observed that the oceans must supply the bulk of animal protein for many people in the future are to be highly complimented for their vision. It is encouraging to know that in a world where population is expected to reach more than six billion people in 40 or 50 years, there are estimates that the oceans could supply animal protein diet needs for more than 15 billion people. In fact, the present unutilized marine protein in United States waters alone could upgrade the vegetable protein diets of over one billion people.

The marine protein product based on present research is one that can be stored, shipped and marketed throughout the world with no diminution of the high nutritional value of the material. There have been estimates that it can be produced, packaged and distributed as a food supplement for a cost of two to three cents per person per day.

The proposal by the Chairman of this Committee and Senator Bartlett follows very closely the proven method of technological development which has taken place with reference to the desalting of sea water. The first legislation for the federal research in the desalting of sea water was authored by the late Senator Clair Engle of California, then a Congressman, and signed by President Truman in 1952. The program was enlarged and later, through the efforts of Senator Clinton P. Anderson and others, including President Lyndon B. Johnson, a program of five demonstration plants was approved. The results of those demonstration plants have already returned many fold the investment by the Federal Government. In fact, it was one of those demonstration plants that was available to be moved to Guantanamo, Cuba, when Fidel Castro cut off the water supply for the United States Navy. That use alone was worth the relatively small investment in the demonstration plants.

I believe the record of that program using demonstration plants is evidence that the program as proposed by S–2720 is the proper manner in which to pursue further research on marine protein concentrate.

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[1] Under Secretary of the Interior, 1961–1964.

It should not, of course, be overlooked that this utilization—full utilization—of the fisheries resources of the United States could be a great boon to the processors and to the fishermen themselves. In many cases 50% of the total catch of fish in the United States fisheries goes to waste. A process that can utilize the entire catch could spell the difference between loss and economical operations for fisheries. The Marine Protein Production program would provide a shot in the arm for American fisheries that is badly needed.

I should like to comment briefly on the importance of this program to the people throughout the world. It was my privilege as the Under Secretary of the Interior to visit with the late Pope John XXIII and, a few months later, with His Holiness Pope Paul VI. It is interesting to note that in both cases, knowing that the Department of the Interior was connected with the development of the Nation's resources, they stressed the need for utilizing the scientific knowledge in the United States to develop means of providing food for the hungry people of the world. Pope John XXIII complimented the United States on its sharing of the Nation's resources to help feed the hungry peoples throughout the world. Pope Paul VI emphasized the need for an all-out effort to meet the world's hunger and malnutrition problems. Knowing that hunger feeds the seeds of rebellion, that hunger demeans the dignity of human beings, and that listless, underfed, undernourished people in any land represent a potential danger to freedom everywhere, he urged that we continue research on utilizing the food resources of the sea.

The M.P.C. research program was the subject of discussion in Japan when President Lyndon B. Johnson sent a cabinet level group there in 1964.

We have had inquiries about the potential of a marine protein concentrate from Monsignor John Romaniello, the famous "Noodle Priest" of Hongkong, who has had success in feeding refugees from the mainland of China.

The possible importance of an adequate protein diet in relation to mental retardation was brought to the Department's attention by Mrs. Eunice Shriver, sister of the late President Kennedy. M.P.C. may be one of the weapons that could reduce mental retardation if it is even partially caused by protein deficiency. The late President Kennedy in his remarks before the White House Conference on Conservation apparently had Marine Protein Concentrate in mind when he said:

". . . we can make the most extraordinary gains in getting food from the ocean depths in the next 10 or 20 years. This question of oceanography has also occupied the attention of the Congress and this administration, how we can double the amount of protein which is available to people around the world. This is a whole new area of conservation, unknown to those who preceded us but which is now coming into public understanding as a result of your efforts and the efforts of others, and which can make the most profound difference to the lives of people who live rather listlessly because of inadequate proteins."

In summary, as one who had the privilege of working with the scientists in the Bureau of Commercial Fisheries, and with several interested members on the Congress, while serving as Under Secretary of the Interior, I appreciate the opportunity to comment on Senate Bill 2720. It can be one of the great legislative milestones of the Congress and the administration of Lyndon B. Johnson.

Marine Protein Production is a scientific program that will rank in importance, if not more importance, than the desalting of sea water. It involves a subject of basic daily importance to two-thirds of the people of the world. It is difficult to even imagine the tremendous benefits that will flow to the United States if we use our technological knowledge to develop something that is beneficial as marine protein concentrate can be to all the peoples of other lands.

In terms of contributions to the peace of the world—to freedom—the development at low cost of a marine portein concentrate as a food additive, is a priceless opportunity. I hope that the United States seizes it. You can assist by favorable action on Senate Bill 2720.

STATEMENT BY HON. HENRY M. JACKSON, SENATOR FROM THE STATE OF WASHINGTON

Mr. Chairman, I wish to wholeheartedly support enactment of S. 2720, a bill authorizing the Secretary of the Interior to provide for the construction, operation and maintenance of five demonstration plants for the production of Marine Protein Concentrate.

In a world where 2 billion suffer to some degree from a lack of animal protein, the importance of this bill cannot be overemphasized. To many of tomorrow's children this legislation literally means life. It will provide them with the protein necessary for survival. A fraction of a penny will purchase enough MPC to satisfy a child's daily animal protein requirement. I believe that the passage of this measure will be a significant step toward balancing the world's protein budget.

MPC is made from Hake, a fish found in abundance in a significant portion of our nation's coastal waters including those of my own State of Washington. At present the Hake is generally ignored by fishermen and has only limited commercial value as animal food. Thus to the fishermen of my State and the Nation, MPC represents a vast new avenue of economic opportunity.

A great deal of credit should be given to my distinguished senior colleague, Senator Warren G. Magnuson, Chairman of the full committee for his work on this legislation. Chairman Magnuson has long been aware of the promise MPC holds. It is his drive and foresight which have made these hearings possible. Those of us in Congress know that the "M" in MPC stands for Magnuson.

