

PHILIPPINES-U.S. WORKSHOP  
ON  
FISHERIES AND OCEANOGRAPHY

4-9 DECEMBER 1967

MANILA

*Under the Joint Sponsorship of the*  
**NATIONAL SCIENCE DEVELOPMENT BOARD — NATIONAL RESEARCH  
COUNCIL OF THE PHILIPPINES**  
*and the*  
**U. S. NATIONAL ACADEMY OF SCIENCES — NATIONAL RESEARCH COUNCIL**  
*in cooperation with the*  
**U. S. AGENCY FOR INTERNATIONAL DEVELOPMENT**

A. I. D.  
Reference Center  
Room 1656 4L

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## SUMMARY FINDINGS

Fish has always been an important food, and a major source of protein in the diet of the people of the Republic of the Philippines. Although total fish production has been increasing, it is insufficient to meet the needs of a growing population. According to 1965 statistics, fish costing P54.5 million in foreign currency was imported to cover a deficit in national production of 8%. Based on national nutritional targets, however, the deficit was much greater—31%.

The Philippines-U.S. Workshop on Fisheries and Oceanography, held in Manila in December 1967, had as its principal aim accelerated production of food from the sea. This was the third workshop held in the framework of a continuing effort to identify areas in which science-based technology might be applied to bring about major advances in economic development. Cooperating in this program are the National Science Development Board-National Research Council of the Philippines and the U.S. National Academy of Sciences-National Research Council, with the assistance of the Agency for International Development.

It has been clear, since the beginning of our joint effort in 1965, that increased fish production should be accorded very high priority in the Philippines. The subject was recommended in both the 1965 and 1966 workshops as a topic for concentrated attention and cooperative Philippines-U.S. action. (See Attachment I for recommendations.) Presidents Marcos and Johnson, in their Joint Communique of September 1966, urged cooperative efforts to achieve the goal of producing more food from the sea. (See Attachment II.) The National Academy of Sciences and the National Science Development Board in consultation with the Agency for International Development in Manila and Washington, chose fisheries and oceanography as the topic of the 1967 workshop.

To assure coverage of the various essential aspects of fisheries development, the Workshop was conducted in both plenary and separate working group sessions. Subject matter emphasis varied somewhat from one group to another, but there was unanimity on the major issues. All working groups agreed that there is both great potential and great need to develop all aspects of fisheries in the Philippines. Fish is second only to rice as a food source, and is of particularly great nutritional significance. All working groups stressed that such development plans and supporting research programs as might be formulated by technical agencies would be of little effectiveness in the absence of a well-defined and well-administered fisheries policy on a national scale. In this respect, attention was called to the government's rice policy as a model and as an approach to be taken in development policy for fisheries.

Because of the transcending importance of having a strategic plan for fisheries development, the workshop as a whole recommended that the government of the Philippines formulate a "National Fisheries Policy and Program." It was urged that:

- a) this policy identify fisheries development as an important national objective;
- b) policy formulation be accompanied by the formulation of an adequate strategy, and by effective measures for implementation;
- c) bold and sound new approaches be defined through research, cutting across jurisdictional boundaries and traditional practices whenever needed; and
- d) major resources of the economy be committed to fisheries development both by the government and the private sectors.

The four working groups made a number of recommendations. Some of these are for Philippines action, some for U.S. action, and others for action by both partner nations in the workshop. They all point toward greater productivity, and thus the betterment of life.

Both the Philippines and the U.S. have made a major investment of effort in preparation for the task of fisheries development. The National Committee on Marine Sciences of the NSDB prior to the workshop collected background data and prepared a study, which was issued in June 1967 under the title "Philippine-U.S. Cooperation in Fisheries and Oceanography." Philippine position papers for each of the four working groups and supplementary data were prepared for the workshop meetings in December. (This material will be included in the Proceedings.)

Dr. I. E. Wallen of the Smithsonian Institution made a preparatory trip to the Philippines in June-July 1967 on behalf of the National Academy of Sciences and the Smithsonian Institution to discuss the scope of the agenda and participation. The Philippines and U.S. groups conducted their separate respective meetings and activities in advance of the workshop to develop effective approaches to the subject. The workshop secretariats, in the NSDB and the NAS,, were in constant communication.

An outstanding feature of the workshop was the active participation of effort and resources by nearly two hundred persons, from every sector concerned with fisheries development. These included in the Philippines the scientific and academic communities, development and technical assistance agencies, government, business and industry. Similarly engaged were institutions of the United States and of other countries of the region, as well as international organizations. There was close cooperation between the Filipino and American co-chairmen of each of the four working groups. The interaction of the workshop group effectively cut across traditional professional barriers. In the workshop all participants were encouraged to enter fully into the joint effort. Some of the most useful

ideas were contributed by observers, particularly those involved in the fishing industry and related fields such as fish processing and marketing.

Broad representation covering the private sector, persons from various parts of the Philippines, small and large fishing operators, and the deep sea, coastal and pond fisheries interests provided a healthy and diverse involvement in policy deliberations, and the basis for more concerted action to increase fish production. Professional and institutional contacts were newly established, or strengthened, during the week of working sessions. These, in addition to contributing toward well-informed decisions, are the basis for a growing, and much needed, cooperation among the participating sectors.

The Filipino and U.S. participants in the workshop strongly recommended that measures be taken to assure sustained attention to development work in this field. They constituted themselves as a committee of the whole to continue the effort, and requested that names and business addresses of all the participants be included in the Proceedings of the workshop, to facilitate communication. The NSDB and the NAS are to explore the feasibility of establishing various mechanisms to continue the work begun during the week of workshop meetings, field surveys and consultations.

Recommendation from Group IV — Earth Sciences Natural Resources Development and Conservation of First Philippines-U.S. Workshop on Scientific and Technological Cooperation and Development — Manila November 22-26, 1965.

**"Marine Resources**

Marine resources have tremendous economic potentials. Financing of fishing will improve the economy of the country; employ more people, reduce the cost of high essential protein food stuffs and improve the overall economy.

More studies should be made on diversified economic uses of numerous marine products other than the usual fishes, such as seaweeds, inedible fish, crustaceans, and mineral products from sea water. Studies should include the extension of fishing to the further Pacific areas off the Philippine territorial waters.

Personnel for fisheries research and training in the fishery institutions must be increased to improve the fishing industry and make possible applied and basic research on marine resources.

There is a need for a comprehensive inventory of the marine algae of the Philippines to determine which species could be exploited commercially and what protective laws will be required to prevent over-exploitation.

It is noted that there are promising opportunities for encouraging the farming of edible marine organisms such as the rock-oysters in Manila Bay which could also be grown in other favorable localities. Attention was called to the already extensive propagation of mussels which form a favorite food. Areas could be set aside where large shrimps can be propagated in the same manner that the milkfish is now being raised in brackish-water ponds.

It was reported that 40 purse seine boats will soon be operating commercially as well as four research vessels with the Philippine Fisheries Commission. It was noted that when students are trained in fishery biology in the U.S. including Hawaii, they were at a loss to apply their training to the solution of practical local fisheries problems. If an "expediter" with the kind of know-how to help overcome these difficulties can be added to the fishery staff, such difficulties could be significantly decreased.

The hope was expressed that title might be acquired to shore areas like Puerto Galera in Mindoro, for permanent research sites for the State Universities of the Philippines. Such seashore, territorial water and sea bottom areas might be granted in perpetuity to the universities as "Sea

Grants" for experimental work, conservation and to stimulate new exploitation of the sea by the university marine scientists and engineers."

Recommendation IV from Second Philippine-U.S. Workshop on Cooperation in Science and Technology, Pacific Grove, California, November 6-10, 1966

**"Cooperation in Oceanography and Fisheries Research**

The Workshop participants agreed their representatives in the field of oceanography and fisheries should stimulate action on the points detailed below in their respective countries:

*in the Philippines —*

- a) Increase efforts in fisheries exploration.
- b) Encourage the private sector to exploit new fisheries.
- c) Improve fisheries technology.
- d) Develop techniques in fish culture.
- e) Gather environmental data related to fisheries from adjacent seas and inshore water, using Navy vessels.
- f) Participate actively in the Intergovernmental Oceanographic Commission's marine planning and operations.
- g) Request participation of Peace Corps representatives and consultants in fish farming and marine activities.

*in the United States —*

- a) Increase the availability of fellowships, traineeships and courses open to Philippine applicants.
- b) Make space available and encourage participations of Philippine scientists on U. S. oceanic vessels in waters near the Philippines.
- c) Encourage training of Peace Corps personnel for work in fish farming and marine activities in the Philippines.
- d) Publicize the need for participation of U. S. scientists and engineers in fisheries and oceanography in the Philippines.
- e) Encourage U. S. industries knowledgeable in fishing technology to train Philippine technologists.
- f) Increase the availability to the Philippines of world oceanographic data from Philippine seas.
- g) Encourage the establishment in the Philippines of a marine specimen sorting center.
- h) Assist in obtaining equipment for Philippine marine research.
- i) Encourage and assist Philippine participation in international oceanography and in the International Biological Program.

*Participants further agreed on the need to*

**bring the NSDB Committee on Marine Sciences into contact with the U. S. National Academy Committee on Oceanography.**

**Following implementation, the NAS and NSDB should consider holding a jointly sponsored marine-science conference in the Philippines to discuss the possibility of establishing a binational or international oceanographic and fisheries research insitute in the Philippines."**



**EXCERPT**

Office of the White House Press Secretary

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**THE WHITE HOUSE**

**TEXT OF THE JOINT COMMUNIQUE BY PRESIDENT JOHNSON AND HIS EXCELLENCY FERDINAND E. MARCOS, PRESIDENT OF THE REPUBLIC OF THE PHILIPPINES, FOLLOWING TALKS IN WASHINGTON, D.C. SEPTEMBER 14 AND 15.**

1. At the invitation of President Johnson, President Marcos made a state visit to Washington September 14 to 16, 1966. This afforded an opportunity for the two Presidents to engage in the friendly and fraternal talks which have become traditional between the two countries.
2. President Johnson and President Marcos had a frank and cordial exchange of views on international developments of common significance as well as the cooperative arrangements which give substance to Philippine-American relations.
3. President Marcos set forth his vision of the Philippine future. He described the many frontiers that mankind faces — in space and in the ocean depths, on the farm and in the laboratory, in economic development and in expanding the capabilities of the young. He expressed his determination to move his country forward across these frontiers, with the exertion of Philippine energy and initiative and with the cooperation of friendly nations, especially the United States.
4. Scientific Cooperation. Both Presidents recognize the need of promoting cooperation in areas of science and technology and the mutual exchange of information and scientific knowledge for peaceful purposes. Such cooperation will furnish incentives to public and private resource initiative of both countries in enhancing and cultivating scientific and technological endeavors as a fundamental basis of a mutually beneficial relationship on science and technology.
5. Specifically, the two Presidents discussed recent developments in space technology. President Marcos expressed his desire to encourage greater training of Philippine scientists and engineers in the peaceful application of such technology, and President Johnson undertook to offer appropriate fellowships for this purpose in U.S. institutions.

The considerable economic loss suffered annually in the Far East from typhoons was discussed by the two Presidents, who agreed that the regional

initiatives undertaken by ECAFE and WMO to improve technical capabilities for typhoon damage control deserved full support. President Johnson offered the services of a United States meteorological team to develop a joint program of typhoon damage control in the Philippine area in concert with regional planning, and President Marcos agreed to the desirability of such a program.

Finally, the two Presidents noted the cooperative programs already started between the Philippine National Science Development Board and the U.S. National Academy of Sciences, and agreed that these programs should be expanded so that private and public research efforts can be applied to the advance of *knowledge about growing food on the land and in the sea in the tropics*. The two Presidents noted the expanded efforts now under way by the U.S. Government in the field of oceanography, in which it was agreed that the Philippines would participate fully.

## MEMBERS OF THE PHILIPPINE PANEL

- SALCEDO, Dr. Juan Jr., *Chairman*  
National Science Development Board
- CAYCO, Florentino Jr.  
Inter-Island Deep Sea Fishing  
Operators Association  
(Deep Sea Fishing)
- CRUCILLO, Cornelio V.  
Director, Office of Foreign Aid  
Coordination  
National Economic Council  
(Economics)
- DALISAY, Dr. Amando  
National Research Council of the  
Philippines  
(Economics)
- ESGUERRA, Ricardo  
Development Bank of the Philippines  
(Economics)
- JOCANO, Dr. Felipe L.  
University of the Philippines  
National Museum (Anthropology)
- LEGASPI, Capt. Constancio M.  
Actg. Assistant Director  
Bureau of Coast and Geodetic  
Survey  
(Hydrology)
- MANE, Andres M.  
Commissioner, Philippine Fisheries  
Commission  
(Fisheries Technology)
- MARTIN, Claro  
Chief, Division of Marine  
Fisheries Biology  
Philippine Fisheries Commission  
(Fisheries Biology)
- MARTINEZ, Ricardo  
Martiman, Inc.  
(Manufacturing-Fish Products)
- MELCHOR, Commander Alejandro  
Presidential Economic Staff  
(Economics)
- SU, Rev. Fr. Dr. Sergio  
Head, Seismological Department  
Manila Observatory  
(Marine Seismology)
- TAN, Dr. Elvira O.  
Chief, Oceanography Section  
Philippine Fisheries Commission  
(Fisheries Oceanography)
- TRONO, Alfredo  
Chief, Technical Studies Section  
Ports and Harbors  
Bureau of Public Works  
(Tidal & Coastal Engineer)
- VELASQUEZ, Dr. Gregorio T.  
National Research Council  
of the Philippines  
(Marine Algae-Taxonomy)
- UMALI, Agustin  
National Museum  
(Ichthyology; Marine Taxonomy)
- YAPCHIONGCO, Dr. Jose V.  
Dean, College of Fisheries  
University of the Philippines  
(Marine Zoology)

### Philippine Resource Panelists

- ALCALA, Dr. A. C.  
Silliman University
- BORJA, Mrs. Priscilla C.  
Philippine Fisheries Commission
- CENDANA, Dr. Silverio  
President, International  
Biological Programme
- FERNANDEZ, Juanito  
Bureau of Mines
- LAYA, Dr. Jaime  
University of the Philippines
- MANANSALA, Mario  
Bureau of Coast & Geodetic Survey

**MONTEMAYOR, Justo**  
Philippine Fisheries Commission

**SULIT, Jose**  
Araneta University

**RASALAN, Deputy Commissioner Santos**  
Philippine Fisheries Commission

**TAPIADOR, Deputy Commissioner Lomingo**  
Philippine Fisheries Commission

**SALCEDO, Dr. Ignacio**  
Mapua Institute of Technology

**National Science Development Board Staff**

**REYES, Dominador O.**  
Workshop Coordinator

**BRILLO, Leticia**  
Workshop Secretary

**Philippine Consultants**

**VILLADOLID, Dr. Deogracias V.**  
National Research Council of the Philippines

**KVRAN, Dr. Einar**  
Project Manager, UNSF Deep-Sea Fishing Development Project  
Philippine Fisheries Commission

**DOMANTAY, Dr. Jose S.**  
National Research Council of the Philippines

**TOLMAN, Dr. Carl**  
Project Manager  
Institute of Applied Geology  
(UNSF) U.P.

**PALO, Macario**  
National Institute of Science and Technology

## MEMBERS OF THE U.S. PANEL

**STEINBACH, Dr. H. Burr**

*Chairman*

Director, Marine Biological  
Laboratory

Woods Hole, Massachusetts and  
Chairman, Department of Zoology  
University of Chicago  
Chicago, Illinois

(Zoology; physiology)

**BARDACH, Dr. John E.**

School of Natural Resources and  
Department of Zoology

University of Michigan  
Ann Arbor, Michigan

(Fisheries; zoology)

Fisheries advisor to AID

Bureau for Far East

**CHAPMAN, Dr. Wilbert McL.**

President, Van Camp Foundation and  
Director, Division of Resources

Van Camp Sea Food

San Diego, California

(Ichthyology; fisheries)

**DOTY, Dr. Maxwell S.**

Professor and Chairman

Department of Botany

University of Hawaii

Honolulu, Hawaii

(Botany; marine algae; euclidean)

**KREBS, William A. W.**

Vice President, Arthur D. Little, Inc.

Cambridge, Massachusetts

(Law; economic development and  
industrial work in developing eco-  
nomies, including the Philippines)

**LILL, Gordon**

Corporate Development Planning

Lockheed Corporation

Burbank, California

(Geophysics; submarine geology)

**MARR, John C.**

Director, Hawaii Area

U.S. Bureau of Commercial  
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Honolulu, Hawaii

(Biology; population dynamics and  
ecology of pelagic marine fish)

**STEWART, Dr. Harris B., Jr.**

Director, Institute for Oceanography  
Environmental Science Services

Administration

Miami, Florida

(Oceanography; current, coastal and  
estuarine oceanography;  
bathymetry)

**STORER, Dr. James Allen**

Dean of Faculty

Bowdoin College

Brunswick, Maine

(Economics; economics of fisheries  
in the Philippines)

**VETTER, Richard C.**

Executive Secretary

Committee on Oceanography

National Academy of Sciences

Washington, D. C.

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**WALLEN, Dr. I. Eugene**

Head, Office of Oceanography  
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Smithsonian Institution

Washington, D. C.

(Marine biology; limnology)

### U. S. Resource Penelists

**KANAHELE, George S.**

Director, Conference Program

East-West Center

Honolulu, Hawaii

**\*LOVE, Alexander R.**

Country Officer for the Philippines

Office of Southwest Pacific Affairs

Agency for International

Development

Washington, D. C.

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\* Unable to attend.

**McLAUGHLIN, Miss Patsy**  
Supervisor for Invertebrates  
Oceanographic Sorting Center  
Smithsonian Institution  
Washington, D. C.

**\*PARMAN, George C.**  
Director, Food from the Sea  
Agency for International  
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Washington, D. C.

**PELLICANI, Nicholas R.**  
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Marine Colloids, Inc.  
Rockland, Maine

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Associate Director  
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New York, New York

**WILSON, Peter**  
Fisheries Management Biologist  
Trust Territory of the Pacific Islands  
Koror, Palau Islands

**National Academy of Sciences Staff**

**SHEEKS, Robert B.**  
Associate Director  
Pacific Science Board

**DULANSEY, Maryanne L.**  
Project Deputy  
Pacific Science Board

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\* Unable to attend.

**PHILIPPINES-U.S. WORKSHOP ON FISHERIES  
AND OCEANOGRAPHY**

**Science Pavilion, NSDB, 4-9 December 1967**

**WORKSHOP SCHEDULE**

**MONDAY, December 4, 1967**

**9:00 A.M. — PLENARY SESSION**

Welcome Address . . . . . Dr. Juan Salcedo, Jr.  
Chairman, Philippine Panel  
Chairman, National Science Development  
Board  
Chairman, National Research Council  
of the Philippines

Response . . . . . Dr. H. Burr Steinbach  
Chairman, U.S. Panel  
Chairman, Pacific Science Board  
Office of the Foreign Secretary  
National Academy of Sciences

**10:30 A.M. — Discussion**

**11:30 A.M. — Conference Business:**  
Assignment of Rapporteurs for each Working Group;  
Discussion of Field Trip Arrangements, etc.

**2:00 P.M. — Working Groups I and IV; Working Groups II and  
III meet together**

**6:30 P.M. — Reception to be tendered by NSDB Chairman and Mrs.  
Juan Salcedo, Jr. at Champagne Terrace, Manila Hotel**

**TUESDAY, December 5, 1967**

**9:00 A.M. — Separate Working Group Sessions**

**Group I — Production Technology**

**Group II — Research**

**Group III — Inventory of Marine Biological Resources —  
Regional Marine Specimen Sorting Center**

**Group IV — Economic and Social Factors**

2:00 P.M. — Working Group Sessions

7:30 P.M. — Dinner — Mr. Wesley C. Haraldson  
Director, U.S.A.I.D., host

**WEDNESDAY, December 6, 1967 — Field Trip**

1:00 A.M. — Fish Landing  
Navotas, Rizal  
All interested parties, especially Groups I and IV.

9:00 A.M.

Group I  
A. Fishing Operations  
B. Shore Facilities  
C. Patis Making

Group II — University of the Philippines  
Bureau of Coast & Geodetic Survey

Group III — National Museum  
Herran, Manila  
University of the Philippines  
Diliman, Quezon City

Group IV — Presidential Economic Staff and National Economic  
Council, Private Industry Groups, or AID.

12:00 Noon — Luncheon to be tendered by Commissioner and Mrs.  
Andres M. Mane for Groups I, I, III and IV at Dagat-  
dagatan Fisheries Laboratory, Malabon, Rizal

1:30 P.M. — Tour of Dagatdagatan Fisheries Laboratory

2:30 P.M. — Sonia Marketing Plant  
Shipbuilding Industry (Fishing Boat Construction Plant)  
(All Groups, if interested. If not, other Groups may  
resume visits to places of interest to them)

**THURSDAY, December 7, 1967**

9:00 A.M. — Working Group Sessions

2:00 P.M. — Working Group Sessions



**FRIDAY, December 8, 1967**

9:00 A.M. — Drafting Sessions by Rapporteurs

10:30 A.M. — Meeting of Chairmen Salcedo and Steinbach and several others to discuss continuing Philippines-U.S. Science Cooperation Program.

3:30 P.M. — Meeting of Co-Chairmen of Groups I, II, III, IV and Rapporteurs to discuss rapporteurs' summaries.

7:30 P.M. — Dinner to be tendered by Mr. Alex Reyes, Jr., Royal Fishing Enterprises, at ROUND TABLE, Sunken Gardens, Manila

**SATURDAY, December 9, 1967**

9:30 A.M. — CLOSING PLENARY SESSION

Science Pavilion

Presentation of Recommendations

Dr. Juan Salcedo, Jr.  
*Chairman, Philippine Panel*

and

Dr. H. Burr Steinbach  
*Chairman, U.S. Panel*

Discussions

Amendments, Additional Considerations,  
Ensuuing Actions

Closing Statement

Dr. Juan Salcedo, Jr.

12:15 P.M. — Lunch on Board "RESEARCHER I", enroute to Corregidor Island (Courtesy of Inter-island Deep-Sea Fishing Operators Association) Pier 15

## **WORKING GROUP TOPICS**

- Group I. Production Technology**
  - A. The present condition
  - B. New technology and potential production
  - C. Conservation
  
- Group II. Research-Fisheries, Aquiculture, New Products, Oceanography**
  - A. Status
  - B. Organization
  - C. Facilities
  - D. Information
  - E. International Biological Program
  
- Group III. Inventory of Marine Biological Resources — Regional Marine Sorting Center**
  - A. Functions
  - B. Value—scientific and economic
  - C. Location
  - D. Relation to region
  - E. Management and support plan
  
- Group IV. Economic and Social Factors**
  - A. Production
  - B. Marketing
  - C. Processing
  - D. Finance: investment incentives and obstacles
  - E. Entrepreneurship and management
  - F. Improving the fisheries industries

**NOTE:**

All four groups will consider various questions, including:

1. Manpower and training needs
2. Opportunities for international cooperation in fisheries research and development — Philippines-U.S., and regional.

## OPENING REMARKS

By DR. JUAN SALCEDO, JR.  
*Chairman, Philippine Panel*

This is a momentous occasion for the Philippines and the United States. Today, two nations are poised to join hands and minds in friendship, goodwill and most important, perhaps, in the brotherhood of science — one nation affluent and a world power ready to share its affluence and scientific might — and the other, a developing nation prepared to contribute its scientific resources for the acquisition of scientific knowledge. This day is made doubly significant by the fact that American and Filipino scientists, economists and representatives from the private sector shall consider the manpower and training needs besides the opportunities for international cooperation in Fisheries and Oceanography Research and Development. Allow me then to extend my warm and sincere welcome to the participants in the Philippines-U.S. Workshop on Fisheries and Oceanography.

During the past few years, the whole world has been most concerned with the rapidly increasing human population and the worsening protein malnutrition. The grim specter of hunger hovers over half of the world. Many of the foreign scientists who have visited our country are greatly impressed by the fact that our territorial waters extend to approximately 438,000 square nautical miles which surround over 7,000 islands with a total coastline of about 21,500 statute miles — a coastline which is longer than that of the United States. As Dr. Athelstan F. Spilhaus puts it in his speech during the 1965 Philippine National Science and Technology Week and I quote — “There is no place in the world where science, engineering and the biological engineering we call fisheries have a more natural laboratory as here in the Philippines — nowhere, the exploitation more important.”

Much has been said and written about the benefits which mankind derives from the ocean. An understanding of the ocean — of that vast expanse of water which covers 70.6 per cent of the surface of the planet earth — would mean the development and efficient management of vast sea food reserves and discovery of new fishing grounds. It would also mean the safeguarding of the health of the people from the continuing pollution and erosion of seashores, bays and estuaries; the protection of life and property from the destructive typhoons (in our country, the significant ones visit us six times a year on the average); the improvement of prediction of rainfall in the interior to guide farmers who raise food from the land; and the recovery and exploitation of the mineral resources which exist in off-shore areas.

This Workshop did not just happen. Permit me to give you briefly the background information about this Workshop.

The First Workshop on Philippines-U.S. Scientific and Technological Cooperation and Development was held here in Manila from November 22 to 26, 1965. Small group discussion sessions were held on agricultural and biological sciences besides four other fields. Among the recommendations of the First Workshop was, and I quote — "Marine resources offer a tremendous potential. Much can and should be done to begin to realize the benefits from rich resources in Philippine waters. The research base for marine resources development should be strengthened by a variety of well proven methods." The First Workshop basically served the purpose of establishing a dialogue between the Philippine National Science Development Board and the U.S. National Academy of Sciences.

From November 6 to 17, 1967, the Second United States-Philippines Workshop on Scientific and Technological Cooperation and Development was held. This Workshop took place in Asilomar, California and Washington, D.C., U.S.A., shortly after the issuance of the joint communique of President Lyndon B. Johnson of the United States of America and President Ferdinand E. Marcos of the Philippines during the state visit of the latter from September 14 to 18, 1966. May I quote the excerpt pertinent to the Workshop — "Finally, the Presidents noted the cooperative programs already started between the Philippine National Science Development Board and the U.S. National Academy of Sciences, and agreed that these programs should be expanded so that private and public research efforts can be applied to the advance of knowledge of growing food on the land and in the sea in the tropics. The two Presidents noted the expanded efforts now underway by the U.S. Government in the field of oceanography in which it was agreed that the Philippines would fully participate." The Second Workshop defined the areas for cooperation and development on science and technology between the Philippines and the United States.

Among the recommendations of the Second Workshop was recommendation IV — "Cooperation in Oceanography and Fisheries Research." Upon my return to the Philippines, I requested the National Committee on Marine Sciences of the National Science Development Board to study Recommendation IV and submit to me suggestions, plans and project proposals to implement it. The National Committee on Marine Sciences which has member representatives from twelve government agencies concerned with Marine Sciences and Technology came up with a report on the "Philippines-U.S. Cooperation in Oceanography and Fisheries Research." This report (I understand that each U.S. panelist has a copy of it) was sent to the U.S. National Academy of Sciences and soon after, Dr. I. Eugene Wallen of the Smithsonian Institution came over to the Philippines sometime in June this year to make an exploratory visit for the U.S. National Academy of Sciences. Finally, the Philippine National Science De-

velopment Board and the U.S. National Academy of Sciences agreed to hold this Workshop on Fisheries and Oceanography. This Workshop, as it turned out, is not only a bi-national one. We have observers from China, Indonesia and Japan.

The Filipino and American scientists, economists and representatives from the private sector are gathered here to discuss in one week's time specific topics of great import to the developemnt of fishing grounds and the production of more fish not only for the Filipino people but for the Southeast Asian peoples as well.

We will have four Working Groups which shall consider: (a) production technology, (b) research, (c) inventory of marine biological resources and (d) economic and social factors. On our part, we have endeavored to put into writing the problems and needs of fisheries and oceanography in the Philipines. We have determined our current production of fish and marine products, our goals of production, our available areas for fish culture, our national goals and base in marine sciences and technology research, the prevailing social and economic factors in fishing villages, our investment, our financial structure and lastly, our infrastructure facilities for fisheries. We hope that this information which we have gathered about fisheries and oceanography in the Philippines shall serve as a start-off point for the discussions in the workshop.

