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**International Center
for
Marine Resource Development**

**ANNUAL REPORT
1971 · 1972**

University of Rhode Island

ANNUAL REPORT

July 1, 1971 through June 30, 1972

University of Rhode Island

International Center for Marine Resource Development

Note: Since both the University of Rhode Island and the Agency for International Development support for this Center are intended as encouragement for overall growth in this area, in other words they are to have a multiplier effect, this report ranges freely into all areas of University activities in the international resources field.

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*Cobble and Christopher

*Constantinides

*Foster

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I. Annual Report Summary
211(d) Grant AID/CSD #2455

Title: International Center for Marine Resource Development
Grantee: University of Rhode Island
Director: Nelson Marshall Acting May 1, 1972 through June 30, 1972
Director as of July 1, 1972

A. Statistical Summary:

Report Period: July 1, 1971 to June 30, 1972

Amount of Grant: \$750,000

Expenditures for Report Year: \$162,891

Accumulated: \$283,490

Anticipated for Next Year: \$219,800

B. Narrative Summary:

The principle accomplishments during the past year include:

1. The activation of the first technical aid program and further expansion of the work of the Consortium for the Development of Technology - see item E of Programmed Activities Section V
2. Sponsorship of the Workshop on Problems of Subsistence Fishermen - see item B of Programmed Activities Section V
3. An overall increase in the participation of individual faculty members at the University in international marine resources activities - see section V in report
4. Reassessment and consequent plan for reorganization of the International Center for Marine Resource Development - see Introduction Section III in report.

The general growth of the Center since its beginning in May 1969 has included the formation of the Consortium and is responsible for the above-mentioned increase in faculty activity.

II. Roster of Center Associates

(See comments in Introduction (Section II) concerning organizational changes and the intended role of the Center Associates. Since the Associates were appointed in late August, technically they should not be included in the Annual Report; however, the personnel appointments are important in indicating on-going planning and interests.)

Lewis M. Alexander

Executive Director, Law of the Sea Institute, Professor of Geography

Clinton O. Chichester

Professor of Food and Resource Chemistry

James W. Cobble, Dean, and Director, College of Resource Development

Spiros M. Constantinides

Associate Professor of Food and Nutritional Science and Biochemistry

Ronald G. Cummings

Chairman, Department of Resource Economics, Professor of Resource Economics

Joel B. Dirlam

Professor of Economics

John M. Gates

Assistant Professor of Resource Economics

Andreas A. Holmsen

Professor of Resource Economics

Sydney Holt

Adjunct Professor of Oceanography

Harlan C. Lampe

Professor of Resource Economics

Leif C. W. Landberg

Instructor in Sociology and Anthropology

Nelson Marshall

Director ICMRD, Professor of Oceanography

Aloys A. Michel
Acting Dean, The Graduate School and Professor of Geography

Foster H. Middleton
Chairman and Professor of Ocean Engineering

Virgil J. Newton
Professor of Resource Economics

Lawrence C. Ousterhout
Associate Professor of Animal Science

John J. Poggie
Assistant Professor of Anthropology

William Rosengren
Chairman, Sociology and Anthropology, and Professor of Sociology

Saul B. Saila
Professor of Oceanography and Director, Marine Experiment Station

John C. Sainsbury
Chairman and Associate Professor of Fisheries and Marine Technology

Milton Salomon
Professor and Chairman Department of Food and Resource Chemistry

C. Robert Shoop
Associate Professor of Zoology and Director, Institute of Environmental
Biology

Thomas F. Weaver
Associate Professor of Resource Economics

III. Introduction

The past year has been one of review and decision making in contemplating the future of the University of Rhode Island International Center for Marine Resource Development. In December 1971, on becoming aware that our first and former director, Dr. Lucian Sprague, would be leaving the University, it was immediately apparent that a review of accomplishments of the first two-and-a-half years of program activity should be made to properly assess our future course of action. For this purpose the University's Provost for Marine Affairs, John A. Knauss, appointed a special committee comprised of many of the former members of the Policy Committee of the Center as well as adding new members for fresh thought and a broader outlook. Nelson Marshall, now Director of the Center, served as chairman.

The committee started with the most basic question: Should the Center be continued on an expanding basis or should it be phased out gradually, perhaps being handled as a terminal effort completing in good faith the initial requirements of the 211(d) grant but not projecting beyond the basic five-year program of the grant? Though endeavoring to consider objectively the latter, somewhat negative, outlook the review committee, without serious hesitation, endorsed the concept of an expanded and much more effective international center of activity provided the central administration of the University would make a strong commitment in support of such an endeavor.

Pertinent excerpts from the committee's report follow:

A Center of greater scope is needed to provide leadership for the University's on-going international marine efforts, to focus activities on specific areas and problems, to provide the impetus

for new programs in the coming years, and to help relate all of this to the strengthening of education and research at the University of Rhode Island. The effort would include a well-conceived blend of foreign students and advanced workers from foreign countries into our program. The Center would give needed direction and publicity to University projects in the international marine and associated areas, would consider opportunities for mutual support and the elimination of overlaps between programs. It would facilitate, where appropriate, a concentration of effort within geographic areas, i.e. Central America and the Caribbean, or upon limited types of marine activity, such as artisan fisheries of both the reef lagoon and the coastal lagoon. Finally, the Center should be in a position to encourage additional grant money and to seed new projects, particularly in areas where concentrated effort is already underway. We feel that, without some central organization, the University's activities in international marine resources programs are in danger of becoming increasingly dissipated which would weaken rather than strengthen the total program.

The President, the Vice President for Academic Affairs and the Provost for Marine Affairs of the University have endorsed this approach and have arranged a University grant to the Center of \$25,000 per year over the next three years. Though this is but a token amount, it is impressive in these days when most all budget decisions involve retrenchments.

Once agreeing to the immediate new direction of the Center, the next step was to seek a new director. The usual procedure of a selection committee

was adopted. This committee was chaired by Professor Virgil Norton of the Department of Resource Economics who had been involved in writing the proposal for a 211(d) grant to help found the Center and who had been Acting Director when, in the beginning, we were searching for a permanent director. Their choice for the directorship was Professor Nelson Marshall who has had broad educational research and administrative experience (see Curriculum Vitae, Annex 7). He is an estuarine ecologist with many years of experience in resources programs. He was chairman of the University committee that prepared the initial proposal for creating the Center and has served on the Policy Committee since the Center's inception. The outlook for the Center under this new administration is discussed under the section on Future Plans.

Following the recommendation of the committee which reviewed the Center substantial organizational changes have been made. The Policy Committee, set up to guide the Director, no longer exists. In its place a group of Center Associates (see Section II) has been named to work with the Director on Center affairs very much as faculty works with a department chairman or a dean. For more immediate administrative action the Director works with an Executive Committee of three particularly active Center Associates appointed on a staggered three-year term basis.

IV. Programmed Activities During the Year

A. Seminar Series - Issues in International Development

The seminar series was sponsored jointly with the University of Rhode Island International Studies Committee.

Fall 1971

- September 22 Mr. Richard B. Loth - International Officer for Industrial National Bank, Providence
STIMULATING ECONOMIC GROWTH IN LATIN AMERICA AS A DEVELOPING AREA
- September 29 Mr. James R. MacLean - Chief, International Trade Division, U.S. Department of Commerce, Boston Business Service Field Office
PROBLEMS FACED BY DEVELOPING NATIONS IN THEIR GROWTH
- October 6 Dr. Thomas F. Weaver - Professor of Resource Economics, University of Rhode Island
CRITICAL ISSUES FACING THE UNIVERSITIES OF THE LESS DEVELOPED NATIONS
- October 13 Dr. Anthony Tang - Chairman, Department of Economics, Vanderbilt University
AN ECONOMIST'S PERSPECTIVE VIEW OF CHINA
- October 20 Dr. John Bardach - Director, Hawaii Institute of Marine Biology, University of Hawaii
PERSPECTIVE IN TROPICAL MARICULTURE WITH EMPHASIS ON SOUTH ASIA AND THE PACIFIC
- October 27 Dr. Saul B. Saila - Professor of Oceanography, University of Rhode Island
SOME ASPECTS OF LEPOR: THE LONG-RANGE AND EXPANDED PROGRAM IN OCEANIC RESEARCH OF UNESCO/IOC
- November 10 Dr. Geoffrey Kesteven - Director, FAO Fisheries Development Project, Mexico
THE NECESSARY REVOLUTIONS FOR HUMAN AND LIVING RESOURCE DEVELOPMENT
- November 17 Mr. Lester R. Brown - Senior Fellow, Overseas Development Council
THE ENVIRONMENTAL CONSEQUENCES OF MAN'S QUEST FOR FOOD

- Spring 1972
- February 16 Dr. Uma Lele - Economics Division, World Bank, Washington, D.C.
STRATEGIES FOR RURAL DEVELOPMENT
- February 23 Mr. William Jones - Diplomat in Residence, University of Vermont
POLITICAL PROBLEMS OF DEVELOPING NATIONS - NIGERIA, A CASE STUDY
- March 1 Mr. Nicholas A. Robinson - U.S. District Court, New York
MULTILATERAL CORPORATIONS AND INTERNATIONAL RESPONSES TO ENVIRONMENTAL PROBLEMS
- March 8 Dr. Y. Iitaka - Chairman, Department of Fisheries, Osaka, Japan, and visiting worker (spring, 1972), Department of Fisheries and Marine Technology, URI
TODAY'S FISHERY IN JAPAN
- March 15 Dr. Donald Swearer - Professor of Religion, Swarthmore College, Swarthmore, Pennsylvania
BUDDHISM IN TRANSITION: ITS ROLE IN NATIONAL DEVELOPMENT
- March 22 Dr. George Borgstrom - Professor of Food Science and Human Nutrition, Michigan State University
WORLD FISHERIES AND THE HUNGER GAP
- April 5 Dr. John Mellor - Professor of Agricultural Economics, Cornell University
USING NEW AGRICULTURE TECHNOLOGIES TO INCREASE EMPLOYMENT AND BROADEN THE DISTRIBUTION OF INCOME
- April 12 Dr. Duane Chapman - Assistant Professor of Agricultural Economics, Cornell University
NUCLEAR POWER AND SEA WATER DESALINIZATION RELATIVE TO PEACE IN THE MIDDLE EAST
- April 19 Dr. Marshall Singer - Professor of Political Science, University of Pittsburgh
ECONOMIC TIES BETWEEN POWERFUL AND LESS POWERFUL STATES

B. Workshop on the Problems of the Subsistence Fisherman

The Workshop on the Problems of the Subsistence Fisherman was held at the University of Rhode Island on November 10-11, 1971. There were about 30 participants.