STATEMENT OF CONGRESSWOMAN JULIA BUTLER HANSEN, D., WASH., ON S. 2720, TO PROVIDE EXPERIMENTAL FISH PROTEIN CONCENTRATE PLANTS

Mr. Chairman, I appreciate the opportunity to make a statement in support of S. 2720, which would authorize the Secretary of the Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate. I regret that the pressure of legislative matters in Washington, D.C. prevented my attendance at the earlier hearings in my district at Aberdeen, Washington.

There are many reasons for my support of this legislation, not the least of which is the fact that my district in the State of Washington borders on one of the most substantial latent marine resources available to this nation—the Pacific hake. Further, there is now being constructed at Aberdeen, Washington, a plant to handle Pacific hake for reduction to fishmeal. The company establishing this pioneer operation on Pacific hake—Pacific Protein, Inc.—is demonstrating great confidence in America's future in marine harvest, and I believe we in the Congress have a responsibility to see that that future is not only assured but properly hastened.

There is no time to lose, Mr. Chairman, in this business of getting out on the oceans and harvesting the fishery resources. Huge fleets of foreign vessels are increasing their operations off our coasts and it is essential that we demonstrate an equal interest. S. 2720 is not a panacea in our efforts to increase the American harvest of the fishery resources off our coasts, but it is a step; an important move forward. The Pacific Protein plant in Aberdeen, as I mentioned, is presently designed to convert Pacific hake to fishmeal, and it will be in production presently. But the broad future of Pacific Protein and the other companies I feel will follow, will be in the reduction of this resource to fish flour, or fish protein concentrate. I understand, Mr. Chairman, that the Bureau of Commercial Fisheries testifying in Aberdeen, has changed the term to Marine Protein Concentrate, and perhaps I should refer to the product in this new term. But FPC or MPC, this is the product which holds so much promise for our fishing industry. A pure, tasteless, odorless flour is produced which, when approved for human consumption, can achieve volume markets here in the United States, but even more important, to those areas of hunger throughout the world.

But the achievement of Government approval for such a product made from whole fish is no simple matter, as the Chairman well knows. We have labored long with the Food and Drug Administration seeking acceptance for method and product on Pacific hake, though I am hopeful that we are just now very near the needed approval. But the approval for Pacific hake will be too limited a one to encompass many of the other species which are found off our coasts. Hake is a dry fish, and the formula or method which is practical and acceptable for this species may well not be acceptable either as to method or product on the more oily species, such as anchovy or menhaden. We need considerable research and experimentation if we are to fully utilize these resources.

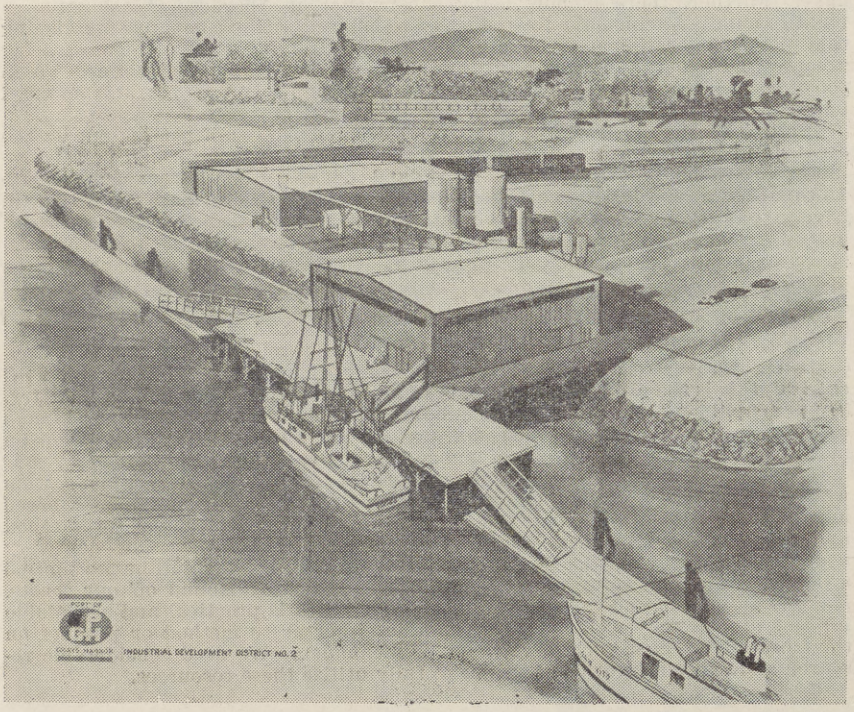
64-610—66——16

In addition to this, it must be noted that the present application to the Food and Drug Administration by the Bureau of Commercial Fisheries is for a particular method. We do not know that this is the most economic approach to converting whole fish to flour, and we are in need of further experimentation on new methods. S. 2720 in my judgment, will provide some of the necessary effort in the construction of proper pilot plants so that we may begin. We cannot expect private investment capital to take the inherent risk in providing huge quantities of money in plant and equipment and then seek necessary approval by the Food and Drug Administration. This is an area where the federal government must assist, not only because of the risk, but because of the need to expedite the progress of the program. Foreign nations are not going to allow virgin fishery stocks to remain untouched, and we can afford no delay in our effort to begin harvest.

There is another area of interest, Mr. Chairman, and it goes far beyond the needs of the fishing industry. Two-thirds of the world is presently suffering from animal protein malnutrition, and I can think of no better way to alleviate this widespread hunger than through the use of Marine Protein Concentrate. It is concentrated, to begin with, thus making transportation less of a problem than with other protein; more important, it does not require refrigeration, can be shipped easily to the areas where it is needed most, and it is economical. Less than a teaspoonful, I am told, can provide visible evidence of improvement in a hunger diseased child in ten days, and the cost of bringing this child back to health is less than twenty-five cents per month.

Certainly, the problem of world hunger is one of our most critical challenges. It has been regularly so emphasized by the President. Marine Protein Concentrate can make a substantial contribution in our present battle to stem the increasing world hunger and the contribution which S. 2720 can make toward expediting this program is most certainly in the broad national interest.