The Working Group on Production and Technology which is headed by Commissioner Andres M. Mane of the Philippine Fisheries Commission and Dr. Wilbert Chapman of the Van Camp Foundation will take up the present condition, new technology, potential production and conservation in fisheries.

The Working Group on Research headed by Captain Constancio M. Legaspi of the Bureau of Coast and Geodetic Survey who by the way is the Chairman of the National Committee on Marine Sciences of the National Science Deveolpment Board and Dr. John C. Marr of the U.S. Bureau of Commercial Fisheries in Hawaii will consider the status, organization, facilities, information for research in fisheries, aquiculture, new products and oceanography. It will also consider the International Biological Program.

The Working Group on Inventory of Marine Biological Resources — Regional Marine Specimen Sorting Center headed by Dr. Gregorio T. Velasquez of the National Research Council of the Philippines and Dr. I. Eugene Wallen of the Smithsonian Institution will discuss the functions, scientific and economic value, location, relation to region and management and support plan of the center.

The Working Group on Economic and Social Factors headed by Dr. Amando Dalisay of the National Research Council of the Philippines and Dr. James Allen Storer of Bowdoin College will examine the economic

and social factors involved in production, marketing, processing, financing and investment, entrepreneurship, and management and improvement of the fisheries industries.

The areas of fish production in the Philippines are: the marine waters, the brackish waters and the fresh waters. The marine waters consist of coastal and offshore or deep-sea waters. The brackish waters consist of mangrove swamps developed into fishpond, estuaries and tidal flats, whereas the fresh waters consist of lakes, rivers, rice paddies, etc. The fisheries resources of the Philippines are around 1,000,000 hectares of freshwater areas, 500,000 hectares of brackish swamplands, and about 166,000,000 hectares of marine area. However, only a minimum of the freshwater areas and about 27 per cent of the brackish water swamplands have so far been developed into productive fishponds. Exploitation of the marine fishing grounds available in the country is concentrated within the coastal and inshore waters. This leaves the offshore waters practically untapped.

The total national fish output in 1966 was estimated to be about 700,000 metric tons. About 46 per cent of this total was contributed by municipal fisheries, 45 per cent by the commercial fishing vessels and 9 per cent by fishponds. The total production for that year represents a sufficiency level of about 69 per cent. Present studies show that fisheries and other marine products make up 17.9 per cent of the total gross physical output, exceeding even rice which is the primary staple of the Philippines. Based on the projected population in 1970 which would be about 38 million, and on the recommended nutritional per capita allowance of 30.66 kilograms, the fish requirement of the country by that year is estimated to be about 1.2 million metric tons. To meet this requirement, a projected program of fish production by the Philippine Government for a four-year period, which started in 1966 has been set at a yearly increment of about 85,000 to 87,000 metric tons. At this rate, it is expected that by 1970, the sufficiency level of fish output would be about 86 per cent.

A ten-year program of exploitation and development of the fishery resources of the Philippines from 1968 to 1977, primarily by the private sector, is recommended by the Ad-hoc sub-committee of the National Committee on Marine Sciences headed by Dr. Elvira O. Tan of the Philippine Fisheries Commission. Through a systematic and expanded program of development by private and public sectors, the output from island and offshore fisheries could be increased by 575,000 metric tons in the next ten years, thus narrowing the gap between supply and consumption requirements over the period.

To attain this goal of production in fisheries, a total capital investment of P414.9 million from private and public sectors is called for. If present trends continue, the estimated deficit in fisheries supply in the next

ten years in relation to total consumption would amount to 40,000 to 50,000 metric tons. Apparently, this gap between supply and consumption may be narrowed down considerably by improving the technology of the fish catch, by a consistent program of research on fishing gears and fishing methods and by strict government regulation in the use of all fishing grounds as well as close adherence to fish conservation laws and regulations.

In 1963 the Philippine Fisheries Commission registered 29,500 fishermen with powered and non-powered fishing boats, about 135,000 persons employed in fishpond and an estimated number of 500,000 fishermen engaged in municipal fishing. On the aggregate, the fisheries industry provides employment to about 6 per cent of the labor force which is estimated to be within 11.2 to 11.8 million persons in 1963.

The development of fisheries in our country has been greatly hampered by the lack of infrastructure facilities, most essential of which is the fishing port. The Philippines with its 2,393 commercial fishing vessels which increase at an average of 152 a year and its fish production of around 315,000 metric tons in 1966 does not have a single adequate fishing port in any of its major fish landing areas. There are about 500 government ports in the country but none has yet been purposely planned and designed to serve the fishing industry. However, the Philippine program for commercial fishing development for the period FY 1967-1970 includes the establishment of an integrated fishing port complex by the Bureau of Public Works in the Manila North Harbor near Vitas. A feasibility study for the development of the Navotas fishing port and fish market complex has been proposed by the Philippine Fisheries Commission and submitted for assistance from the Japanese Government under the Reparations Program. There are other feasibility studies for the construction of seven fishing ports being undertaken by the Bureau of Public Works and the U.N.-supported Deep-Sea Fishing Development Project. Priority has also been given by the Philippine Government for the completion of ice plant and cold storage facilities.

Another major factor that deters the progress of Philippine fisheries development is the big gap that exists between the industry and fisheries research. This gap includes the biological, ecological, technological and economic information that the fishing industry needs for development, improvement and expansion.

The largest sector of the fisheries industry is the marine fisheries which calls for the corresponding researches along the various aspects of the resources. Marine fisheries researches currently undertaken include biological investigations on commercial species of fish and minor sea products, oceanographic investigations, fisheries assessment and ecology of seaweeds.

In the Philippines, basic and even applied researches in physical oceanography are of limited extent. Adequate hydrographic surveys have been conducted by the Coast and Geodetic Survey on coastal and inland waters. Tidal and current surveys have also been carried out mostly in populated areas and along commercially important harbors. In marine geology, no investigations have been recorded except for some bottom samples taken during the bathymetric surveys by Coast and Geodetic Survey vessels. This scarcity of recorded data is even more apparent in marine geophysics. In the Philippine region, what marine gravity and geomagnetic data exist has invariably been observed by foreign scientists.

In inland fisheries, current researches being carried out in this area include fishpond management techniques, fish propagation and breeding, limnological investigations, inland fisheries evaluation and fish planting and water pollution studies.

Fresh water fish culture in this country is still in its infancy. New innovations are being tried while the present techniques are beginning to improve. However, there are still many problems that need research in this particular industry and among which may be mentioned the problems of feeds and feeding, control of diseases and parasites, breeding techniques, etc.

The National Committee on Marine Sciences has prepared a long-range National Program on Marine Sciences and Technology. Foreign assistance in some of the projects of the program would serve the national interests of participating countries especially on basic researches such as the seismic, geomagnetic and gravimetric survey of the Philippine waters.

A survey made by the National Committee on Marine Sciences on the manpower resources showed a total of 227 marine scientists and 462 technicians employed in 16 government agencies and private institutions. There are eight research vessels and fourteen laboratories for marine sciences research.

The Philippine National Committee for the International Biological Program as organized coordinates local activity in biology especially marine biology and establishes relation with other national biological programs under the international biological program.

Taxonomy is the basis of biological studies of marine organisms, including the ones of economic importance. In the Philippines, the basic need for good teaching and research in marine biology is a comprehensive and reliable taxonomy of the marine flora and fauna. Today, our basic problem in marine biology still remains taxonomic. The majority of our marine animals unlike those on Europe and U.S.A., are still unclassified.

I have endeavored here to give you a general picture of what we have in the Philippines, our problems and our needs in fisheries and oceanography research and development. Our Philippine panel will discuss these topics in detail when they sit down in the group sessions with their American counterparts.



It is my sincere belief that the keen enthusiasm and interest that have been generated by this Workshop spring from the exciting challenge that the study of the oceans has to offer — of the promise of new knowledge — new discoveries — of new horizons in science and technology which shall be opened by ocean research and development. But behind this intense and consuming desire to quench the thirst for knowledge is the sober realization that on the shoulders of scientists and technologists fall the burden of discovering ways and means to help, nay, even save, a world beleaguered by the serious and fearful problems of hunger, want, disease and poverty. Our scientists gathered here today, I venture to say, will have to seek solutions to the problems which confront production of food from the sea. The cooperative projects on research and development in fisheries and oceanography which may be developed as a result of the dialogue between the Philippine panelists and the U.S. panelists shall be carried out in our Philippine territorial waters and adjacent regions. I have mentioned earlier that the Philippines has been referred to by Dr. Spilhaus as a natural laboratory for fisheries and oceanography research and development. Nowhere, Dr. Spilhaus points out, is there a greater need for exploitation. From these cooperative studies we can then hopefully expect that our problem of fish deficiency shall be solved. New and/or improved techniques for efficient management and conservation of our fishing grounds, new and/or improved techniques for fish production which shall be used by efficient and trained fishermen may be reasonably expected. This new knowledge on fisheries and oceanography which may be acquired will not and should not be limited for the use of the Philippines and the United States. This knowledge must be shared not only by Southeast Asia but by the whole world if so needed and found to be useful in any particular area of the world. Knowledge must be shared if man wants to survive. Faster means of communication and travel have made our world smaller —we must therefore learn to live together and share scientific knowledge and discoveries for man's sake.

I look forward to fruitful and meaningful results from this Workshop in this "Pearl of the Orient Seas." If during our discussions we should find opportunities for international cooperative programs, it behooves on us to select only projects which can be readily financed and implemented and those which can create an impact on the common "tao" in the rural areas, the village fisherman and the industrial sector. If the program should result in low cost but high quality fish on the table of the common "tao" and his family as part of their daily meal, increased income for the village fisherman and the creation of new industries, big or small, then these opportunities for international cooperation programs would be worthwhile exploiting.

Lastly, I wish the Philippines-U.S. Workshop on Fisheries and Oceanography all the success and may the Divine Providence guide you in your week-long deliberations.

## RESPONSE

By DR. H. BURR STEINBACH  
*Chairman, U.S. Panel*

Chairman Salcedo, participants in the Philippines-U.S. Workshop, representatives of Embassies, international organizations, private industries and other distinguished guests.

It is my pleasure and honor to bring greetings from President Frederick Seitz of the National Academy of Sciences, Doctors Harrison Brown and Roger Revelle (the Foreign Secretary and Deputy Foreign Secretary respectively), and also from several other colleagues and good friends. These include Dr. Athelstan Spilhaus, who wishes that he could be here today, as he participated in the First and Second Workshops, and as you may remember, addressed the 1965 Science and Technology Week on the subject of marine resources. He has however just recently accepted the presidency of the Franklin Institute in Philadelphia, and his new duties have prevented him from joining us in person, although he is very much here in spirit.

As Chairman of the Pacific Science Board, I have the pleasure of extending the best wishes of the entire Board on this occasion and conveying the personal greetings of its Executive Director who is well known to you, Dr. Harold J. Coolidge.

Chairman Salcedo has given us all a welcome which is both eloquent and serious. I wish to join Dr. Salcedo in emphasizing the seriousness and the importance of the problems which we face together. Unless all of us, individually and as nations, work together in peaceful cooperation, none of us will have risen to the challenge of developing this earth — its full physical and human potential. The potential resources of the sea as Chairman Salcedo has pointed out are as vast as the oceans themselves. Much has been written and said about these resources and their importance to mankind. It is our task in this Workshop in Manila to outline significant and specific instances of the potentiality of ocean resources in a fashion precise enough to be meaningful for the welfare of the Philippines as well as for world science and technology.

There are severe limits to what can be achieved in one week, regardless of how hard we work and how well qualified the participants may be. We hope, however, to bring to bear the best possible joint thinking and experience so as to add our maximum contributions to the development effort, not only here in the Philippines, but in the region and in the world generally.

Dr. Salcedo has spoken of the progress of the Philippines-U.S. Workshops. The first Workshop, held in Manila in 1965, was truly a pioneering

effort. In the short two years since the first Manila Workshop, binational programs have been launched with several countries including Brazil, Peru and Nigeria. These binational programs, including the Philippines-U.S. program, have all benefited from, and indeed been made possible, by the encouragement of the Agency for International Development. Other binational programs are to be added in the near future.

Our first workshop was an exploratory one which attempted to survey a broad spectrum of science-related technological development problems in the Philippines, specifically those which might lend themselves to binational cooperation. That workshop found much to be done, and recommended a continuing series of workshops to come to grips with these development needs.

The second workshop, held in Asilomar, California and in Washington, D.C., selected for focus several major fields and attempted to assign certain priorities. It is extremely gratifying to observe that the National Science Development Board and the National Research Council of the Philippines have during the past year appointed highly qualified task forces to work on the five recommended priority tasks and to accomplish the necessary groundwork. As Dr. Salcedo has mentioned, this workshop on fisheries and oceanography was one of the recommendations. I can assure all of those present today that a large burden has been shouldered by the Filipino workshop panel. All of us are much ahead as a result of the hard and thoughtful work undertaken in preparation for this week's event.

We have before us no less a task than to meet the challenge set forth by Presidents Ferdinand Marcos and Lyndon B. Johnson in their joint communique which was quoted by Chairman Salcedo. We must grapple with plans and programs for "the advance of knowledge about growing food in the sea" for the ultimate benefit of all mankind. While we shall focus our special attention on instances of specific potential benefit to the Philippines, we shall also be serving in a large measure the economic welfare of all nations, as all nations have a stake in the knowledge of the proper use of the oceans. The task thus is twofold: (a) to consider specific resources of the ocean in this vital sector of the world and (b) to consider the technological means that will best allow scientific knowledge of the ocean and its resources to benefit the people of the Philippines and of the region on a sustained development basis. Secondly I would observe that we live in a world in which science and technology are transcending geographic boundaries and must quite soon transcend social, political, economic and other boundaries which separate men and nations. What we learn together and do together will advance the process of man's unification.

I would observe also that in the working sessions before us this week we have brought together something deeper and better than some specialists and experts consider as important as experts are. Chairman Salcedo and I believe that this workshop has brought together men of wisdom and fore-

sight, who have a real feeling and talent for the different and worthwhile job to be done. We will be addressing ourselves to the production of more fish for the table of the common man and more products from the seas and the ponds. Beyond this we shall consider the factors which make possible a major expansion of capabilities for continued development of fisheries. This means we must direct attention to education, training, research, management and information functions. We must consider practical means of achievement as well as the intrinsic value of scientific knowledge. Our working groups must undertake not only long-range thinking, but also assembling the "nuts and bolts" required for the machinery to get programs started now. I feel confident that the men for this task are in this room this morning. Chairman Salcedo and I ask only that each of us do his best to contribute to the maximum his experience, his knowledge, his imagination and inspiration.

From this workshop will come a report. This will not be a conventional report of a conference. It will rather be in the nature of recommendations and plans, cogent and timely. It will be in sections, reflecting the outline of the working groups and their respective frames of reference. The recommendations will have direct bearing on an important area of Filipino national economic and cultural life. Speaking for the U.S. group I earnestly hope that Dr. Salcedo, as Chairman of the NSDB, and his colleagues from various sectors-governmental and private in the Philippines—will find this report of genuine and practical value in both the short and long run. I hope that it will, in substance, lend itself to consideration for inclusion in the policies and programs which the NSDB and various branches of government undertake in the fields of fisheries and oceanography.

The art of making wise policy, and of devising effective programs, defies description. Who must decide where scarce manpower and funds are to be spent on a national scale? The answer to this is not the purpose of this conference. It is the purpose of this workshop to provide, insofar as possible, a sound basis on which such essential administrative and political judgments can be made.

Ladies and gentlemen of the Third Philippines-U.S. Workshop, working group members, resource panelists, advisors and observers, may I again urge, together with Chairman Salcedo, that you give this forthcoming week of meetings the benefit of your best thinking and efforts. I would like to call also for your contributions not only to make a success of this Workshop, but, more importantly, to sustain your involvement so that in the months and years ahead we may together advance as substantially as possible fisheries, oceanography, and science itself.

This conference is a beginning. It will be hard work but the real work must go on after we adjourn. It will involve many people and many institutions in the Philippines, in the United States, and in the Pacific

region. A good beginning has already been made, witness the excellent work that has been going on these past months here in Manila in anticipation of this meeting. I think it would not be immodest to say that we have been at work in the United States also. A month ago, for example, most of the U.S. panel held a meeting in Washington, D.C. and our people and their institutions have been increasingly involved. I can assure you we will continue to work with our Filipino colleagues when the workshop has ended.

During the week ahead, we hope to set goals and aims that are realistic, within a time-framework of the immediate, the intermediate, and the long-range. Above all we will commit ourselves to getting things done.

In closing I wish to extend sincere thanks on behalf of the National Academy of Sciences, and the U.S. panel members here today, for the opportunity to take part in this important task. I wish especially to express gratitude to Dr. Salcedo for the very thoughtful and effective hosting arrangements which have been made for us by him, his colleagues and his staff. I would like also to express my personal appreciation to Dr. Salcedo for this opportunity to work with him; and in this I know I am echoing the feelings of our U.S. Co-chairmen and all of the members of the panels in respect to working with their Filipino counterparts.

Lastly, may I appeal to every one here, including the gentleman of the press, to become involved in the task before us and in turn to involve more people and more institutions in the Philippines, in the United States, and in other countries of the region in rising to the challenge of development in this last half of the 20th Century—particularly man's great adventure in cultivating his aquatic environment which, with God's grace, we may make flourish as the agricultural arts and sciences have done for the land on which we live.

If I may quote one of our members, Dr. Harris B. Stewart, who in 1963, while he was Chief Oceanographer of the U.S. Coast and Geodetic Survey, wrote of "The Global Sea".

"It is man's last great resource on earth, and the oceanographer is dedicated to obtaining the necessary understanding of the sea on which must be based efficient utilization. The time has come to consider the ocean in its proper perspective, to realize that if we are to survive on this earth we must first understand the intricate workings of the global sea and the role this great body of water will play in the future of the human race."

**THANK YOU.**

## **JOINT SUMMARY**

By DR. SALCEDO JR., and DR. STEINBACH

Dr. Salcedo, Jr.:

Members of the Workshop Groups from the American and Philippine panels, panelists, resource persons, observers, guests, ladies and gentlemen:

It is a pleasure to report this morning on the work that has been attempted and completed since the opening of this workshop on Monday morning.

The Philippines and U.S. Panels, together with resource persons from several countries, were formed into four working groups. On Monday afternoon, Groups I and IV met together. These two groups were focussed upon Fisheries Production Technology and upon Social and Economic Factors affecting productivity. Likewise Groups II and III met together; their subject matter being Research and the Inventory of Marine Biological Resources.

The purpose of this joint session by two pairs of Working Groups was to come to grips with the practical task of considering a many-faceted subject in such a way as to properly relate these facets. On Tuesday and Thursday, in four half-day sessions, the four working groups met separately. Provision was made for linking the groups, with communication among them.

We feel that the Workshop subject, then, has been considered in its major aspects and that these have been correlated. Different perspectives of each group are reflected in somewhat different priority ratings for particular activities. For example, the amount of research, the kinds of research, the balance between short-range and long-range research, and other such considerations vary somewhat according to group. The areas of complete agreement, however, predominate throughout the findings and recommendations of the working groups.

### **Working Group on Production Technology**

The Co-chairmen were Commissioner Andres M. Mane and Dr. Wilbert M. Chapman; rapporteurs were Deputy Commissioner Domingo Tapiador and Dr. John E. Bardach.

Considering projected population increases it is clear that the Philippine Government with its agencies and the private fishing industry of the Republic must aim at further stepping up fish production in order to raise the per capita fish supply and to close the gap between supply and demand now filled by imports.

While the total fish production in the Philippines has steadily increased during the last decade, there existed according to 1965 statistics a supply deficit of about 8% of landings by weight which was made up by foreign imports. Based on aims for *nutritional sufficiency* for the Republic the deficit is far greater, namely 31%, according to the preliminary statistics for 1966. Though the value of the fish catch in 1965 was P722 million or 4.2% of the national income, the above-mentioned fish import necessitated expenditures in foreign currency amount to P54.5 million.

Group I, on Production Technology, therefore attempted to clarify present problems in fish production and possibilities for the expansion of fisheries. They analyzed ways and means to raise fish production, covering in their consideration commercial and municipal sea fisheries, brackish and fresh water fish production and certain training and manpower needs.

The group has presented twelve recommendations which are arranged in order of estimated impact upon a national effort to increase fish production. Each of these twelve recommendations is carefully spelled out in the full text which is available this morning.

#### **Working Group on Research**

We proceed now to a brief summary of the report of Working Group II, on Research. This group considered research requirements for fisheries for "aquiculture" (or the cultivation of fresh, brackish, and marine water areas), for new products, and in certain general aspects of oceanography.

The Co-chairmen were Captain Constancio M. Legaspi and Dr. John C. Marr; rapporteurs were Dr. Elvira O. Tan and Dr. Lucian M. Sprague.

The charge to Working Group II was to examine the status, organization, facilities, information services, manpower and training needs, opportunities for international cooperation in fisheries research and development, and the International Biological Program. A proposal was also heard (in a joint meeting with Group III) for a Marine Biological Sorting Center. The assigned topics were examined in the context of identifying problems, barriers, and deficiencies. Accordingly, the agenda followed was: factors needed to increase fish production, divided into inland, littoral, and marine fisheries; structures of the government sector; structures of the academic sector; and basic research in aquatic resources.

The prime emphasis of Group II was placed on the need for national policy on the wise use of aquatic resources. The group found that about 6% of the labor force in the Philippines depends on the products from the aquatic environment for its livelihood. Nearly 38% of the yearly animal protein requirements of the Filipino people is furnished by domestic aquatic protein sources. With the rate of population increase, one of the highest in the world at 3.2%, a clear need for additional sources of animal protein now exists, and the need will increase very rapidly in the future. Although

there may be some restricted areas in which the rate of harvesting aquatic resources already exceeds the rate of natural production, there is no doubt that the total sustainable harvest of aquatic resources is capable of substantial expansion. A complex series of social, economic and biological problems now exist which serve to inhibit the full development of the existing aquatic resources and the discovery of new resources and new products. Resolution of these problems will require action at the highest levels of government. The working group strongly recommended that policies be promulgated at the highest levels of government and articulated in the form of a carefully formulated national policy on the wise and full utilization of the aquatic environment, and that these policies, once articulated, be implemented promptly through all levels of the executive, legislative and judicial branches of government at the national, regional, and community levels.

At this stage I would like to yield the podium to my Co-chairman, Dr. H. Burr Steinbach.

Dr. Steinbach:

Thank you, Dr. Salcedo, Members of the panels, observers, guests. It is my pleasure to continue this report with a brief summary of the Third and Fourth Working Groups.

#### **Working Group on Inventory of Marine Biological Resources**

Our Third Working Group addressed itself to a somewhat more focussed topic, that of an inventory of the marine biological resources of the Philippines and adjacent waters of the region. The Co-chairmen were Dr. Gregorio Velasquez and Dr. I. Eugene Wallen; the rapporteurs were Mr. Claro Martin and Mr. Richard C. Vetter.

By way of background, it should be stated that the Second Philippines-U.S. Workshop on Scientific Cooperation in Science and Technology held in California and in Washington, D.C. in November, 1966 recommended that the U.S. representatives should pursue certain specified aims, one of which was to encourage the establishment in the Philippines of a marine specimen sorting center. The Smithsonian Institution, it was recommended, should be urged to assist the Philippines in the development of a specimen processing center in the Philippines.

This working group discussed the need for such a center in the Philippines. They investigated in great depth the value of such a center in resolving taxonomic and biological problems, the scientific and economic benefits the center will contribute to the country and to the region, where it would be best located, and the steps to be taken toward its establishment; and other related matters. The working group reviewed and developed further a position paper prepared by the Philippine Panel as a



basis for the development of a proposal, which appears as an appendix to the full report by Group III.

The participants strongly recommended the establishment of a specimen sorting center, which may be designated "The Indo-Pacific Aquatic Resources Center." It should be located in a suburb of Manila, preferably at the University of the Philippines. It would be established, hopefully, subject to a memorandum of agreement to be drawn up by the National Economic Council of the Philippines and the U.S. Agency for International Development. The full report, containing a number of sections, is available in the material distributed this morning.

#### **Working Group on Social and Economic Factors**

We come now to the report of the Fourth Working Group, which dealt primarily with social and economic factors. The Co-chairmen were Dr. Amando Dalisay and Dr. James A. Storer; rapporteurs were Director Cornelio Crucillo and Mr. William A. W. Krebs.

The Working Group on Social and Economic Factors has presented eleven enumerated findings with eleven corresponding or closely related recommendations. Group IV focussed its attention on obstacles and limitations in the economic field which restrain optimum development of the fisheries resources of the Philippines. The discussion recognized that conditions vary widely among deep-sea, coastal, brackish water, and inland freshwater fisheries, but that some factors are common to all the resource areas. In making the findings and recommendations, the conferees wished to make it clear that neither time nor data were adequate for conclusive determinations, but that, under the circumstances, the views recorded represent the pooled best judgment of a group of informed persons. The recommendations covered eleven key topics, which you will again find summarized in the material available to you.

We are indebted to Working Group IV for stating well a finding that has been shared in all four working groups, which I would now like to quote in full. "The successful development of fisheries resources in virtually all economies has followed from a systematic and comprehensive effort to develop a program with at least the following ingredients:

- a. High level policy decisions by government which identify fisheries development as an important national objective.
- b. These decisions are followed by an adequate strategy and implementing measures on the part of government.
- c. Adequate research to define sound approaches to the problems of development, cutting across jurisdictional boundaries and traditional practices.
- d. The political will to execute these development programs in the face of competing demands, many of which are also meritorious but rationally of lower priority.

- e. Adequate economic incentives, consistently pursued and sustained over a long enough period of time to generate confidence on the part of investors, large and small."

In the words of recommendation number one, we would re-state the importance of a national commitment.

"Purposeful, consistent development of the fisheries resources of the Philippines should be identified as a national program of high priority, requiring the commitment of major resources of the economy by both the Government and the private sector, in a well-planned, integrated effort. The increasingly successful national program to expand the production of rice provides an example worthy of emulation."

We would reiterate also a point brought out in discussion, namely, that while sound and inspired policy is essential, it must be accompanied by good strategies to implement policy, and effective organization to carry through these strategies. If we wish to witness comparably dramatic results in the increase of fish production as has been seen in rice — and we are firmly convinced this can be achieved — then we require comparable organization and commitment to tackle the job.

We would now like to bring this summary to a close with a few brief comments.

The findings and recommendations will be edited and included in a full report of the workshop to be published soon. This will include all of the background data, position papers, agenda, lists of participants, and so forth. We shall include, and shall make available before the publication of the final volume, a list of all participants, indicating their office address. The purpose of this is to enable all to constitute a "committee of the whole" for continuing communication and cooperation. We would urge that everyone, upon receipt of this listing, place the names on distribution lists of their respective institutions and publications, and in addition, to keep in touch personally and directly. We will also be exploring the feasibility of following up various recommendations, and of establishing suitable mechanisms for continuing this effort.

#### **Continuing Program of Science Cooperation**

It is our pleasure to report that solid progress has been made in regard to plans for the continuing Philippines-U.S. dialogue on scientific and technological cooperation and development. Our present schedule calls for three workshops between now and the middle of 1969. The first, probably at mid-year 1968, is to be a comprehensive and intensive workshop on the coconut industry in all its aspects. The second, late in 1968, will be on industrial development and research, and the third, to be held about mid-1969, will be on food, nutrition and demography.

A continuing program committee of fourteen persons met twice this week to work on these future activities. Yesterday, a nucleus group was formed, and has begun its planning for the next workshop, the one on the coconut industry. It is gratifying to note that our current workshop has gone into the matter of fisheries, a vital adjunct to the wonderful work which has been done in the field of rice production. Coconut research and development will, together with rice and fish, constitute a vital grouping of highest priority tasks.