Though the attendance was not as representative as desired, good progress was made. Our on-campus capabilities in this development area were brought together and common interests were recognized.

Just who a subsistence fisherman is was discussed with no really satisfying definition. However, a conceptual model was proposed and discussed which involved a scale with the highly capitalized commercial fishing enterprise on one end and the poorest handline fishermen at the other. Within this conceptual framework, it was generally realized that most subsistence fishermen were in the rural sector of a continuum which begins with the man whose entire catch just about meets his and his family's basic needs for survival within his society. The other end of the continuum was the dividing line between the basically rural, but capitalized, fisherman and the urban commercial fisherman. This dividing line was felt to be an arbitrary one. The individual fisherman who works for a commercial firm, but lives at his society's subsistence level, was thought to be a separate problem.

As the discussion progressed, it soon became evident that "rural" fishing was more explicit conceptually than "subsistence" fishing in describing our area of concern.

Given a reasonable fishery resource base, the elements of the rural fishing problem were generally agreed to be: 1) policies which discouraged equitable income distribution, 2) lack of available credit, 3) lack of

technology to increase production, and 4) lack of markets to absorb the production increases. Several strategies for handling these problems were discussed. In particular, the role that the biologist, economist, sociologist and anthropologist could play in formulating problems and trial solutions was emphasized.

It was suggested that a follow-up conference should consider specific well-documented development projects and approaches circulated among the participants before the conference.

During the week of the Workshop and in conjunction with the Workshop, Dr. Geoffrey Kesteven of the FAO Fisheries Development Project in Mexico presented lectures as follows:

Monday, November 8	ETHICS AND RESOURCE USE
Tuesday, November 9	THEORY OF BIOLOGICAL INQUIRY INTO RESOURCE USE
Wednesday, November 10	AIONOMORPHIS: THE CHARACTER OF MAN'S DEVELOPMENT AND SOCIAL CHANGE
Thursday, November 11	DEVELOPMENT AID PROGRAMS
Friday, November 12	MANAGEMENT OF THE EXPLOITATION OF FISHERY RESOURCES

Future plans call for editing these lectures and publish

Center Occasional Paper series.

C. Law of the Sea Institute

The Law of the Sea Institute is administered at the University of Rhode Island under an independent Board of Directors. Each year LSI sponsors a major conference. This year the conference topic was "Needs and Interests of Developing Countries". Aided by a special grant from the Ford Foundation the conference was able to attract visitors from more than thirty developing countries.

Being an independent entity the Law of the Sea Institute makes a separate annual report.

D. Certificate Program in International Development

This specialized curriculum, which was established in the spring semester 1972, is described in detail in Annex 3. This five-course, 15-credit program offered at the graduate level is sponsored by the University's Committee in International Studies and ICMRD. Several departments including economics, geography, political science, resource economics and sociology are the primary contributors to this curriculum. A wide range of students take the courses involved and about six per year enroll for the certificate award.

E. Consortium for the Development of Technology (CODOT*)

The Consortium has begun operations on several fronts. An initial

* The food science departments of five universities (University of California, Michigan State University, University of Rhode Island, University of Washington and the University of Wisconsin) are participants in this consortium. The group is chaired by Professor Clinton O. Chichester of the University of Rhode Island who maintains an executive office for the group through the International Center for Marine Resource Development.

project utilizing the Consortium concept was started in November 1971. In the pilot project the Consortium is working with the Institute for Technology and Industrialization of Central America (ICAITI). Its efforts thus are concentrated in the five countries between Mexico and Panama. The objectives of the project are to increase the utilization of technology in Central America. This is to be accomplished by developing the competence of the Institute which, under a Common Market Law, serves to disseminate information throughout Central America. Initially a survey of the food industry (which is the largest industry in the area) will be made and areas in which an increased input of technology will result in economic expansion or the development of a better food supply to the population are to be identified.

Two Central Americans are being trained in the United States in various food technology areas. One in marine technology at the University of Rhode Island, another in fruit and vegetable processing at the University of California.

Faculty in resource economics from the University of Rhode Island participated in the development of the survey of the industry and will assist in the analysis of the data obtained. The University of California has supplied experts in the field of fermentation and food processing. The University of Washington has supplied individuals in the field of marine technology, the University of Wisconsin in dairy technology and Michigan State University in meats.

The project is now well underway and the results so far have been excellent. The initial funding of the project was from the Office of Science and Technology of the Agency for International Development; however, recently the project has been taken over by the Latin American Bureau

and its funding increased. The total funding is now estimated at approximately \$750,000 over a three year period.

In other areas of the world, the Consortium has signed an agreement with Kasetsart University in Thailand to assist them in the development of their food technology area. In Chile an agreement has been signed with the National Office of Science to assist them in the food processing industry. In the latter case, Dr. Spiros Constantinides of the University of Rhode Island is spending six months working with the Catholic University of Valparaiso in the development of their marine technology program. Negotiations are under way with the National Research Council of Argentina and the equivalent organization in Brazil.

F. Short Course for National Oceanographic Data Center Grantees

On three different occasions (once in July, October and June) during the past year the Center has hosted groups of grantees from an AID-funded course organized by the National Oceanographic Data Center in acquisition, processing and utilization of ocean data. About 35 grantees come to this country on the recommendation of the United Nations Education, Scientific and Cultural Organization. The grantees come mainly from Latin America and Southeast Asia.

The portion of the training programs held at the University of Rhode Island is one week in length. During this time the grantees had conferences with the various professors, used the library and toured the URI campus, the Narragansett Bay campus, the Department of Fisheries and Marine Technology, and the Marine Experiment Station facilities. The purpose of their week of training at URI was to gain an understanding of aspects of oceanography,

marine affairs and marine resources studies other than oceanographic data processing. URI, with its interdisciplinary approach to marine affairs provides an ideal setting for such a program.

V. Year's Activities of URI Faculty in International Marine Affairs
(see also list of publications - Annex 2)

Lewis M. Alexander

Professor of Geography and
Director of the Law of the
Sea Institute

As his directorship title conveys Professor Alexander is very active in law of the sea affairs for the Law of the Sea Institute which is administered at the University of Rhode Island though governed by an independent board. Appropriately his activities in this area are reported fully for LSI but it is noted in this report that these interests are a decided asset to ICMRD. One of Professor Alexander's most noteworthy pursuits during the past year was his work on the analyses of special circumstances in defining territorial sea and similar boundaries.

In addition to his role with the Law of the Sea Institute, Professor Alexander administers the Master of Marine Affairs curriculum at the University. About 20 students earn the MMA every year. The coverage includes international as well as domestic affairs and soon international students will be added to the U.S. students presently in the program.

Clinton O. Chichester*

Professor of Food and
Resource Chemistry.

Graduate Assistants

Chong Min Lee, Korea
Munehiko Tanaka, Japan
John Jenks, U.S.A.

Research at URI Campus

In Fiscal Year 1972, work was continued on the extraction of protein from red crab, squid and shrimp debris. Feeding trials on protein concentrate directly extracted from these sources were used on weanling rats to determine the protein efficiency ratio of the extracted proteins. In all cases, the PER exceeded that of casein; growth rates indicated that they were superior to the control; and no problems were evidenced in adapting the animals to the food. Examination of the animals after a 28-day feeding period indicated no abnormalities of their internal organs. The results were as expected.

The amino acid patterns of the protein concentrates were determined and in all cases they showed an excess of lysine above the FAO pattern. This would indicate that they would be equivalent to fish protein concentrate in supplementing cereal or other protein sources deficient in lysine.

Limited acceptability trials were performed on the concentrates. The water extracted material was rejected by the majority of panel members as having a residual taste that was entirely too fishy. The isopropanol extracted material, however, was considerably superior in that it could be incorporated into cookies or cakes at a level of 6% without being detected

* See also Consortium for the Development of Technology, item E.

or insignificantly changing the flavor of the product.

A cooperative study on the methods to determine the protein efficiency value of a number of protein sources was initiated. This cooperative study will use six protein sources, including fish protein concentrates, as a substrate. Four methods of determining the utilization of proteins by rats will be used. Protein sources projected for use in this experiment are fish protein concentrate, soy isolate, wheat gluten, casein, oatmeal and crystalline egg albumen. The methodology to be used for intercomparing the protein values of these products consists of the Canadian 2.0 protein efficiency ratio, the NRC protein efficiency ratio, the NRCTER, the NTU, and the 4.0 slope ratio method. Collaborators in the study are the School of Public Health at Harvard University, the ICMRD of the University of Rhode Island, the Department of Nutrition at the University of Wisconsin, the University of Wisconsin Alumni Foundation, and the Pillsbury Company. The results of these inter-comparisons of methodology should be available within the next four months.