I am proud to associate myself in support of this necessary legislation, and I commend the Commerce Committee Chairman, Senator Magnuson and Alaska Senator E. L. Bartlett for their wisdom and foresight in introducing this legislation which can do so much to further our fisheries.



STATEMENT OF E. M. NORTON, SECRETARY, NATIONAL MILK PRODUCERS FEDERATION, 30 F STREET, N.W., WASHINGTON, D.C.

The National Milk Producers Federation is a national farm organization. It represents dairy farmers and the dairy cooperative associations which they own and operate and through which they act together to process and market at cost the milk and butterfat produced on their farms.

Dairy cooperatives represented through the Federation are engaged in the manufacture and sale of nonfat dry milk solids.

Nonfat dry milk is composed of the milk solids remaining in milk after the butterfat has been removed and used for other purposes, such as butter or cream. The nonfat milk solids are a valuable source of food minerals and of protein. The product is storable and easy to manufacture and transport. It is made of clean and wholesome food which has been produced and handled under the highest sanitary conditions.

Substantial quantities of the product are used domestically. It is used in the manufacture of dairy products; as a supplement in other foods, such as bread; and to recombine with water for use as skim milk.

It is one of the important products in the relief feeding programs both domestic and foreign. It is particularly well suited for foreign relief and is accepted in the diets of needy peoples of foreign nations. It provides a ready source of highly nutritious proteins and food minerals.

Nonfat dry milk solids contain 35.9 percent protein, 52 percent carbohydrates, and substantial contributions of phosphorus and calcium.

Approximately 2 billion pounds of nonfat dry milk solids are produced in the United States annually. It is a very important outlet for the nonfat portion of the Nation's milk supply.

Nonfat dry milk solids play an important part in the agricultural price support programs. Surplus milk which does not find a commercial outlet is converted into butter and nonfat dry milk solids and sold to the Commodity Credit Corporation under the support program.

Approximately one billion pounds of nonfat dry milk solids were acquired by the Commodity Credit Corporation in the calendar year 1965. Substantial portions of these purchases are used for domestic and foreign relief feeding programs.

Milk supplies can be increased to supply additional amounts of this sanitary, highly nutritious food if there should be a need to do so.

While there might be some sound basis for turning to questionable sources of supply for protein food in times of great emergency and shortage, there does not appear to be any valid reason for using matter ordinarily considered not suitable for food when we have on hand supplies of high-protein food produced under high sanitary standards from acceptable sources.

Surely it would be unwise to recover protein from fish waste and leave unused present stocks of a high-quality food the acceptance of which both at home and abroad is unquestioned.

There is nothing new about the recovery of foods from material which ordinarily is considered unfit for food. This is merely a new application of the idea to fish, including the offal and waste. If it is to be applied here, it would be equally logical to apply it to other wastes which ordinarily go into fertilizer and feed.

There is no need for fish flour made from inedible portions of fish, and, in the absence of a compelling emergency, its sale ought not to be permitted.

The Federal Food and Drug Administration has indicated a solution of this problem which is fair to the proponents of this legislation as well as to other industries and the consuming public. It has proposed a standard for fish flour made from edible portions of fish, but has not recognized fish flour made from whole fish including the offal and waste portions.

S. 2720 would utilize public funds to develop a protein product of doubtful public acceptance and for which there is no compelling need.

Enactment of this legislation would undermine the confidence of consumers in our food and drug laws. If the product were labeled as made from whole fish the public would assume that this meant cleaned and edible portions of fish. There would be a most unfavorable reaction upon discovery that the high food standards this country has always maintained had been lowered to permit the manufacture of foods from fish waste and offal.

The general effect also would be to break down other sanitary standards as other products sought to meet this competition by relaxation of the requirements applicable to them.

The product would be rendered bland so that its origin could not be recognized by taste or smell. Running through the arguments in support of the product is the inference that esthetic tastes would not be affected unless consumers knew that the fish flour was made from fish including the offal and waste.

We are concerned with this aspect of the matter. The product would be used in bread and in other foods so that the consumer, in most cases, would not know what he was getting. Even if the consumer noticed on the label that whole fish flour was used, he would assume that this meant only the edible portions of fish and that the Food and Drug Administration would not permit the article to be sold if it were made from inedible portions of the fish.

In conclusion, there is no real need for turning to such questionable sources of supply for food, and very great harm would be done to the whole pure food program in this country by enactment of this legislation.

We oppose the use of public funds to develop a food product from fish material ordinarily considered filthy and inedible.

U.S. SENATE,
Washington, D.C., May 16, 1966.

Hon. E. L. BARTLETT,
Merchant Marine & Fisheries Subcommittee,
Senate Commerce Committee, Washington, D.C.

DEAR BOB: There is much interest in the Great Lakes area in S. 2720, the fish protein concentrate bill. The attached memorandum, prepared at my request by the Ann Arbor laboratory of the Bureau of Commercial Fisheries, outlines the possibilities of putting to use as protein concentrate the abundant low cost fish of the Great Lakes.

Specifically, I support Section 2(a) of the bill which authorizes the construction of five demonstration plants to experiment in use of other types of fish and other extraction processes. One of these could advantageously be located in the Great Lakes area. In Lakes Huron and Michigan are abundant alewives and small chubs. In Lake Erie are millions of pounds of unused carp, goldfish, sheepshead, gizzard shad and alewife.

As a means of providing a nutritious food to help meet the world's nutritional needs, marine protein concentrate offers enormous promise and I support your efforts to secure passage of S. 2720.

Sincerely,

PHIL HART.

MEMORANDUM

The largest single population of little-used fish, the alewife in Lake Michigan, would prove ideal for studying the economics and feasibility of producing marine (fish) protein concentrate (MPC) from freshwater fish. The size of the Lake Michigan alewife stock and its availability at reasonable cost virtually throughout the year has been well established by systematic explorations and biological evaluations. The neophyte trawl fishery and fish meal industry in Lake Michigan fully support this interpretation of the situation. In contrast, most marine species being considered for MPC use are available for periods of only 3 to 4 months in any particular area.