We hope that all of the participants in the Third Philippines-U.S. Workshop will continue to extend their interest, support, and participation as this program of cooperation proceeds and grows in the years ahead.

It has been a privilege for us to serve in this noteworthy event.

## REPORT OF WORKING GROUP I PRODUCTION TECHNOLOGY

### *Philippine Panel*

*Chairmen:* Com. Andres M. Mane  
*Rapporteurs:* Dep. Com. Domingo Tapiador

*Members,* Atty. Florentino Cayco  
*Resource* Dep. Com. Santos Rasalan  
*Persons and* Mr. Ignacio Salcedo, Jr.  
*Consultants* Mr. Jose Sulit  
Mr. Alfredo Trono  
Mr. Einar Kvaran

### *U. S. Panel*

Dr. Wilbert Mcl. Chapman  
Dr. John E. Bardach

Mr. Nicholas R. Pellicani  
Mr. Peter Wilson

### **Introduction**

While the total fish production of the Philippines has steadily increased during the last decade, there existed according to 1965 statistics a supply deficit of about 8% of landing by weight which was made up by foreign imports. Based on aims for nutritional sufficiency for the Republic the deficit is far greater, namely 31%, according to the preliminary statistics for 1966. Though the value of the fish catch in 1965 was P722 million (4.2% of the national income) the above mentioned fish import necessitated expenditures in foreign currency amounting to P54.4 million.

Considering projected population increases it is clear that the Philippine Government with its agencies and the private fishing industry of the Republic must aim at further stepping up fish production in order to raise the per capita fish supply and to close the gap between supply and demand now filled by imports.

The production panel of the Phil.-U.S. Workshop on Fisheries and Oceanography therefore attempted to clarify present problems in fish production and discussed possibilities for the expansion of the fishery.

There follow here brief accounts of the salient points in the discussions mainly about ways and means to raise fish production, separated according to commercial and municipal sea fisheries, brackish and fresh water fish production and certain consideration of training and manpower needs. Cognizant of both joint and separate roles that the government agencies and private sectors of both countries may play in future fisheries developments of the Philippines, recommendations resulting from the panel's discussions (referred to by numbers in the text arranged by order of estimated impact on additional fish production) are presented, wherever possible, so that responsibilities and action spheres can be ascertained.

## **Findings**

### **The Commercial Fishery**

Commercial fishing operations in Philippine waters accounted in 1966 for about 45% of the supply; they have trebled their output within the last decade. A division can be made into the more important pelagic sector, relying on sardines, scads and mackerels and using bagnets and purse seines and a demersal one fishing with other trawls mainly for slipmouth and also for several other bottom dwelling species. The biology of neither the one nor the other species complex is sufficiently known, especially lacking is information about population parameters (6). Present statistics based on "fish caught" fee records are suspected to be inaccurate and need improvement (6). Pelagic stocks appear amenable to increased exploitation especially if further attempts are made, with the development of proper technology, to include tuna in the pelagic catches (11).

Demersal stocks near shores have been reduced and in places well nigh exhausted even though dynamiting, a prevalent method of fish catching is purported to have declined (8). Trawling and most other ways of fishing is carried out mainly in shallow waters. While life histories of the trawled species are not known (11) it is certain that mostly their juveniles are caught in the trawls for which no mesh size regulations exist (12).

Once captured pelagic and demersal catches alike are liable to suffer from the scarcity of ice, refrigeration and marketing facilities (1). These shortcomings often causing financial hardships are very pronounced in Manila, the largest market for fresh fish and the one which sets island-wide prices. They also cause disfunctions in other localities (1). Especially in need of consideration is the control through licensing by the Philippine Public Service Commission of the establishment of new ice plants and means to insure adequate performance by franchise holders. Certain curbs to the expansion of commercial fishing also exist in customs tariffs on selected fishing accessories (4) and in the difficulties of obtaining credits for commercial fisheries developments (2). Also noted were insufficiencies in training opportunities (7).

### **The Municipal and Subsistence Fishery**

The numerous smaller vessels engaged in inshore fishing now land about as much fish as the commercial sector but their contribution to the total catch has increased more slowly during the last decade. Municipal fishing is under local municipal government control, with some revenue derived through taxation and from returns of auctions for fishing sites. As the fishermen truly take what they can get and as they have increased and will continue to increase in number, the municipal and subsistence fishery needs to have conservation measures applied to it. Such measures would require that the P.F.C. be given paramouncy in the regulation of fisheries for conservation purposes (9). Execution of such measures as the P.F.C.

may deem appropriate in this context has political constraints the removal of which can be reached by the formulation and the pursuit by all sectors of the government of a positive fisheries policy. No further discussion of these measures is made in this report but it should be noted that the municipal sector of the fishery has more limited scope for expansion than both the commercial offshore fisheries and fish culture. Even so improvement measures both concerning gear and continued motorization must be applied to it.

#### **Brackish and Freshwater Fish Culture**

Fish have long been grown in brackish water ponds all throughout the Philippine islands. The culture of the milkfish, the primary species involved has, however, been very extensive with little heed given to fertilization, suppression of competing species, staggered harvests etc. In consequence the average per hectare yields remained at a quarter or less than those possible (see attached summary on Philippine fish culture by Dr. Yun-An Tang, FAO). It appears possible only through application of modern techniques to raise the present production of 64,000 metric tons, well to be noted without establishing new ponds. Now unused swamplands along the coast of the Philippines have even greater development potential in the long run. Other euryhaline species such as mullet can also be grown in certain types of brackish water ponds and mixed shrimp and fish culture is promising (5). Even though modern techniques of fish culture also applicable to the Philippines have been worked out in Taiwan certain adaptive research geared towards local conditions and practices will still be necessary (9), while extension efforts are required for dissemination and eventual adoption of advanced fish culture practices (3).

Shallow water marine aquaculture has been developed in other parts of Asia; there exists such potential also in Philippine waters; this aspect of fisheries development also warrants attention. Especial aquicultural potential lies in the development of inland, freshwater fish culture with possible future yields estimated at 500,000 metric tons. The particular value of developing upland aquaculture would be in supplying proteins to presently food-poor regions where no transportation facilities exist. In the lowlands fish farming would lend a new dimension to diversifying agriculture. Possibilities for adaptive research (5) and extension (3) needs to be provided.

#### **Manpower**

Government sectors (P.F.C.), the commercial fishing industry and fish culture now suffer from lack of trained manpower. Training facilities range from being inadequate (fisheries high schools) to be somewhat under par. Many do not offer practical training such as would be required to make their absolvents fill industry positions satisfactorily (6).

## **Recommendations**

- 1) Concerns infrastructure of the commercial fishery, ice, markets, docks.
- 2) Concerns credit for commercial fisheries development.
- 3) Concerns extension services to disseminate knowledge of modern methods.
- 4) Concerns customs tariff regulations for fishing accessories.
- 5) Concerns fresh and brackish water research station.
- 6) Concerns gathering of fishery statistics.
- 7) Concerns on the job training of fishermen.
- 8) Concerns scientific investigation into the effects of dynamite.
- 9) Concerns paramouncy of the PFC in the conservation regulation of all fisheries.
- 10) Concerns tuna fishery demonstrations in the U.S. Trust.
- 11) Concerns the gathering of biological information on pelagic and demersal fish stocks.
- 12) Concerns regulation of trawl mesh size.

### **1. *Infrastructure of the Commercial Fishery***

Fish once caught must reach markets and from there they must be distributed to the consumers. If the catch cannot be preserved or unloaded increases in catch do not properly fill the demand that brought them about. There is lack, in the Philippines, of ice, cold storage, adequate docking and fish unloading facilities. Their establishment is one of the most important steps that can be taken to increase supply, if through no other method than by curbing spoilage. Workshop participants consider that these are matters that concern the Fisheries policy of the government which customarily supplies these infrastructures for its industry. Strong representation is required by all interested parties to bring about early realization of plans for the above-mentioned improvements, first in greater Manila and subsequently in other locations in the Republic.

### **2. *Credit for Commercial Fisheries Development***

Commercial fishermen have difficulties obtaining credit at reasonable rates for expanding and developing their operations. The influence is limited which a technical agency such as the P.F.C. can have on the banking sector; the workshop panel participants, therefore, recommend consideration of this matter by national banking establishments and other concerned parties. Like the lack of infrastructure, particularly inadequate fishing ports are delayed, difficult credit arrangements seriously hamper the expansion of the commercial fishery.

### **3. *Extension Services***

Adaptive and basic research is considered necessary for the development of brackish and fresh water fish culture but there are lacking

adequate facilities for this research. The establishment of such facilities now under consideration for financing by USAID is strongly recommended by the panel.

4. *Customs Tariff Regulations*

Fishing nations customarily favor their industry by special customs regulations. While certain customs tariff remissions exist in the Philippines they are by no means rational and leave certain important fishing accessories in the realm of highly taxed commodities. Cooperation is recommended between the P.F.C., spokesmen of the private industry and the Customs Bureau, if necessary involving representation with the legislative body of the Republic, to provide customs tariff remission for all fisheries accessories. Need is further seen for speeding processes in governmental offices towards the granting of such permits as are necessary for the importation of commodities essential to the fishing industry.

5. *Fresh and Brackish Water Research Stations*

Much development in the fisheries sector of the economy depends on effective dissemination of new information. Content and guise of this information must be geared to the intended recipients. There is presently a lack of manpower to be employed in this endeavour. Such extension work requires certain skills that might be extant in Peace Corps volunteers. Their use in fisheries extension work is recommended, after they have received some training either in the U.S. or in the Philippines. Use of Peace Corps volunteers should not exclude other arrangements to disseminate information and demonstrate techniques, such as on the job training of junior experts, etc. The panel wishes to stress the need for fisheries extension work in the Philippines to all agencies concerned, those of the participating governments as well as others, especially the United Nations agencies. U.N. agencies (FAO and UNESCO) might also be reminded that there is a scarcity of printed fisheries instructional material at all levels and that the preparation of such materials, especially for vocational schooling should be pressed.

6. *Fishery Statistics*

Statistics derived from "fish-caught" fee records which are also the basis of some government revenue and accessible to official scrutiny are always suspected to be low; they are now adjusted by an arbitrary "raising factor." It is, therefore, desirable to derive catch figures through other channels. It is recommended that the P.F.C. implement the plans, jointly with the fishing industry, to devise a sampling technique that reflects more accurately than that now employed, the landings of fish in the Philippines. Peace Corps volunteer services may be of value here.



## 7. *Training of Fishermen*

It is recommended that facilities be used for improved training wherever they may be found, e.g., the High Commissioner of the Trust Territory of the Pacific Islands may be asked to assist the Philippine Government in establishing a Fisheries Training Center in the Palau Islands where various techniques of commercial inshore and offshore fishing are now being practiced and where modern infrastructure such as ice plants, cold storage plants, docks, boat building and dry-docking facilities are available. The Fisheries Training Center should provide intensive training in those areas where the skills of the individuals can best be put to use. Such training should consist of but not be limited to:

1. Conservation principles as they could be utilized by a Conservation Officer or Extension Agent.
2. Various techniques of inshore and offshore fishing.
3. Proper operation and maintenance of engines, vessels and gear.
4. Various preservation techniques.
5. Wholesale and retail marketing practices.

## 8. *Scientific Investigations on Dynamite Fishing*

Divided opinions appear to exist about the effects of dynamite on fish and their habitat. The P.F.C. would be well advised to undertake impartial studies of the use of charges of various sizes and in various depths of waters and directed towards various species. Properly documented materials on the effects of dynamite should be assembled, with the assistance of appropriate U.S. sources, together with the results of the PFC findings, to be turned into educational tools of a kind that can be used in schools and fishing villages. Peace Corps assistance may be useful in this phase of the operation.

## 9. *Conservation Regulation of all Fisheries*

It is recommended that the formulation and implementation of fishery development and management in the Republic be elevated in the policy making structure of the Federal Government and thus the entire position of the PFC in the government be enhanced and greatly strengthened. Among the changes of this sort most required is giving of an amount to the PFC in carrying out conservation practices for all fisheries.

## 10. *Tuna Fish Demonstrations*

There exists in Philippine waters a substantial source of live bait species such as anchovies which can be "converted" into tuna much more effectively than into dried fish. Also, the skipjack resources of the Philippines are not being utilized as they are in such nearby islands

as the Celebes and the U.S. controlled Palau Islands, 500 miles to the East of Mindanao. The Panel urges the Philippine Government to take steps encouraging introduction of foreign capital and technicians to assist in the development of a tuna fishing industry by joint venture or other means. Also recognizing the need for on-the-job training programs and demonstrations of actual commercial tuna fishing techniques, the Panel recommends that the Philippine Government request the High Commissioner of the Trust Territory of the Pacific Islands to assist in providing such facilities, personnel and equipment as might be made available to provide selected Philippine nationals with a background in commercial fishing, especially for tuna.

11. *Biological Information on Pelagic and Demersal Fish Stocks*

Gathering of biological information in the age and growth parameters of an exploited species requires intensive and long term studies, much of them of a routine nature but still requiring careful planning and coordination. Scarcity of highly trained experts suggests efficient use of those that exist. It is therefore recommended that NAS canvass interest and availability for limited periods of U.S. marine population ecologists to organize and direct research into pelagic fish stocks in Philippine waters. Depending on their affiliation the involvement in Philippine fisheries research may be done through sister university arrangements, however, with logistic support, vessel, etc., by the PFC

12. *Regulation of Trawl Mesh Sizes*

Restrictions on mesh sizes are universally employed in efforts to afford the escapement of young fish. Inasmuch as there appear no trawl mesh limitations in the fishing laws of the Philippines, the P.F.C. should undertake studies to determine whether or not their introduction would be feasible and effective.

**A Brief Report to the  
RP-US Workshop on Fisheries and Oceanography  
Working Group I — Production Technology**

**"IMPROVEMENT OF POND FISHERY PRODUCTION  
IN THE PHILIPPINES"**

By DR. YUN-AN TANG, FAO

1. *The general feature of pond fishery in the Philippines*
  - 1.1 Brackish pond fishery
    - a) Total area of fishponds: Approx. 137,000 hectares
    - b) Tidal lands available for development: Approx. 700,000 hectares.
    - c) The rate of development in area: 2.3% or equivalent to 3,000"/yr.
    - d) The annual fish production: 63,000 MT
    - e) The average annual fish production: Approx. 460 kg./ha.
  - 1.2 Freshwater pond fishery
    - a) Total area of fishponds: Approx. 6,000 hectares
    - b) Floodlands available for development: 186,000 ha.
    - c) The yearly fish production: 2,000 MT
    - d) The average fish production: 350 kg./ha./yr.
2. *The Problems*
  - 2.1 Fish production from the Philippine fishpond is lower than that of modern fishponds in other countries.
    - a) Brackish-water ponds: One fifth of modern fishponds
    - b) Freshwater ponds: one tenth of modern fishponds
3. *The vital causes of low fish production in brackish water ponds*
  - 3.1 Fish production from the Philippine fishponds are mostly dependent on the natural productivity of the waters.
    - a) 70% of the total fishpond area or equivalent to 100,000 hectares of the fishponds in this country is entirely dependent on the natural productivity of the bodies of water.
    - b) 30% of the total fishpond area or equivalent to 35,000 hectares of fishponds are receiving a limited quantity of manure, fertilizer and supplemental feeds.
  - 3.2 Inadequate pond construction
    - a) The dikes of the majority of fishponds are unable to hold water nor able to prevent floods.
    - b) Lack of water supply and drainage systems

- c) The bottoms of the ponds are not leveled.
- 3.3 Lack of advanced techniques of pond management.
- 4. *Methods for improvement of brackish-water pond production*
  - 4.1 The dikes of the fishponds should be constructed on scientific basis i.e., the design and engineering of the dikes should be based on the data of the elevation of the land, the range of the tide, the structure of the soil, the drainage of the river basin, the watershed and topography of the river systems, the climatic and flood conditions of the area, etc.
  - 4.2 Proper layout of different kinds of ponds to facilitate water supply and drainage systems and install water control gates.
  - 4.3 Providing feeder roads to facilitate transportation to fishpond area.
  - 4.4 Application of modern techniques of pond management
    - a) Pond fertilization
    - b) Supplemental feeding
    - c) Algal pasture protection
    - d) Manipulation of pondfish population
    - e) Fish parasite and disease control
- 5. *Accomplishments of the UN/FAO Fish Culture Development Project*
  - 5.1 Improvement of brackish-water pond fishery
    - a) Demonstration of modern technique of pond management in large scale throughout the country
      - 1) Increase of fish production to over 300% to the national average fish production from the ponds of those: a) having strong dikes and b) having leveled pond bottoms
      - 2) Increase of fish production to over 300% to the national average fish production from the ponds of those: a) having strong dikes, b) having leveled pond bottoms, c) providing water supply and drainage systems and d) installing water control gates.
    - b) Extension activities
      - 1) Fish culture seminar for dissemination of modern techniques of pond management:  
Totalling 48 fish culture seminars with a participation of 1,250 farmers were conducted in various regions of fish culture centres of the country
      - 2) Technical assistance to private sectors:  
420 units fish farms with a total area of approximately 18,000 hectares of fishponds were received with technical assistance for improvement of fish production rendered by the technical personnel of this project.
  - 5.2 Development of freshwater pond fishery
    - a) 17 units with a total area of about 70 hectares of "upland fish-

pond" have been developed. The average yearly fish production from this type of fishpond is about 3,000 kg. per hectare.

- b) 6 units with a total area of about 50 hectares of "lowland fishpond" have been developed. Demonstration of fish production from this type of fishpond is being undertaken. Periodical sampling from the demonstration ponds indicates very promising results.

#### 6. *Prospects of the Philippine fish culture industry*

##### 6.1 Brackish-water pond fishery

- a) By modernization of existing ponds the fish production is expected to reach 350,000 MT/annum
- b) By development of available tidelands into modern fish ponds the fish production is expected to attain 2,000,000 MT/ annum

##### 6.2 Freshwater pond fishery

###### a) Lowland fishpond:

There are 186,000 hectares of available flooded land and can be expected to produce 600,000 MT/annum

###### b) Upland fishpond:

This is a great potential for development for this type of fish pond in the country because of the availability of rolling lands and because of the abundance of rainfall

#### 7. *Conservation of tidelands*

Without proper control and wise management, the development of tidelands into fishponds along the coasts may result in the causes of the following problems:

- 1) The occurrences of floods in the river systems
- 2) The loss of breeding and nursery grounds of fish stocks in the seas along the continental shelf
- 3) Competition with small fishermen for fishing grounds along the coasts
- 4) The loss of natural barriers between the open seas and the solid shorelines.

In order to eliminate or minimize the foregoing damages caused by the development of tidelands, the following solutions which are experienced in other countries may be adopted to the conditions of this country. These include the following suggestions:

- a) Based on data of investigation, the extent of flood area in the downstreams of each river systems in the country be determined. The tidelands located within the flood extents of the river basins be prohibited to be developed into fishponds.
- b) Based on biological and climatic conditions, the minimum extents of tidelands extends to the sea floor into the inland

which are used as natural barriers between the open seas and the solid shorelines be determined and the development of this area be regulated.

- c) Comparative evaluation of the economic productivity in particular areas among the tidelands be determined and priority be given to the local inhabitants to utilize these higher economic important areas.
- d) With financial assistance from the Government or other institutions, the fish farmers' cooperatives organized by the fishermen who are inhabitants in the tidelands be given priority to develop fishponds or, the government be responsible to finance and construct the fishponds and the completed fishponds be sold to the local fish farmers by repayment in yearly installments of long term.

**Probable Prospectos for a Ten-Hectare Bangos Fishpond Project  
Supplied by the Philippine Research Society on Fish Culture (PHILRES)**

**A. Capital**

Application fee .....		P 5.00	
Bond Deposit .....			100.00
<b>Cost of development</b>			
Clearing the area at P300/ha.	P 3,000.00		
Construction of main dikes (Perimeter-1,350 lineal meters w/ vol. of 6.24 cu. meter per 1. m., plus 20% for shrinkage, at P1.50 per cu meter) ..		15,163.50	
Puddle trench along main dike (1.0 m wide x .5 m. deep) or 0.5 cu. m. per lineal meter, 1350 meters long, at P.50 per cu. m.			337.50
Secondary dikes (650 meters w/ a volume of 3.0 cu. m. per lineal meter, plus 20% for shrinkage at P1.30 per cu. m.) .....			3,042.00
Puddle trench for secondary dikes (0.5 m x 0.5 m., 650 1. meters at P.50 per cu. m.) .....			81.25
Uprooting of tree stumps, approx. 100 stumps per hectare, at P5.00 per stump, for 10 hectares ..			5,000.00
Excavation of 1,250 cubic meters per hectare (cut and fill preparatory to final levelling) at P.80 per cubic meter, for 10 hectares .....		10,000.00	
Leveling at P500 per hectare		5,000.00	
1 caretaker's shed .....		1,000.00	
1 main concrete gate .....		2,000.00	
4 secondary wooden gates at P120 .....		480.00	
2 small wooden gates and 1 culvert type nursery gate at P50.00 .....		150.00	
Bamboos, tying materials other supplies .....		500.00	
			<u>46,254.25</u>

Miscellaneous equipment

1 gill net (gayed) . . . . .	180.00		
1 fingerling suspension net . . . . .	100.00		
1 fingerling seine . . . . .	100.00		
1 big banca for hauling fish, fertilizers, supplies, etc. 2 to 3 ton capacity . . . . .	400.00		
10 flatboats for excavation and leveling work	1,200.00		
Digging blades, pails, rakes, bales, basins, etc.	100.00	<u>2,080.00</u>	<b>₱48,439.25</b>

**B. Gross Income**

1. 15,000 kilograms of bangos at ₱1.50 (1,500 kilos per hectare per year) . . . . .	₱22,500.00		
2. Miscellaneous species of fish shrimps, crabs, mullets, samarals, kitanga etc.) . . . . .	₱ 1,000.00	<u>₱23,500.00</u>	

**C. Operating Expenses**

1. Annual rental at ₱10.00 per hectare . . . . .		₱ 100.00	
2. Purchase of 120,000 bangos fry at ₱10.00 per thousand		1,200.00	
3. Salary of 1 caretaker at ₱120.00 per mo. . . . .		1,440.00	
4. Emergency labor . . . . .		100.00	
5. Supplies and materials . . . . .		150.00	
6. 30 tons agricultural lime .. (neutralizing action — 10 years)		60.00	
7. 2,500 kilos of organic fertilizers at ₱.13 per kilo and 10 bags chemical fertilizers at ₱20.00 per bag . . . . .		5,250.00	
8. Miscellaneous and other expenses . . . . .		300.00	
9. Depreciation on equipment			
2% on cost of concrete gate . . . . .	50.00		
20% on cost of wooden gates . . . . .	126.00		
50% on cost of nets . . . . .	190.00		
15% on cost of flatboats	180.00	546.00	



10. Fixed charges			
10% interest on capital		4,843.90	
11. Sales charges			
Broker's commission			
(4% on sales) . . . . .	940.00		
Marketing expenses (1/2			
of gross sales) . . . . .	117.50	1,057.50	
12. Caretaker's bonus ₱10.00 per			
ton of fish produced . . .		150.00	
13. 20 pcs. fish containers			
(boxes or baskets) . . . .		40.00	15,237.40
		<u>          </u>	<u>          </u>
D. ANNUAL NET INCOME FOR			
ONE YEAR . . . . .			₱ 8,262.60
E. PERCENTAGE OF ANNUAL			
PROFIT TO CAPITAL . . . . .			17%

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NOTE: The above expenses are based on the assumption that (1) the area is a virgin swamp, with 2nd growth forest; (2) there are at least 2 cracks to close; (3) desired elevation is 1 foot lower than the diurnal tide range for the area (figures may be taken from Tide and Current Tables of the Philippines under Tidal Differences and Constants); (4) labor is imported and workers get at least ₱5.00 per day and (5) that in leveling, 50% of the area has to be excavated.

## REPORT OF WORKING GROUP II: RESEARCH-FISHERIES AQUICULTURE, NEW PRODUCTS, OCEANOGRAPHY

	<i>Philippine Panel</i>	<i>U. S. Panel</i>
<i>Chairmen:</i>	Capt. Constancio M. Legaspi	Dr. John C. Marr
<i>Rapporteurs:</i>	Dr. Elvira O. Tan	Dr. Lucian M. Sprague
<i>Members, Consultants Persons and Resource</i>	Dr. Silverio Cendaña Fr. Sergio Su, S.J. Mr. Juanito Fernandez Mr. Mario Manansala Mrs. Priscilla C. Borja Dr. Jose Domantay Mr. Macario Palo	Dr. Maxwell S. Doty Dr. Harris B. Stewart

### Introduction

The charge to Working Group II under this general subject heading was to examine status, organization, facilities, information, the International Biological Program, manpower and training needs, and opportunities for international cooperation in fisheries research and development. A proposal was also heard (in a joint meeting with Group III) for a Biological Sorting Center. The Working Group agreed at its first session that the assigned topics could best be examined in the general context of identifying problems, barriers, and deficiencies. Accordingly, the agenda followed was:

- I. Factors needed to increase fish production
  - a. inland
  - b. littoral
  - c. marine
- II. Structures of government sector
- III. Structures of academic sector
- IV. Basic research in aquatic resources

Although it is not specifically stated in this report, it is obvious from the contents of the report, as it was during the course of the discussions, that the problems having major effects on the course of research are frequently not research problems. The first of these is the need for a policy decision at the highest levels of government concerning the importance of aquatic research. The second relates to inadequacies and imbalances in funding, staffing and facilities.

The need for increased cooperation and coordination among governmental and private organizations concerned with aquatic resources and the aquatic environment was noted.

A number of what may be termed institutional barriers were identified, the most important of which is the linkage of taxes to fishery statistics. This linkage effectively prevents the collection of accurate catch statistics which form the basis for rational resource management.

Additional studies needed in six broad areas were identified.

Other general problems were also identified.

Finally, the need for effective mechanisms to facilitate the continuity of workshop activities was noted.

Although it is difficult, if not impossible, to indicate priorities in a linear listing, the general order (starting with the most important) of importance attached by the Working Group to its recommendations has been followed in the list of recommendations.

## **Recommendations**

### **Need for National Policy on the Wise Use of Aquatic Resources**

About 6% of the labor force in the Philippines depends on the products of the aquatic environment for its livelihood, nearly 38 per cent of the yearly protein requirements of the Filipino people is furnished by domestic aquatic protein sources, and the rate of population increase, one of the highest in the world, is 3.2 per cent. A clear need for additional sources of animal protein now exists and the need will increase very rapidly in the future. Although there may be some restricted areas in which the rate of harvesting aquatic resources already exceeds the rate of natural production, there is no doubt that the total sustainable harvest of aquatic resources is capable of substantial expansion. A complex series of social, economic and biological problems now exist which serve to inhibit the full development of the existing aquatic resources and the discovery of new resources and new products. Resolution of these problems will require action at the highest levels of government.

*The Working Group strongly recommends* that policies be promulgated at the highest levels of government and articulated in the form of a carefully formulated national policy on the wise and full utilization of the aquatic environment.

*The Working Group further recommends* that these policies, once articulated, be implemented promptly through all levels of the executive, legislative and judicial branches of government at the national, regional, and community level.

*The Working Group wishes to emphasize the opinion* that the development of such a national policy, and its implementation, are the actions most needed to stimulate research in the aquatic environment and the increased use of that environment for protein production and economic growth.

### **Need for Review of Objectives — Programs — Funding — Budgets — Staffing — Facilities**

The Working Group has encountered a common set of problems, which exists in both the governmental and academic sectors of the research community dealing with the aquatic environment. These problems include too

low a level of financial support, too large a percentage of total budgets expended on salaries, and too few facilities.

*The Working Group recommends* that the total amount of financial support for aquatic science be increased.