Studies on the nutritional effects of the Maillard reaction in fishery products were continued. Extractables from isopropanol and ethylacetate, as brown mixtures, were tested biologically in rats, using casein as a control. The extractable materials were added to a casein based diet. As a control, the equivalent amount of solvent was evaporated and added to the control diet. A third control was used which contained a normal casein based diet. Data indicate that the solvents themselves were equivalent to the control. The extract, however, when added to the diet at the 1% level, decreased growth rates in all cases. The isopropanol extract decreased growth more than the ethylacetate extract. Examination of body organs indicated that the isopropanol extract did significantly influence liver weight.

Individual components of the extracts are now in the process of being analyzed to determine the nature of the components contained in them. It is expected that identification of the major components of the extracts will be completed in the forthcoming year. These components then will be tested individually to determine which of them is responsible for the growth effect.

Program in Chile

A project has been underway for a number of years concerned with the development of infant and weanling foods based upon sources of proteins available in the southern Latin American region. This project, initiated by an AID grant, has utilized protein sources hitherto not considered in the production of foods for pre-school children. This program, of necessity, took the proposed courses of protein food through the classical nutritional evaluation procedures, toxicological investigations, formulation steps, acceptability trials, processing developments, economic evaluations, and, finally, into a moderate scale introduction to a target population. The sources of food which were initially considered were fish protein concentrate and sunflower presscake meal. Later, rapeseed presscake meal was added to the products that were considered.

The work led to large scale testing of a product, "Leche Alim", derived from fish protein concentrate, sunflower seed meal, vitamins, powdered milk, and wheat flour has taken place in a section of Chile south of Santiago. This test, on a population of about 1,100 families, was tried after initial testing for acceptability on normal children in orphanages. "Leche Alim" (translated: "nutritious milk") is about half the price of milk and proved to be successful in the test group. About 85% of the families using the

product continued to ask for it after the test period. It was found, after extensive interviews and examinations, that the growth rate of the infants in the test group was equivalent to that of a control group of infants receiving powdered milk.

Traditionally, milk has not been accepted by some of the Chilean people. The people mistrust milk because of its reputation in Latin America for causing sickness. This reputation, in the early days, was well founded. Powdered milk, most of which is imported and perfectly good, has not had widespread use in the area because of this tradition. Further, when powdered milk is accepted by a family, it often is distributed among all the family members, or sold, so that the infant receives a relatively small amount. Although records do not always show it, malnutrition is the primary cause of death among Chilean infants.

Studies indicate that Leche Alim has been accepted as an infant food and is not being detoured from the infants. This is partially due to the fact that Leche Alim is utilized with toasted wheat flour which already has a reputation for being an infant food. It is felt that Leche Alim will prove to have a high level of nutritional efficiency over the long term, not because it is necessarily better than milk, but because its usage is better than milk.

Leche Alim is not yet sold in the market but in the coming year an emphasis will be placed on wide scale distribution of the product by the National Health Services of the Chilean government.

During the development and research efforts in Chile concerned with this project, liaison and coordination was maintained with a series of institutions, each of which contributed its expertise to the overall problem

under consideration. Dr. C. O. Chichester, who conceived of the project with Dr. Fernando Monckeberg, serves as overall project coordinator. Dr. Monckeberg, of the Department of Pediatric Nutrition at the University of Chile, directed the nutritional testing and toxicological screening.

Other Activities

Conferences attended:

Protein Advisory Group of the United Nations Meeting

November 1971 - Geneva

June 1972 - Paris

Report given: Food and Nutrition Research and Training
Institutes

International Food Technologists Meeting

May 1972 - Minneapolis

Report given: The Establishment of Food Technology Research
Institutes in Developing Countries

International Fish Protein Concentrate Conference

June 1972 - Boston

Report given: Fish Protein Concentrate as a Protein Source
for Human Consumption

Travel as Chairman of Mission Studies for the National Academy of Science entitled: "Introduction of Programs in Food Science and Tech- nology and Nutrition into National Development"

Argentina - July 1971

Peru - September 1971

Chile - October 1971

James W. Cobble

Professor of Animal Science
formerly Dean of the College
of Resource Development

During the first year Professor Cobble assumed duties as Chief of the AID funded Party on Agricultural Research in Korea arranged by the New England Center for Continuing Education. Dr. Everett P. Christopher, former Associate Director of the Agriculture Experiment Station at URI, has been assisting Dr. Cobble.

Spiros M. Constantinides

Professor of Food and Nutri-
tional Science and Biochemistry

Graduate Students

Miss Eeva M. Nikkila, Finland
Miss Jiassie Horng, Taiwan

Dr. Constantinides is in Chile, on a six month leave of absence, as a visiting professor at the Catholic University of Valparaiso, School of Food Science and Fisheries. He is organizing Chilean research projects and course work in the area of food science. One of his objectives is to bring back ideas for cooperative projects that will be developed at URI on his return.

While in Chile he has instituted six projects dealing with the utilization of marine products. These products employ known techniques and the recent findings of his University of Rhode Island laboratory.

During the past year support was made available for two graduate students at URI working on two different projects under Professor Constantinides. Miss Nikkila completed her project on "Utilization of Fish Protein Concentrate for Human Consumption". The following is an abstract of this project, used for her Master's Thesis.

Utilization of fish protein concentrate (FPC) in typical baked products used in both malnourished and well-fed countries was studied. FPC was incorporated in Arab bread (baladi bread), Indian bread (puri), pizza and cookies. The supplemental value of three different types of FPC was compared. Methanol-extracted FPC (FPC III) prepared from hake fillets was superior to casein, to isopropanol-extracted FPC (FPC II) prepared from eviscerated herring and to dichloroethane-isopropanol-extracted FPC (FPC I) made from whole red hake, when fed to rats as the unprocessed FPC form or

when baked into breads. Taste panel tests showed that the supplemented products were well accepted by natives of the countries concerned, when ten percent of bread flour was replaced by FPC. Pizza and chocolate cookies were also well accepted, when the FPC supplementation level was fifteen and twenty percent of the flour, respectively.

The supplemented products showed no apparent differences in any aspect from the standard ones. When ten percent FPC III was used in puri or baladi bread, the protein efficiency ratio (PER) was not significantly different from casein. It was demonstrated that extremely high dry heat (650°C) required by baladi bread or cooking in oil (180-190°C) as puri did little to decrease the protein value of FPC, when the baking or cooking time was about one minute.

Cookies containing five percent FPC produced a significantly better weight gain and appearance in rats than the diet containing standard cookies as the sole protein source. FPC I, which otherwise had lower quality than the other test FPCs, was equal to casein in a recovery diet for malnourished rats, as measured by weight gain, growth rates and protein efficiency.

A second project related to the utilization of marine products, specifically shrimp, is being conducted by Miss Horng. Apparently fresh raw shrimp are quite perishable because of their characteristically high amino acid content and enzymes. The high amino acid content provides a favorable substrate for the development of microorganisms. The proteolytic type enzymes rapidly break down the protein providing bacteria with still more food.

The ultimate objective of this project would be to find ways of controlling autolytic activity in shrimp. With this in mind the immediate aims of

the work is to evaluate the enzymatic deterioration process and study the physical and chemical characteristics of the enzymes involved. Dr. Constantinides reports that this work has already found interesting and important applications in Chile especially with small shrimp.

Howard H. Foster, Jr.

Assistant Professor of
Community Planning and Area
Development

Graduate Assistant

Ivor Jackson, Antigua

Dr. Foster and Mr. Jackson have been working on the preparation of a Regional Development Assistance Proposal for the Eastern Caribbean Region. The purposes of the project would be: 1) to provide technical assistance in planning and evaluating alternatives for natural resources development, 2) to train local government planners, and 3) to improve the application of previous regional study findings (by UNDP, Canada, Britain, U.S.) to local problems.

This area of the Caribbean appears to have great potential for development toward self sufficiency. Unfortunately an analysis of previous programs, also discussion with members of the Monserrat, St. Kitts-Nevis-Anguilla, and Antigua-Barbuda governments, suggests that these broad regional development programs have not been of particular benefit in solving the specific and somewhat unique problems of the development of the small islands in the region.

John M. Gates

Assistant Professor of
Resource Economics

During the 1971-72 year, Professor Gates worked on economic potential of aquaculture. This work included examination of market potentials and tentative cost projections for North American markets. It also included outlines of general economic considerations relevant to aquaculture in less developed nations. Annex 2 mentions three papers presented at conferences during the report period relating to the above topics.

During the past year Professor Holmsen has been studying the economics of the spiny lobster industry. The spiny lobster comprises a number of species which are spread around the world in both temperate, subtropical and tropical waters, and is one of the most important crustaceans in the world trade. While there are various catch methods used for this species, the methods of processing are rather similar. The standards observed in different countries vary, however, and this is the main reason for a considerable difference in price for products from different countries.

In some developing countries like Ghana there seems to be a significant and under-utilized spiny lobster resource. However, too little is known about the harvesting, processing or marketing of this lobster.

Professor Yunosuke Iitaka

Visiting Worker

Dr. Iitaka, who is Chairman of the Department of Fisheries at Kinki University at Osaka, spent two and one half months with the Department of Fisheries and Marine Technology at the University. In addition to his writing during the stay he gave 16 lectures to both year-classes of students, gave eight seminars to instructors at the School of Fisheries and Marine Technology, and gave a campus-wide seminar on the Issues in International Development Series. All these activities were based on Dr. Iitaka's knowledge of fishing gear technology and Japanese fishing.

Dr. Iitaka brought to the University of Rhode Island a highly developed understanding of fishing gear technology, especially net design and he increased the exchange of information between the U.S. and Japan. Two of his writings will be published as URI Sea Grant Marine Technical Reports.

John A. Knauss

Professor of Oceanography
and Provost for Marine Affairs

Professor Knauss has continued his scholarly pursuits both in physical oceanography and in international affairs. It is the latter that are most pertinent in reporting for ICMRD. Briefly:

He served as a member, U.S. Delegation, Third Preparatory Committee for the Law of the Sea, 1973,

He is a member of the Advisory Committee on the Law of the Sea of the U.S. State Department.