Alewife are in Lake Michigan in great abudance right now. Since they live only about 3 years, millions of pounds are wasted each year through natural mortality. To transform some of this waste into MPC would be highly commendable. An MPC plant located on southern Lake Michigan could probably operate on Lake Michigan alewife alone. It it is to be a government-financed pilot plant feasibility study, it would be desirable to process Lake Huron alewife, carp, and suckers, and Lake Erie carp, gizzard shad, and sheepshead to determine suitability of other species for MPC and to work out economical methods to bring fish into an MPC plant from distances of a few hundred miles.

Underutilized stocks of freshwater fish in the Great Lakes and Midwest considered to be potentially suited for marine protein concentrate are listed below.

[In millions of pounds]

Species and location	Estimated annual commercial production rate	1964 commercial landings
Alewife:		
Lake Michigan	200	
Lake Huron	100	
Lake Ontario	50	
Total	350	12
Gizzard shad:		
Lake Erie	50	
Tennessee-Cumberland River Reservoirs	100	
Arkansas-Red-White River Reservoirs	125	
Total	275	0
Carp:		
Lake Erie	60	
Lake Huron	20	
Lake Michigan	20	
Missouri River reservoirs	50	
Upper Mississippi River reservoirs and lakes	50	
Tennessee-Cumberland River Reservoirs	50	
Arkansas-Red-White River Reservoirs	50	
Total	300	25
Sheepshead (total for region)	190	2
Suckers (total for region)	130	2
Grand total	1,245	

THE RESOURCES AGENCY OF CALIFORNIA,
Sacramento, Calif., May 17, 1966.

Hon. E. L. BARTLETT,
Chairman, Subcommittee on Fisheries, Senate Committee on Commerce, U.S. Senate, Washington, D.C.

DEAR SENATOR BARTLETT: As indicated to you in my telegram of May 13, 1966, we support S. 2720, your bill to develop practicable and economic means for the production of fish protein concentrate.

It is our understanding that recommendations have been made to amend the bill to provide for construction of only one plant for the production of a fish protein concentrate. We strongly support the bill as written, so that this vital experimentation and development may proceed as rapidly as possible. The construction of five plants will permit the experimentation and processing of a substantially larger number of species under a greater diversity of conditions.

It is our strong conviction that the United States can ill afford the luxury of piecemeal and slow development of this much needed process. We have watched our domestic fisheries sag, while other nations have accelerated the growth of their expanding fishing fleets. The development of a FPC process promises to be an important boost to this nation's important but often ignored commercial fishing industry. Implementation of this bill will be of significant benefit to the economy of all our coastal states.

There is, off California, a vast reservoir of marine resources, as yet relatively untapped, that may readily be adapted for use in production of fish or marine protein concentrate. The Pacific hake, for example, is a significantly large population occurring over a vast range extending from Alaska southward to and into the Gulf of California. It is known to occur at least as far as 350 miles offshore. While surveys by State and Federal agencies have found this species to be one of the most numerous fish species off our coast, its present utilization is insignificant.

Another example is the Pacific saury, a schooling fish of the open ocean. It is found along the west coast from Mexico to Alaska and off Asia to Japan. It is an abundant form of a vast, but yet unknown, magnitude, and supports a sizable fishery off Japan. While it is abundant off our shores, it is not harvested.

The jack mackerel has an extensive range extending from Canada to Mexico,

and over a thousand miles offshore. Our fishermen currently fish only the inshore fringes of this huge population.

A number of species of squid occur off the Pacific coast. Only one species is taken commercially and it is being underharvested. The present fishery is being conducted in only a small segment of the range of the species. The squid species represent a sizable potential of wealth awaiting utilization by man.

There are over fifty species of shark, skate and rays off California. Thousands of tons are netted each year by our fishermen, yet most are discarded back to the sea for lack of utilization by man.

These species and others constitute a wealth of tremendous magnitude that await harvest for the benefit of mankind. We believe that S. 2720 initiates the necessary technology to make it possible to transform these latent resources into low-cost protein to aid in feeding the under-nourished peoples of the world. We, therefore, strongly support your most important measure, S. 2720.

Sincerely yours,

HUGO FISHER,
Administrator of Resources.

VIOBIN CORP.,
Monticello, Ill., April 12, 1966.

MR. WILLIAM C. FOSTER,
Staff Counsel, Senate Commerce Committee, New Senate Office Building, Washington, D.C.

DEAR MR. FOSTER: Mr. Cohen has talked to me about his visit with you. I would like to outline our views on Senator Bartlett's bill. The present status of FPC can be considered from two viewpoints; one, the immediate need, and secondly, the long term engineering research.

Considering the immediate need, VioBin can provide FPC by interesting capital in using our methods. If the United States, through any of its agencies, wants any amount of FPC made under the rules and regulations of the FDA, we will guarantee to produce it at a specific price, a price incidentally which is half of what the Bureau of Commercial Fisheries estimate the cost will be for the FPC it proposes. So there is no problem of money for research as far as we are concerned. All we need is an order.

Referring now to the long term significance of Senator Bartlett's bill. To do research to utilize the fishing resources of the United States and to convert them into FPC is an objective of the highest order in our United States policy for laying the groundwork on which private capital can proceed to provide food needs of national and international significance.

My suggestions have to do with the direction of this research. I would not hesitate to say, if I were at a hearing, that to permit the Department of the Interior to direct this research would be a mistake. They are not equipped by training, experience or administrative judgment to direct such a development. I think it would be of interest for you to carry out a private investigation of what they did with the two million dollars that have been spent. You would be surprised at the scattering of funds for basic research, unnecessary travel, and a host of impractical ideas that did not deal with the objective of FPC produced immediately.

It is my belief that if the bill passes the money should be spent under the approval of engineers from the Massachusetts Institute of Technology, the Chemical Engineering Department of the University of Illinois, and any other independent engineering groups interested in applied engineering knowledge to FPC production on a large scale. They would bring in a report within a year on the direction in which this money should be spent. Surely the Department of the Interior would not object to this. Perhaps the National Academy of Sciences should be involved, but a committee, many of whom are now getting grants of funds that have been provided to the Bureau, cannot possibly be completely detached from the Bureau's influence. This conflict of interest should not be permitted. It goes without saying that I don't question the integrity of the people on the Advisory Committee. However, note that the N.I.H. long ago set up a policy that any grants provided by the N.I.H. should not be evaluated or instituted by scientists who are likely to obtain grants under the provisions of the project involved.