*It further recommends* that the relative amount of support provided for aquatic science be increased. There is a need for more money, and a need that the money now available be balanced in its distribution in such a way that aquatic research activities receive a larger proportion of the total available funds for research. It appears that too large a proportion of the available research funds are now spent on staff salaries, creating a situation in which funds are not available for the supplies, and other operational expenses needed for the trained personnel to carry out their work. Such imbalance occurs when the percentage of total budget expended on salaries gets to be much greater than 65%.

In the case of the Universities, highly trained persons capable of conducting scientific work should be encouraged to do so by the provision of facilities, funds, and teaching load reductions in proportion to their capabilities and the requirements of their research fields in the light of national needs for the products of their research, (i.e., knowledge and increased number of well trained students).

*The Working Group wishes to emphasize and strongly recommends* that the above recommendations for increasing the favorable climate of research be carried out in the context of a careful, selective, and creative program review.

*The Working Group believes* that periodic timely reviews of program carried out in a constructive and helpful way and which inquire not only into what is being done, but also why, are helpful to all organizations.

*The Working Group recommends* that such reviews be conducted to ascertain program objectives, priorities, staffing patterns, budget allocations, patterns of support for technical and non-technical staff and that scientists in administrative positions conduct, authorize, and restructure programs on the basis of such reviews.

#### **Increased Cooperation and Coordination among Marine Activities**

The Philippine Navy, Bureau of Coast & Geodetic Survey, Philippine Fisheries Commission and the College of Fisheries of the University of the Philippines all operate ships in the waters of the Philippines and the latter three have ships with oceanographic capabilities. The Bureau of Mines, Weather Bureau, Philippine Atomic Energy Commission, National Museum, and the College of Arts and Sciences, U.P. as well as other universities throughout the country all have plans for work at sea.

The present resources of facilities, equipment, and trained manpower are seriously limited for undertaking moderately large programs.

*The Working Group recommends* that the National Committee on Marine Sciences appoint a working panel composed of scientists representative of each agency or college concerned and charge this group with the task of determining for the Committee those areas where effective interagency cooperation can be undertaken immediately and further to determine what obstacles may be in the way at maximum utilization of interagency cooperation and to recommend means for removing such obstacles and implementing cooperative work.

#### **Statistics—Enforcements—Review—Others**

During the course of its discussions the Working Group encountered a number of problems which restrict the ability of research workers to gain access to needed data or which in other ways serve to deflect the impact of research or management upon the fisheries.

The most important of these concerns the ability to collect accurate and representative statistics on the landings of commercially valuable species.

The present practice of imposing taxes based on reported landings leads to the inaccurate reporting of landings and a reluctance on the part of industry to furnish or to cooperate in the collection of statistics and other kinds of research data.

*The Working Group recommends* that the functions of taxation and the reporting of catch statistics and scientific data collection be clearly and completely separated.

*The Working Group recommends* that the identity of the sources of data furnished for or needed for scientific data be regarded as an inviolate trust and that the data be compiled and tabulated in such a way that the sources of the data are anonymous. Such sources should be protected by such legal machinery as is necessary to protect and promote the collection of reliable data concerning the harvest of aquatic resources.

*The Working Group recommends* that equitable and needed tax revenues, as opposed to equitable license fees, drawn from the harvest of aquatic resources be assessed on a basis other than total landings, type of gear, units of gear, size, weight, length, tonnage of boats, etc. which lead to inefficiency and therefore uneconomic methods of harvesting. Therefore, the *Working Group recommends* that taxes commensurate with taxes on other segments of the economy be assessed on the basis of net income.

*The Working Group further recommends* that a major portion of such taxes as are derived from equitable taxes and license fees be automatically appropriated to the Philippine Fisheries Commission to assist the industry from which the taxes and fees are drawn through research and scientific resource management.

In addition, the *Working Group recommends* that, since wise utilization of aquatic resources depends upon a balance between knowledge, law and

enforcement, each of these elements should be related to the others in workable ways. Good laws that are not enforced are just as bad as laws that are enforced.

*The Working Group recommends* that import tariffs affecting the fishing industry, such as those on synthetic twine and tinsplate, be carefully examined to determine if they are economically sound alternatives as regards the total economy.

*The Working Group believes* that there may be significant gaps between the theoretical availability of fishing development loans and their actual availability and, if this is the case, *the Working Group recommends* that loans be made available for the purpose of stimulating the production of aquatic products.

*The Working Group recommends* that overseas training of selected individuals not be undertaken without the firm assurance that on return from training, a position, and more strongly a more responsible position commensurate with the level of training, will be available.

*The Working Group recognizes* the need for additional within-country opportunities for various kinds of training as, for example, vocational training for captain-master fisherman.

#### **Needed Studies**

In the course of its discussions, the Working Group identified six areas in which additional research or other actions are needed. *The Working Group recommends* that provisions be made for these activities as follows:

*Stock assessment* studies, including those studies necessary to determine resource abundance, distribution, and maximum sustainable yield, should be undertaken for those agencies accounting for substantial proportions of existing yields or which may be capable of adding substantially to existing yields.

*Pond fish management and research*, including both brackish and freshwater ponds, should be pursued. Application of already existing knowledge to current management practices could add substantially to existing yields.

*Offshore resource development* work should continue to be carried out, along the lines currently being done under the UNDP Special Fund Deep Sea Fishing Development Project.

*Oceanographic studies* are needed at a much greater level of intensity than is presently the case, particularly to support the missions of the various government organizations and to support the research and training activities of the universities. Attention is called to the availability of pertinent oceanographic data from the CSK Data Center and World Data Centers A and B, as well as to the forthcoming results of the CSK Symposium to be held in Honolulu early in 1968.

*Ecological studies of the littoral areas* are needed, particularly, for example, in relation to such resources as *Eucheuma*.

*Estuarine studies* are needed, particularly with respect to mangrove swamps and similar areas. The inclination to regard these areas as latent resources for brackish pond fish culture needs to be critically examined. These areas may be nursery grounds for other valuable resources (shrimps, for example) and their conversion to pond fish culture could possibly result in a net loss to the economy.

#### **Other General Recommendations**

The lack of trained manpower is a serious barrier to increasing research and fisheries productivity. This lack is aggravated by the disproportionate movement of scientifically trained persons away from the Philippines. Incentive to continue professional life in the Philippines is low as opposed to the opportunities abroad.

The proportion of the Gross National Product devoted to research funding is about 0.5% and a great concentration of the existing research funding is in research-non-productive salaries. Some countries devote over two per cent of their G.N.P. to research and distribute much of this rather directly to research productive individuals or agencies.

*The Working Group recommends* that encouragement be given to increasing the amount of financial support for research based on research productivity.

*It further recommends* the direction of significantly greater portions of the research funding to the trained individuals (especially the recently highly trained, often younger segments of the scientific community to the end that scientific and fishery productivity is increased by providing research incentive of sufficient magnitude to counteract the "Brain Drain."

Much time is necessary for the planning and execution of research, especially biological research. The time costs of current customs and immigration practices are often disastrous to the research programs undertaken. The monetary income to our respective nations from the regulations related to these time-consuming practices are, indeed, minor, in respect to the monetary value of the research knowledge to be gained, salaried time lost, research materials lost, and losses incurred in the form of increasing reluctance to even undertake biological research involving interchange between our two countries. The gain to both countries by enhancing the scientific interchange and cooperative research between the scientific communities of our respective nations will far outweigh the gains from the present customs and immigration restrictions.

*The Working Group recommends* that the National Research Council of the Philippines and the U.S. National Academy of Sciences, discuss and promote removal or waiving of customs barriers to interchange of scientific materials and immigration barriers to the exchange of personnel.

*The Working Group recommends* that, since organizations and individuals, especially those outside Manila, have a great need for reference

material and since the NIST Documentation Center services are available to these persons, the NIST Documentation Center be supported to procure an increasingly large number of references which are available from overseas sources and to facilitate the provision of microfilm services, within the country.

There is evidently a need to more adequately and rapidly translate the results of research on aquatic resources to all levels of the fishing industry, so that the benefits of such results may contribute to the national economy. *The Working Group recommends* the establishment of an extension service and *further suggests* the investigation of the broader role such an extension service could perform in the coastal barrios.

*The Working Group believes* that continuing bi-national programs of cooperation in science can be most effective if some provisions are made for continuity. Such continuity should include provision for considerable overlap in personnel between successive workshops and should also include provision for working groups to continue work in the period between workshops. *The Working Group recommends* that mechanisms to these ends be established.

To provide for effective and continuing oceanographic and fishery research, *the Working Group recommends* the establishment of a Philippine National Institute of Fisheries and Oceanography.



**REPORT OF WORKING GROUP III: INVENTORY  
OF MARINE RESOURCES — REGIONAL  
MARINE SPECIMEN SORTING CENTER**

	<i>Philippine Panel</i>	<i>U.S. Panel</i>
<i>Chairmen:</i>	Dr. Gregorio Velasquez	Dr. I. Eugene Wallen
<i>Rapporteurs:</i>	Mr. Claro Martin	Mr. Richard C. Vetter
<i>Members, Resource Persons and Consultants</i>	Dean Jose Yapchiongco Mr. Agustin Umali Dr. A. C. Alcala Dr. Deogracias Villadolid Dr. Carl Tolman	Mr. George S. Kanahela Miss Patsy McLaughlin

### **Introduction**

The Second Philippines-U.S. Workshop on Scientific Cooperation in Science and Technology held in Asilomar Conference Grounds at Pacific Grove, California on November 6-10, 1966 recommended that the U.S. representatives should pursue definite objectives, one of which was

- (g) Encourage the establishment in the Philippines of a marine specimen sorting center. The Smithsonian Institution should be urged to assist the Philippines in the development of a specimen-processing center in the Philippines.

This Working Group discussed the need for such a Center in the Philippines including: its value in resolving taxonomic and some biological problems, the scientific and economic benefits it will contribute to the country and to the region, where it is best to have it located, the steps toward its establishment and other related matters. The Working Group reviewed and developed further a position paper prepared by the Philippine Panel as a basis for the development of a proposal. This paper is attached as Attachment I.

### **Recommendation**

The participants strongly recommended the establishment of a specimen sorting center (to be designated Indo-Pacific Aquatic Resources Center) in a suburb of Manila (preferably at the University of the Philippines) subject to a memorandum of agreement to be drawn up by the National Economic Council of the Philippines and the U. S. Agency for International Development.

## THE INDO-PACIFIC AQUATIC RESOURCES CENTER

### A. Background

The Second Philippines-U.S. Workshop on Scientific Cooperation on Science and Technology held in Asilomar Conference Grounds, Pacific Grove, California, on November 6-10, 1966 recommended that the U.S. encourage the establishment in the Philippines of a Marine Specimen Sorting Center and that the Smithsonian Institution should be urged to assist in the development of such a Center. In June 1967, Dr. I. Eugene Wallen of the Smithsonian Institution visited the Philippines to explore the possibility of establishing the Center. During this trip, he found evidence of substantial interest among other Southeast Asian countries and international organizations, especially FAO, in the development of this Center.

The following material is based on a position paper prepared by the Philippine Panel as background for a dialogue on a Regional Marine Specimen Sorting Center during the Philippines-U.S. Workshop on Fisheries and Oceanography held on December 4-9, 1967.

### B. Functions of the Center

The Indo-Pacific Aquatic Resources Center would perform several functions.

1. Its primary service would be to process (sort and classify) aquatic organisms collected from Philippine and other Indo-Pacific waters and to provide collections to be used in the study of basic and applied problems of vital interest to the governmental, industrial and private sectors.

2. A second service of the Center would be to provide scientists and specialists with specimens of taxonomic groups for various studies.

3. The Center would develop techniques for and provide instructions on collecting, preserving and labelling aquatic specimens and attempt to develop techniques for rapid sorting.

4. Finally, the Center would provide practical training to technicians and students.

Furthermore, the functions of the Center would be well served if it were closely associated with a depository which, in this case, will be the National Museum of the Philippines. This undoubtedly would enhance the value of the Center for it to be related to a permanent curatorial staff.

### C. Location

In considering the location for the Center with a view to its permanency as an entity, the University of the Philippines campus was

selected. Here it could form as a sub-unit of the University where the training of manpower under the specialists of the Center could be carried on under a very suitable atmosphere.

The Government initially shall provide approximately 1,000 square meters of covered space. The Center should be provided with adequate ventilation, water and electric facilities.

#### **D. Value — Scientific and Economic**

The Indo-Pacific Aquatic Resources Center would play a vital role in stimulating the progress of the aquatic sciences in the Philippines and in providing the basis for economic development of Philippine and Southeast Asian aquatic resources. The Center would serve as a catalyst to stimulate scientific studies of the kinds, distributions and inter-relationship between aquatic organisms by providing scientists with the "raw materials", (specimens collected in sufficient quantity and geographic extent and related environmental facts) to make possible a wide range of basic research studies. Many of these studies would be of direct economic interest, such as:

fish larval concentrations and distributions,  
predictions of the occurrence and abundance of  
commercial and game species, and harvesting  
and management of aquatic products.

In addition, the Center would help the Philippines in providing career incentives in aquatic biology.

Of fundamental importance to aquatic biology is the proper identification of the various species being studied. The number and variety of unknown species in Philippine waters is so large that the talents of many scientists will be required to comprehensively and reliably determine their taxonomy. Even now, there are so many unclassified specimens stored that await taxonomic studies at local scientific agencies and institutions. Such collections may be found at the National Museum of the Philippines, the Philippine Fisheries Commission, the University of the Philippines, University of Santo Tomas, Silliman University, Xavier University, San Carlos University and Mindanao State University, to mention only a few. The Center will sort and provide these specimens to experts for identification and study.

#### **E. Relation to Region**

One of the major reasons for the establishment of the Indo-Pacific Fisheries Council is the wide range in the distribution of common fauna from Pakistan to Hawaii and from Japan to Australia. The Philippines enjoys a strategic location in the Indo-Pacific area.

As shown by a recent correspondence of the Marine Biology and Environment Branch, Fishery Resources and Exploitation Division of

FAO to the Project Manager of the FAO/SF Deep-Sea Fishing Development Project of the Philippine Fisheries Commission, there exists a mutual interest in the establishment of a regional sorting center.

In the immediate future there will be established in the region the Southeast Asian Fisheries Development Center with its Research Department in Singapore. It is expected that the Singapore Center and the proposed Manila Center would cooperate fully.

**F. General Policy Advisory Committee**

An Advisory Committee is essential to assure international coordination and develop the Center's long-range objectives. The Committee should be composed of Filipino and American scientists and members of such other appropriate national and international cooperating organizations. Membership in the Committee should be flexible and representative of the principal interests and activities of the Center including individuals from academic institutions, government agencies, industry, and supporting organizations.

**G. Support**

It is estimated that the cost of operation of the Center will be approximately \$200,000.00 per year and it is anticipated that the support, except for space furnished by the Philippines, will be initially provided by an agency or agencies of the U.S. As the Center develops and proves its value, it is anticipated that an increasing share of operation costs would be supplied by the Philippines.

## REPORT OF WORKING GROUP IV: ECONOMIC AND SOCIAL FACTORS

### *Philippine Panel*

### *U.S. Panel*

*Chairmen:  
Rapporteurs:*

Dr. Amando Dalisay  
Dir. Cornelio Crucillo

Dr. James A. Storer  
Dr. William A. W. Krebs

*Members,  
Resource  
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Mr. Ricardo Esguerra  
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Dir. Tito Mijares

Dr. Gordon Lill  
Mr. Robert Sheeks

### **Introduction**

Following an initial joint session with Group I — Production Technology, Group IV adjourned to separate meetings. Attention was focused on obstacles and limitations in the economic field which restrain optimum development of the fisheries resources of the Philippines. The discussion recognized that conditions vary widely among deep-sea, coastal, brackish water, and inland fresh-water fisheries but that some factors are common to all the resource areas. In making the findings and recommendations which follow, the conferees desire it to be clear that neither time nor data are adequate for conclusive determinations, but that, under the circumstances, the views herein recorded represent the pooled best judgment of a group of informed persons.

### **Findings**

1. The fisheries resources of the Philippines represent an economic resource of great potential which, in the light of the protein requirements of a fast growing population and opportunities for expansion of the export trade, have received less attention and effort than their potential warrants. There is a clear need for an expanded rational utilization of these resources.

2. Statistics and other vital informations in the Philippines about the availability of resources, levels and fluctuations in production and prices, costs of production, productivity, and other significant characteristics of the fisheries industry are inadequate. A large source of difficulty in the collection of basic data on the catch is the present linking together of the tax collection function with that of data gathering. Apart from the inadequacy of data it also appears that little use had been made of the available data to provide analyses and studies necessary in determining priorities and/or develop policies essential to the progress of the industry.

3. Despite the presence of growing commercial activity in the exploitation of fisheries resources, there is uncertainty in the private sector concerning the reality of the economic opportunity in fisheries and the degree of the commitment of the government to support fisheries development.

4. The physical infra-structure necessary for expanded production of

fish — especially port facilities, ice-making facilities, refrigerated storage, and the transportation system — is inadequate. Steps toward improving these conditions have in the past been taken, and some are even underway today, but they require vigorous, consistent prosecution to become effective. These facilities will, for the most part, require government action. Their availability, however, would provide incentives for further investment and expansion by private sector.

5. There is a scarcity of adequately trained manpower at almost all levels of the industry, from that of the ordinary fisherman to that of the skilled technologist and scientist. At the same time, education and training programs appear to be of limited effectiveness under present conditions in correcting these inadequacies. In the case of the fisheries high schools the resources seem to be spread so thin and the training facilities to be meager as to preclude a very effective and practical program. Even so fisheries schools cannot be considered as a complete substitute for effective training programs by the industry itself.

There also is no adequate extension system, or its equivalent, to communicate to those already in the industry, information about advances made in fishery research and technology which would be of benefit to them. At the professional level the contributions of economics cannot be brought to bear upon the problems, both domestical and international, of fisheries development. It would be helpful if professional personnel from the Philippine Fisheries Commission were to participate in the training program on economic development for government officers conducted by the Institute of Economic Development and Research of the University of the Philippines as well as training programs of other organizations.

6. Even though past efforts have not been notably successful, there may well be possibilities for the organization and expansion of cooperatives in the fishing industry. To be effective such organizations require adequate capital, management, and leadership as well as a sense of commitment upon the part of the individual members. If these circumstances obtain, cooperatives would be a way of achieving economies of scale and some of the needed infra-structure, and at the same time would mobilize available small savings and augment the income possibilities of the small fisherman.

7. Incentives to stimulate entry of the required new capital and manpower into fishing appear less than adequate. Reference is made here not only to the inadequacy of the infra-structure but also to government tax and tariff policies including such aspects as the dutiable status of imported equipment. The lack of incentives is accompanied by a variety of restraints and impediments, such as the cumbersome and time-taking procedure for obtaining fishpond permits and titles to develop fishponds. Together, all these constitute barriers to the flow of factors into fish production. It also seems to be true that inadequate income incentives exist

for the young men considering fishing as an occupation. In part, this may be a function of low productivity but it may also reflect an unduly low level of wage payments. Another depressing factor upon individual incomes maybe the custom of employing an unnecessarily large number of crew members.

8. A number of programs and measures have been launched by different government agencies to provide capital for private enterprise in fishing. It may be observed, however, that for more effective results there could be a greater degree of coordination with and relationship to the on-going programs of the Fisheries Commission.

9. It was recognized that the consequence of developing certain sectors of the fishing industry on a large-scale basis would have serious implications for the viability of other sectors of the country, especially for the hundreds of thousands of small scale subsistence fishermen whose mobility is not very great. To meet the needs of these fishermen, special programs of assistance involving education and capital are required. Furthermore these are not exclusively economic problems but also have very significant social and cultural implications.

10. Resources of technical, managerial and organizational know-how suitable for supporting the expansion of fisheries in the Philippines are available from many sources, including international, and regional agencies, foundations, private enterprise, and educational institutions, but apparently, have not been applied to fisheries development in the Philippines as effectively and systematically as may be desired.

11. The successful development of fisheries resources in virtually all economies has followed from a systematic and comprehensive effort to develop a program with at least the following ingredients:

- a. High level policy decisions by government which identify fisheries development as an important national objective.
- b. These decisions are followed by an adequate strategy and implementing measures on the part of government.
- c. Adequate research to define sound approaches to the problems of development, cutting across jurisdictional boundaries and traditional practices.
- d. The political will to execute these development programs in the face of competing demands, many of which are also meritorious but rationally of lower priority.
- e. Adequate economic incentives, consistently pursued and sustained over a long enough period of time to generate confidence on the part of investors, large and small.

## **Recommendations**

1. Purposeful, consistent development of the fisheries resources of the Philippines should be identified as a national program of high priority,

requiring the commitment of major resources of the economy by both the Government and the private sector, in a well-planned, integrated effort. The increasingly successful national program to expand the production of rice provides an example worthy of emulation.

2. To facilitate such a program, systems for the collection and dissemination of data necessary for sound policy decisions about fisheries development, both by Government and by the private sector, should be strengthened. A principal feature of such an effort should be as complete as possible a separation of systems for the collection of production data for statistical purposes from systems for tax collection.

3. Encouragement must be given to the establishment of an adequate research program not only in the natural sciences but also in the social sciences. Participation in this program should include not only the Philippine Fisheries Commission but the University of the Philippines and other private universities as well.

4. Means and measures should be found for more directly linking the educational resources of the Philippines to growing needs for trained manpower in fisheries at all levels.

5. Efforts to improve the physical infra-structure supporting fisheries production and distribution — particularly with respect to fishing port facilities, ice making facilities, cold storage and transportation to markets — should be carried forward vigorously.

6. A careful review should be made of the framework of governmental regulation bearing on fisheries to bring about the repeal or revision of outmoded requirements which restrict production or unnecessarily limit the flow of new resources in the industry. It is also desirable that the interests of local governments be harmonized with the policy and implementing measures of the national government.

7. The role of tariff and tax policy affecting the expansion of production merits consideration. This seems especially relevant with respect to the importation of certain types of equipment needed for deep sea fishing and certain raw materials important in the fish processing industry.

8. Careful attention should be given, in allocating scarce resources for fisheries development among competing demands and areas, to estimates of comparative productivity conceding that simpler and, sometimes, more appealing criteria must also be applied.

9. A review of restraints which may be limiting adequate flow of new capital into fisheries seems called for. In this connection, the need for technically competent evaluation of project applications which are reaching financial institutions appear particularly important as does the need for speedier administration of governmental systems such as the



review of applications for reclassification of the public land for utilization as fish ponds and for the granting of fisheries products.

10. Capital resources flowing into the industry might be supplemented and further encouraged by closer coordination of the lending policies and programs of the government financial institutions with the activities of the Philippine Fisheries Commission.

11. Maximum use should be made of assistance available for fisheries development through Southeast Asia regional or international cooperative programs and institutions, thus extending the financial and human resources going into Philippine development.

**POSITION PAPER FOR WORKING GROUP I**  
**PRODUCTION — TECHNOLOGY**

*Prepared by*

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## R.P. POSITION PAPER ON PRODUCTION - TECHNOLOGY

### INTRODUCTION

Fisheries is one of the important industries of the Philippines contributing in no small way to the national economy. Besides supplying one of the basic foods of the people, it produces income and provides the means of livelihood to a big segment of the population. It also provides opportunities for employment and supplies raw materials to the manufacturing and food processing industries. It earns foreign exchange for the country, although quite limited.

In 1965, it contributed to the national income ₱722 million or 4.2 per cent. It provided employment to 4.0 per cent of the total labor force, and earned about ₱3 million in foreign exchange.

Fish is one of the essential foods of the people which is only second to rice in importance. In fact rice and fish go together in their daily diet. As bread and butter is to the Americans, so rice and fish is to the Filipinos.

### THE PRESENT CONDITION

#### a. The Fishery Resources

The fishery resources of the Philippines are comprised in about one million hectares of freshwater (lakes, rivers, rice paddies, etc.), 500 hectares of brackish water (mangrove swamps for fishponds, estuaries, and tidal flats), and 166 million hectares of marine water (coastal and offshore or deep-sea).

The Philippines is composed of 7,100 islands, large and small, with an area of 114,000 square statute miles. Its coastline of approximately 11,400 miles (18,417 kilometers), is more than twice that of the United States. It is highly indented with many fishable bays and gulfs.

The fishable shelf, the seat of commercial fishing, is generally narrow and steep. In many places the shelf forms only narrow strip as the sea bottom drops abruptly into great depths. Many interisland seas from deep basins separated from one another by definite oceanographic topographical boundaries.

The waters of the open sea are made up of distinct water masses with distinct properties of temperature and salinity. The surface water where the greatest biological activity takes place is distinctly tropical in character. In summer, the temperature generally exceeds 28°C and in winter only a degree lower. There is practically little variation in salinity which ranges from 33.5‰ to 35.4‰.

There are about 2,100 species reported in the Philippine waters, the most important of which, are the round scad, sardines, mackerels, tunas, milkfish, sea bass and a few more others.

The fishery resources are not as yet fully tapped. Only about 43 per cent of the freshwater areas are exploited; about 29 per cent of swamplands have so far been developed into fishponds, and only the coastal and inshore waters of the marine areas are being exploited, leaving the deep-sea and offshore areas towards the high seas practically untapped.

#### **b. The Fishery Industry**

The Philippine fisheries have three distinct areas of production: the marine waters, the brackish waters and the freshwaters.

The marine fisheries are classified into two major groups, namely, the commercial fisheries carried out by vessels of more than three (3) tons gross and the municipal fisheries carried out by boats of less than three (3) tons gross.

The municipal fisheries are characterized by the use of very diversified range of fishing gear which are mostly hand operated. The most common types are various traps, snares, cast nets, drift nets and impounding nets, seines and small trawls. Recent survey indicates that there are more than 250,000 fishing bancas with these outfits with only 30 to 40 per cent motorized. The rest are sailing or rowed boats.

The commercial fisheries are bigger and more modern gear. Among these are the otter trawls, bag nets, purse seines, long lines, gill nets, etc. In 1965, there were registered 2,390 of these commercial fishing vessels of which 941 are three to less than three tons gross; 430 are of 10 to 20 tons gross; 364 are of 50 to 90 tons gross; 121 are of 100 tons and over; 207 are of tonnage unreported.

Out of the 500,000 hectares of brackish swampland, only about 137,000 hectares were developed up to 1965. The remaining portion is idle and unproductive. Baños (Chanos chanos) is the main species cultivated, although other species that accidentally enter the fishpond while still young are among the harvest.

#### **c. Fish Production**

The national fish output in 1966 was estimated at about 700,000 metric tons total, excluding the production from freshwater areas. About 46 per cent of this total was contributed by the municipal fisheries, 45 per cent by the commercial fishing vessels, and 9 per cent by the brackish-water fishponds.

The total production for that year represented a sufficiency level of 69 per cent based on the fish allowance of 30.66 kilograms per caput per

year recommended by the Food and Nutrition Research Center. With the projected population in 1970 of about 38 million, and on the basis of the above per caput allowance, the fish requirement of the country by that year is estimated to be 1.2 million metric tons.

To meet this requirement, a projected program of fish production by the Philippine government for the four-year period which started in 1966, has been set at a yearly increment of about 85,000 metric tons. At this rate, it is expected that the sufficiency level of fish output would be about 86 per cent in 1970.

## NEW TECHNOLOGY AND PRODUCTION POTENTIAL

### a. Marine Fisheries

Development in the marine municipal fisheries has been rather slow. Production increased from only about 254,000 tons in 1957 to about 327,000 tons in 1966. Future developments in the municipal fisheries are expected to be on increased motorization and use of modern materials for fishing gear. With motorized boats farther fishing grounds which have not as yet been tapped could be reached. The present fishing grounds which have been fished year-in and year-out and which show declining yield could be rested and their productivity improved.

The establishment of a network of ice plants and cold storages in strategic fishing areas can give a boost to the inshore and municipal waters.

The output of commercial fisheries increased from 93,000 tons in 1957 to 315,000 tons in 1966 or more than three times within a decade. The accelerated increase was due to the addition in the fleet of bigger and higher power boats and introduction of better and more efficient fishing gear. The introduction of tuna longline and purse-seining for tuna would provide bigger landings of tuna.