Harlan C. Lampe

Professor of Resource Economics

Two programs were carried out with the FAO-Inter-American Development Bank Cooperative Program. The first involved the preparation of a fisheries development program for Barbados and the second a fisheries development program for Costa Rica.

Professor Lampe also completed a study of the export potential for fisheries products from Latin America for the Inter-American Development Bank.

Walter C. Labys

Assistant Professor of
Economics

Professor Labys has been working on his monograph, Dynamic Commodity Models: Specification, Estimation and Simulation. This draft will be finalized over the summer when the final two chapters will be added.

The development of the monograph and his future work on commodity model building concerned with lauric and palm oils will provide a basis for constructing sounder and more sophisticated models important to the future of marine resources, particularly for the countries of Southeast Asia which constitute the Asian coconut community. This work is also directly applicable to the construction of further models of the demand and supply of various types of fish and fish products.

Professor Labys is also working as a consultant for the commodities division of United Nations Conference on Trade and Development in Geneva for which he is constructing a model of the international lauric oils market and serves as UNCTAD representative to the Asian coconut community.

Leif C. W. Landberg

Instructor of Sociology and Anthropology

Mr. Landberg is currently writing his Ph.D. dissertation, "The Socio-Economic Networks of Ngalawa (Double Outrigger Canoe) Fishermen, Tanzania, East Africa," for the Department of Anthropology of the University of California, Davis. Part of the dissertation was presented as a professional paper, "Socio-Economic Correlates of Fishing Effort in the Coastal Fisheries of Northern Tanzania," at the Annual Meeting of the American Anthropological Association, New York, November 1971.

His "Bibliography for the Social Study of Maritime Communities and Fishing Industries" is nearing completion.

Work on the development of an "Index of Current Maritime Social Research" is progressing well. The first section of the index, covering research in progress, has been published by the Department of Maritime Studies at the University of Wales Institute of Technology, Cardiff. The second and final section of the index, covering bibliography relevant to the research projects reported in the first section, is being compiled cooperatively with William R. Rosengren and is currently in press with the University of Wales Institute of Technology.

In addition to these activities, Mr. Landberg is also conducting research on and preparing materials for the study of the human use of coral reefs and reef lagoons, with special emphasis on Tanzania and the western Indian Ocean.

Nelson Marshall

Graduate Assistants

Professor of Oceanography

Ray Gerber
Gregory Telek, Puerto Rico

In cooperation with Professor Saila, Professor Marshall has initiated research to determine the fisheries potential of lagoon and coral reef environments.

As part of this overall program Dr. Marshall is directing work at Eniwetok lagoon. He has also been involved in the literature review on reef fisheries as covered under Dr. Saila's program in which research assistance was given by David Stevenson.

Professor Marshall's studies directed toward determining the primary food sources available to support the reef and reef lagoon fisheries include:

His review (including his own work) of dissolved and particulate organic matter in typical Atlantic and mid-Pacific reef areas, being prepared for publication.

Ray Gerber's beginning studies to ascertain consumer utilization of particulates as available in reef areas.

Basic to conducting observations on the particulate organic matter available in reef areas Gregory Telek has been developing a new technique operating a CHN analyzer below the CaCO_3 dissociation temperature and thus avoiding carbonate interference.

Professor Marshall, after reviewing the work on organic matter input and after considering the literature on fisheries (see report of work under Saila) has prepared an evaluation suggesting that the reef fisheries

potential may be greater than commonly recognized. This has been the basis for proposing further fisheries development work in reef and reef lagoon areas.

Saul B. Saila
Graduate Assistants

Professor of Oceanography
James J. Griffin
David Stevenson

In June 1972 Dr. Saila went to Edinburgh as a participant in SCOR (Scientific Committee on Oceanographic Research) Working Group to propose an expansion of biological data exchange, principally through inventories or specialized data centers.

During the past year Dr. Saila, assisted by Mr. Griffin, undertook background research for developing a model applicable to the operation of salmon rearing facilities. This research, coupled with the on-going research at the University's Marine Experiment Station, has produced a model of an efficient salmon rearing facility where low cost thermal energy is available and the climate is relatively cool. Such low cost thermal energy could be derived from hot springs or nuclear power station effluents.

A literature review on coral reef fisheries, in which Professors Saila and Marshall were assisted by David Stevenson, suggests that, even with relatively inefficient and selective fishing gear, the great abundance of reef fish might permit considerable harvest. Evidence from Jamaica, however, suggests that extensive and uncontrolled fishing on inshore reefs can rather rapidly deplete fish populations, especially species which mature at a larger size and are less likely to move freely from one area or reef to another. This literature review also included: a consideration of fishery sampling methods that might be applied in reef areas; trophic interrelationships in reef fish populations; and the relation between fish protein utilization and human populations on simple atoll systems.

William R. Rosengren

Professor of Sociology

Professor Rosengren spent several months during the second semester in Cardiff, Wales with the Department of Maritime Sociology at the Institute of Science and Technology at the University of Wales. He studied the function of maritime sociology, as presently being developed at the University of Wales, and its applied aspects in and value to the industry both in Britain and in Spain. His long range aim is to develop, on the University of Rhode Island campus, a funded program of academic/applied research addressing itself to the sociological problems of the maritime division of labor. The University of Wales Maritime Sociology Department was chosen for his recent visit because it constitutes the most useful working model for the integration of both the applied and academic orientation in the field of maritime sociology.

While based at the University of Wales, Professor Rosengren made a brief trip to Spain to gather preliminary baseline data on a range of marine oriented communities, with a view to undertaking a larger study concerning the social and economic outcomes of planned and contemplated changes. Spain is of interest because it offers, along with an expanding economy, examples of the full range of technological advancement from post-peasant organization in shipping and fishing to the most modern of techniques.

During the year, Professor Rosengren was named to be one of two American Associate Editors of a new journal, entitled Maritime Studies and Management: An international journal, to be published on a quarterly basis by Scientifica, Ltd., Bristol, England.

John C. Sainsbury

Professor of Fisheries and
Marine Technology

Professor Sainsbury spent three weeks in November 1971 on a trip to Ghana for the International Development Research Center in Ottawa. He went as a member of a team which prepared a project proposal for rural fisheries development. Specifically Professor Sainsbury wrote the section on production systems components for vessels, gear and fishing operations.

Milton Salomon

Graduate Assistant

Professor of Food and Resource
Chemistry

Francisco Ly Sanchez, Peru

Mr. Sanchez is currently working with Dr. James G. Bergan, also in the Department of Food and Resource Chemistry, on the problems of fat and oil removal from anchovetta.

John McN. Sieburth
Graduate Assistant

Professor of Oceanography
Raja Seshadri, India

The potential of seaweeds as a food source for man and animals is severely limited since neither possesses the enzyme to break down the algal polysaccharides, the bulk of the biomass. The most straightforward conversion of seaweeds for developing countries would be as yeast cells. As early as 1923 Nadson in Russia showed that this was possible using terrestrial species of yeasts. Although seaweeds should have a rich marine yeast flora of their own, this had not previously been demonstrated. The only study to seriously attempt this failed.

In recent studies Sieburth and Seshadri (1971) have developed procedures for the cultivation and estimation of yeasts on seaweeds. These techniques have been used to follow the seasonal populations which occur on common seaweed species. The yeast isolates have been compared using both classical keys and numerical taxonomy to describe the yeast microflora of seaweeds and the factors which affect them. As one result of this work yeast isolates are now available in the laboratory to study the production of yeast cells from seaweeds.

Lucian M. Sprague

Graduate Assistant

Professor of Oceanography

John H. Arnold

Professor Sprague went on three different missions for the International Bank for Reconstruction and Development. On the first, a month-long agricultural sector mission to Thailand, Professor Sprague advised the World Bank as to the feasibility of major fishery development potentials in the Gulf of Thailand. On the second, a three-week mission to Ghana, he made recommendations to the World Bank concerning an existing International Development Association loan for the coastal and offshore fisheries of that country. On the third trip, a month-long fisheries appraisal mission to the Peoples Democratic Republic of Yeman, he analyzed the fishery resource and development potential of that country for consideration for possible IDA financing.

At the request of the Department of State Professor Sprague attended the annual meeting of the UNESCO Intergovernmental Oceanographic Commission meetings as a member of the United States delegation.

With Mr. John Arnold, Professor Sprague prepared three institutional review papers to gain a clearer understanding of the potential harvestable world marine resources, one journal on world fishery trends, the other on fishery development in LDC's and the third on the potential resources available for fish protein concentrate. Available analyses to date indicate that, while the ocean could perhaps supply as much as four to six times its present yield, a better understanding of marine food chains is needed to determine the effects of intense harvest on the ecosystem. Also needed are much better international agreements to regulate harvests and apportion and regulate fishing effort in economic terms.

During the year a research program was initiated on the shrimp industry of Latin America. At the present time, the economic performance characteristics of several types of ownership patterns (co-op fleets, private fleets and owner-operation) are being examined within the context of the Mexican Pacific shrimp fishery, with a view to estimating the consequences for future fisheries development. Mr. Wadsworth obtained five-year records for over 300 vessels from 12 cooperative, private fleet owners and owner-operators.

The Subsecretaria de Pesca, interested in the bearing of Wadsworth's research on upcoming contract negotiations in the fishery, named him to direct a field research project on costs, earnings and institutional problems in the fishery, for which they made available three economists on a full-time basis and various other staff on a part-time basis. During the three-month period of this project, Mr. Wadsworth assisted the co-operatives and the government in analyzing operating costs and other data; he held seminars and workshops for government personnel on fishery economics, development, and research methodology; he suggested a new pay system and other contractual changes in the fishery; and finally he prepared an advisory report to the government on the above topics.