I would be willing to cooperate in every aspect in the expenditure of such funds, with the definite understanding that none of these funds would go to any

VioBin plant. As I pointed out above, there is no need for public funds for a VioBin plant. We are ready to produce it immediately.

The fact that we can produce it at a guaranteed specific price, and that such a plant would have guaranteed performance, and that capital is available if there is a firm order for any quantity, should have important meaning to Senator Bartlett and all of those who want FPC produced *now*. We can do it in the Seattle area, in the New Bedford area, off the coast of Maine, or anywhere that hake is present. If the FDA expands its allowance for the use of croaker, we could put up a plant with private capital immediately in Louisiana. If menhaden is accepted, we could put up a plant immediately to make FPC on the East Coast. When I say "we" I don't mean the VioBin Corporation, I mean our process is available for private capital to use anywhere.

Next week the first plant for the production of FPC outside the United States by the VioBin method will be contracted for Peru.

To sum it up, VioBin does not need government funds for providing FPC. We will guarantee to produce it as fast as plants can be erected, at a specified price, based on cost of fish and FDA requirements for production. We will license anyone to produce FPC. If the quantity is specified and ordered under the Food for Freedom bill, any quantity can be made available within nine months.

We believe in the ideas of long term engineering research for the production of FPC by any method. If this research must be set up under the Department of the Interior, then certain definite guide lines should be spelled out to be sure that it is adequately directed and carried out. This will make sure that the funds are used wisely for the benefit of the fishing industry *now*. Long term basic research is another important matter which the Bureau of Commercial Fisheries is well equipped to do.

Sincerely yours,

EZRA LEVIN, *President.*

WHITTAKER CORP.,
Los Angeles, Calif., May 9, 1966.

Re S. 2720, fish protein concentrate.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate, Washington, D.C.

DEAR SENATOR MAGNUSON: The nutritional needs of the nation and the world dictate expedition of programs embodying the intent of your and Senator Bartlett's pending legislation. Validation of the criticality of this rapidly developing need is abundant in the literature from studies of both private groups and public agencies here and abroad. Your support and encouragement of the Department of Interior's several programs in fisheries has scientifically confirmed the potential source of a food product for satisfaction of that need and established a valid basis for the establishment of the U.S. fishing industry in its proper place in the world. Senate Bill S. 2720, as tentatively conceived for passage, intends to insure expeditious filling of the remaining gap between harvest and consumption, i.e., the demonstration of practicable means for economic conversion of the raw product to an acceptable food or food supplement.

The severity of the developing need and the timely resolution of remaining technical, economic and sociological problems in the conversion of whole fish to food would seem to demand a compression of time inconsistent with the magnitude of effort proposed in S. 2720. Means should be brought to apply a maximum concerted effort to the attainment of desired goals.

An amplification of total effort could be accomplished by means already practiced in federal procurements of military, NASA, AEC, NIH, USDS/OS, etc., products, services, studies, etc., i.e., by the application of funds to expediting the demonstration of partially and fully developed commercial processes for accomplishing the early availability of fish (marine) protein concentrate from many species of fish as soon as is consistent with the several developing needs here and around the world.

The Bureau of Commercial Fisheries formally suggested an apparently cautious and, in view of the Aberdeen testimony, technically appropriate approach to the extrapolation of its proposed process, i.e., construction of *one* demonstration plant. The funding differential between the Bill and the expressed desire in Director McKernan's testimony could effectively be applied to the advancement

of the state of development and demonstration of industrially initiated and, to-date, sponsored protein concentrate process plants.

Bill S. 2720, paragraphs Sec. 1. and Sec. 2.(a) as presently worded would allow procurements of contracted efforts to demonstrate the effectivity of other than the isopropanol process by industry, in parallel with the Bureau of Commercial Fisheries demonstration plant effort. Parallel process study sponsorship would appear to

(1) reduce the technical risk associated with dependency on success of another year or two effort on a single process,

(2) increase probability of attaining an economical protein concentrate source in time to meet the world's developing needs,

(3) extend the concentration processing concept more rapidly to many other fish species, including hake,

(4) generally more effectively benefit the U.S. fishing industry by insuring early success of several processes—perhaps yielding in properties of product sufficiently unique as to further increase the market value of the array of end products—and, hence, the ex-vessel price of fish.

To accomplish the end of industrial expedition of the several process developments suggested above, therefore, one need only modify Sec. 2.(b), (which tends to discourage private enterprise from accepting "catalytic" funding particularly in lines 21, 24, 25) to permit demonstration of economic convertibility of most fishes to wholesome, nutritional, chemically and biologically pure edible protein concentrates.

Sec. 3. could similarly be slightly reworded to effect funding in concert with the intent of the above suggestion.

The need seems to justify an all-out enlistment of governmental and industrial teams in a cooperative effort to advance timely, beneficial and economical solutions to this challenging opportunity.

The forementioned suggestions for changes in your bill's wording will materially advance its overall intent to the benefit of mankind, to the benefit of the United States, and to the benefit of the U.S. fishing industry: I respectfully commend it to you and the Committee for serious consideration.

Very truly yours,

Dr. Leland G. Cole,
Vice President, Research and Engineering.

Sport Fishing Institute,
Washington, D.C., May 4, 1966.

Hon. Warren G. Magnuson,
Chairman, Senate Committee on Commerce,
Senate Office Building, Washington, D.C.

Dear Mr. Chairman: The Sport Fishing Institute is vitally concerned with the aquatic life of this nation and therefore we are interested in and would like to express an opinion on S. 2720, the bill proposing the use of certain fishes in a fish protein concentrate.