The Philippine Fisheries Commission and the UNSF FAO Deep-Sea Fishing Development are actively investigating the feasibility of adopting tuna long line fishing and purse seine and live-bait fishing for tuna. Improvement in trawling is also looked into with the introduction of efficient fishing nets and improved winches. Midwater trawling is also being tried as echo sounder and sonar readings show the presence of schools of fish at intermediate water levels. Exploration of new fishing grounds will help increase production of commercial fishing vessels.

### b. Brackish-Water Fishpond Fisheries

Improved methods of fish culture through the use of fertilizers, pesticides, and better management techniques have been found to increase fish-

pond by two or three times. Increase in fishpond output would be pursued through the introduction of yield-increasing inputs.

In view of the big potential area for fishpond development, the President of the Philippines has issued early this year to all government agencies concerned a directive to hasten the development of these areas. Among others, the directive provides the hastening of the granting of titles to public swamplands applied for fishpond purposes and extending financial assistance in the form of loans by the Development Bank of the Philippines on liberal terms of payment.

Lack of trained and experienced people in the improved techniques of fishpond management has been a deterrent to increased production.

New techniques of freshwater fish farming such as stock manipulation, use of fertilizers and artificial feeding have increased fish production. Although a well-managed fish farm can produce a minimum of 3 tons per hectare per year as already known in cooperator-demonstration projects assisted jointly by the UN/FAO and the Philippine Fisheries Commission, the present freshwater fishponds continue to produce much less due to lack of adequate financing needed to acquire yield increasing inputs and techniques.

Out of a total of 186,000 hectares of potential freshwater fishponds, only 6,000 are developed. These are nearly a million hectares of inland bodies of water which are potential areas for increasing fish production under sound management practices.

Improved methods of handling and processing fish will not only improve the quality of the product but may also prevent wastage of fish catch. These will encourage fishermen to put more efforts in producing fish especially when better profit may be realized.

### **c. Fish Processing**

Aside from the improvement of traditional methods of fish processing the Philippine Fisheries Commission is also encouraging the adoption of new methods of fish utilization such as canning of round scads, milkfish, herring and tuna; fish sausages and improved smoked milkfish for increased and economical utilization of fish catch.

Work is also being done on development of new products such as frozen fish, protein concentrates and fish cakes. Studies are being conducted on the utilization of seaweeds, shellfish and crustaceans.

The bulk of fish consumption in the country is in the fresh condition so that studies are being made by the Fisheries Commission on improvement of fish handling, storage and distribution of fresh fish.

#### **d. Infrastructure Facilities**

##### **(1) *Fishing Ports and Fish Landing Facilities***

While the Philippines has 2,393 licensed commercial fishing vessels and the number is increasing at an average of 136 a year, not one fishing port exists in the Philippines. Seaports used for shipping purposes are shared by fishing boats in landing their catch. Otherwise, fish are landed on beaches without the benefit of wharf and other fish landing facilities. The establishment of fishing ports, therefore, is badly needed in the national effort of accelerating fish production.

The major fish landing center of the Philippines is located at Navotas, Rizal which is at the north boundary of the city of Manila. The fish landing site, being an open beach, is devoid of sheltered berthing places and related facilities and requires expensive double handling of the fish catch. The fishing vessels anchor about 2 miles offshore and have their catch transported to the shore by amphibian trucks.

Fishing ports are necessary for the efficient and economical operation of fishing vessels due to the security of fishing boats and the convenience relative to loading and unloading operations. With the fishing port, fish market terminals and cold storage plants, etc. could be built as adjunct for improved handling and marketing of fish.

In the face of increasing number of commercial fishing boats and in consonance with the program of deep-sea fisheries development, the Government has initiated the construction of one fishing port in Manila. Seven others are being planned in strategic places in the country. A preliminary feasibility study of one of these was made at Dalahican, Lucena, Quezon. The result indicates the need for more comprehensive feasibility studies for the fishing ports proposed to be established.

The construction of the fishing port in Manila at the Manila North Harbor is being started by the Bureau of Public Works and is programmed to be completed within 3 1/2 years. When completed the project will cost P22 million and will provide 18 berths for unloading of fish catch and another 18 berths for servicing of supplies and bunkering. The fishing port will be an integrated complex and provide spaces for a wholesale and fish auction market, slipways and boat repair docks, ice plants and cold storage, fish drying and processing, net and gear supplies, government and commercial offices and parking for cars. So far, only P2.9 million out of P22 million has been available for the project. A P10-million loan from the Asian Development Bank is proposed to be taken and the balance has still to be appropriated by Congress.

The Philippine Fisheries Commission has limited financial resources to undertake development of fishing ports needed by the fishing industry today. Likewise, the Bureau of Public Works, although supported by an

annual fund of ₱60 million has to tend primarily to the improvement of shipping ports for general cargo which are also in dire need of improvement, hence only a token amount if any, can be spared for the development of specialized fishing ports.

(2) *Ice Plants and Cold Storage*

Ice plants and cold storage facilities for fish are inadequate. The country has 308 ice plants for the general public with a total daily output of 6,000 tons and 73 units of cold storage with a total capacity of 845,000 cubic meters registered with the Public Service Commission. Since these facilities cater to service of the general public, the needs of the fishing industry are not sufficiently met.

The increase in the number of bigger commercial fishing outfits and greater distance of the fishing grounds covered require the provision of more ice and cold storage facilities for the industry. These facilities are also indispensable in the establishment of an efficient fish marketing system. Moreover the establishment of these facilities are inducements to municipal fishermen to increase their catches. This will secure the small fishermen safe storage and market for their fish catch, thus establishing fish supply and process in the area covered.

The Philippine Fisheries Commission has initiated the establishment of sixteen ice plants and cold storage projects in major fishing municipalities as a means of encouraging fish production in these areas. Five of these projects are nearing completion and ready to operate. The remaining eleven are in the early process of construction. The operation of these facilities is proposed to be given eventually to the private sector through lease agreement or outright sale.

## CONSERVATION

Continued efforts at increasing catch by expanding the fleet and tonnage of fishing vessels, use of improved gear for efficient fishing, and restoring to destructive methods with use of explosives and fish poisons in catching fish have intensified the problems of overfishing and the need for the conservation of the fishery resources of the sea.

The problem of declining productivity and/or depletion of the fishery resources also occurs in inland waters. The placement of barricades that serve as barriers to migrating fishes in reaching the sea to spawn and the youngs to come up the freshwater areas have seriously depleted these inland waters.

Water pollution also serves as serious problems that threaten the conservation of the fishery resources in the face of the fast expanding industrial plants whose effluents carrying deleterious substances to aquatic life are dumped into the rivers and eventually drained to the sea.



The expansion of production in brackish water fishponds is threatened by the shortage of fish seeds or fish fry due to the wholesale catching of the bangus spawners.

Realizing these, conservation measures have been promulgated to conserve the fishery resources through legislative acts, executive orders and administrative orders of the Secretary of Agriculture and Natural Resources duly approved by the President. However, these conservation measures are still on a hit-and-miss method as most of them have no biological basis. The following are the measures intended to conserve the different fishery resources:

**a. Marine Fisheries**

The major measures to conserve the marine resources are embodied in the Fisheries Act (Act No. 4003 as amended) which includes among others prohibition of the use of explosives, obnoxious substances and fine mesh nets in fishing and declaration of "close and open season" for fishing. Some fish conservation laws that were enacted recently are the prohibition of trawl fishing in areas seven fathoms deep or less (RA 3043) and illegal possession, sale or distribution of fish and fish products caught or killed by illegal means (RA 428 as amended).

**b. Brackish-water Fishponds**

To insure a ready and constant supply of bangus fry needed by the industry, Republic Act No. 3586 was passed by Congress. The law prohibits the exportation of bangus fry by any person, association or corporation to any foreign country effective as of June 21, 1963. Another is the Fisheries Administrative Order No. 25 which prohibits the catching, possession and sale of bangus spawners (sabalo) from February 1 to July 31, of each year.

**c. Freshwater**

Until some years ago, fish conservation has paid little attention to water pollution. However, with the advent of industrialization especially since after the last World War, certain bodies of waters, particularly inland, have become fully polluted seriously affecting the fishery resources. The sources of industrial pollution are from mining companies, forest and allied products, pulp and paper mills, textile industries, distilleries, food manufacturers, chemical industries, brewery plants, sugar centrals, tanneries and gasoline and oil refineries.

For the protection and conservation of the inland water fisheries of the country, the National Water and Air Pollution Control Commission and Pollution Control Law (R.A. 3931) was enacted by Congress.

An administrative order prohibiting the use of electric current in freshwater fishing was also promulgated.

#### **D. ENFORCEMENT OF FISH CONSERVATION LAWS**

A major problem with regard to conservation is the enforcement of laws relative to illegal fishing. The Government has launched a campaign against the rampant use of explosives, but the geographical condition of the country and lack of sufficient personnel make enforcement very difficult.

Measures undertaken by the Fisheries Commission include the creation of inspection and sampling teams to conduct intensive on-the-spot examination of fish landed in the Greater Manila area and nearby provinces to determine whether they are caught by explosives or not, and surveillance of all fishing vessels suspected to be engaging in blast fishing. Mobile X-ray units are being used for positively identifying dynamite-caught fish for presentation as evidence in court.

An Anti-Blast Office has been created by the President to coordinate and intensify government efforts in effectively combatting illegal fishing. A joint Task Force representing the Fisheries Commission, Coast Guard, Philippine Navy and Constabulary has been established for the apprehension of blast fisheries.

#### **MANPOWER AND TRAINING NEEDS**

The continuing growth and development of the fisheries industry requires qualified technicians both in the government and private sectors. In the government service, there is a need for more technically trained technologists (boats and gear, fish culture and processing), biologists (inland and marine) and engineers (refrigeration, ports and harbors, fishponds). In the private sector, fishpond engineers, fish farm managers, master fishermen and fishing boat crew, fish refrigeration engineers and fish processing consultants or managers are badly needed.

Higher learning in fisheries in the country is given in the College of Fisheries of the University of the Philippines. The college offers two kinds of courses; one leading to a Bachelor of Science degree in fisheries and another a semi-vocational course leading to a certificate in fish capture or fish culture or fish processing. The output of the college has been rather low. During the past nine years only 42 have graduated with B.S. degrees and 237 with certificates. Most of the graduates of B.S. degrees go into government service or in teaching or research work. Recently, another college of fisheries was established under the Mindanao State University in Marawi City in 1965.

In addition to those colleges of fisheries, there are 36 secondary vocational fisheries schools already under the Bureau of Vocational Education that are in operation.

A majority of graduates from these existing fisheries colleges and schools have not been utilized in government service or in the industry,

due mainly to their poor preparation to take technical jobs in the government and practical fishing in the private sector. There is need to upgrade the present educational system in fisheries and on-the-job training to meet the needs for technicians and manpower for the fast growing fisheries industry.

#### OPPORTUNITIES FOR INTERNATIONAL COOPERATION IN FISHERIES RESEARCH AND DEVELOPMENT — PHILIPPINES-U.S. AND REGIONAL

In the field of fish production, the Philippines is assisted by the United Nations Food and Agriculture Organization through the UN Special Fund Project on Deep-Sea Fishing Development. The Philippine Fisheries Commission is the cooperating or counterpart agency in this project. There is also FAO Freedom-from-Hunger-Campaign Project in fish culture whose funds have been donated by Australia.

In the field of regional cooperation, there is a projected establishment of the Southeast Asian Fisheries Development Center (SAFDC) with the Training Department to be hosted by Thailand and located in Paknan not far from Bangkok and the Research Department to be located and hosted by Singapore. The functions of the Training Department of SAFDC are to train fisheries technicians of the Southeast Asian countries in various aspects of modern marine fisheries, engineering and navigation techniques; to make studies on such types of fishing gears and methods suited to the fisheries in Southeast Asia; and to undertake such other activities as may be determined by the Council of the SAFDC.

On the other hand, the functions of the Research Department of SAFDC are to develop the fishing grounds in Southeast Asia by experimenting on fishing methods and general handling of fish at sea in close cooperation with the Training Department, to conduct investigation of fisheries resources, and research in fisheries oceanography for Southeast Asian countries; to train personnel and technicians; and to undertake such other activities as may be determined by the Council.

## POSITION PAPER FOR WORKING GROUP II

### RESEARCH

(Fisheries, Aquiculture, New Products and Oceanography)

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## R.P. POSITION PAPER ON RESEARCH

(Fisheries, Aquiculture, New Products and Oceanography)

### S T A T U S

Oceanography has received world-wide attention in the last few years. However, until about a decade ago, physical oceanography has been one of the least understood of the sciences. Even in more technologically advanced Western nations, it has found practical application only in the solution of marine fisheries problems. It is only in recent years that advances in research has indicated its intimate relation with atmospheric phenomena and geological processes at the land-sea interface.

In the Philippines, basic and even applied researches, in physical oceanography are of limited extent. Early navigators have conducted a few bathymetric investigations. A report by Fr. Selga at the 5th Pacific Science Congress in 1931 mentioned isolated temperature and salinity investigations, mostly conducted by private shipping companies and Coast and Geodetic Survey vessels for cartographic purposes. Some temperature vs depth data were recorded in that report. An article was also written on marine deposits and some seismological records. Adequate hydrographic surveys have been conducted by the Coast and Geodetic Survey on coastal and inland waters. Tidal and current surveys have also been carried out mostly in populated areas and along commercially important harbors. In marine geology, no investigations have been recorded except for some bottom samples taken during bathymetric surveys by Coast and Geodetic Survey vessels. This scarcity of recorded data is even more apparent in marine geophysics. In the Philippine region, what marine gravity and geomagnetic data exist has invariably been observed by visiting scientists.

The present major factor that deters the progress of Philippine fisheries development is the big gap that exists between the industry and fisheries research. This gap includes the biological, ecological, technological and economic information that the fishing industry needs for development, improvement and expansion.

The main strategy of the present fisheries development program of the country lies on these major aspects: (1) Vigorous investment program to provide the necessary infra-structure facilities for the fisheries industry; (2) provision of liberal credit facilities to the industry; (3) man-power training, and (4) improved technology. The last is a major gap which can be bridged over only through a vigorous program of applied and basic oceanographic and fisheries research. It is felt that the present program of fisheries development can not succeed if any of the above-mentioned avenue of improvement is neglected.

The largest sector of the fisheries industry is the marine fisheries which calls for corresponding researches along the various aspects of the resources. Marine fisheries researches currently undertaken include biological investigations on commercial species of fish and minor sea products, oceanographic investigations, fisheries assessments and ecology of sea weeds.

The other sector of the local fisheries industry is the inland fisheries which includes the estuarine and fresh water areas. Current researches being carried out in this area include fishpond management techniques, fish propagation and breeding, limnological investigations, inland fisheries evaluation and fish planting and water pollution studies.

Estuarine fish culture is mainly confined to the culture of milkfish locally known as "bangos." Fish culturists in the Philippines have recently realized the beneficial effects of fertilization and supplementary feeding. With these methods, fish farmers are able to double or even treble the number of harvests in their ponds.

Fresh water fish culture in this country is still in its infancy. New innovations are being tried while the present techniques are beginning to improve. However, there are still many problems that need research in this particular industry and among which may be mentioned the problem of feeds and feeding, control of diseases and parasites, breeding techniques, etc.

The fishery resources of natural inland waters call for more extensive research progress to facilitate proper exploitation, management and conservation. Limnological investigations, fisheries evaluation and fish planting are the activities being carried out in these bodies of water. The Philippine Fisheries Commission has a small unit that undertakes studies on water pollution, although the National Air and Water Pollution Control Commission is the national agency that is responsible for such problems. This Commission is not yet operating due to lack of funds.

An inventory of the Philippine fauna, organization and maintenance of national reference collections, researches in systematic and related biological problems are also being undertaken.

As a complement to the program of biological research supporting the drive towards increasing fish production, a program of research on the technological aspect of fish production is likewise being pursued. Towards this end, researches on improving fish capture techniques as well as on developing new methods of capture of fish adaptable to the various conditions obtaining in the different parts of the country are being carried out. In this connection, studies are being undertaken along the line of fishing boat and gear construction and preservation.

Another aspect of technological research being tackled which is complementary to the drive for increased fish production is that of improving

local fishery product utilization techniques. While this country is still suffering from shortage in fish production, this problem is further being aggravated by wastage of a considerable volume of fish caught simply due to the perennial ignorance of efficient and scientific ways of fish handling and processing prevalent in many parts of the country. To a great extent, the potentialities of a great number of sea products like the sea weeds and many invertebrates, are not being fully taken advantage of now due to lack of sufficient knowledge and information on how they can be utilized and exploited for commercial purposes. Toward solving this problem, a division in the Philippine Fisheries Commission is devoting itself in undertaking researches along the line generally embracing (1) improvement and development of traditional fish processing materials (2) development of new fish products (3) improvement and development of fish preservation techniques and (4) improvement and development of fish handling practices.

While there seems to be great enthusiasm and interest being shown by local fisheries scientists in giving their share in the overall effort to harness, the potentiality of the fisheries resources of the country, not much headway is being attained to the present as far as fisheries research is concerned. There are multifarious problems that handicap the program of fisheries research in this country and foremost of this may be singled out the perennial lack of funds to support the implementation of various researches geared to help increase local fish production. While facilities for research have greatly improved of late mainly due to foreign aid like the Colombo Plan, FAO-UN, AID, Japanese Reparation, the Government has been slow in providing funds sufficient to muster enough personnel to maintain these facilities as well as to provide for other operational expenses related to the implementation of these researches, more so of acquiring other facilities needed.

With the existing appropriation provided for the present activities of the various agencies concerned with fisheries research, notably the Philippine Fisheries Commission, it is notable that the pay provided for the technical men (scientists and technicians) is considered miserably low compared to those being enjoyed by workers of the same kind in other countries. Hence, highly trained local minds generally shy away from this job and many are lost to the other countries or if ever they stay at home would prefer to be employed elsewhere.

#### ORGANIZATION

In the last few years, there has been a growing awareness of the important role oceanography could play in man's advancement, both in commerce and even in the physical sciences. As a result of these technological advances, there has been a gradual reorientation of some institutions in the Philippines. Some agencies of the government like the Philippine Fisheries Commission (formerly Bureau of Fisheries), and the Bureau of Coast and Geodetic Survey, which are principally concerned with the study

of the seas and environs have increased their activities in this field. The Bureau of Mines has a program for marine-shelf explorations which combines geological, geochemical and geophysical investigations. A section on Physical Oceanography has been proposed in the Geological Survey Division of the Bureau of Mines. The Philippine Navy, to improve its defense capability in its natural element, has also increased its oceanographic activities. Among other governmental agencies interested in oceanography may be mentioned the Weather Bureau, primarily on air-sea interaction and the resulting phenomena on winds, weather, and precipitation; the Philippine Atomic Energy Commission, on marine radioactivity and water pollutant transport.

Universities/academies and other educational institutions have also been affected by these advances. In the University of the Philippines, the College of Arts and Sciences has the Institute of Applied Geology, and the Institute of Fisheries Research and Development dealing on the subject. The College of Fisheries, U.P., has been in existence for sometime. The Mindanao State University and Xavier University in the Southern Philippines also has been in existence for sometime. At the Ateneo de Manila University of the Society of Jesus, interest has been focused on seismological and related marine geophysical phenomena including studies on the Upper Mantle. The National Research Council is of course interested in the discipline both in basic and applied research. Its Volcanology Commission is interested in regards to submarine volcanic activity and geothermal studies.

In the private field the Philippine Deep Sea Fishing Association would be interested in researches in Physical Oceanography. Some oil and mineral exploration companies have shown interest in submarine geology of our continental shelf-areas and marine geophysical surveys.

Fisheries research in the Philippines is being undertaken mainly by the Philippine Fisheries Commission thru the following divisions: (1) Marine Fisheries Biology (2) Fish Utilization (3) Technological Services (4) Estuarine Fisheries and (5) Freshwater Fisheries.

Other offices involved are the College of Fisheries, U.P., the Institute of Fisheries Research and Development, U.P., the Biological Research Center of the NIST, the National Museum and the U.P. College of Arts and Sciences.

In 1962 after the UNESCO sponsored a 2nd meeting of Representatives of Marine Science Institutions in East and Southeast Asia, a National Committee on Marine Sciences was created under the aegis of the National Science Development Board. The creation of this committee is pursuant to a recommendation of the above-mentioned meeting of representatives of marine science institutions. The Terms of Reference of this committee were the following:



(1) To serve as the focal point and coordinating body on marine researches undertaken by the various national agencies and laboratories of the government;

(2) To act as the clearing house of the government for all matters concerning the Inter-governmental Oceanographic Commission (IOC);

(3) To act as the adhering body to the Scientific Committee on Oceanic Research (SCOR), a committee of the International Council of Scientific Union (ICSU), and

(4) To formulate and implement a long range national program for the development of marine science in this country.

A total of 13 agencies and laboratories undertaking researches in marine sciences as of July 1967 are members of this Committee.

#### INTERNATIONAL BIOLOGICAL PROGRAM

The Philippine Fisheries Commission and other offices are represented in the Philippine National Committee for the International Biological Program which coordinates local activity in biology especially marine biology and establishes relation with other national biological programs which maintain their membership with the International Biological Program.

#### MANPOWER AND TRAINING NEEDS

A survey made by the National Committee on Marine Sciences on the manpower resources showed a total of 227 marine scientists and 462 technicians employed in 16 government agencies and private institutions. Of this number, 191 marine scientists are with the government agencies and 36 are with the private institutions. Four hundred fifty-five (455) technicians are with the government agencies and seven (7) are with the private institutions. Among the marine scientists, 16 are Ph.D. and D.Sc. holders, 4 are M.S. holders and 147 as B.S. holders. A detailed report on the manpower resources by agencies for marine sciences is included in NCMS Publication No. 2 (Annex I). The existing manpower for marine research today leaves much to be desired. There is an apparent need for the upgrading of technical personnel to graduate and post graduate levels, either locally or abroad.

The following five-year program of study and training is recommended:

MARINE SCIENTISTS

<i>Field of Study</i>	<i>Duration</i>	<i>No. of Participants</i>					<i>Total</i>
		<i>1st Yr.</i>	<i>2nd Yr.</i>	<i>3rd Yr.</i>	<i>4th Yr.</i>	<i>5th Yr.</i>	
Physical Oceanography (M.S. or Ph.D.)	2-3 Years	2	2	2	2	2	10
Chemical Oceanography (M.S. or Ph.D.)	2-3 Years	2	2	2	2	2	10
Biological Chemistry (M.S. or Ph.D.)	2-3 Years	2	2	2	2	2	10
Marine Fisheries Biology (M.S. or Ph.D.)	2-3 Years	2	2	2	2	2	10
Biological Oceanography (M.S. or Ph.D.)	2-3 Years	2	2	2	2	2	10
Fresh Water Fisheries (M.S. or Ph.D.)	2-3 Years	1	1	1	1	1	5
Biological Chemistry (Training)	6-12 mos.	2	2	2	2	2	10
Chemical Oceanography (Training)	6-12 mos.	2	2	2	2	2	10
Marine Fisheries Biology (Training — various phases)	6-12 mos.	4	4	4	4	4	20
Biological Oceanography (Training)	6-12 mos.	2	2	2	2	2	10
		23	23	23	23	23	115

MARINE TECHNOLOGISTS

<i>Field of Study</i>	<i>Duration</i>	<i>No. of Participants</i>					<i>Total</i>
		<i>1st Yr.</i>	<i>2nd Yr.</i>	<i>3rd Yr.</i>	<i>4th Yr.</i>	<i>5th Yr.</i>	
Fish Processing Irradiation in Fish	12 mos.	1	1	1	1	1	5
Processing Microbiology in Fish	12 mos.	1	1	1	1	1	5
Processing Net Preservation	12 mos.	1	1	1	1	1	5
Marine Refrigeration Engineering	6 mos.	1	1	1	—	—	3
Design & Construction of Fishing Boat	12 mos.	1	1	1	1	1	5
Design & Construction of Fishing Gear	12 mos.	1	1	1	1	1	5
Fish Culture & Propagation	12 mos.	2	2	2	2	2	10
Fishpond Fertilization	6-12 mos.	2	2	2	—	—	6
Artificial Propagation of Fish	6 mos.	1	1	1	1	1	5
Marine Algae Culture	12 mos.	2	2	2	—	—	6
	6 mos.	1	1	1	1	1	5
		13	13	13	10	10	59

Experts and/or Consultants are also needed for the following fields of study:

<i>Field of Study</i>	<i>Duration</i>	<i>No. of Participants</i>
Physical Oceanography	2 years	1
Ichthyoplankton	2 years	1
Marine Botany (Benthic algae)	1 year	1
Phytoplankton	1 year	1
Zooplankton	1 year	1

### FACILITIES

As a developing nation, the Philippines could boast of only limited facilities for oceanographic and fisheries investigations.

The Bureau of Coast and Geodetic Survey has 2 over-aged hydrographic vessels of 1057 and 750 T. each, with limited oceanographic capability. Two other comparatively new hydrographic vessels of 150 T. each are equipped with more modern instruments. Because of the absence of advanced position-fixing equipment like Loran C, Decca or Hi-Fix, these vessels have to operate in near shore areas and inland seas. Their Precision Depth Recorders or Fathometers are of the shallow water type and could not be utilized in the off-shore areas and even in some areas of the Sulu Sea and Visayan Seas. In addition to its vessels, the Bureau of Coast and Geodetic Survey has acquired through UNESCO several bathythermographs, an Ekman-Merz type Current Meter, an Inductive Salinometer, and a tide gage recorder. Apart from its purely oceanographic equipment, the Bureau also possesses magnetometers, a land gravity meter, and standard surveying equipment like theodolites, baseline apparatus and an A-8 Stereo Photogrammetric plotter. It has no laboratory facilities, though one has been recently proposed.

In the field of geological oceanography, the Bureau of Mines could contribute its extensive laboratory facilities. Its petrographic, paleontological and physical laboratories could be utilized in marine geological investigations.

The Philippine Navy has one vessel available, more or less, for fisheries and limited oceanographic work. With the addition of more sophisticated instrumentation, the oceanographic survey capability of the Navy could be enhanced.

The University of the Philippines has limited facilities for physical oceanographic investigations. This would mostly be in laboratory equipment. Its IBM-360 computer could be used in the solution of complex mathematical problems. The Ateneo de Manila University has very little to offer in oceanographic facilities but its knowhow in the broad field of geophysics could be properly utilized in a consultative or advisory capacity.

**The Philippine Fisheries Commission has the following facilities:**

**1. Vessels**

- a) M/V Researcher I — A 419 G.T. steel ship acquired thru the Japanese Reparations Program. Built in Japan, it arrived in Manila on December 26, 1966. It is designed and equipped to do oceanographic and biological investigations and for stern trawling and longline fishing.
- b) M/V Malasugui — A steel ship acquired in 1960 from the Reparations, it is presently used in echo-sounding survey and in assisting purse seine entrepreneurs.
- c) M/V Sabalo — A steel ship acquired in 1966 from the Reparations. It is a combination trawl seiner.
- d) M/V Maya-Maya — This vessel was acquired by the UN as part of its contribution in equipment to the UN/FAO Special Fund Fisheries Development Project in the Philippines. It was built in Japan and arrived in Manila December 26, 1966. It is a combination purse-seiner-trawler.

**2. Shore Laboratories**

**a) Dagat-dagatan Central Laboratory**

This laboratory located in Malabon, Rizal, is utilized in the study of major commercial fish species and also in the analyses of oceanographic samples taken from cruises of the research vessels or a. of the vessels of the Philippine Fisheries Commission, in various parts of the country.

To enable the performance of such analyses and other research activities, this laboratory is equipped with the primary biological and hydrographical facilities.

**b) Shrimp Biology Laboratories**

There are four of these, one located in Malabon, Rizal. One to be established in Carigara, Leyte; one being constructed in Paguil Bay, Misamis Occidental; and one in Paracale, Camarines Norte, still to be established.