While in Mexico City, Mr. Wadsworth conceived and developed a computer simulation model showing the effects on crew share, boat expenses, co-op profits, and rate-of-return to boat owner, of the various modalities of present and proposed contracts between boat-owners and co-ops, for any possible combination of catch, ex-vessel price, operating costs, and interest rates.

Mr. Wadsworth addressed the Twenty-First Annual Convention of the

Shrimp Association of the Americas on the topic: "Effects of institutional arrangements on the shrimp fisheries of Mexico." He also participated in a survey of human resources in the North Pacific area of Mexico, a project conceived and carried out by the Subsecretaria de Pesca of the Secretaria de Industria y Comercio.

Thomas F. Weaver

Associate Professor of
Resource Economics

Professor Weaver was appointed Chairman of the Southeast Asia Development Advisory Group's (SEDAG) Rural Development Panel. In this capacity he will be organizing and chairing several seminars in development planning.

Dr. Weaver is also currently involved with CODJT in Guatemala as a consultant on a food industry survey and evaluation project and is developing research projects concerned with the marine resources of Central America.

Professor Weaver is working on the outline and contents for a book on integrated national commodity resource development and planning and is developing research proposals in that area.

Notes on Students

No attempt is made in this report to list all students at the University pursuing studies and research relating to the overall objectives of ICMRD. Individuals are mentioned under the activities of professors where they are rendering service as assistants.

General mention is made of the studies of Mahn Bovichitra, Acting Head of the Faculty of Fisheries, Kasetsart University, Bangkok, Thailand. He is currently enrolled as a candidate for the M.S. degree in the Graduate School of Oceanography of URI, being sponsored in his studies by the Rockefeller Foundation.

VII. Future Plans

The direction of effort of the International Center for Marine Resource Development will certainly change substantially in the coming year. The selection of a new director and the appointment of a faculty group of Center Associates are, as discussed in the Introduction, intended to stimulate a new outlook to the program. Just how this will take shape is difficult to state at this time since, at the end of this report period, the present personnel had not assumed office. Some of the general trends anticipated are:

There should be a stepped up research for program funding outside the resources of AID. This will not preclude continued close attention to programs of direct interest to AID.

There should be an increased reliance on expertise within the University of Rhode Island faculty in seminar and information exchange activities. This does not preclude the previous use of outside experts.

ICMRD should make a conscious effort to encourage the broadest possible participation of University of Rhode Island faculty in international marine programs.

We can expect a continued growth of the work of CODOT (the Consortium for the Development of Technology).

Among the new activities being considered the following are mentioned:

Advisory Workshop for the Planning of University Marine Programs (see Annex 4)

This is an outgrowth of a suggestion from the Latin American Scholarship Program of American Universities commenting on the rising intent of

developing countries to foster university marine programs and the need for guidance as to how this should be done. According to tentative plans the first such workshop, which should be something of a shakedown experience, will be held in Peru early in '73 and will be financed by Peruvian interests.

Comprehensive Fisheries-Mariculture Program for Puerto Rico in Cooperation with the Puerto Rico Nuclear Center of the University of Puerto Rico.

Our intent to move into this program hinges on several points:

- 1) For some time U.R.I. personnel have considered cooperative work with the University of Puerto Rico, taking advantage of personnel exchanges made in the past.
- 2) A study of this sort can be cast a comprehensive approach to fisheries and mariculture focussing on a distinct geographic and political entity.
- 3) Work done in Puerto Rico should have broad application to tropical developing countries.
- 4) Getting a program of this sort started in Puerto Rico would provide an outlet of operations in the tropics for U.R.I. marine workers.

Several financial sources are being considered in the search for backing, namely the National Science Foundation (for which the excerpts shown in Annex 5 were written), the National Oceanographic and Atmospheric Administration, and the National Defense Education Act program in international studies at the graduate level.

World Marine Resource Assessment Program

If this program materializes U.R.I. would become a world center of information on marine resources. This will require some degree of central administration, some further build-up of our own expertise and, because the

marine resources subject is so broad, various contractual arrangements.

It is expected that the program will get off to a modest start with work on tuna supported by Resources for the Future. Fulfillment of the overall goal will require more extensive funding from the Food and Agriculture Organization of the United Nations.

A number of other new projects are also being considered including:

Further expansion of the CODOT programs, possibly in Brazil and Thailand, also increased activity in Central America.

Projected expansion of nutrition technological work in Chile pursuant to the interests and planning of both Professors Chichester and Constantinides.

A suggested study of fisheries impact on Eniwetok Atoll with the anticipated return of the Eniwetokese into an area unfished for the past two decades - this may be worked out by Professor Marshall cooperatively with the University of Hawaii marine scientists.

Expansion of basic research on coral reef fisheries food chains under the direction of Professor Marshall with funding assured from the National Science Foundation.

New developments in short courses including instruction bearing on the marine resources as being planned by Professor Lampe for the Institute of Public Administration of the University of Connecticut.

Development of salmonid culture in Iceland using natural warm spring water as projected by Professor Saila.

Work on physical planning by Professor Foster concentrating in the Antigua area and being closely tied to United Nations Development Program work there

Expanded studies in resource economics in Mexico to be led by Professor Lampe and linked with an overall lagoon research effort being promoted by Geoffrey Kesteven, co-director of the FAO-UNDP Fisheries Project in Mexico. Professor Lampe will seek new funding from Resources for the Future for this effort.

Technical aid programs not as yet planned. This is a catch-all to express continuing interest in the possibility that favorable technical aid programs, as through AID, might materialize. According to recent report such an opportunity might unfold relative to South Vietnam. We are also exploring technical assistance ideas relative to the coral reef fisheries in Tanzania.

Our report on the immediate future appropriately highlights, in conclusion, the Fisheries Development Workshop: Socio-Economic Research Issues in Fisheries Development to be held on our campus October 25-27. This is being financed by the Agricultural Development Council. The program plan is presented as Annex 7.

In all our new ventures and in the reassessment on upgrading of on-going work we anticipate considerable help from Sydney Holt who has been appointed and has accepted status as Adjunct Professor of Oceanography at the University of Rhode Island.

With the new program orientation in its formative stage we cannot be specific as to expenditure planning. The following general guidelines have been adopted by the Executive Committee of ICMRD.

1. We should "seed" heavily in directions we intend to grow.
2. Once growth areas receive funding they should seek to become more

self-sustaining.

3. We should curtail extraneous spending, for example visiting workers who do not contribute to program growth and publications of comparable remote value to the program.

ANNEX 1. Budget and Expenditure Information

Table I

Distribution of 211(d) Grant Funds and Contributions From Other Sources of Funding

Review Period July 1, 1971 to June 30, 1972

Research Support (see item V Year's Activities of URI Faculty in International Marine Affairs--for work accomplished)	Period Under Review	Cumulative Total	211(d) Expenditures		Non 211(d) Funding Amount*
			Projected Next Year	Projected to End of Grant	
C. Chichester	30,154.38	59,344.46	32,000	35,000	
L. Landberg	15,304.34	27,782.97	15,500	17,000	Contract with ICAITI(PIOT 099-96503-2001 69,000 to CODOT
S. Salla	4,251.92	4,251.92	6,300	10,000	
J. Sieburth	6,159.41	14,440.16	—	—	5,000 - URI salary support for PI **
N. Marshall	5,302.51	5,302.51	10,000	14,000	2,000 - URI salary support for PI
A. Holmsen	5,694.52	5,750.75	—	—	5,000 - URI salary support for PI
S. Constantinides	4,516.23	4,516.23	8,000	12,000	
H. Lampe	10,815.11	10,615.11	14,000	16,000	10,000 - URI salary support for PI
P. Wadsworth	11,288.25	14,663.66	6,000	—	
T. Weaver	14,344.39	14,344.39	16,000	20,000	
L. Sprague	5,353.31	5,353.31	—	—	
H. Foster	112.92	112.92	500	2,000	
M. Salomon	1,111.00	1,111.00	6,000	7,000	2,000 - URI salary support for PI
W. Labys	300.00	300.00	—	—	2,000 - URI salary support for PI
<u>New programs</u>			50,000	50,000	2,000 - URI salary support for PI
<u>Director's Office (administration and program development)</u>	33,551.81	95,792.02	50,000	55,000	
<u>Curriculum Development</u>	4,692.92	7,207.10	2,500	3,000	
<u>Visitor's Lectures and Professional Visitors</u>	9,938.28	12,402.26	3,000	3,700	
TOTAL	162,891.30	283,490.77	219,800	246,700	

*University of Rhode Island facilities support is not entered in estimates below.

**Principal Investigator

Table II

Expenditure Report
(Actual and Projecte

Under Institutional Grant #AID/csd - 2455

Review Period 7/1/71 to 6/30/72

(Line Items to Conform to Budget in Grant Document)	Expenditures To Date	Cumulative Total	Projected Expenditures X000 Year			
			2	3	4	5
Personnel Costs	\$ 112,109.73	\$204,905.62	-	-	120.0	135.0
*Graduate Fellowships	28,012.67	39,688.83	-	-	30.0	30.0
Travel Domestic	4,564.53	9,799.77	-	-	8.8	10.0
Foreign	6,627.05	8,580.71	-	-	11.0	12.0
Other			-	-	50.0	59.7
Equipment	2,558.14	4,605.14	-	-		
Supplies	1,178.82	2,029.56	-	-		
Publication	198.41	769.14	-	-		
Communications	909.43	2,307.77	-	-		
Library	333.45	843.23	-	-		
Misc. (inc. Xerox, Rental, etc.)	<u>6,399.07</u>	<u>9,961.00</u>	-	-	<u>50.0</u>	<u>59.7</u>
	\$162,891.30	\$283,490.77			219.8	246.7

* The figures previously reported under the heading "Graduate Fellowships" have not been accurate due to the fact that an accounting clerk failed to place people in the proper budget category. The figures as now reported are correct.