Certainly we are in favor of an economic supply of food to feed these starving world "relatives." Too, we believe in the definition that conservation is a *wise use* of our valuable natural resources. In this connection, Mr. Chairman, the Sport Fishing Institute is pleased to note that there is a directive force toward the utilization of fishes not now being sought by sport or, to any extent, commercial interests. The hake and sea robins of our territorial coastal waters could provide a suitable base for the FPC. These are mere examples of fishes currently in long supply.

At the present time in the Great Lakes there appears to be an overabundance of the alewife. However, were appreciable game fish introduced into the Great Lakes that would feed extensively on the alewife we might have a different opinion of its use in FPC.

We feel, however, that it is necessary to interject a precautionary note of the possibility that due to lack of much information now needed the interrelationships of some of these fishes could be disturbed whereby other dependent aquatic life may be adversely affected by heavy harvest. As long as a maximum economic yield or an optimum yield is the basic consideration for the harvest criterion of these fishes we see no imminent problems. We do wish to stress a note of caution in proceeding down this now-apparent rosy path.

I am certain, Mr. Chairman, that you can appreciate the necessarily fluid nature of a permissive regulation wherein new knowledge and new developments might bring on the scene cause for alarm, were such fishes as now are considered for utilization in FPC basic to other food chains producing higher economic yield. Too, an inadvertent harvest in the nets of young game fishes is highly conceivable, so we must guard against this!

We would appreciate your entering these remarks as a part of the record of public testimony. Thank you.

Sincerely,

PHILIP A. DOUGLAS,
Executive Secretary.

CITY OF GLOUCESTER FISHERIES COMMISSION,
Gloucester, Mass., April 28, 1966.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate, Washington, D.C.

DEAR SIR: The Gloucester Fisheries Commission created by an act of the Massachusetts legislature for the purpose of promoting the commecial fisheries of Gloucester, Massachusetts is composed of representatives of the fishing industry, the municipal government, and the public. This commission has voted unanimously to record itself in favor of S. 2720 which provides for the construction of five fish protein concentrate plants.

We feel this is the most efficient way of attracting private industry into the field of fish protein concentrate production on a large scale. Extensive commercial operations in this area would be a great contribution to ending protein starvation for about two-thirds of the world's population.

In addition, we feel large scale fish protein concentrate production would be a boon to our ailing commercial fisheries. The harvesting of the presently unused species of fish in U.S. Coastal waters would provide profitable employment to many American fishermen.

Therefore, enactment of S. 2720 will help solve the world problem of protein starvation, while at the same time aiding our American economy by providing a much needed stimulant to the fisheries.

Sincerely yours,

SALVATORE J. FAVAZZA, *Executive Secretary.*

NATIONAL WILDLIFE FEDERATION,
Washington, D.C., April 28, 1966.

Hon. WARREN G. MAGNUSON,
Chairman, Senate Committee on Commerce,
New Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: It is our understanding that your Committee has invited public comment upon S. 2720, relating to fish protein concentrate, and I would appreciate having this letter made a part of the record of the forthcoming hearings.

The National Wildlife Federation is a private organization which seeks to attain conservation goals through educational means. The Federation has affiliates in 49 states. These affiliates, in turn, are made up of local groups and individuals who, when combined with associate members and other supporters of the National Wildlife Federation, number an estimated 2,000,000 persons.

Generally, we are in accord with the objectives of S. 2720 because of the impact which the development of fish protein concentrate, if economically produced, can have upon the starvation conditions which face millions of people. This agreement, however, must be tempered with a few words of caution and emphasis on the reference in S. 2720 to "fish which are in abundant supply and which are not now widely sought after for human food. . . ."

The National Wildlife Federation has urged that Committees of the Congress grant additional funds for marine game fisheries research and the situation outlined in S. 2720 offers a good case in point. We assume that the species of fish being mentioned prominently with respect to fish flour are hake and menhaden. Admittedly, these are "trash" fish by most present standards, but the unfortunate

fact remains that we simply do not know or understand what place, if any, these species have in the food chain or on the environment for other and more desirable species. It is risky to categorize any species as "trash" or undesirable without more information which, at the present time, we do not have. We need to know much more about the interrelationships of these creatures.

It is our opinion that the Committee should set out some guidelines or principles to govern this program. First, the taking of fish should be regulated so that the basic stocks will not be reduced beyond the capacity to sustain itself at a level. Hopefully, this policy would prevent a recurrence of what happened to such species as the California sardine. Second, the taking of fish for protein concentrate must be selective and regulated to the extent that no desirable game fish or shellfish will be involved. It is important to emphasize that, with respect to game species, sport fishing should take precedence over commercial fishing because of the wider economic and aesthetic public benefits. It would be a tragedy of enormous proportions if commercial fishermen, with newly developed gear and fishing techniques, are encouraged to take all species of fish within areas utilized by salt water sports fishermen, retaining only those species of the proper size and marketable, reducing all else to fish meal regardless of the effect on sport fishing. The bill should be amended to provide proper management for priority consideration of sport fishing in those areas where this use of the resource is significant.

Thank you for the opportunity of making these observations.

Sincerely,

THOMAS L. KIMBALL, *Executive Director.*

STATE OF ALASKA DEPARTMENT OF FISH AND GAME,
Juneau, May 13, 1966.

Hon. E. L. BARTLETT,
U.S. Senate, Washington, D.C.

DEAR BOB: S. 2720, a bill to authorize the Secretary of Interior to develop, through the use of experiment and demonstration plants, practicable and economic means for the production by the commercial fishing industry of fish protein concentrate, is being considered by the Senate. The Alaska Department of Fish and Game highly endorses S. 2720.

Fish production in the waters of the North Pacific Ocean adjacent to Alaska has been estimated at capable of sustaining an annual yield of about 1 billion pounds of shrimp, 1.5 billion pounds of flounder, 300 million pounds of ocean perch, 140 million bounds of cod and pollock, 100 million pounds of sablefish, 1.2 billion pounds of herring, 700 million pounds of hake, and production of about 500 million pounds of various other fishes. A conservative postulation of the sustained yield of the various fishes cited will show that well over 5 billion pounds of fish could be harvested off Alaska's shares annually.