Actually studies on the biology of shrimps and other minor fishery resources as well as experiments are conducted only at the Dagat-Dagatan Central Laboratory, in Malabon, Rizal, because the others are not equipped, hence, not in full operation, though these laboratories are already provided with personnel by the PFC. This also holds true with the following enumerated laboratories.

**c) Tuna Biology Laboratory**

This is located in Dapa, Siargao, Surigao del Norte. It is on the Pacific side, very near the famous Philippine Deep, within the belt of the migratory path or possible breeding ground of the deep-swimming tunas. It is located at the edge of the Kuroshio current and the point of deflection of this current, hence such are presumably rich in fish resources. This is an appropriate center for studying the biology of the tunas and their tuna like fishes such as the sailfishes, sardine, spearfishes, and spanish mackerel.

**d) Turtle Biology Laboratory**

This laboratory is proposed to be put up in Taganak, Turtle Islands, to undertake researches on the biology of the fast-depleting turtle population.

**e) Marine Biological Laboratories**

The laboratory in Zamboanga City receives assistance from the Central Laboratory; also undertakes fishery biological and oceanographical investigation studies of the waters immediate to these areas. It studies the ecology of the very important and potential agar-agar sea weed of the *Eucheuma* species.

Studies of similar nature have also been started at the Lucap Demonstration Station in Alaminos, Pangasinan.

**f) Limnological Laboratories**

The Division has a limnological laboratory located in Los Baños, Laguna, adjacent to Laguna Lake. This was established thru the assistance of the United Nations on freshwater fisheries in 1959 to 1964.

It has adequate laboratory space and fundamental equipment for limnological work. Additional technical staff and field equipment are needed to cope with various activities in limnological studies and fisheries evaluation work.

Two other limnology laboratories will be established; one in Lake Lanao in Mindanao and the other in Lake Paoay, Ilocos Norte Province.

**g) Fish Culture Facilities**

The only complete station for freshwater fish culture work is the Central Luzon Demonstration Fish Farm, Tanay, Rizal. It has 3.0 hectares of developed tanks and a small office-laboratory building. Concrete experimental ponds are available

but this station still needs additional pond areas for applied tests and re-applications of experiments.

The Magsaysay Fish Nursery, and Demonstration Fish Farm in Looc, Zambales is only good for the growing and storage of breeders. It does not have facilities for the conduct of fish culture research work neither does it have technical personnel to conduct research.

The Limnological Laboratory in Los Baños has a small area which was converted into experimental ponds and concrete tanks. This is being used for research on induced spawning of catfishes. It has also a big laboratory space which is being converted into a wet-laboratory and hatchery for the spawning of catfishes and other indigenous species.

The rest of the freshwater fish farms in the various provinces in the country are still being completed. These projects, however, when completed will not satisfy the requirements for the conduct of fish culture research. They are primarily designed for demonstration rather than for experimentation.

The apparent lack of facilities to enable the conduct of fish culture researches account for the slow development of the fresh water fish culture industry.

#### **h) Water Pollution Facilities**

While the Freshwater Fisheries Division has a Water Pollution Section, there is no laboratory in which to undertake such studies. The section utilizes a small space in the Dagat-dagatan Experimental Station, Malibon, Rizal, which is far from adequate. It is only good for keeping chemicals and storage of materials but no laboratory facilities and equipment for bio-assay tests of pollutants are available. The present activities on water pollution is limited to spot surveys of bodies of water reported to be polluted. There is also a lack of technical personnel trained for water pollution work.

#### **i) Infra-structures**

The Commission also acquired from foreign aid and received from the defunct EEA several units of ice plants and cold storages which will be installed during this program as funds for the purpose become available.

The Commission has also requested additional 20 units of ice plants from the Reparations to be installed for the period 1967-70.

The University of the Philippines has the following facilities:

1. Vessel — The College of Fisheries has a fishing vessel, the M/V Pampano, which is used to train students on various aspects of marine science aside from fish capture.
2. Laboratory facilities of the College of Fisheries and College of Arts and Sciences are being utilized for instructional and research activities which are equipped with the primary biological and research facilities.

The National Museum has a laboratory equipped with the primary instruments used in taxonomic and ecological investigation exclusive of a vessel.

#### INFORMATION

The Philippines has no central repository for oceanographic information or data. Each agency of the ten or more entities of the government dealing with oceanographic investigations maintains their own individual records or archives. The Coast and Geodetic Survey publishes its bathymetric investigations in about 200 nautical charts of the Philippine region. Tidal and current tables for Philippine ports are also prepared and published annually.

In fisheries research, results of research studies are published in the official scientific journal of the Philippine Fisheries Commission, the *Philippine Journal of Fisheries*. Oceanographic data collected and compiled are sent to the World Data Center for Distribution to interested member countries.

The National Committee on Marine Sciences has recommended the Documentation Division of the National Institute of Science and Technology to be the National Data Center for Oceanography and Fisheries Research.

#### OPPORTUNITIES FOR INTERNATIONAL COOPERATION IN FISHERIES RESEARCH AND DEVELOPMENT — PHILIPPINES-U.S. AND REGIONAL

##### 1. Existing and/or drafted

##### a. Southeast Asian Fisheries Development Centre

The projected establishment of the Southeast Asian Fisheries Development Centre (SAFDC) with the Training Department to be hosted by Thailand and located in Paknam not far from Bangkok and the Research Department to be located in and hosted by Singapore is an opportunity for regional international cooperation which has been opened to the Philippines. The draft of the agreement was adopted in the meeting of the 2nd Working Party on the Establishment of the SAFDC created by the Second Ministerial Conference for Economic De-

velopment of the Southeast Asia, in Manila, April 26-28, 1967. According to the agreement, membership to the centre is open to "Southeast Asian Countries" which include the Philippines, on a contribution of less than US\$12,000 each year to insure the regional character of this Center."

b. Cooperative Study on the Kuroshio and adjacent waters (CSK)

The Intergovernmental Oceanographic Commission (IOC) of the UNESCO is the coordinating body of the CSK. The Philippines as a member of the IOC has committed to participate in the investigation. Some equipment had been received from the UNESCO which were, however, not sufficient. With the acquisition of the M/V Researcher I of the Philippine Fisheries Commission (PFC) which is equipped with more oceanographic and biological equipment the National Committee on Marine Sciences of the NSDB together with other national governmental agencies (refer to paragraph 15) will undertake investigation of some section of the CSK east and west of the country sometime in winter of 1967-68.

c. *Rastrelliger* Research

Mackerel of the genus *Rastrelliger* is widely distributed in the waters of the Southeast Asia and Indian Ocean region. Due to this significance in distribution and to the fisheries of most of the Indo-Pacific region, regional cooperative study was recommended by the Indo-Pacific Fisheries Council (IPFC). The cooperation of the UN/FAO training centers were sponsored to undertake subjects on the biology, methodology on research and assessment of stock. Standards were established which could be used in fisheries investigation in the region. The *Rastrelliger* Working Group under the IPFC was formed to study and recommend measures and to investigate progress in research and development. Besides the higher Working Group of the IPFC region, the three member countries of the Association of Southeast Asia (ASA) who are also members of the IPFC have considered "*Rastrelliger* Research" as one of their cooperative projects.

d. Studies on Seaweeds (*Eucheuma*)

Ecological and Biological Investigations of Seaweeds. (*Eucheuma*)  
— In view of the great demand particularly by foreign markets of the seaweeds of the genus *Eucheuma*, studies on the ecological aspects of the seaweeds community and the growth rate and cultivation of *Eucheuma* are being undertaken in cooperation with the Marine Colloids Inc., thru the Botany Department of the University of Hawaii. Facilities nevertheless are still very limited so that NEC-USAID assistance has been requested. The project proposal on seaweed development had been submitted to the NEC several months ago and is awaiting final approval of the grant.



**e. Freshwater Fish Culture Development Project**

This project assisted by the Freedom from Hunger Campaign Project and implemented thru the United Nations under the assistance of Mr. Yun-An Tang, Inland Fishery Biologist, is in progress. It was started last year and will be on until 1969. This is mainly for the development of the freshwater fish culture industry and training of local counterparts. As the program progresses, problems are encountered and such problems need research. Unfortunately, the government is not at present in a position to answer the demands of the industry due to lack of facilities and trained manpower to conduct research.

It seems that an international cooperation on freshwater fisheries research is the best arrangement that could be made. This will facilitate exchange of know-how and information on certain research activities.

**2. Proposed Cooperative Venture with U.S.**

**a. Studies on Seaweeds (Eucheuma)**

This project proposal is still awaiting formal approval of the grant-in-aid from the NEC-USAID. This proposal is a very conservative estimate and that only a few of the enumerated objectives could be investigated-ecology and growth rate within the first two (2) years, so that it is then important that more discussions on the projection with regards to expansion of the project on the 2nd year be effected in order to realize practically all of the set objectives of the project proposal within a 5-year period.

**b. Cooperation in the Fisheries Oceanographic Investigation of new and less exploited fishing grounds.**

This project is to supplement the Fisheries Oceanographic Investigation of the PFC. The PFC has only one well-equipped vessel, (M/V Researcher I) another one with some research facilities (M/V Maya-Maya) and two other fishing vessels which are being used for demonstration fishing trips which are provided with some simple collecting devices to gather some oceanographic data from the other vessels. Therefore in order to be able to immediately develop the still less explored waters in the country external assistance is important considering the large amount involved for such ventures.

This shall be a three (3) to five (5) years project, that is, 2 years actual survey and one year for final evaluation and analysis of the data.

This shall also be used as an opportunity for training young scientists in various fields of oceanography, marine geology, marine meteorology and fisheries.

The territorial waters of the Philippines shall be divided into regions and each vessel (PFC M/V Researcher and U.S. vessel) shall have its respective regions for investigation.

c. Cooperative Research Project on Freshwater

Sometime last September, Professors Romer Swingle and Don Ross of Auburn University came to this Office to explore the possibility of setting up a cooperative research project on freshwater fish culture. The USAID was responsible for their visit. Surveys of possible sites for the project were undertaken in various parts of the country. At the moment, this Office is not aware of the background of this matter. The proposed project is very good and it would be of interest to have this matter taken up in this Workshop.

The National Committee on Marine Sciences has prepared a long-range national program on marine sciences and technology (See background material). Foreign assistance in some of these programs would serve the national interests of participating countries especially on basic researches as the seismic, geomagnetic and gravimetric survey of Philippine waters. The Philippines has commitments in the International Union of Geodesy and Geophysics to do her share in the study of the Upper Mantle under the Philippine Region. A well-equipped oceanographic vessel is essential for this cooperation.

As a member of the Intergovernmental Oceanographic Commission, the Philippines is ready to cooperate in international oceanographic programmes. In spite of its very limited resources and facilities, the Philippines takes pride in having participated in such major scientific undertakings of global nature as the International Geophysical Year and the International Quiet Sun Year. As a member of the International Union of Geodesy and Geophysics, tidal records from several principal stations in the country have been contributed to data published by the Permanent Committee on Mean Sea Level. The Philippines has also sponsored before several U. N. cartographic conferences a proposed oceanographic survey of a portion of South China Sea, west of Palawan Island. Increased knowledge of ocean environment in this part of the world would be of great benefit not only to our country and the other bordering states, but also to the whole brotherhood of nations. It is comforting to state that the Intergovernmental Oceanographic Commission and the International Hydrographic Bureau share our views and have adopted resolutions in this regard. More intensive and continuous study of our seas is urgently necessary and this could be accomplished with great success by the establishment of an institution that will devote its full efforts to learning and understanding the seas in order to benefit from them in the most effective manner.

The major objective for the establishment of the Institute is to improve, expand and accelerate the development of the vast marine resources of the country thru research of the ocean and thus establish knowledge about the physical, chemical and biological aspects and to accelerate them with the fisheries of the area, besides improving navigation and strengthening the national security and the development of other related industries from the ocean.

The proposed organization shall be under the National Science Development Board and shall require facilities for laboratory, research vessel, equipment, transportation, manpower, training and development.

This National Institute of Oceanography and Fisheries Research is proposed to be established within five years. Foreign Aid Funds would be welcomed.

**POSITION PAPER FOR WORKING GROUP III**  
**INVENTORY OF MARINE BIOLOGICAL RESOURCES —**  
**REGIONAL MARINE SPECIMEN SORTING CENTER**

*Prepared by*

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## **INVENTORY OF MARINE BIOLOGICAL RESOURCES — REGIONAL MARINE SPECIMEN SORTING CENTER**

### **A. FUNCTIONS**

The concept that the Regional Marine Specimen Sorting Center would function as (a) a center for the collection of marine organisms from all over Southeast Asian Countries for accumulation, cataloguing and storage (b) a place where the collection may be classified up to families and from where scientist or specialist may draw by request specimens of certain group or groups for taxonomic study and (c) then to serve finally as a reference collection center is inherent in an institution of the kind.

If such a center should benefit the country substantially, then a sort of a small Smithsonian Institution in the region is in order. This will need a team of specialists and literature on taxonomy, marine biology and fisheries oceanography.

### **B. VALUE — SCIENTIFIC AND ECONOMIC**

The Philippines as a developing country views the establishment of the Sorting Center from a realistic angle as technical assistance to suit local conditions. One basic need in the country which is very important in good teaching and research in biology is a comprehensive and reliable taxonomy of the marine flora and fauna.

At this juncture, it is worthwhile mentioning that there are at present many preserved specimens in several local scientific agencies and institutions that are ready for taxonomic studies. If and when the center is realized, then these studies will appear in scientific literature. Taxonomy developed in the region, will eventually be the basis of more biological studies of marine organisms, including those of economic importance.

The establishment of a Marine Biological Station opened throughout the year is a necessary adjunct to the continuous operation and faster progress of the Sorting Center. This station should be developed and equipped with such facilities that would attract specialists as well as students taking advance courses in the biological disciplines.

Furthermore, the functions of the Center could serve well as a center if it were only for sorting but also as a depository. This undoubtedly would enhance the value of the center for it would have curatorial staff to ensure its institutional permanence.

### **C. LOCATION**

The consideration of a location convincingly support the possibility of availing of a site in the campus of the University of the Philippines, which has the advantage of being in a university community equipped with all its educational and scholarly resources.

#### D. RELATION TO REGION

The Philippines, for regional consideration, is strategically located within the Indo-Pacific area.

#### E. MANAGEMENT AND SUPPORT PLAN

With reference to these points, quoted hereunder are pertinent remarks of Dr. Wallen in a Special Meeting of the National Committee on Marine Sciences (NCMS) at Dagat-dagatan Fisheries Laboratory, June 23, 1967.

"The Center will need a complement of 30 personnel. The Director of the Center will be a Supervisory Scientist of the Smithsonian Institution and Filipino Supervisory Scientists for (1) Plankton, (2) General Invertebrates, (3) Fishes, (4) Algae and (5) Sediment Samples together with the necessary Filipino Technical aides (Sorters), and administrative personnel will be paid by the United States Agency. Operational costs, equipment, supplies, etc. shall be at the expense of the United States Government. It is estimated that the operation costs shall be \$200,000.00 per annum.

"The Assistant Supervisor should be a college graduate with a post-graduate Master's degree. The Technicians or Sorters shall be graduates of high school or shall have obtained a degree of A.A. These Sorters shall be trained for 6 weeks.

"The Center shall develop instructions on collecting, preserving and labelling marine specimens. Inventions for rapid sorting shall be part of the activities of the Center.

"The Philippine Government shall provide 6,000 sq. ft. of space. The layout shall be modelled after the Limnology Laboratory of the Philippine Fisheries Commission at Los Baños, Laguna. Water and light facilities should be available."

#### NOTE 1. Manpower and Training Needs

The initial stages of the Sorting Center will need the services of foreign specialists. Since these specialists will stay in the country for short periods of time, there will be a need for the training of local manpower under these specialists. For further training, local men should be sent abroad to take graduate studies in order to replace the foreign specialists permanently.

#### NOTE 2. Opportunities for International Cooperation in Fisheries Research and Development — Philippines - U.S. and Regional.

At this point, it may be mentioned, that opportunity for regional international cooperation with the Training Department of the projected Southeast Asian Fisheries Development Center (SAFDC) has been opened to the Philippines. This will be hosted by Thailand and located in Paknam not far from Bangkok and the Research Department to be located in and hosted by Singapore.

**POSITION PAPER FOR WORKING GROUP IV**  
**ECONOMIC AND SOCIAL FACTORS IN MARINE SCIENCES**

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## ECONOMIC AND SOCIAL FACTORS IN MARINE SCIENCES

### INTRODUCTION

The importance of fisheries and marine products to the national economy of the Philippines is widely recognized. What is not so well known is the need for improving fisheries production and technology through improvement in fishing methods, sustained scientific research effort, and the maintenance and improvement of government facilities for fisheries regulation, fisheries extension, and the proper conservation of fishery resources.

Present studies show that fisheries and other marine products make up 17.4 per cent of the total gross physical output, exceeding even rice which is the primary staple of the Filipinos. The contributions that fish and marine products can make to the food supply and nutrition of the Filipinos are indicated by the proportion of the total supply of fish and marine products to the average net disappearances of all food supplies in the country and the need for increasing the protein supply in the Filipino diet. According to Bantegui and Sumagui, the annual net supply of fish and marine products averaged 940,000 metric tons in calendar years 1964 and 1965, or 8.7 per cent of the average food supply from all sources.\* Of the annual total protein supply, 27.7% is estimated to come from meat, poultry and fish. This protein supply is, however, inadequate to meet optimum nutritional requirements.

The economics of supply and consumption of fish and marine products show that the rate of growth of fishery production can hardly keep pace with the rate of growth of consumption. The Fisheries Commission indicated that the gap will likely widen over the years under the proposed program for fishing improvement and adoption of modern techniques are persistently pursued. If present trends continue the estimated deficit in fisheries supply in the next ten years would be about 14 to 16 per cent of total consumption requirements. The trade in fishery and marine products indicates that while exports of these products have hardly increased, their importation, particularly of canned fish, has been increasing over the years.

In terms of national production at current prices in 1965, the contribution of the fishing industry in all aspects is estimated at P722 million, or 4.2% of the GNP.

Apparently, the production gap can be narrowed down considerably by improving the technology of the fish catch, by a consistent program of research on fishing gear and fishing grounds as well as the close adherence to fish conservation laws and regulations. A hardly tapped area for improvement lies in the development of inland fisheries and the improvement of freshwater fish culture.

\* Bantegui and Sumagui. The food balance sheet of the Phil. for calendar year 1965. *The Statistical Reporter*, Vol. X, No. 4, October-December 1966.



The economics of collaboration and scientific research in marine sciences and technology would seem to indicate bright possibilities of cooperation with the American Academy of Sciences — National Research Council in certain fields. The implications of these researches would lie not only in the long-run possibilities of focusing the attention of our government and people to certain areas of research and regulation which would considerably improve production and enhance conservation of fish and marine products in this country.

#### PRODUCTION AND SUPPLY IN RELATION TO CONSUMPTION

The gross available supply of food from animal sources amounts to 1.97 million metric tons of which 1.42 million metric tons are meat, poultry, and fish; 464,000 metric tons whole milk and 92,000 metric tons fresh chicken and duck eggs.

For the calendar years 1964 and 1965 net available supply of food of animal origin (for human consumption) amounts to 1.90 million metric tons, or 17.6 per cent of the total food supply. This is obtained by deducting 70,000 metric tons used for non-food purposes. Of the total food supply from animal sources, about 1.47 million metric tons, or 74.3 per cent, are produced locally, and 507,000 metric tons are imported.

Of the total supply of fish and other marine products amounting to 996,000 metric tons, about 829,000 metric tons or 83.2 per cent are fish, 59,000 are crustaceans and 108,000 are mollusks. Of the total gross supply of fish and other marine products, about 41,000 metric tons are imported and 56,000 metric tons are utilized for non-food purposes. There is, therefore, a net annual supply of 940,000 metric tons for human consumption. In 1965 the consumption of fish alone was estimated at 709,471 metric tons, or 22.0 kilograms per capita.

#### FOOD BALANCE IN MARINE PRODUCTS

The net food supply in fish and other marine products is estimated for calendar years 1964 and 1965 as follows:

	<i>Thousand Metric Tons</i>
Production	955
Net Imports	41
Gross Available Supply	996
Non-Food Utilization	56
Net Available Supply for Human Consumption	<u>940</u>
Per Cent of Total Food Supply	<u>8.7%</u>

## FINANCING AND INVESTMENT INCENTIVES

The principal investments in the fishing industry are in fishing boats and fishing gear, fishpond development, and infrastructure facilities for the fishing industry. It is felt that increased investment in the industry will depend upon the government fiscal and monetary policies, the encouragement and assistance given by the Fisheries Commission to the adoption of new methods of fish utilization and processing, and the strengthening of fishermen's organizations or associations in the different regions.

Investment estimates of the Philippine Fisheries Commission show that private investment in fishing vessels (with a gross tonnage of over three tons) increased from P83.1 million to P180.8 million in the period 1963 - 1966, or an average of about P90.0 million over the four year period. These investment estimates do not include those in small fishing boats with or without motor and in small bancas that serve a multiplicity of purposes in the numerous islands of the Archipelago. No value estimates have been made for these numerous fishing crafts all over the country.

Another indication of the considerable investment in fishing and in fishery products are the loans granted by the government financial institutions as well as the rural banks to fishpond owners and for the operation of deep-sea fishing vessels. Available data for 1966 reveal that the total loans granted by these financial institutions amount to P41.7 million a year, with the PNB accounting for P12.4 million (only loans outstanding); the DBP, P12.8 million; and the Rural Banks, largely in small loans to fishery owners, P16.5 million (See Attachment I).

Estimates of the investment in fishing ports and fish landing facilities, ice plant and cold storage, and fishing boat construction facilities must be considerable but are not readily available. There are no fishing ports in the large islands of the Archipelago, but there are many shipping ports for inter-island vessels and quite as numerous as non-descript and primitive landing points along the coastlines of the many islands of the Archipelago.

Cold storage facilities for fish and fishery products are admittedly inadequate. There are 308 ice plants all over the country for the use of the general public, with a total daily output of 6,000 tons ice, and about 73 units of cold storage with a total capacity of 805,000 cubic meters (as registered with the Public Service Commission). These serve the fishing industry only indirectly. These facilities are designed for the general public and only incidentally assist the needs of the fishing industry.

Lack of fishing ports with facilities for handling fish products and inadequate capacity and poor distribution of cold storage plants are definite obstacles to the development of the fishing industry. Provision of these facilities in adequate measure is absolutely necessary for the

development of an efficient fish marketing system, and their efficient operation would serve as the economic incentives or inducements to municipal fishermen and the deep-sea fishing enterprises. The efficient handling of the catch through an orderly marketing system will have serious impact on total fish consumption and the family budgets for fish and other food products.

The lending policies of the PNB and DBP, together with the program of assistance by the Fisheries Commission, are designed to provide economic incentives to the private sector of the fishing industry. The loans of the DBP, for instance, for deep-sea fishing are proving effective in increasing the number of vessels and in improving fishing gear and other equipment. Both the PNB and DBP are also giving incentive loans to fishpond owners for freshwater fishpond development. Noteworthy also are the loans being made by the DBP for the culture and distribution of fingerlings for freshwater ponds. The rural banks are also granting small loans to small freshwater pond owners.

#### ESTIMATED FUND REQUIREMENTS FOR THE EXPLOITATION AND DEVELOPMENT OF PHILIPPINE FISHERY RESOURCES

The development of a ten-year program of exploitation and development of Philippine fishery resources primarily by the private sector is recommended by the Ad-Hoc Committee, chaired by Dr. Elvira O. Tan of the Philippine Fisheries Commission. This program involves the maximization of annual production from coastal and offshore fisheries resources by the private sector; the financing of the private sector in improving method, fishing gear, and increasing the size of the fishing fleet; the control of dynamiting and other forms of illegal fishing by government agencies in cooperation with private enterprises; and in the gathering and compilation of fisheries data in cooperation with the Fisheries Commission. The Committee expects that through an expanded and systematic program of development by the private sector, the output from inland and offshore fisheries could be increased by 575,000 metric tons in the next ten years and thus narrow the gap between supply and consumption requirements over this period.

- A. To attain the goals of the program, an annual capital investment of P28.5 million from the public and private sectors will be required for the first phase (1968-1970) of the ten-year period within which to narrow the gap between the supply and consumption requirements. Of this amount, P10 million will be needed for private shore facilities. This will mean a total investment of P85.5 million for the first three years of the program. During this three-year period, 1968-70, the Fisheries Commission shall require a total appropriation of P13.38 million.

For the second phase (1971-73) of the ten-year period the total capital investment required will amount to P112.5 million, with an

annual outlay of P37.5 million. The last phase of the ten-year period (1974-77) will call for a capital investment of P117.7 million. For the second and third phase of ten-year period, the Fisheries Commission will need P35.82 million; thus, a total of P49.2 million will have to be appropriated for the Fisheries Commission for the ten-year period.

B. The ten year program (1968-1977) calls also for capital investments from the private sector and loans to private enterprises as follows:

Private sector investment .....	P 83.4 million
Loans to private enterprises .....	P173.1 million
Expenditures of public agencies for infrastructure facilities .....	P109.2 million

C. *Completion of ice plant and cold storage facilities*

Some units of ice plant and cold storage facilities were turned over by the Emergency Employment Administration to the Philippine Fisheries Commission sometime in 1964. These include: (1) eleven (11) units of ice plant and cold storage with a capacity of 143 tons; (2) four (4) units of ice plant and ice storage with a capacity of 36 tons; and (3) three(3) units of cold storage of cold storage with a capacity 150 tons. Considering that these projects are located in various fishing bases and their completion will greatly alleviate the insufficiency of such facilities in those areas, they are being given top priority.

With the completion of these facilities, fishermen will be induced to improve their fishing activities since they would be assured of a safe storage and ready market for their fish catch. The supply of fish will also become more stabilized.

D. *Fish market at Navotas, Rizal*

The Philippine Fisheries Commission has programmed the establishment of a fish market at Navotas, Rizal, at the present site of the major fish landing in the country.

The works involved are the reclamation and development of about 2 1/2 hectares of land, complete with a fish market and government buildings of about 7,000 square meters, ramps, roads, drainage, parking areas and fence. The ramps are to enable amphibian trucks coming from the fishing boats to unload directly to the fish market.

This project is aimed primarily to provide an immediate measure to improve the present fish landing and marketing system until an integrated port complex within the Navotas and Manila area is finally made available. It may be stated that the double-handling system of unloading fish and the provisioning of supplies by means of amphibian trucks have still to be resorted to inasmuch as no berthing facilities

are to be provided. The area is still devoid of protection from the inclemencies of the weather and, owing to limited area available, no ice plant and cold storage facilities can be provided.

The project is now under construction with an available appropriation of P500,000.00. However, an additional amount of about P1,500,000.00 is still needed to complete the project.

*Potentials for Increased Production*

The potentials for increased fish production in the near future will depend on the increase of fishing vessels, the further motorization of bancas, and the adoption of modern fishing methods; the development of infrastructures to take care effectively and efficiently of the fish catch; improved methods of fish culture through the judicious use of fertilizers, pesticides; and adoption of better management practices and the development of better inland fish-culture methods on farms and freshwater streams.

On the basis of 30.66 kg. allowance per person, the estimated total fish consumption requirement by 1976 (44.8 million people) would amount to 1.37 million metric tons. Under present production trends estimated total production at that time would amount to 1.34 million metric tons per year.