ANNEX 2. List of Publications, Reports and Manuscripts (in press)
Relating to ICMRD

- Chichester, C. O. 1971. The role of the food industry in nutrition. Proc. Third Latin American Soc. of Nutrition Conf..
- Chichester, C. O. 1971. Round table discussion Moderator, Food Protection and Environmental Degradation. Proc. Western Hemisphere Nutrition Congress III.
- Chichester, C. O., D. Ballester, E. Yanez, M. Rojas and F. Monckeberg. 1971. Detoxification of rapeseed meal. Proc. Western Hemisphere Nutrition Congress III.
- Chichester, C. O., N. Merchack and F. Monckeberg. 1971. Studies of Food Habits and Beliefs in the Curico Province. Proc. Third Latin American Soc. of Nutrition Conf.
- Chichester, C. O., F. E. Monckeberg, E. Yanez, D. Ballester, V. Gatta, M. Araya, and M. Rutman. (in press). Fish protein concentrate as a protein source for human consumption. Proc. Internat. Conf. Fish Protein Concentrate, Boston, Mass. 1972.
- Chichester, C. O., F. Monckeberg, E. Yanez, D. Ballester, V. Gattas and N. Merchack. 1971. Studies of the acceptability of a mixture of unconventional protein bases and toasted flour on pre-schoolers in the Curico Province. Proc. Third Latin American Soc. of Nutrition Conf.
- Chichester, C. O., F. Sanchez, J. Karmelic, J. Granadino and E. Hiche, 1971. The employment of opaque-2 maize in the elaboration of macaroni foods. Proc. Third Latin American Soc. of Nutrition Conf.
- Chichester, C. O., V. C. Sgarbieri, M. Tanaka and J. Amaya. 1971. Some nutritional consequences of the Maillard Reaction. Proc. Western Hemisphere Nutrition Congress III.
- Chichester, C. O., E. Yanez, D. Ballester, and F. Monckeberg. 1971. A protein-rich mixture based on dry skim milk, toasted wheat flour, fish flour and sunflower meal. Proc. Western Hemisphere Nutrition Congress III.
- Constantinedes, Spiros M. 1972. Problemas de nutricion en Chile y sus posibles soluciones. Revistas de Estudios del Pacifico, No. 4; 99-105.
- Fricke, P. H. and E. M. Fricke, editors. 1971. The index of current maritime research. Department of Maritime Studies, University of Wales, Institute of Science and Technology, Caveliff.

- Gates, John M. (in press). Appraising the feasibility of fish culture. Proc. Sym. on Fisheries Economics, sponsored by the Fisheries Division of the Organisation for Economic Cooperation and Development.
- Gates, John M. 1971. Aquaculture in less developed nations: Some economic considerations. Proc. Seventh Annual Conf. of the Marine Technological Soc., Washington, D.C.
- Gates, John M., G. A. Matthiessen, C. A. Griscom. (in press). Aquaculture in New England. A report to the New England Regional Commission with G. C. Mattheissen and C. A. Griscom, New England Regional Commission, Boston.
- Holmsen, A. A. 1972. Harvesting spiny lobsters off Florida. Maritimes, 16:(3) 6-7
- Holmsen, A. A. 1971. South Vietnam looks to its fisheries. Maritimes, 15:(4) 3-4.
- Johnson, P. W., J. McN. Sieburth, A. Sastry, C. R. Arnold and M. S. Doty. 1971. Leucothrix mucor infestation of benthic crustacea, fish eggs, and tropical algae. Limnology and Oceanography, 16: 962-968.
- Laby, W. C. 1972. Projections and prospects for the lauric oils, 1972-1987. Published in the Jour. Amer. Oil Chemists Soc.
- Laby, W. C. 1972. Commodity modeling alternatives for policy simulation analysis. In Volume III, Computer Simulation versus Analytical Solutions for Business and Economic Models. Gotheborg, Graduate School of Business Administration.
- Lampe, H. C. 1972. A development proposal for lagoons. Maritimes, 16:(2) 13-14.
- Lampe, H. C. (in press). A fisheries development program for Barbados. Inter American Development Bank, Washington, D.C.
- Lampe, H. C. (in press). A fisheries development program for Costa Rica. (Span.). Inter American Development Bank, Washington, D.C.
- Lampe, H. C. 1972. Self-help for Latin American fisheries. Maritimes, 15:(3) 5-6.
- Lampe, H. C. and W. Schurra. 1971. The export potential for Latin American fisheries products, (Span). Inter American Development Bank, Wash. D.C.
- Landberg, Leif C. W. and Pamela L. W. Landberg. (in press). Maendeleo: Economic modernization in a coastal Tanzanian fishing village. Papers of the Symposium, "Modernization and the Traditional Socio-Cultural Environment", held at the University of Rhode Island, May 1971. (Exact title of book to be announced). Greenwood Press, Westport, Conn.
- Rosengren, W. R. and M. S. Bassic. (in press). External control and organizational adaptability: American, British, and Spanish Merchant Marine Academies. In Seafarer and Community, P. H. Fricke, Editor, Croom-Helm Ltd., London.

- Saila, S. B. 1971. Container dumping in the North Sea. *Marine Pollution Bulletin*, 2: 125-127.
- Saila, S. B. 1971. Mercury and marine fishes. *Community Health*, 3: 129-132.
- Saila, S. B. and J. D. Parrish. 1972. Exploitation effects upon Interspecific relationships in marine ecosystems. *Fishery Bulletin*, NOAA FSYB-A, 70: 383-393.
- Sainsbury, J. C. 1971. Commercial fishing methods - an introduction to vessels and gear. Fishing News (Books) Ltd., London.
- Seshadri, Raja and J. Mc. Sieburth. 1971. Cultural estimation of yeasts on seaweeds. *Applied Microbiology*, 22: 507-512.
- Sprague, L. M. 1971. The role of fishery resources in developing countries and some implications for the problems of international resource management. *Marine Tech. Soc, U.S. Ann. Conf.*
- Sprague, L. M. and J. H. Arnold. (in press). Fish protein concentrate: the present and future status of available oceanic resources. *Proc. MIT Conf. on Food Protein Concentrate.*
- Sprague, L. M. and J. H. Arnold (in press). Trends in use and prospects for the future harvest of world fisheries resources. *Amer. Oil Chemistry Soc. Jour.*
- Wadsworth, P. (in press). El papel que juega la economia pesquera en el proceso de desarrollo (The role of fishery economics in the development process). Tecnica Pesquera, Mexico.

ANNEX 3. Certificate Program in International Development

The fifteen-week International Development Program offers persons going to and coming from various parts of the world the opportunity to view problems of development from a cross-national and interdisciplinary perspective, and thus gain new insights into these societies. Participants may concentrate upon a disciplinary approach to specific problems or an interdisciplinary study of a specific geographic area. Through other course offerings at the University, participants may study societal developments in the United States as well as the American role in international cooperation.

Participants

The program is designed for persons who wish to gain understanding of development phenomena in various countries, including: State Department officers locating in Washington or going to new posts overseas; AID officials going to new posts and looking for a concentrated program emphasizing an interdisciplinary understanding of development problems; private business and banking officers with overseas interests who desire a review of the economic and political problems of a specific area; Peace Corps members returning to the United States evaluating their experiences and preparing for related work in this country; governmental employees from various developing nations who wish to gain an understanding of developmental phenomena and a detailed analysis of cross national approaches to special governmental problems.

The program is open to the holders of the master's degree or its equivalent in any of the participating disciplines or related developmental and technical fields, as well as to candidates for such a degree at the

University of Rhode Island.

The Program

In the spring of 1971, the Departments of Economics, Geography, Political Science, and Resource Economics began a five-course 15-credit program, to be offered each spring semester. This program leads to a Graduate Certificate awarded by the Dean of the Graduate School. The Department of Sociology and Anthropology also participates in certain aspects of the program. Sponsored by the University's Committee in International Studies and supported by the International Center for Marine Resource Development, the program provides supplemental, interdisciplinary concentration on the problems and processes of modernization and international development.

The program is built around a core segment in which several disciplines are represented with related specialized seminars in several of the disciplines including political science and economics, and a directed studies course in which the student engages in individualized research under the guidance of an interdepartmental panel. This research course allows each participant to pursue a topic of particular interest to him. In addition, the participant chooses one elective course from an expanding list of four or five choices in any semester. Thus it is possible to complete the entire program in a single spring semester, a factor of importance to those on leave from other institutions or governmental and international agencies.

Participating Faculty and Their Interests

Richard R. Brand, Geography - West Africa; urban migration

Leon F. Bouvier, Sociology - demography; population problems

C. O. Chichester, Food and Resource Chemistry - food technology and
nutrition in developing nations

Norman Coates, Organizational Management and Industrial Relations - international business and public service development; South America and Middle East

Howard Foster, Community Planning - economic development in the Caribbean: administration planning

John Gamble, Political Science - international law; marine politics and law

John M. Gates, Resource Economics - marine resource development, aquaculture

Dieter Hammerschlag, Community Planning - urban design in Europe; design planning in developing areas

Andreas A. Holmsen, Resource Economics - fisheries development

Arthur D. Jeffrey, Community Planning - economic development and regional planning in India; new town development in Britain

Harlan C. Lampe, Resource Economics - South America; marine resource development

Leif C. W. Landberg, Anthropology - East Africa; community development and fisheries

Robert N. Lynch, Anthropology - politics of small communities

Thomas L. Meade, Fisheries and Marine Technology - fisheries development

Aloys A. Michel, Acting Dean of Graduate School, Geography - India and Europe; regional development and planning

Josephine F. Milburn, Political Science - British Commonwealth and Africa; comparative urban politics; British business in Ghana; marketing boards

Robert L. Nwandwo, Journalism - mass communications in Africa

John J. Poggie, Jr., Anthropology - Latin America; culture and society

John C. Sainsbury, Fisheries and Marine Technology, - fisheries development

Milton Salomon, Food and Resource Chemistry - impact of agriculture
(as part of ecosystem) on the environment; food production for
world population

Irving Spaulding, Sociology and Resource Economics - urban density

Arthur Stein, Political Science - Asia; political community

Gilbert Suzawa, Economics - economic theory of development

Thomas Weaver, Resource Economics - Southeast Asia; rural development;
planning; strategies for rural resource development

Robert G. Weisbord, History - Sub-Saharan Africa

ANNEX 4. Advisory Workshops on the Planning of University Marine Programs -
A Prospectus

The Area of Concern

Just what are the marine resources of your country or region? What is their value? What is their potential? Finally, what is being done to realize, to develop and to manage this resource potential? For those of us concerned with education and research, these questions must be asked in terms of the role of higher education in support of marine interests. We must ask just how education is and should be responding to these needs. How can university education and research programs interact most effectively with both government and commercial enterprise bearing on the marine resource potential?