I cite the above figures to clearly illustrate that the waters off Alaska's coast can be considered as one of the richest fishing areas of the world. Foreign fishing nations are well aware of this as evidenced by the buildup over the years of a fleet of more than 700 large, modern, efficient, foreign vessels that have been fishing between three and fifty miles off our coast.

These Japanese and Russian vessels travel several thousands of miles from their home base in order to reap the abundant fishery resources right in our front yard. How is it possible for these fishermen, with the multiplicity of logistics problems, to harvest these fishes when the United States has an insignificant effort on these stocks? The answer to this is rather complex and would include a need for these nations to provide protein to feed their people at home and for export. Their ability to conduct such a fishing operation is in no small measure due to their lower labor costs, lower vessel prices, lower costs for gear and equipment, and so on. Additionally, one would have to consider that in the case of Russia, individual profit considerations can be ignored, and in the case of Japan, a carefully regulated method of controlling exploration and development of commercial fishery endeavors on a worldwide scale is supported by the Government.

It is incumbent upon the United States Government to take the necessary leadership which will provide for participation by United States nationals in the harvest of these fishery resources of the eastern North Pacific Ocean. S. 2720 is a step in this direction. S. 2720, by authorizing research in, and the development of, Marine Protein Concentrate would unquestionably have a salutary

effect on removing some of the risk for private enterprise (fishermen and processors), thus encouraging their entering into and vigorously prosecuting this fishery. Construction of five experimental and demonstration plants for the production of Marine Protein Concentrate by the Government would lead the way toward the establishment of a viable, vigorous new commercial fishing industry for the production of the MPC.

The State of Alaska vigorously supports the enactment of S. 2720, and petitions the Congress to appropriate the necessary funds for full implementation.

I understand hearings are to be held in connection with S. 2720 in the near future. I would appreciate having my comments made a part of the record.

Sincerely yours,

WALTER KIRKNESS, *Commissioner.*

JUNEAU, ALASKA, *May 17, 1966.*

Hon. E. L. BARTLETT,
Senate Office Building,
Washington, D.C.:

State of Alaska strongly supports passage of S. 2720 relating to fish protein concentrate plants. Enactment of this legislation would be boon to U.S. fishing industry and growing population of the world. Is essential to United States if we are to hold claim to, and produce protein from, our coastal waters in face of present large subsidized foreign fleets. Would strongly recommend that no less than five plants be funded.

WILLIAM A. EGAN, *Governor.*

THE CITY OF SEWARD, ALASKA, RESOLUTION No. 492

Whereas, the Honorable E. L. Bartlett, United States Senator from Alaska, has introduced in the United States Senate a bill which would authorize the Secretary of the Interior to contract with private firms to construct and operate large scale experimental plants manufacturing fish protein concentrate; and

Whereas, lack of protein is a prime cause of malnutrition; and

Whereas, fish concentrate provides far more protein than other foods and can be produced and distributed at less cost; and

Whereas, fish protein concentrate therefore promises to be exceptionally effective in overcoming the malnutrition and the effects of malnutrition which afflict a large portion of the world population; and

Whereas, Alaskan waters produce an abundant and unused supply of fish for this purpose;

Now, therefore, be it resolved that the Common Council of The City of Seward, Alaska, endorses Senator Bartlett's bill relating to experimental plants for manufacturing fish protein concentrate and urges the United States Congress to act favorably on it.

Copies of this resolution shall be sent to the Honorable Carl Hayden, President Pro Tempore of the Senate, the Honorable John W. McCormack, Speaker of the House, the Honorable Henry M. Jackson, Chairman, Senate Committee of Interior and Insular Affairs, the Honorable Wayne N. Aspinall, Chairman, House Committee on Interior and Insular Affairs, and to the Honorable E. L. Bartlett and the Honorable Ernest Gruening, U.S. Senators, and the Honorable Ralph J. Rivers, U.S. Representative, members of the Alaska delegation in Congress.

Passed and approved this 21st day of February, 1966.

[SEAL]

R. W. KIRKPATRICK, *Mayor.*
BEATRICE E. WATTS, *City Clerk-Treasurer.*

RESOLUTION

Whereas, the Honorable E. L. Bartlett, United States Senator, has introduced in the Senate a bill which would authorize the Secretary of the Interior to contract with private firms to construct and operate large scale experimental plants manufacturing fish protein concentrate; and

Whereas, the present cost of, and lack of protein is a prime cause of malnutrition; and

Whereas, fish concentrate will provide far more protein than most other foods at less cost, and be as palatable; and

Whereas, Alaskan Waters produce an abundant supply of fish for this purpose, especially in the Prince William Sound area; and

Whereas, Seward is in need of industry, to replace that lost due to the recent earthquake and tidal waves, and is situated near this heavily concentrated area of raw fish supply; and

Whereas, Seward has one of the finest harbors in the world, and a large available industrial area suitable for such industry, along with an adequate unemployed work force experienced in seafood products; and

Whereas, Seward is presently expanding their boat harbor to adequately handle a large fishing fleet; and

Whereas, local interests are desirous of establishing and building plants and storage facilities to handle various seafood products;

Now, therefore, be it resolved that the Seward Chamber of Commerce, of the city of Seward, Alaska, heartily endorses Senator Bartlett's bill relating to experimental plants for manufacturing fish protein concentrates, and urges Congress to act favorably, and establish one such plant here.

Passed and approved by the Board of Directors of the Seward Chamber of Commerce this 15th day of February, 1966.

Attest:

LAWRENCE URBACH, *President.*
BEVERLY DUNHAM, *Secretary.*

CALIFORNIA FARMER-CONSUMER INFORMATION COMMITTEE,
Santa Clara, Calif., June 2, 1966.

In support of S. 2720, to authorize construction of five experimental fish flour production plants.

Hon. WARREN G. MAGNUSON,
Chairman, Senate Committee on Commerce,
Washington, D.C.

DEAR MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE: The California Farmer-Consumer Information Committee representing an affiliated membership of more than a quarter of a million, including farmers, their bargaining associations and cooperatives, organized labor, professional, resource and consumers, has as one of its affiliates a group called: "California and World Fishermen to Correct Inequities".