Some estimates of increased production through improved potentials in the different fishing areas are:

1. *Marine fisheries* *Metric Tons*

With increased investment in additional fishing vessels and the adoption of improved deep-sea fishing techniques, it is estimated that the deep-sea catch in the next ten years could be increased annually by ... 55,000

2. *Brackfish waters of swamplands*

a. With 10% of the developed areas of brackfish fishponds utilizing improved techniques and the remaining areas continuing the traditional methods, an estimated increased of production from 13,700 ha. at 1,000 kg. per ha. may be realized annually, amounting to ... 13,700

b. With 5% of the existing underdeveloped swamplands put into production annually, out of a total of 563,000 hectares, an estimated yield of 500 kg. per ha. from 30,000 ha. of developed swamplands will amount to an annual yield of ..... 15,000

3. *Freshwater fisheries*

a. With an estimated 1,000 ha. put into production every year in a period of ten years, the fully developed freshwater ponds would increase from 6,000 hectares to

16,000 hectares, out of a potential area of 186,000 hectares of freshwater fisheries. The increase in yield per year from these newly developed freshwater fishponds could easily amount to .....	3,000
b. The tapping of additional freshwater ponds and lakes in different regions of the Archipelago would yield an estimated increase in fish production amounting to	500
Estimated increase in annual production .....	87,200

It can be seen therefore that the estimated fishery deficit of 16% in the next ten years can be narrowed down considerably, so that by the end of the tenth year the annual deficit may amount to only 40,000 to 50,000 metric tons. To attain this position, it will be necessary to complement vigorously a comprehensive and practical program of production and conservation.

*Funding Requirements of the Project on the Improvement of Fisheries Technology*

As studied by an ad-hoc committee on fisheries technology, the program in this sector will consist of research in improvements in fish processing, development of fish processing methods, and the problems of the fish-processing industries. The program for a period of five years involves a total outlay of P16,800,000 among the government agencies. The implementation of the program would involve an increase in total fund outlays of P3,000,000 per year for the entire period.

*Funding Requirements of the Project on the Development of Techniques in Fish Culture*

Most of the research on the improvement of fish culture, particularly on inland fresh water lakes has been done by the Philippines Fisheries Commission and in schools and colleges of fisheries. However, only limited funds have been appropriated for this purpose and facilities therefor such as motorized bances, fish nets, and aquaria and experimental ponds are inadequate.

Perhaps the greater problem in fish culture is how to grow more fish food in old as well as in newly opened fish ponds. Continuous culture of fish food for long years without the necessary replenishment has lead to the exhaustion of the nutrient elements in the fields, thus these fields require fertilization.

Another problem is the supply of the fish fry. The fry is gathered along the seashore during certain seasons of the year and its supply is oftentimes uncertain. Both these problems exist largely because of the paucity of trained men for fish culture development.

The establishment of additional four (4) stations in selected regions would involve an annual government outlay of P1,780,000 for the next four

years. This will not include private investment in fishponds and fish culture as envisioned by the Philippine Fisheries Commission and the different schools of fisheries. However, under the rice and corn program of this administration, a pilot project has been launched to conduct training in inland fish culture for selected barrio youth under the auspices of the Rural Development Committee, with the active cooperation of the Philippine Fisheries Commission and the agricultural schools and colleges that have existing freshwater ponds or contemplating the establishment of freshwater ponds for production and instructional purposes. Both the fisheries instructors in these schools and colleges and the selected barrio youth can profit from the wealth of experience of private fishpond owners in Bulacan, Rizal, and Cavite.

### ECONOMICS OF BILATERAL COOPERATION

1. The current appropriations of government agencies undertaking research in marine sciences and technology and/or employing marine scientists and technicians amount of ₱46,277,746. The biggest appropriation for the current year is for the Philippine Fisheries Commission, amounting to ₱5.3 million of which ₱327,911 is for research activities. Together with the fund derived from income for all sources (amounting to ₱348,822), the total outlay for research in marine sciences and technology for the current year of the Fisheries Commission would amount to ₱666,733.

The agencies employing marine scientists and technicians most of which have not reported the outlays for research and/or current appropriations may be enumerated as follows:

- 1) National Museum
- 2) Bureau of Coast & Geodetic Survey
- 3) Philippine Fisheries Commission
- 4) Philippine Atomic Energy Commission
- 5) National Institute of Science and Technology
- 6) Weather Bureau
- 7) National Research Council of the Philippines
- 8) University of the Philippines
- 9) Bureau of Vocational Schools
- 10) Mindanao State University
- 11) FEATI University
- 12) University of San Carlos
- 13) College of Agriculture, Xavier University
- 14) Silliman University
- 15) University of Sto. Tomas
- 16) El Observatorio de Manila Inc.

For lack of time, the computation of the current appropriations as well as the outlays for fishery research and experimentation has not been completed.

However, among those agencies that have reported total current appropriations and outlays for research and training in marine sciences and technology, the following data are illustrative:

<i>GOVERNMENT</i>	<i>Outlay for Research and Training</i>	<i>Total Outlay Of Agencies</i>
Phil. Fisheries Commission	666,733	5,359,980
Mindanao State University	46,504	2,170,000
Bureau of Vocational Education	5,551,416 <sup>a</sup>	38,495,766
	<hr/>	<hr/>
	6,264,653	46,025,746
 <i>PRIVATE</i>		
El Observatorio de Manila	35,000	252,000
Xavier University	5,000	32,000
	<hr/>	<hr/>
	6,304,653	46,309,746
	<hr/>	<hr/>

#### *2. Manpower Resources for Marine Science Progress and Technology.*

Sixteen government agencies and privately-owned institutions have reported that they employ marine scientists and marine technicians. A total of 227 marine scientists and 462 technicians are employed in these institutions. Of the total number of scientists, 191 are with the government agencies and only 36 are with the private institutions. Among the technicians, 455 are employed with the government agencies and only 7 are with the private institutions. Among the marine scientists, 16 are Ph. D.'s and D. Sc.'s holders while 147 are with B. S. degrees and 40 with M. S. degrees. (See Attachment III).

#### *3. Facilities for Research in Marine Sciences and Technology.*

There are eight research vessels available for fisheries and oceanographic investigations distributed among five agencies of the government as follows: Bureau of Coast and Geodetic Survey, four, Philippine Fisheries Commission, Philippine Navy, U.P. College of Fisheries, and Bicol School of Fisheries, one each. For descriptions of these research vessels please see Attachment IV.

There are 14 laboratories now engaged in the field of research in marine sciences and technology. The listing of these laboratories and the types of research conducted and the specialized equipment in these laboratories are indicated in Attachment V.

#### *4. Assistance received from external sources for marine sciences and technology.*

<sup>a</sup>—Appropriation for the 42 schools of fisheries under the Bureau of Vocational Education.



Foreign aid for the Fisheries department was channeled through these outlets: The U.S. Government and the United Nations Development Programme.

In compliance with the Philippine Rehabilitation Act of 1946 under which a cooperative agreement was concluded between the U.S. and the Philippine Governments, the Bureau of Fishery and/or Philippine Fisheries Commission embarked on a project entitled, "Fisheries Rehabilitation Program in the Philippines" with the assistance of the U.S. government. Under the agreement, the said Act directed the U.S. Fish and Wild Life Service to conduct in the Philippines, oceanographic, biological, fish culture, technological, engineering, statistical, economic and marketing studies, demonstrations and fishery exploration. The Philippines availed of training grants for 125 participants at an estimated cost of \$600,000. Provision of equipment, too, were made available, such as a 30-ton vessel, the M/V Star Jordan; one sardine purse seine; 2 vehicles and 1 pilot cannery and fish processing equipment.

In 1955, equipment valued at \$65,752 was provided among which were outboard motors, engine generators, echo sounders, sea scanners, air compressors, trap nets, etc., through the ICA-Philcusa Aid Program. Under the same program, 11 participants trained for 3 months each in the field of Marine Fisheries. Ice plant equipment was also provided by AID to the EEA which was later on turned over to the Philippine Fisheries Commission upon the abolition of the agency. This equipment included 2 ice cold storage (5-tons) valued at \$99,066, five ice making machines worth \$53,040, one plersa rapid ice making machine worth \$30,000 and four contact plate freezers valued \$17,000. The entire equipment amounted to \$199,872.

The projects implemented under the UNDP/EPTA were The Marine Fishery Biology (1956-1958), Off-shore Fishery (1956-1963), and Limnology, now Freshwater Fishery Development (1957-1967). Experts assistance for 221 man-months of service, 12 fellowship training grants and equipment valued at \$39,504 were made available. The estimated value of assistance totalled \$357,109.

##### *5. Current UN Assistance.*

Assistance given to the Fisheries Commission under the UNDP Program for 1967 includes a Freshwater Fishery Expert, a Fisheries Statistics Expert, and one fellowship in Fish culture at a total cost of \$47,600.

Under the UNSF, the Deepsea Fishing Development Project started in 1965 which covers a 5-year period. Dollar assistance is \$1,396,900 to cover the cost of experts, fellowships and outlay for equipment, including vessels and gear. The peso support for the project amounts to P2,348,250, of which P328,892.00 was expended from FY 1965 to 1967.

6. *The fund requirements of the Philippine Participations in the CSK.*

The participation of the Philippines in the CSK involves synoptic surveys within the areas extending from the northeastern tip of Luzon to the southeastern tip and extending not more than 500 kilometers seaward. Additional surveys will also be made across Luzon Strait from Luzon to Taiwan and in the China Sea. Oceanographic cruises will be made twice a year beginning with the winter cruise of 1967-68 and lasting to the summer cruise of 1968.

This project involves a total outlay of public funds amounting to ₱4.3 million among the different participating agencies covering salaries and wages, equipment, supplies, and materials. To supplement the contributions from the participating agencies, the National Science Development Board has provided financial assistance amounting to ₱60,000 and UNESCO, \$7,000 worth of oceanographic equipment which was donated to the National Science Development Board for the exclusive use of the project.

7. *Recommended projects for bilateral collaboration.*

As recommended by the panels on Production and Research, four principal projects are recommended for collaboration between the American Academy — National Research Council and the NSDB-NRCP in the next three to five years. These projects are (1) research on seaweeds (*Eucheuma*), (2) oceanographic investigations, (3) development of improved fisheries technology, and (4) inland fish culture.

The fund requirements for these research projects are indicated below:

	<i>Present Public Outlay (Thousand Pesos)</i>	<i>Estimated Total Outlay (Next 3 to 5 years)</i>	<i>Estimated Annual Outlay</i>
a) Seaweeds ( <i>Eucheuma</i> )	N.E.	₱ 135,040 or 227,200	₱ 120,745
b) Oceanographic Investigations			
1) Fisheries Oceanographic Investigations (3 years)	₱ 487,000	2,980,904	996,968
2) Combined Oceanographic— geophysical survey of the Phil. (5 years)	1,641,400	11,850,000	2,370,000
c) Development of Fisheries Technology			
1) Deep-sea fishing (5 years)	875,805	7,310,800	1,460,000
2) Fish processing (5 years)	200,000	913,096	187,619

d) Freshwater Fishponds Development			
1) National Fish Seed Production Center and Hatcheries (4 years)	N.E.	1,780,000	445,000
2) Freshwater fisheries biology research and limnology project (4 years)	N.E.	630,000	157,500
<b>TOTAL</b>	<b>P 3,205,205 *</b>	<b>P25,827,040</b>	<b>P 5,737,832</b>

\* No estimates are available for projects (a) and (d).

In order to provide a basis for effective research collaboration between the American and Filipino scientists in the next 5 to 10 years, it will be desirable to adopt a systematic programming of individual projects, determine the responsibilities of the local scientists and of the visiting research group, firm up the fund commitments of the Philippine Government for these projects, if possible, ascertain the assistance that may be extended by the American group. The real basis of any collaboration is goodwill and confidence on the capacity and competence of each group to contribute to the attainment of common objectives and the realization of anticipated benefits from the research and investigations.

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2. Bantegui and Sumagui. The food balance sheet for CY 1965. *The Statistical Reporter*, Vol. X, No. 4, October-December 1966.
3. Fisheries Statistics, 1961-1965, Fisheries Information Division, Philippine Fisheries Commission.
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5. Project Studies on Manila North Harbor Fishing Port and Navotas Fish Market Site, Division of Ports and Harbors, Bureau of Public Works.
6. First Input — Output Table: Production Peculiarities. *The Economic Monitor*, Vol. II, No. 40, October 23, 1967.

ATTACHMENT I

INVESTMENTS IN FISHING BOATS, GEAR AND FISHPONDS

I. Investments in Fishing Vessels

	<i>Number of Vessels</i> (over 3 tons)	<i>Estimated Investment</i> (million pesos)
1963	1,929	P 83.1
1964	1,947	93.1
1965	2,393	106.6
1966	2,544	180.3
Average	<u>2,205</u>	<u>P 90.8</u>

II. Loans for Marine and Inland Fishing (1966)

	<i>Number of A/C</i>	<i>Amount</i> (1,000 pesos)
1. PNB (Outstanding)	1,215	P12,419
2. Dev. Bank of the Phil.	332	12,847
Salt and Fishpond	289	6,133
Deep-sea Fishing	43	6,714
3. Rural Banks	12,691	16,484
<small>(small loans granted)</small>		
Total for three institutions		<u>P41,750</u>

SOURCE OF DATA: Philippine National Bank and Development Bank of the Philippines, Annual Reports for 1965 and 1966.

ATTACHMENT II

IMPORTS OF FISH AND FISH PRODUCTS

	1965	1966
	(In thousand pesos)	
Canned fish	P56,359	P54,178
Fresh fish	36	36
Fish meal	5,164	5,082
Processed, dried, salted	132	212
Total inputs	<u>P61,691</u>	<u>P59,508</u>

EXPORTS OF FISH AND FISHERY PRODUCTS

	1965	1966
	(In thousand pesos)	
Buttons, finished	P1,273	P1,129
Fish, fresh and processed	468	1,949
Shrimps, frozen	152	197
Reptile, Skins	94	60
Shell, raw	346	688
Miscellaneous	443	885*
Total exports	<u>P2,776</u>	<u>P4,908</u>

\* Including seaweeds valued at P462,000.

SOURCE OF DATA: Philippine Fisheries Commission, Fisheries Statistics, 1961-1965.

ATTACHMENT III

DISTRIBUTION OF MARINE SCIENTISTS AMONG THE REPORTING AGENCIES/UNITS AND EDUCATIONAL GROUPS

<i>Agency</i>	<i>B.S.</i>	<i>M.A./M.S.</i>	<i>Ph.D./D.Sc.</i>	<i>Marine Nautical Eng'g.</i>	<i>Special Training</i>	<i>Others</i>
1. B C G S	68	3	—	—	—	—
2. P F C	28	2	2	—	—	—
3. W B	30	2	—	—	1	9
4. P A E C	1	2	—	—	—	—
5. N M	4	1	—	—	—	—
6. N I S T	—	1	—	—	—	—
7. B V E	—	2	—	—	—	—
8. M S U	2	3	—	—	—	—
9. U P	6	15	9	—	—	—
10. P I N (No reported scientists)	—	—	—	—	—	—
11. S U	1	—	1	—	—	—
12. U S C	1	4	2	—	—	—
13. U S T	4	4	1	—	—	—
14. F E A T I	—	—	—	14	—	—
15. X U	2	1	—	—	—	—
16. E O M	—	—	1	—	—	—
17. N R C P	—	—	(2)	—	—	—
<b>T O T A L</b>	<b>147</b>	<b>40</b>	<b>16</b>	<b>14</b>	<b>1</b>	<b>9</b>

DISTRIBUTION OF MARINE SCIENTISTS AMONG EDUCATIONAL GROUPS

<i>Education Category</i>	<i>Number</i>	<i>Percentage</i>
B.S.	147	64.76
M.A./M.S.	40	17.62
Ph.D./D.Sc.	16	7.05
Marine/Nautical Eng'g.	14	6.17
Special Training	1	0.44
O t h e r s	9	3.96
<b>T O T A L</b>	<b>227</b>	<b>100.00</b>



RESEARCH VESSELS

Name of Agency	Name length-beam-draft (tonnage (1-G) built-operator complement (A))	speed (knots range-endurance /propulation-hp propeller fuel (B))	electrical power for scientific work (C)	navigation communication sounding equipment winches & deck gear (D)	laboratories, observations, special features, remarks (E)
Bu. of Coasts & Geodetic Survey	<b>PATHFINDER</b> 180' long 30' breadth 14' draft 935 tons displacement Built 1908 by New York Ship-building Co.	12 knots steam turbine twin-screw 500 H.P.	Gen. No. 25 KW,115V DC Diesel  Gen. No. 2 250 KW 120 V DC Diesel  Gen. No. 3 Hercules Diesel 15KW 120 V DC  Gen. No. 4 Kohler Gasoline 5KW. 120 DC	Sperry Gyro-compass  3-TCP Transmitters 1-RAO Receiver 1-TCS Receiver 2-RC 105 Receiver	None
	<b>RESEARCH</b> 180 length 33' breadth 9' draft 771 tons Built 1944	10 knots Diesel engine Cooper-Bessemer twin-screw  Gen. No. 2 Cummins Diesel 75 KVA 450 V,AC	Gen. No. 1 Fairbanks-Horse, diesel 100 KW 440 V AC  Gen. No. 2 Cummins Diesel 75 KVA 450 V,AC	1-ET Transmitter 2-TCS Transmitter 2-RAO Receiver 1-RC Receiver 1-CMU Receiver	
	<b>ARINYA</b> 93' length 22' breadth 10' draft 250 tons Built 1962	9 knots Diesel engine General Motors Twin-screw	Gen. No. 1 G.M., Diesel 30 KW 220 V, DC  Gen. No. 2 GM Diesel 30 KW 220 V DC	1-AWA Transmitter 1-TCS Transmitter 1-AWA Receiver 1-TCS Receiver	
	<b>ARLUNYA</b> 93' length 22' breadth 10' draft 250 tons Built 1962	9 knots Diesel engine General motors Twin-screw	Gen. No. 1 GM Diesel 30 KW 220 V, DC  Gen. No. 2 GM Diesel 30 KW 220 V DC	2-AT Transmitter 1-TCS Transmitter 1-AR Receiver 1-TCS Receiver	

Phil. Fisheries Commission	M/V RE-SEARCHER 44.50 m 3.20 3.47 m 419.59 G.T. 1966-Philippine Fisheries Com. 32 c 12 cdt. 6s	10.5 knots 6,500 m 27 d Diesel-850 8HP single, control-able pitch diesel fuel oil	65 KW-DC 2 4 V 20 h. Bat. 2 sets 230 V dc 105 V ac 4 converters 1 inverter	mag compass gyro-com- pass, shiplog, radar, Loran, Sonar, RDF, 3 repeaters, combination wind vane & anemometer, 3 echo sounders & recorder source recorder, Transmitter 500 w,  Transmitter 75w, 2 Receiver all waves, Trans- receiver SSB 100w, Pub. Address system, 30w, Auto Keyer Trawl winch, gerating cold 2 hydrographic winch 5,000 & 1500 m, booms windlass, air conditioners electric tem- perature re- corder, refri- gerating cold storage	4 lab.-Hydro- biological w/dark room, wet fish biology, aquarium; conference stores, Oceanographic, bottom samling, coring, dredging biologes fishing; live tank equipped w/refrigerat- ing unit for catch fish conveyor
Phil. Navy	RPS MALA- MAYA SOUND (AF-20) Length-111' 6 3/4' Beam-18' 8 1/2 Draft: Fwd Aft Light 4' 5' 5 1/2 Full 5' 7' 1/2 Full displace- ment 114 tons Bul Built by Quincy Yacht Inc. Massachusetts 1943 and con- verted by Ship Repair Yard CNB, Cavite 1961 Operator-Phil. Navy Component-25 O'z & EM	Speed-10.5 kts Endurance- 1,800 Propulsion- win-Engine GM-8269A HP-480 EA Eng. Fuel-Diesel Oil	DC 120 V CM 2.71	Provided with fol. Radar for navi- gation; Rdo reverse; sounder, Echo Atlas Monograph 58 type 568 for sea scanner and echo sounder; small manual windlass for anchor winch trawling Gen. Elect type and Oceanographic Winch Century Elec. Co.	Vessel is pro- vided with gears and equipment for trawl fish- ing



## LABORATORIES

Name of Agency	Name of Laboratory	Name of Sub-Unit	Type of Research	Specialized Equipment in Laboratory
Bu. of Coast & Geodetic Survey	Primary Tide Station	Tides & Current Section	Tidal Observation Temp. & Density of water	Automatic Tide gage, Hydrometers Thermometers
Phil. Fisheries Commission	Dagatdagatan Fisheries Lab.	Marine Fisheries Biology Division Biological Research  Oceanography  Minor Sea Products	Fish Biology  Physico-chemical  Biological	Microscope, Stereoscopic compound, Balances Salinometer, hydrographic winches, reversing thermometers, & Sampling Bottles Bothy-thermographs Peterson grab Meter Precision balance. Aerators Air compressors Microscopes Stereoscopic compound Equipment for home canning & fish sausage making
PFC, Fisheries Utilization Div.	Central Tech. Laboratory	Fishing Processing  Minor Sea  Chemical & Microbiological	Studies on the processing & utilization of fish & fishery products  Studies on the processing & utilization of minor sea products  Chemical & Microbiological investigations on fish & fishery products	None-Newly established.  Spectrophotometer Soxhlet apparatus kjelhdal apparatus; Muffle furnace; Analytical balance Low-level counting equipment
Phil. Atomic Research Com.	Health Physics Dept.	Site & Environmental Survey Group	Determine radioactivity of marine samples	Reference Collections; Mammals, Birds, Reptiles & Amphibians Fishes Crustaceans Mollusks & other marine animals
Nat'l. Museum	Nat'l. Museum	Mamalogy Ormithology Herpatology Ichthyology Garcinology Conchology Miscellaneous Marine Invertebrates Phil. Herbarium	All Taxonomy & Ecology	Seaweeds, Other Equipment: Dissecting; Microscopes Plankton Microscopes
Nat'l. Inst. of Sc. & Tech.		Biological Research Center		

LABORATORIES

Name of Agency	Home of Laboratory	Name of Sub-Unit	Type of Research Conducted	Specialized Equipment in Laboratory
Silliman Univ. Dumaguete Univ. of San Carlos-Cebu City	Only field lab. Dept. of Biology	None	Ecological Mostly taxonomic	none Plankton microscope, stereoscopes, photomicro set, Secchi dish for turbidity, minimum-maximum thermometer; komer water sampler. Plankton nets; glass-bottomed boxes; glass-bottomed boat (good for 6 to 8 men); an underwater camera owned by Mr. Juario but available for our use); launches owned by family of Mrs. Pages & available anytime for use of the Department
Univ. of Sto. Tomas-Mia.	Dept. of Chemistry		mostly research on sea	none Microscopes w/different accessories for research purposes; Plankton nets; Elec. oven & drier; Centrifuge, high power; Fishscopes, glass bottom boxes; Microtomes different types; Ph. Meter Expanded Scale; Mettler Analytical Balance; Micro-histological technique apparatus; Aeroters; Refrigerator, temperature controlled; Gas Pressure regulator for oxygen & carbon dioxide; Tissue grinder; & skin diving kit.
Col. of Fisheries U.P.	College of Fisheries, UP	Marine bio. life history taxonomy; oceanography ecology; population study		Nansen bottle. Reversible thermometer; plankton nets knudsen burette; salinometer; calculating machine; chemicals and equipment for analysis of sea water such as analysis of salinity; dissolved oxygen; phosphate-phosphorus

Capiz School of Fisheries Roxas City	Fish culture lab. Fish processing Limnology lab.	Capiz School of Fisheries C.S.F.	Fertilization Fish processing Fishpond researcher	water ph meter, soil analysis apparatus pressure cooker, dehydrator same as in dishculture
Bicol School of Fisheries Tabaco, Albay	Fish Pres. Lab.	Fish Preservation	Technical Services	Pressure cooker, can sealer
Mindanao State Univ. Marawi City	MSN Marine Fisheries Res. Center	Maawan Mis. Oriental	Estorine biology covering Marine Fishes, Crustaceans Mollusks.	Echo-sounder; Microscope w/ camera attachment Eckman-Dredge; Plankton net & Picket Light Meter; Stream Bottom sample; Thermistor; Finger bowls; Water dip net; substrictible dip net Replacement nets; Current Meter outfit. Seismic Recorder.
(Private Agencies) Manila Observatory	Seismological laboratory	Marine Seismologist lab.		

**SOCIAL FACTORS IN THE DEVELOPMENT OF THE FISHING INDUSTRY**

To have deeper insights into the problem of development of the fishing industry in the Philippines, one needs to look beyond the purview of technology and inquire further into such vitally related factors as living conditions of the fishermen and laborers involved in the production and marketing systems, the prevailing work-organization of fishermen, the existing skills and know-how, family size and level of income, local concepts of savings and nature of capital investments, and so forth. Such consideration may be focused either on modern factory organization or on the actual life of the community. After all, any planned program for technological development and change will eventually come to grip with people whose social, cultural, and economic activities determine its success or failure.

In fishing, any radical change in the industry will almost certainly generate far-reaching changes not only in the lifeways of those who are directly involved in it, especially the fishermen, but also in the social structure of the community where it operates. From this standpoint, therefore, technological development ceases to be merely an increase in production, the introduction of better techniques in fishing and manufacture, the installation of better and more adequate capital equipment or the improvement of particular skills of labor. It automatically assumes a sociological character — that is, it becomes a *qualitative change* in the economy, a fundamental alteration of the existing skills and know-how, and a new organization of labor. In other words, technological development also means transformation of the basic productive capacities of people and ultimately the standard of their living conditions.

To date, however, studies in human elements or social factors in the fishing industry, especially on the factory or village, level, are few and the data available are inadequate to give any observer a good picture of the local conditions. So far there are only two intensive research studies being carried out at present (and coincidentally these are in the western coast of Panay island), with aim in view of discovering in detail the societal mechanisms involved in the introduction of modern technology among the fishermen. The rest of the existing materials so far available deal with technical research. They comprise mainly annual statistics of production, technological equipment, methods of curing and canning, introduction of new fishing methods, and results of small scale experiments in fish cultures. The social organization of the people involved in the whole process of development or who will be affected by the new industry has been treated adequately. But the implication of technological development for the life of the people among whom it will be initiated and maintained needs special investigations, too. The non-technological fac-

tors in the development schemes sometimes function as powerful determinants in the acceptance or rejection of technology.

It is hoped then that in this collaborative work in the exploitation and utilization of marine resources of the Philippines this aspect of development will be considered. For in shaping any program for the fishing industry, it is essential to understand the social mechanisms involved in its *implementation*. And a thorough knowledge of this significant factor in the development program would require a systematic investigation of regional conditions in order to assess the variations in the social organization and cultural orientation of the fishermen, the people among whom technological change has to be initiated. It would be important to know the answers to a few broad questions, such as: What is the regularity of employment in fishing communities and what subsidiary or alternative occupations are available to fishermen? How much of the local fishing industry are financed by local savings and how much by outside investment? How well are market facilities developed? What is the nature of the marketing system in fishing communities? What kind of adaptations do fishermen make to their ecological and socio-economic environments? What societal mechanisms has tradition provided for such adaptations and what are being developed in response to the exigencies of contemporary living? What is the pattern of fishermen's value system and how does this affect the technological organization of a fishing society in attaining its paramount goal—economic sufficiency?

## **CLOSING REMARKS**

**DR. JUAN SALCEDO, JR.**  
*Chairman, Philippine Panel*

Our task is done. Another step has been taken to internationalize our efforts in scientific and technological research and development. Ahead of us, however, looms a more important and more difficult task — that of implementing the recommendations of the four Working Groups on Production Technology, Research, Inventory of Marine Biological Resources, and lastly, on Economic and Social Factors. This task before us will not be as difficult as it seems if the same freedom of thought, the open and frank exchange of views and the close collaborative and cooperative efforts which produced these recommendations shall continue to prevail.

It heartens me, indeed, to note that the Workshop discussions struck a responsive chord in the private sector and that the role played by those who are in the fishing industry and private educational sector was an active one which greatly helped shape the recommendations of the Workshop. Their energetic and articulate participation in the discussions — their frank appraisal of the obstacles and problems of fisheries development and fisheries and oceanography research — the manner by which the doors of the industrial enterprises were opened to give the Workshop participants an insight of the actual operations of the fishing industry not only stimulated the minds of the Workshop participants but also inspired them to work hard — for work hard they did — to recommend the courses of action that have to be taken to solve the problems of fish protein deficiency and underproduction of the fisheries industry in so rich a fishing ground as the Philippines.