In the United States these questions have been probed intensively over the past decade. As a result university marine resources efforts have expanded substantially beyond the marine science, fisheries biology and oceanographic work of earlier years. Several universities have developed a total marine resources outlook which involves a comprehensive approach to marine problems, interrelating the input from the social sciences with the more familiar contributions of the natural sciences. In addition engineering, technology and vocational training, also law, policy and advisory services collectively play a substantial role in modern university marine resource programs.

The University of Rhode Island, starting with its Marine Resources Program in 1960 and subsequently building its capabilities with support from the federal Sea Grant Program, has been the pioneering U.S. institution

developing this broader approach to marine resources. A sense of the University's overall involvement in marine work can be gained from the listing on page 6. For countries or regional organizations wishing to share the insights gained through this experience, the International Center for Marine Resource Development of the University of Rhode Island can arrange for an Advisory Team to make an advanced study of your country or region, to visit the area, and to join in an Advisory Workshop focussing on developing an integrated university marine program. Topics to be covered in the lectures, panels, discussion sessions and illustrated presentations of such a workshop include:

The scope and nature of the marine resources - What is meant by marine affairs?

The scope of a comprehensive university marine resources program - What can be done in programs of lesser scope: through division of effort, through inter-institutional cooperation?

The harvested fisheries as a marine resource.

Mariculture as a marine resource.

Technology and engineering in relation to marine resources development.

University interaction with industry concerned with marine resources, including liasion with the fishery.

University relationships with other government agencies concerned with marine resources.

Faculty, students and research in support of marine resource interests:

Oceanography
Biological sciences
Fisheries
Engineering

Resource Economics
Geography and Law of the Sea
Food and Nutrition
Sociology, Political Science
and Planning

Levels and kind of education: graduate, undergraduate, vocational.

Overseas education in relation to the development of a university program.

Marine advisory or extension services.

Education in marine subjects for children and for teachers of children.

University administration provisions for a marine resources program.

Funding a university marine resources program.

Such a workshop is but a suggested first step in a series of contacts with educational programs in your region. Later steps could include more prolonged advisory visits by personnel from the University of Rhode Island dealing with selected disciplinary areas. Other follow-up steps might include short or extended visits to the University of Rhode Island by personnel from your country who wish to study or do research here. Still other patterns might unfold but follow-up, as important as it is, can best be handled after an initial workshop.

Participants in an Advisory Workshop

The Advisory Workshop is designed to aid decision makers who are responsible for government and national educational planning and to provide background information for those responsible for program planning within universities. Personnel with such responsibilities are selected for participation in such Workshops, together with the Advisory Team from the University of Rhode Island. Leaders representing economic interests in marine resources may be added to the roster of participants.

The visiting Advisory Team from the University of Rhode Island will represent the entire scope of the University interests and more specifically, the following areas: Oceanography and ocean engineering, resource economics, nutrition, vocational education, law, and marine advisory work. On each

Advisory Team there is at least one contributor well versed in matters of academic administration and funding and one having first hand experience with ties between universities, industry and government agencies. For a broadened perspective we will select one or two representatives from other U.S. universities having comparable programs. Selected additional observers from the United States or from the world community (United Nations or World Bank for example) are encouraged to attend. Before travelling to your country the visiting Advisory Team from the University of Rhode Island will spend the equivalent of one week studying source materials to acquire an introductory familiarity with the area. The first week in your area will involve further study and observation before the final five-day comprehensive workshop session ending with the preparation of summation information.

Arrangements

In setting up and planning a Workshop the International Center for Marine Resource Development of the University of Rhode Island assigns one person to work cooperatively with a representative of the country being visited. Any group contemplating a workshop should anticipate a schedule, somewhat as follows:

Ten to eight months in advance - initiate correspondence with Director, URI International Center for Marine Resource Development

Eight to six months in advance - confirm the basic administrative and financial arrangements

Six to four months in advance - coordinator from the University of Rhode Island visits your country to work on arrangements, to plan for participating personnel and to obtain materials for the pre-visit studies of the Advisory Team.

One week in advance - visiting Advisory Team spends the period on location making observations of:

coastal physiographic features
coastal engineering projects
port sites
fishery fleet centers
fishery market facilities
mariculture activities
educational institutions
research facilities

all the foregoing are to involve observations on the institutional factors governing the region's marine resource activities.

The cost of holding an Advisory Workshop must be calculated separately in each instance. In essence the country involved, or an outside agency, is expected to cover the round-trip air fare (in most cases from Providence, Rhode Island) and twelve days per diem for four advisors, plus two round-trips and per diem for the coordinator from the University of Rhode Island who also serves as a member of the visiting Advisory Team. Estimating personnel at \$580 per advisor per week (to cover prorated salaries and indirect costs) and adding per diem plus \$500 as the round-trip fare over a median distance, the foregoing costs total less than \$15,000 U.S. Ordinarily other observers from the United States and the world community are expected to find means to cover their own expenses.

The group requesting the Advisory Workshop is expected to handle whatever local administrative participatory costs might be involved, including translations and arrangements for advisors to see marine resource features during the week prior to the workshop. These costs might range from minor incidentals to substantial sums when expensive meeting arrangements and fees for country participants must be absorbed.

The University welcomes opportunities to offer these Advisory Workshops through outside funding as from the United Nations, from foundation backing, or from technical assistance programs.

The Scope of Faculty Participation in Marine Programs at the
University of Rhode Island

The following chart shows the multi-disciplinary setting that exists at the University of Rhode Island for the study of marine resource problems. Numbers represent full-time equivalent faculty members and graduate students active in marine-oriented programs. (Technical assistants and supporting administrative staff are not included.)

	Faculty	Graduate Students
Biological oceanography including estuarine, coastal, and reef ecology	9	50
Physical, chemical and geological oceanography	16	65
Fisheries biology and aquaculture	4	15
Supporting biological disciplines	5**	20
Ocean engineering and allied engineering fields	10*	85
Vocational education for fisheries and marine technology	5	N.A.*
Food chemistry and nutrition	5	15
Resource economics	9	31
Geography, marine affairs, law of the sea, community planning and public administration	5	25
Sociology applied to fisheries and marine enterprises	4	10
Marine advisory services	8**	N.A.*

* Not applicable

** Chiefly staff, non-faculty appointments

ANNEX 5. Excerpts from Program Definition Proposal: To plan a research and development mariculture-fisheries project in Puerto Rico in cooperation with the Puerto Rico Nuclear Center of the University of Puerto Rico.

Abstract:

This proposal involves a projected cooperative effort on the part of the International Center for Marine Resource Development of the University of Rhode Island and the Puerto Rico Nuclear Center of the University of Puerto Rico to undertake a research and development program dealing with the harvest fishery and the potential for mariculture in Puerto Rico. The intended program would be concerned with the technical, socio-economic and cultural-institutional aspects of development. Physical and biological advantages of an undertaking such as this in Puerto Rico are discussed. The advantages of a total program, focussing on a single geographic-political entity such as the island and Commonwealth of Puerto Rico, are also mentioned. Such work, it should be noted, would be applicable extensively throughout the tropics where there are extensive reef and reef lagoon coasts.

The potential for future cooperation with both government and private interests is discussed. This would be further considered during the program definition stage.

Objectives:

To undertake a comprehensive review of the combined harvest fishery and mariculture potential of Puerto Rico, studying it as a geographic and socio-economic unit.

To identify the technology needed for the fulfillment of this potential.

To identify the socio-economic and the cultural-institutional requirements for the fulfillment of this potential.

To define a comprehensive and cooperative development program for fisheries and mariculture in Puerto Rico.

The potential of improved fisheries, particularly through mariculture, has been widely proclaimed in recent years. For developed areas the interest focuses on business enterprises concerned with choice and often luxury items. For developing areas the interest focuses on the more pressing issues of meeting protein needs and on upgrading the living standards of the fisherman and the consumer. Effective mariculture has been practiced in the orient for many years; nevertheless, mariculture development in the western world is highly innovative and spotty. The approach proposed herein meets two very basic needs lacking in other western mariculture ventures:

- (1) The need to work comprehensively with a total geographic entity such as a large island where the overall mariculture effort can be considered without separation from the socio-economic and cultural institutional requirements involved in fulfilling the objectives.
- (2) The need to inter-relate the mariculture and the harvest fishery developments.

By recognizing the first need we say, in essence, that advances in mariculture technology, failing to take into account relevant socio-economic factors are meaningless. To show how remiss we have been in this regard we need only cite the most comprehensive available work on aquaculture (Bardach and Ryther, 1968), which is rich in technological information but, due to the absence of relevant study, is generally lacking in substantive socio-economic and cultural institutional observations.