In support of the objectives of this group which has no home either in the U.S. Department of Agriculture, the Department of Interior or California agencies, we favor enactment of S. 2720 to authorize the Bureau of Commercial Fisheries to construct five experimental fish flour production plants as one step in utilizing the presently unused "Food from the Sea" recognized by the Food & Agriculture Organization of the United Nations as a partial "Solution for Malnourished Millions." Copy of the May-June 1964 issue of "Freedom From Hunger Campaign News" entitled: "World Fishing" is being sent you with particular reference to pages 26–27.

The July 1964 issue of the California Farm Reporter (now California Farmer-Consumer Reporter), describes the plight of the California South-Coastal fishing industry for the ten years ending with 1963. Page 6 of this issue is enclosed. I will merely quote one section:

"We want to get off the unemployment insurance rolls * * *

"According to the State Department of Employment, the cost of unemployment insurance to California fishermen is taking an ever increasing bite out of the fund's 'Reserve Balance'. In the year ending June 30, 1960, the deficit against contributions was $2,220,307. By the end of fiscal 1963 it had grown to $3,342,278.

"Drop in insured unemployment for the 10 years 1954–1963 inclusive was 37.7% for wage and salaried workers and 42.8% for self-employed fishermen.

"It is tragic that with a world crying for food and with the resources of the Pacific Ocean, bordering our state in this sought-for protein, the California cannery operators have moved into foreign areas where costs and living standards are low to the detriment of our own skilled craftsmen who are deprived of their livelihood . . ."

Page 4 of the September 1964 *California Farm Reporter* stated:

"Government scientists told the U.S. Senate Committee on Fisheries, Aug. 13, that high protein fish concentrate could be used as a dietary supplement by the world's 2 billion undernourished people.

"This product, sometimes called 'fish-flour', is 85% protein and can be produced now at 12 cents to 14 cents per lb. and probably much cheaper as demand for it develops.

"It can be made in many different forms. For areas such as Asia, where the taste of fish is highly prized, the concentrate would retain its fish flavor. For use in the U.S. and Europe, all taste could be eliminated. It can be added to baked goods, soups, cereals, stews and baby food to increase protein content . . .

"Donald McKernan, Director of the Bureau of Commercial Fisheries, predicted that the Food and Drug Administration would soon lift its ban on the product and that manufacture and sale of fish flour in the U.S. would revitalize the now sluggish American fish industry as well as stimulate jobs in shipbuilding and food processing. The only reduction plant presently operating in the U.S. is at New Bedford, Mass." (Note that this was two years ago, and the ban has not yet been lifted.)

Our Committee sincerely hopes that the hearings on S. 2720 and its adoption will prove to the Food and Drug Administration and to the consumer that modern science has already made possible a fish flour completely sanitary, with no objectionable odor or flavor, and of great value as an additive to foods lacking in protein.

The story on page 4 of the September Reporter: "Waste versus Jobs—the Case of the Anchovy" demonstrates the difficulty in combating the selfish interests of the sports fishermen. They came en masse at a hearing called by the California Fish and Game Commission in Monterey, California on May 11, 1964. The proposal had been made by State Senator Fred Farr of Carmel to permit a pilot program to fish only 13,000 tons of anchovy from Monterey Bay.

The August, 1964 Reporter describes what took place at this hearing and is attached for your reference.

Subsequently, the State Fish and Game Commission reviewed the situation and granted a quota of 75,000 tons of anchovy to be fished during the season Oct. 15, 1965–April 30, 1966. Allocated to coastal areas in five zones, with 10,000 tons each with the exception of 35,000 tons for the Open Ocean Area (Zone 4) west of Catalina and the Santa Barbara Islands, the catch comprised only 23% of the total quota.

Fish canneries, equipped to process fish meal for cattle and poultry feed, handled this tonnage. No plant in California is equipped for the experimental research on volume and cost provided for in S. 2720.

Recent research dealing with harvesting of bottom-dwelling hake, opens up new fields for fish meal processing as a high protein food supplement. Until the Food and Drug Administration changes its out-moded position on use of scientifically processed, sanitary meal for human consumption, Commercial fishermen in California and the Pacific Northwest, will have to confine their catch of hake to capacity of existing canneries for non-human consumption.

200 million pounds of hake will be available to U.S. commercial fishermen from May 1966 through October, as a result of the special fishing gear developed by the U.S. Bureau of Commercial Fisheries Gear Research Base in Seattle.

A new reduction plant, being established in Aberdeen, Washington, to be operated by *Pacific Protein*, has already contracted with 8 vessel owners who will outfit their trawlers with the new mid-water trawl developed in 1964. The plant will have a capacity of 25 tons per hour. (Protein content is expected to be as high as 70 to 72%.)*

The letter dated May 17, 1966, addressed to Senator E. L. Bartlett, author of S. 2720, from Hugo Fisher, Administrator, California Resources Agency, in its support of this measure, refers to the "vast reservoir of marine resources as yet relatively untapped" off the coast of California. The letter refers to the Pacific hake population from Alaska to and into the Gulf of California, in addition to other fish suitable for fish meal processing.

The Resources Agency points to the need for stimulating California's fishing industry and considers that all five experimental plants are needed because conditions in various areas of the nation differ materially.

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*From May 1966 issue, Pacific Fisherman.

Our Committee also appreciates this fact and supports the Resources Agency position.

We have discussed S. 2720 with the representative of the California and World Fishery Association, Anthony Ostoich, San Pedro and are authorized to present this statement on his behalf as well as on behalf of our entire membership.

As stated in my night letter of 6/2/66 requesting that you place our Committee on record in support of S. 2720 and that detailed statement would follow, to be made part of the hearings record, we hereby submit this statement in the hope that your Committee will report the measure favorably so that it may be considered and adopted by the 89th Congress. We also urge that every effort be made to convince the Food and Drug Administration that the world's billions of hungry people require the essential protein supplement latent in reserves of "Food from the Sea" awaiting release for human consumption so far withheld by the U.S. Food and Drug Administration in spite of research amply justifying such release.

Sincerely,

Mrs. Grace McDonald,
Executive Secretary.

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