It is also noteworthy that representatives from the industrial and private organizations of both nations other than the Workshop participants were equally cooperative in defining the problems and presenting solutions to the problems in fisheries and oceanography in the Philippines.

If we look closely into the recommendations presented by the Workshop on Fisheries and Oceanography, it will be noted that there are some recommendations which can be implemented unilaterally, and some bilaterally. By this, I mean, that there are some problems in fisheries and oceanography which are closely and inherently tied up with the political, social, economic and educational structure of our country, and unless we ourselves, as a nation, have the will to solve our own problems, we shall never achieve the goal of economic self-sufficiency which we have set for ourselves. There are, however, some recommendations which would make the Philippines the center of regional activities in fisheries and oceanography and these recommendations need binational or even international cooperative

efforts for their implementation. Depending then on the nature of the recommendation of the Workshop, we have either to work out the solutions to our problems ourselves or to work cooperatively with other nations to bring about progress in regional scientific and technological activities — in regional fisheries and oceanography research and development.

There is a need, however, for all of us who are gathered here together today to bring about the realization of the objective of this Workshop to help free Man from the threat of hunger through increased fish and other marine products production. We need to continue to work closely as we did during the week-long Workshop deliberations to convince the top policy making bodies of both our nations that we in this Workshop have thought out the appropriate ways and means to increase fish productivity in this part of the world — that the Philippines may well serve as the pilot project to demonstrate to all the other countries whose ocean wealth and rich marine products reserves remain untapped and that the objective of our Workshop efforts can be achieved.

If we can bring about these international cooperative efforts into fruition — if we can develop and implement the cooperative projects recommended by the Workshop — then we will have shown to the whole world that race, creed, national boundaries and religion matter not in science and technology where the welfare of this planet we live in is at stake — we will have shown that through close collaborative and cooperative efforts of nations shall spring an understanding of ourselves as MAN and the satisfaction of the basic needs of MAN.

To our American friends from the scientific, industrial and educational sectors of the United States who participated in the Philippines — U.S. Workshop on Fisheries and Oceanography, I say well done and thank you for the hard work you put into this Workshop. To my Filipino countrymen, I also give my thanks and appreciation for the unstinted cooperation which you have given to the National Science Development Board and the National Research Council of the Philippines to make possible the Philippine participation in this Workshop of which I am justifiably proud. And to my very distinguished Co-Chairman, Dr. Steinbach, all my deep gratitude and very sincere admiration for the leadership you have contributed in a very friendly manner to all our proceedings.

Thank you all.

## **CLOSING REMARKS**

**DR. H. BURR STEINBACH**  
*Chairman, U. S. Panel*

Dr. Salcedo and Members of the Workshop, Resource Persons and all those who contributed to the success of the Philippines-U.S. Workshop on Fisheries and Oceanography:

I sincerely share your admiration for the people who put in such intense work in this activity and I would echo the sentiments that you have made. In this closing remarks, I would attempt to convey some of the feelings which, I am sure, exist in all who have been guests as well as participants in this Workshop. I think it is the mark of this conference that all of us were made to feel that we were given a homecoming welcome. The personal warmth and the fine touches have been most remarkable. I could mention a range of activities which led to the success of the Workshop and which have been so graciously carried out by Dr. Salcedo and his colleagues. Notable, of course, was the preparation of the background materials incurring hard and extra work; and such simple things as the assembling of the materials in the manageable conference kits, complete with stationery, personalized with names. There were many courtesies such as transportation, secretarial help, hotel arrangements, and of course, one that none of us could overlook, the joy that we had at being met at the airport and the friendly and warm fashion with which this fine personal welcome was made and last but not the least, the wonderful food that we had.

To me, the greatest reward, the most rewarding asset of this has been, as Dr. Salcedo mentioned the freedom of give-and-take in the discussion I noticed this because I had the privilege of being, what I think was called, a floating participant. It was an enriching experience for me to watch and see experts in various lines, those responsible for government operations, those who carried the brunt for the private sector, speak to other as free men, working for a common objective and bringing about the communication essential to complete cooperation. This was a demonstration that the ingredients of intelligence and goodwill when focussed upon desirable objectives can lead to complete cooperation.

I look forward to our working together again, not only as Workshop participants when Workshops are held, but also as individuals. Speaking for all the Americans here, we do hope that when you go to our home country as members of the Workshop continuing group or as private visitors please do see us and get in touch with us so that we may continue this very fruitful dialogue. While the next Workshop is recommended to be held in the Philippines, we look forward to a subsequent one in the near future when we can welcome you in the United States again. Most likely,



there will be a workshop related to industrial research and development in the United States.

We wish also to thank the resource people, Filipinos and Americans, and others like Mr. Tang of China and Mr. Grant of Iceland, who have given so generously their time and talent; and, to their institutions, for making possible their participation in the Workshop. It really is impossible to express the gratification of the members of our United States Panel. We do wish all of you the best of success in the follow-up of this Workshop and we will be most honored to be called upon to help to the best of our ability

On behalf of the U.S. Panel and the Philippine Panel as well, I wish to express appreciation for the far-sighted support and encouragement provided by the Agency for International Development. I also wish to express my thanks to the director of the AID here in Manila, Mr. Wesley Haraldson, who is with us today and to his colleagues, Dr. Ernest Neal, Deputy Director, and Mr. Philip Ruppert, the Officer-in-Charge for Industrial Matters.

Chairman Salcedo, it has been, indeed, a great pleasure, a complete pleasure, to deal and work with you, a most gracious, wise and able co-chairman.

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**Ichthyology, Marine Taxonomy. Born: Odiongan, Romblon, January 15, 1906. B. S. Zoology, University of the Philippines, 1924-1928; Pensionado in Fisheries to Japan, 1938-1939. Senior Ichthyologist, National Museum, 1950 to present; Contributing Editor, Philippine Journal of Science, 1956 to present. Associate Member, National Research Council of the Philippines; Member, American Society of Ichthyologist and Herpetologists; Founder Fellow, Philippine Association for the Advancement of Science; Delegate, 8th Pacific Science Congress, 1954; 3rd Meeting, Indo-Pacific Fisheries, 1953. Deep-sea fishing in the Philippines; fishery industries and their problems; ichthyology in the Philippines; training fishermen for increased food production.**

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**VELASQUEZ, Gregorio T.**

**Director, Philippine Science High School**

**Marine Algae-Taxonomy. Born: Calumpit, Bulacan, September 2, 1901. B. S., University of the Philippines, 1925; M. S., University of the Philippines, 1931; M. A., Michigan, 1937; Ph. D., Michigan, 1939. Full Professor, 1958-1967; Faculty of the Graduate School of Arts and Sciences, 1962-1967; Professorial Lecturer in Botany, 1964-1967. Member and Past Chairman, National Science Research Council, 1952-1965; Director, Philippine Science High School, 1964-1967; Vice President, Chairman, Division of Biological Science, PHILAAS, 1959-1967. Member, International Physiological Society; Phycological Society of America; Committee on National Biological Programme; Chairman, Division V, National Research Council of the Philippines; Contributing Editor, Philippine Journal of Science. Studies on Marine benthic algae; freshwater algae; myxophyceae, aquatic plants, thermal algae; distribution and seasonal abundance of local edible seaweeds; bibliography of Philippine phycological studies; biological research; science development in the Philippines.**

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**YAPCHIONGCO, Jose V.**

**Dean and Professor of Fisheries, College of Fisheries, University of the Philippines**



Zoology. Born: Aliaga, Nueva Ecija, July 17, 1904. B. S. Zoology, University of the Philippines, 1929; M. S. Zoology, University of the Philippines, 1934; Ph. D. (Fisheries), Washington, 1941. Assistant Professor, University of the Philippines, 1947-1955; Associate Professor, University of the Philippines, 1955-1963; Dean and Professor of Fisheries, University of the Philippines, 1963 to present. Member, Executive Committee, Curriculum Committee, Committee on Educational Policy; Member, The Academy of Zoology; American Fisheries Society; National Research Council of the Philippines; Philippine Association for the Advancement of Science; Society for the Advancement of Research. Delegate, 18th Pacific Science Congress, 1963; 11th Pacific Science Congress, 1966; Intergovernmental Oceanographic Commission (5th Session), 1967. Biology of dalag, *Ophicephalus striatus* Bloch; aspects in the biology of the fimbriated sardine; spawning habits of snakehead fish; biology of *Therapon plumbeus*.

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REYES, Dominador O.

Officer-In-Charge, Office of the Vice-Chairman and Executive Director, NSDB & concurrently Chief, Office of International Science Relations, NSDB.

International Relations Ll. B., MLQ University, Manila, Philippines. Member—Planning Committee, 3rd Regional Meeting of Representatives of Marine Science Institutions in East and Southeast Asia; First Meeting of the International Coordinatiton Group for the Cooperative Study of the Kuroshio and Adjacent Region, Manila; Presidential Science Working Group; Committee on Trade Promotion and Policy, Assn. of Southeast Asia (ASA); Participant, Royal Institute of Public Administration (Oxford). Formerly Director for Management, NSDB; Executive Officer, Office of Science Coordination, Office of the President.

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BRILLO, Leticia

Senior Scientist for Natural Resources Research, National Science Development Board.

Research Administration; Born: Tacloban, Leyte, June 24, 1919. D. V. M., University of the Philippines, 1940 (cum laude); Special Studies on Research Administration, NEC-AID, Columbia University, New York City 1963-64. Professor in Sciences, Mindanao College, Davao City 1950-58; Specialist, Bureau of Agricultural Extension, Manila 1955; Manager, Agric. & Veterinary Dept., Pfizer Products, Belman Drug Corp., Manila 1955; Executive Assistant, National Economic Council, Manila 1957-59; Development Projects Coordinator, National Economic Council, Manila 1959-60; Executive Secretary, National Committee on Marine Sciences, NSDB, 1962-present. Member, Phi Kappa Phi Honor Society. Attended 2nd Regional Meeting of Southeast Asia Marine Sciences Institutes, Manila, 1962; International Standards Organization Conference, Washington, D.C., 1963; 3rd Regional Meeting of Southeast Asia Marine Sciences Institutes, Manila, 1965 and 1st International Coordinating Group Meeting for the Cooperative Study of the Kuroshio and Adjacent Regions, Manila, 1965. Research Administration Practices in the U.S. and Japan. The Concept of Research Administration, National Research Coordination — Its Concept and Nature.

**Vitae Information of Members of U.S. Panel**

**STEINBACH, Dr. H. Burr, Chairman**

Department of Zoology, University of Chicago, Chicago, Illinois.

Zoology; physiology. Born: Dexter, Michigan, October 7, 1905. B.A., University of Michigan, 1928; M.A., Brown University, 1930; Ph.D. (Zoology), Pennsylvania, 1933. Assistant Physiology and Biochemistry, Brown, 1928-1930; Instructor in Zoology, University of Pennsylvania, 1930-1933; National Research Council Fellow, University of Chicago, 1933-1934; Instructor, University of Minnesota, 1935-1936; Assistant Professor, University of Minnesota, 1936-1938; Assistant Professor, Columbia University, 1938-1942; Associate Professor, Washington University (St. Louis), 1942-1946; Professor, 1946-1947; Professor, University of Minnesota, 1947-1957; Guggenheim Fellow, 1955-1956; Professor and Chairman of Zoology Department, University of Chicago, 1957-present; Member of Corporation, Oceanographic Institution, Woods Hole, Massachusetts, Trustee, President of the Corporation and Director, Marine Biology Laboratory, Woods Hole; Assistant Director, National Science Foundation, 1953-1954; Chairman, Division of Biology and Agriculture, National Research Council, 1958-1961; Chairman, Pacific Science Board, 1967-present; Managing Editor, "Biology Bulletin," 1942-1950; Member, Society of Zoologists, President, 1957-1958; Physiological Society; Society of General Physiologists, President, 1956-1957; Charter Member, Biophysical Society; Member, AIBS Founding Committee. Bioelectric phenomena; injury potentials, sodium potassium equilibrium of cells; ontogenes's of enzyme system of granular components.

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**BARDACH, Dr. John E.**

Professor, School of Natural Resources and Department of Zoology, University of Michigan, Ann Arbor, Michigan.

Zoology and Fisheries. Born: Vienna, Austria, March 6, 1915; U.S. citizen, 1953. B.A., Queen's (Ontario), 1946; M.Sc., University of Wisconsin, 1948, Ph.D. (zoology) 1949. Instructor, Biology, Iowa State Teachers College, 1949-1951, Assistant Professor, 1951-1953; Department of Zoology, University of Michigan, 1953-1955; Associate Professor, 1955-1961; Professor, 1961-present. Senior Visiting Fellow in Science, OEEC, 1961. Director, Fisheries Research Program, Bermuda Government, 1955-1958; Advisor, Royal Cambodian Government, 1958-1959; Independent Investor, International Indian Ocean Expedition, 1954; Consultant (UN), Mekong Project, 1965-1966. Fellow AAAS; Fellow Academic Zoologists; Ecologists Society; Society of Limnologists and Oceanographers; Society of Zoologists; Fisheries Society; Institute Fisheries Research Biology; International Society of Limnologists. Aquatic ecology; physiology and behavior of fishes; coral reef fishes; the senses of fishes; fisheries development; natural resources ecology.

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**CHAPMAN, Dr. Wilbert McLeod**

Director, Division of Resources, Van Camp Sea Food, and President, Van Camp Foundatiotn, San Diego, California.

Ichthyology. Born: Kalama, Washington, March 31, 1910. B.S., University of Washington (Seattle), 1932, M.S., 1933, Ph.D. (Fisheries), 1937. Science aide, International Fisheries Commission, 1933-1935; Biologist, State Department of Fisheries, Washington, 1935-1940, 1941-1943; Assistant Biologist, Fish and Wildlife Service, U.S. Department of Interior, 1940-1942; Curator of Fishes, California Academy of Science, 1943-1947; Professor of Fisheries and Director, School of Fisheries, University of Washington (Seattle), 1947-1948; Special Assistant to the Undersecretary, U.S. Department of State, 1948-1951; Director, Research, American Tuna-boat Association, 1951-1959; Director of Resources Committee, 1959-1961; Division of Resources, Van Camp Seafood Company, 1961-present; President, Van Camp Foundation, 1962-present. Lecturer, School of Fisheries, University of Washington (Seattle), 1938-1943; Guggenheim Fellow, 1947. Associate Editor, "Pacific Discovery"; Editor, "Aquarium Journal", 1945-1947. Senior Fisheries Specialist, Board of Economic Warfare, 1943-1944. AAAS; Society of Ichthyology and Herpetology; Society of Limnologists and Oceanographers; Systematics; anatomy, relationships and geographical distribution of fishes; statistics of salmon and pilchard fisheries; economic fisheries research on salmon, herring, sardine, razor clams, oysters, halibut and tuna; economic oceanography; law of the sea.

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DOTY, Dr. Maxwell Stanford

Department of Botany, University of Hawaii, Honolulu, Hawaii.

Marine biology. Born: Portland, Oregon, August 11, 1916. B.S., Oregon State College, 1940; M.S., 1942, Ph.D. (biology), Stanford, 1945. Assistant Botanist, Oregon State College, 1939-1941; Biologist, Stanford, 1941-1945; Instructor in Botany, Northwestern University, 1945-1946, Assistant Professor, 1946-1950; Associate Professor, University of Hawaii, 1950-1954; Professor and sometime Chairman of Department, 1954-present; Head, Department of Botany, Marine Biology Laboratory, Woods Hole, Massachusetts, 1946-1951. AAAS; Society of Limnologists and Oceanographers; Botany Society; Ecology Society; Phycology Society. Marine algae; primary productivity and ecology.

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KREBS, William A.W.

Vice President, Arthur D. Little, Inc., Cambridge, Massachusetts.

Law. Born: Ebenesburg, Pennsylvania, August 16, 1916. B.A., Yale, 1938, LL.B., Yale Law School, 1941. Has served as member of staff of U.S. War Production Board; the Joint (U.K.-U.S.) Production and Resources Board; Office of Undersecretary of Navy; Counsel for the Office of Naval Research; member of legal staff of A.E.C. and General Counsel of NSF. Joined faculty of MIT School of Industrial Management, 1953 and is still affiliated with MIT as senior lecturer. *The Strategy of Industrial Development*. Has supervised or participated in Arthur D. Little industrial and economic development projects in many countries and regions, including the Philippines.

**LILL, Gordon Grigsby**

Corporate Development Planning, Lockheed Corporation, Burbank, California.

Geology. Born: Mt. Hope, Kansas, February 23, 1918. B.S., Kansas State College, 1940, M.S., 1946. Assistant Chief Party, State Highway Commission, Kansas, 1941; Assistant Geologist, California, 1946-1947; Head, Geophysics Branch, U.S. Office of Naval Research, 1947-1959; Earth Sciences Advisor, 1959-1960; Corporate Research Advisor, Lockheed Aircraft Corporation, 1960-1964; Director, Project Mohole, National Science Foundation, 1964-1965. Private research, U.S. National Museum; Geologist, Bikini Science Resurvey, 1947; Mineral Surveyor, Central and West Provinces, Liberia, 1949-1960. Consultant, Committee of Geophysics and Geology, Research and Development Board, National Military Establishment, 1947-1953. Chairman, Panel on Oceanography, International Geophysics Year; American Miscellaneous Society Committee; Project Mohole, National Academy of Sciences-National Research Council, U.S.A., 1941-1945. AAAS; Fellow Geology Society; Geophysics Union Sedimentary petrology; submarine geology.

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**MARR, John Cassidy**

Director, Hawaii Area, U.S. Bureau of Commercial Fisheries, Honolulu, Hawaii.

Fisheries biology. Born: Oakland, California, December 20, 1918. A.B., Stanford, 1941, M.A., 1944. Junior Biology Aide, U.S. Fish and Wildlife Service, Stanford, 1941-1942; Curatorial Assistant, Natural History Museum, 1942; Assistant Sanitation Inspector, U.S. Public Health Service, California, 1942; Port Recorder, Office of Coordinator of Fisheries, 1943-1944, Coordinating Agent, 1944-1945, Port Supervisor, 1945-1946; Aquatic Biologist, U.S. Fisheries and Wildlife Service, Stanford, 1946-1949; Chief South Pacific Investigator, 1949-1954; Director, La Jolla Biology Laboratory, 1954-1959, Honolulu Biology Laboratory, U.S. Bureau of Commercial Fisheries, 1959-1961; Director, Hawaii Area, 1961-present. Lecturer, Food and Agricultural Organization, Chile, 1952; Director, Marine Life Research Program, Scripps Institute, California, 1954-1957; Guggenheim Fellow, 1934. U.S.N.R., 1943, Ensign. AAAS; Ichthyology and Herpetology Society. Biology of the pelagic marine fish, especially herrings and tunas; population dynamics and ecology of temperate and tropical pelagic marine fishes.

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**McLAUGHLIN, Patsy A.**

Supervisor for Invertebrates, Smithsonian Oceanographic Sorting Center, Smithsonian Institution, Washington, D.C.

Zoology. Born: Seattle, Washington, May 27, 1932. B.A., University of Washington (Seattle), 1957 Graduate work in zoology, 1961-1963; Graduate Ph.D. program, George Washington University, 1967-present. Fisheries Research Biologist, Seattle Biological Laboratory, Bureau of Commercial Fisheries, 1957-1960; Zoologist, Department of Oceanography, University of Washington, 1960-1965; Supervisor for Invertebrates, 1965-present. U.S.A.F., 1951-1955. AAAS; Phi Sigma; Society of Systematic Zoology. Zoology; systematics of barnacles.

PELLICANI, Nicholas R.

Vice President, Marine Colloids, Inc., Rockland, Maine.

Industrialist. Born: November 14, 1915, Rockland, Maine. B.S., Chemistry, Bates College, Lewiston, Maine, 1937; Research, Algin Corporation of America; U.S. Navy, 1943-1946; Kraft Foods, Freeport, Illinois, 1947-1959 (carrageenan extraction processes); Marine Colloids, 1959-present; Vice President for Raw Material Procurement, Extensive travel, Pacific Area, Asia, Latin America.

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SPRAGUE, Dr. Lucian M.

Associate Director, Medical and Natural Sciences, The Rockefeller Foundation, New York, New York.

Genetics. Born: Salt Lake City, Utah, April 14, 1926. A.B., University of California, 1950, Ph.D. (genetics), 1957. Research Scientist, Bureau of Commercial Fisheries, La Jolla Laboratory, 1956-1960, and Honolulu Laboratory, 1960-1962; Deputy Area Director, U.S. Bureau of Commercial Fisheries, Honolulu, 1962-1967; Associate Director, Medical and Natural Science, The Rockefeller Foundation, 1967-present. Member; Hawaii Governors Committee on Science and Technology, 1963-1965; FAO Expert Panel for Facilitation of Tuna Research, 1964; Graduate Affiliate Faculty, University of Hawaii, 1960-1967. Research interest: population genetics of marine fishes, particularly the Pacific sardine and tuna.

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STEWART, Dr. Harris Bates, Jr.

Director, Environmental Science Services Administration, Institute for Oceanography, Miami, Florida.

Oceanography. Born: Auburn, New York, September 19, 1922. A.B., Princeton, 1948; M.S., California, 1952, Ph.D. (oceanography), 1956. Hydrographic Surveyor, U.S. Naval Hydrographic Office, 1948-1949; Instructor, private school, Connecticut, 1949-1951; Research Assistant, Scripps Institution of Oceanography, 1952-1956; Project Director, current surveys, Geological Diving Consultants, 1956-1957; Chief Oceanographer, U.S. Coast and Geodetic Survey, 1957-1961; Deputy Assistant Director, Office of Oceanography, 1961-1965; Director, ESSA Institute for Oceanography, 1965-present; Diving Geologist and Vice President, Geological Diving Consultants, 1954-1957. USAAF, 1942-1946. American Association of Petroleum and Geologists; American Geophysical Union; Geological Society of America. Currents, coastal and estuarine oceanography, bathymetry, near-shore sediments.

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STORER, Dr. James Allen

Dean of Faculty, Bowdoin College, Brunswick, Maine.

Academic. Born: Watertown, New York, 1922. B.A., Bard-Columbia University, 1943; M.A., Harvard, 1948, Ph.D. (economics), 1955. Instructor of Economics, Bowdoin College, 1948-1950, Assistant Professor,

1950-1956, Associate Professor, 1956-1962, Director, Center for Economic Research, 1959-1965, Professor Economics, 1962-present; Economic Advisor to Director, Bureau of Commercial Fisheries, Department of Interior, 1955-1956; Lecturer, University of the Philippines, 1959-1960. *Planning for Progress* (Contributed with Teresita L. de Guzman), 1960; *The Economic Survey of Limay* (with Augusto Cesar Corvera), 1961; *Marine Business Indicators* (editor). Regional research concerning Maine and New England economies.

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VETTER, Richard C.

Executive Secretary, Committee on Oceanography, National Academy of Sciences-National Research Council, Washington, D.C.

Oceanographer. Born: Homer, Michigan, April 17, 1923. B.A., Albion College, Michigan, 1949; M.S., Scripps Institution of Oceanography, 1951. Instructor, University of California, 1951; Oceanographer, Office of Naval Research, 1951-1957; Executive Secretary, Committee on Oceanography, 1957-present. Annual Review of Oceanography for Science Year (World Book Science Annual, 1965-1967); Chapter of NASCO in Ocean Sciences, 1964; Oceanography Information Sources, 1946; Editor, An International Directory of Oceanographer, 4th edition, 1964; articles for oceanography for AGU Transactions and Navy Times. Director, National Oceanography Association; 1st Vice President, Marine Technology Society, 1964-1967.

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WALLEN, Dr. I. Eugene

Head, Office of Oceanography and Limnology, Smithsonian, Institution, Washington, D.C.

Marine biology; limnology. Born: Afton, Oklahoma, October 4, 1921. B.A., Oklahoma State University, 1941, M.S., 1946; Ph.D. (limnology), University of Michigan, 1950; Instructor, Oklahoma State University, 1941-1942, 1945-1946, 1948-1949; Teaching Fellow, University of Michigan, 1946-1948; Assistant Professor, Oklahoma State University, 1949-1953; Associate Professor of Zoology and Chairman, Biological Science Courses, 1953-1956; Assistant Director, Science Teaching Improvement, AAAS, 1956-1957; Senior Foreign Training Officer, AEC, 1957-1959; Marine Biologist, 1959-1962; Assistant Director for Oceanography, Smithsonian Institution, 1962-1966. USN, 1942-1945; Lt. Commander, AAAS; Washington Academy of Sciences; Society of Limnologists and Oceanographers; Marine Technology Society; Society for Systematic Zoology. Limnology; oceanography.

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WILIMOVSKY, Dr. Norman Joseph

Senior Staff Member, The National Council on Marine Resources and Science Development, Washington, D.C.; Professor of Fisheries, University of British Columbia, Vancouver, British Columbia.

Ichthyology. Born: Chicago, Illinois, September 9, 1925. B.S., Michigan, 1948, M.A., 1949; Ph.D., Stanford, 1956. Head, Fish and Game Office, Military Government Bavaria, Germany, 1946; Consultant, U.S. Fish and Wildlife Service, 1949-1950; Associate Ichthyologist, Fisheries Sur-

vey, Brazil, 1950-1951; Principal Investigator Arctic Investigation, Stanford, 1951-1954; Research Associate, 1955-1956; Chief Marine Fisheries Investigation Alaska, 1955-1960; Associate Professor of Fisheries and Zoology, University of British Columbia, 1960-1964, Director, Institute of Fisheries, 1963-1966, Professor of Fisheries, 1964-present. Member of expeditions, U.S. and Canadian, 1947-1949, Mexico, 1950, Alaska and North Canada, 1951-1960. U.S. Army, 1944-1946, Lt. AA; Society of Ichthyology and Herpetology; Fisheries Society; Society of Limnologists and Oceanographers; Society for Systematic Zoology; Fellow Arctic Institution, North America. Systematics of fishes; fisheries; ecology of ice and arctic oceanography; underwater instrumentation; history of biological exploration in the arctic.

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**SHEEKS, Robert Bruce**

Associate Director, Pacific Science Board, National Academy of Sciences, Washington, D.C.

Far Eastern Studies. Born: Shanghai, China, April 8, 1922. B.S., Harvard, 1946 (class of 1944), M.A., 1948. Research Analyst on China, Department of the Army, Washington, D.C., 1948-1949; Director, U.S. Information Service, Taiwan, Department of State and American Embassy, Taiwan, 1949-1952; The Asia Foundation, 1952-1963; Representative in Malaya-Singapore, 1952-1954; Director, Northeast Asia Programs Division, 1954-1959; Research and Development Department, 1960-1963 (San Francisco); Associate Director, Pacific Science Board, Office of Foreign Secretary, National Academy of Sciences-National Research Council, 1963-present. Member, Association of Asian Studies; American Association for Asian Studies; American Association for the Advancement of Science. History of science in Asia; international cooperation in sciences; conservation of nature.

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**DULANSEY, Maryanne Ludmila**

Project Deputy, Pacific Science Board, National Academy of Sciences, Washington, D.C.

Political science. Born: Johnstown, Pennsylvania, July 8, 1937. B.A., University of Pittsburgh (magna cum laude), 1959; University of Pittsburgh School of Law, 1959-1960; American University, postgraduate studies in Latin America area, 1961 and 1965. Office Manager, Jeanner Viner Associates, Washington, D.C., 1961-1962; Secretary, American Liaison Committee, American Council on Education, 1962-1965; Research Analyst, Georgetown Research Project, Atlantic Research Corporation, 1965-1966; Assistant to Head of Science Organization Development Staff, 1966-1967; Project Deputy, Pacific Science Board, National Academy of Sciences, 1967-present. Phi Beta Kappa; American Academy of Political Science.

**LIST OF AVAILABLE \*  
BACKGROUND MATERIALS**

- 1. National Program on Marine Sciences and Technology**
- 2. Organization, Manpower Resources and Facilities for Marine Sciences Research and Technology**
- 3. Philippine-U.S. Cooperation in Fisheries and Oceanography**

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\* Available upon request.