"Why Puerto Rico"

There is a broad range of acceptable, even choice, shellfish, crustacean and finfish products endemic to nearshore Puerto Rican waters.*

Favorable temperatures (ranging from 74-78° F according to Ting, 1972) are conducive to an expanded production and utilization of these resources. In contrast to sites in continental United States, mariculture ventures would not be threatened by low-temperature winter kills.

Combinations of productive supporting environments, most notably extensive mangrove shores, Thalassia beds, and coral reefs, surround the Puerto Rican coastline (refer to Golley, et al., 1962, H. T. Odum, et al., 1959, and Marshall, ms. in prep., as representative works on organic input from the mangrove, the Thalassia and the reefs respectively).

Coupled with the above attributes, Puerto Rico is a readily identified geographic entity which can be considered in terms of the socio-economic and cultural-institutional features that interact with fisheries and mariculture and must be considered in a development program.

Puerto Rico serves as a political and cultural link between the United States and Latin America. Under the auspices of the U.S. Department of State and the Commonwealth of Puerto Rico a North-South Center has been established in San Juan to develop this link.

A number of critical economic and cultural problems in Puerto Rico may, in part at least, be responsive to a program to improve the fisheries.

* The expression nearshore is used to avoid confusion with tuna landings which are brought into Puerto Rico from distant oceanic waters, even from the Pacific, for cannery processing.

The per capita income is approximately one-third the average for the people of continental United States (Finance and Development, Quarterly #1, 1972).

Food is expensive and there is such a demand for fishery products that substantial quantities are regularly imported (Ting, R., 1972, reports that the inhabitants of Puerto Rico consume 55 million pounds of fishery products valued at 18 million dollars annually and that 95% of this is imported though the island has a coastline of over 400 miles; Holmsen, 1966, gives similar figures).

Nearshore fishery practices have not changed substantially for over a century (Ting, in press) and, whereas the pursuit of modern large-scale fishery techniques would no doubt severely deplete stocks almost immediately, revised methods, improved conservation practices and fishing in deeper water could greatly improve the fishery harvest.

Mariculture concepts remain relatively unexplored and, until very recently, have received almost no attention.

Though land costs are high, government rights along the coastline, plus the extensive and accessible shallow areas nearshore, could provide the space and water rights needed for aquaculture development. There are also unutilized lagoons and impoundments, such as former salt evaporation basins, that could be developed.

A substantial spin-off would be expected from a development program in Puerto Rico illustrating points applicable to the numerous developing countries of the tropics that have mangrove and reef shorelines. As in Puerto Rico, many of these countries are importing fish from temperate areas while failing, due to a technology and development lag, to use their own resources adequately.

ANNEX 6. Fisheries Development Workshop: Socio-Economic Research Issues
in Fisheries Development

Participants at this workshop will identify and discuss researchable issues in fisheries development within the context of national development, with the objective of establishing research and educational priorities. Fisheries development is to be considered within a total industry framework covering all aspects of ocean and inland fisheries.

In order to accomplish this broad charge, which we feel is appropriate as a first workshop activity, the workshop will be structured as a mix of general and working group sessions. The first morning of the workshop will be spent setting the stage for subsequent working group activity by a general discussion of 1) national development objectives and their relevance to fisheries development, 2) the potential for development based on resource assessment and technology, and 3) the conflict of interest of developed and developing nations in coastal and ocean waters.

Within the framework thus suggested by national development objectives and resource potential the workshop will then divide into working groups to consider more specific topics of fisheries development. Separate working groups for marine commercial fisheries and for artisan inland and marine fisheries will attempt to identify socio-economic research issues in factor supplies, capture and production, preservation and national and international marketing and very importantly human resources and institutional inputs in fisheries development.

Other working groups will address themselves to the development of the range of fisheries models and their implications for and applicability in planning for national fisheries development and to the special relationship

between agriculture and fisheries development.

On the final day of the workshop we will receive and separate reports of the working groups and attempt to summarize our findings with respect to research and educational priorities in fisheries development. Additionally, we will address ourselves to two very important issues for U.S. academic institutions, that is university fisheries education programs and the direction and relevance of fisheries research for the developing nation.

Following the general outline of working group activity given above follows a listing of working groups with a set of general guidelines as a basis to initiate discussion.

The working groups will be divided as follows:

A. Commercial/Industrial Fisheries

1. levels of commercialization, direction of strategy for modernization.
2. preservation and distribution, direction and strategy for modernization.
3. price policy - price stabilization, internal markets and export trade.
4. subsidies and incentives in relation to commercial fisheries development.
5. institutional structure of the fishing industry.

Artisan Fisheries

1. Marine Based

- a. Degree of commercialization, possibilities for modernization based on employment and income objectives.
- b. Government programs including incentives for artisan fisheries development.
- c. Potential of and current use pressure on artisan fishing grounds.
- d. Institutional impediments to change.
- e. Community development and land based fisheries.

2. Land Based Fisheries

- a. Potential level of commercialization and distributional components.

- b. Integrated river development, fisheries component of inland river development.
- c. Potential for fish culture, including marketing and distribution.
- d. Price policy and government incentive programs.

C. Fisheries Models and Development Implications

- a. Models types, components and operational state.
- b. Special problems in population dynamics for fisheries models.
- c. Policy generating potential of current modeling efforts.

D. Fisheries and Agriculture

- a. Relation of agriculture to fisheries development.
- b. Competing resource use in fisheries and agriculture.
- c. Special problems in fisheries education within agricultural education institutions.
- d. Fisheries as an alternative enterprise in artisan fisheries.
- e. The fishing and agricultural coastal communities and the nuclear and extended family as basis production units.

The three-day fisheries workshop schedule is as follows:

Day 1 - Morning - General Session

8:00-8:15	Introductory remarks - A.D.C. representative
8:15-8:30	Introductory remarks - Nelson Marshall, Director, ICMRD
8:30-9:30	National Development objectives and their relevance to fisheries development - T. Weaver
9:30-10:00	Coffee
10:00-11:00	Development potential based on resource assessment and technology - H. Lampe
11:00-12:00	Conflict of interest in fisheries development
12:00-13:15	Lunch
13:15-17:00	Working group sessions
17:00-18:00	Progress reports of workshop (15 min. each)

Day 2

8:30-10:00	Working group sessions
10:00-10:30	Coffee
10:30-12:00	Working group sessions
12:00-13:15	Lunch (Chairman lunch)
13:15-14:30	Working group sessions
14:30-14:45	Coffee
14:45-17:00	Working group sessions

Day 3

- 9:00-11:00 General session - final reports of working groups --
Chairman - John Gates
- 11:00-12:00 Summary of policy and research implications - John Gates
- 12:00-13:15 Lunch
- 13:15-14:30 Fisheries education in U.S. universities, its applicability
for students from L.D.C.'s - Chairman, A. Holmsen
- 14:30-14:45 Coffee
- 14:45-16:00 Future of fisheries research programs in U.S. institutions,
Chairman, V. Norton

ANNEX 7. Curriculum Vitae of Nelson Marshall, newly appointed Director of the International Center for Marine Resource Development

BIRTH: [REDACTED]

INTERESTS: Estuarine and coral reef ecology, marine and coastal resources

EDUCATION: Ph.D. University of Florida, 1941
M.S. Ohio State University, 1938
B.S. Rollins College, 1937
Post doctoral fellow Woods Hole Oceanographic Institution, summers 1943-44.

PROFESSIONAL SOCIETIES: Fellow American Association Advancement of Science; Sigma Xi; Phi Sigma.

PROFESSIONAL ACTIVITIES: Director, University of Rhode Island International Center for Marine Resource Development, formerly Chairman, U.R.I. Committee on Marine Resources and the University Committee on Coastal Zone Studies; Executive Committee of Master of Marine Affairs Program, U.R.I.; New England Interstate Water Pollution Control Commission, Chmn. 1970-71; R.I. Delegate to Coastal States Organization; Member founding Executive Committee of the Chesapeake Bay Institute; formerly Consultant in Marine Sciences for Southern Regional Education Board; Consultant to Millstone and Northeast Utilities Service Company; Honorary Member Board of Trustees Rollins College; Review of Misc. Proposals for AEC, NSF, and American Scandinavian Foundation; Research travel includes Eniwetok Atoll, Great Barrier Reef, Caribbean, Mexico and Bahamas areas.

EMPLOYMENT:

1959-	Professor of Oceanography, Univ. of Rhode Island (also served as Dean, Summer Session 1959-61).
1955-1959.	Dean, College Liberal Arts, Alfred University
1954-1955.	Visiting Investigator, Bingham Oceanogr. Lab., Yale Univ.
1952-1953.	Associate Director, Oceanographic Institute, Florida State Univ.
1947-1951.	Director, Virginia Inst. Marine Sci. (then Va. Fish. Lab), Prof. Biol. College of William & Mary and Dean of College, 1949-1951.
1946-1947.	Assoc. Prof. Zool., Univ. North Carolina.
1945-1946.	Asst. Prof. Zool. and Marine Lab., Univ. of Miami.
1941-1945.	Instructor, Asst. Prof. of Zoology, Univ. of Conn.

TEACHING EXPERIENCE: Chiefly marine ecological and estuarine-coastal zone studies.

PUBLICATIONS:

- Marshall, Nelson, C. A. Oviatt and D. M. Skauen. 1971. Productivity of of the benthic microflora of shoal benthic environments. *Int. Revue ges Hydrobiol.* 56: 947-956.
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- Cooper, R. A., S. B. Chenoweth and Nelson Marshall. 1964. Condition of the quahog, Mercenaria mercenaria, from polluted and unpolluted waters. Ches. Sci. 5(4): 155-160.
- Marshall, Nelson. 1964. Edited Symposium of Experimental Marine Ecology. Occ. Publ. No. 2, Grad. School of Oceanogr., Univ. of R.I.
- Marshall, Nelson and S. Rubinsky. 1964. A microstratification water sampler. Ecology 45(1): 193-195.
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