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1974-75
Annual Report

International Center for Marine Resource Development

University of Rhode Island

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I. Statistical Summary

211(d) Annual Report

Date due: October 6, 1975

Date: May 17, 1976

Grant Title: Institutional Development Grant
AID/csd 2455

Grantee: The University of Rhode Island
International Center for Marine Resource Development
Kingston, Rhode Island 02881

Grant Program Director: Gerald A. Donovan

AID Supporting Technical Office:

Statistical Summary:

Period of Grant: May 7, 1969 to August 5, 1975

Amount of Grant: $925,000. Expenditures for Report Year $210,786.37

Accumulated $916,969.01 Anticipated for next year: $200,000.

II. Narrative Summary

This report covers the period July 1, 1974 through August 5, 1975, to provide a logical sequence of events in the growth of the development phase of the University's "specialized competency related to the development and utilization of marine resources, especially fisheries, in less developed nations" to quote the original 1969 purpose of the 211(d) grant. During this period URI completed the transition from its former broadly-based development approach to marine resource problems to "a new approach and focus in the area of artisan fishing and aquaculture," to quote the purpose of the 1974 grant supplement and extension. Stated otherwise, it was a transition from the development phase to the utilization phase.

Principal accomplishments during the period include the Seminar-Workshop on Coastal Artisanal Fisheries and Aquaculture in Central America and Panama held at San Jose, Costa Rica, May 13-17, 1975, and the resulting development of a six-project, small-scale fisheries improvement program. There were initial steps in the new utilization phase. The program was approved and funded by AID in the 1975 grant supplement and extension.

Principal accomplishments during the life of the grant include many research projects, foreign student training, conferences, courses and seminars which enabled URI to attain the required specialized competency related to the development of marine resources--especially fisheries--in LDCs. An example of potential operational significance for LDCs stemming from its efforts is the proposal to base three of the above-mentioned fisheries projects in Ghana. There, research on one of the projects concerned with the under-utilization of food technology in LDCs would be undertaken by a former 211(d)-supported URI Ghanaian student, who earned his doctorate in June 1975 for his research on improving the traditional West African method of preserving fish with hot smoke. It is planned to use his improved preservation method in the project, which should benefit LDCs in Africa as well as elsewhere.

Concurrently with its substantive transition, the International Center for Marine Resource Development, the University's vehicle for administering the 211(d) grant, was transferred, reorganized and restaffed--including a new Director--in a major URI effort to strengthen its commitment to marine resource programs designed to assist the LDCs.

III. Detailed Report

A. General Background and Description of Problem

In view of the importance of marine resources to the State of Rhode Island, it is not surprising that its University had earlier established a program for a directed, comprehensive study of marine resource problems. Having done so, it was led to continually widening horizons beyond the State and beyond New England until by 1969 it decided to expand its marine resource capabilities on an international scale.

The University realized that it could not realistically expect the taxpayers of Rhode Island indefinitely to provide major support for international programs. Consequently, it logically sought such support from

an agency dedicated to international development. On April 15, 1969, the University submitted to the U.S. Agency for International Development a request for a five-year grant of $750,000 to:

> "...develop within the University of Rhode Island specialized competency related to the development and utilization of marine resources, especially fisheries, in less developed nations."

The vehicle for administering the grant was to be the International Center for Marine Resource Development. The Center was to develop programs to strengthen its research, teaching, consultation and resource capabilities in marine resources, and thus allow the University to direct to the problem of lesser-developed countries its existing, planned and proposed integrated strength in applicable disciplines and activities.

On May 7, 1969, AID awarded Grant AID/csd-2455 in the amount of $750,000 for a five-year period.

B. Purpose of the Grant

The AID grant document succinctly states that the grant "is for the purpose of implementing the project 'Development and Utilization of Marine Resources'"--a description that is still applicable six years later. This purpose has been refined, and modified by the passage of time and events, but it has been achieved, insofar as the "Development" phase is concerned. URI has now entered "Utilization" phase, but not before considerable discussion between AID and the University concerning the future course of action as the grant neared the end of its first five years of existence. At one time it was evident that AID was about to discontinue support for fisheries programs. Only at the last moment was it decided within AID to continue such support, and in 1974 URI received a one-year extension of the grant and an increase of $175,000--

> "For the purpose of permitting your institution to continue to implement the original objectives. . .in accordance with your revised Proposal dated June 3, 1974. Further, it is agreed and understood that your institution will develop a new approach and focus in the area of artisan fishing and aquaculture and will undertake an Artisan Workshop and Seminar in Central America." (underlining added)

The underlined portion defines the current (1974-75) modification of the originally-stated purpose.

IV. Objectives of the Grant

A. Objectives restated

The general objectives were an "integrated multi-discipline Center* with capabilities for identification of and consultation on the solution of economic, biological, technological, social and institutional problems and constraints and the development and attainment of opportunities related to the role of marine resources in less-developed countries."

*The International Center for Marine Resource Development (ICMRD)

B. Review of Objectives

In May 1974, an AID team met with officials of the Center and officials and faculty of the University to conduct an in-depth review of the grant and its objectives for the purpose of determining whether it should be extended.

Inasmuch as the original grant was due to expire on May 6, 1974, Amendment No. 1 dated April 22, 1974, had been issued to extend the grant through August 6, 1974, without additional funding. This extension provided the additional time needed by AID officials to determine whether AID policy would call for further support for fisheries programs.

It was determined that fisheries programs would continue to be supported, at least temporarily, and based on the recommendations of the AID team, the URI grant was extended another year, and increased by $175,000. As stated above, this extension permitted URI to continue and expand the original grant objectives and to develop a new approach and focus on artisan fisheries.

C. Review of Critical Assumptions

Critical assumptions outside URI's control were not identified prior to 1975.

V. Accomplishments

Topic Title: Seminar-Workshop on Coastal Artisanal Fisheries and Aquaculture in Central America and Panama

Principal Investigators: Spiros M. Constantinides
James J. Griffin
Harlan C. Lampe
Nelson Marshall
Richard B. Pollnac
Saul B. Saila

1. Narrative Description - Throughout Central America and Panama almost 17,000 artisan fishermen rely to some extent on fishing for their livelihood, providing most of the fish consumed locally. With their dependents, they number about 100,000 persons and constitute an important socioeconomic group within the region.

As a group, these fishermen generally lack the education and/or economic means to rise above their present difficult existence. They are trapped by a situation where low income, often at subsistence levels, stifles the hope of significant improvement without outside help. Efforts to alleviate this situation have had only limited success. The object of the Seminar-Workshop was to identify factors which would facilitate development of the small-scale fisheries and, in doing so, increase availability of much needed animal protein in the region as a whole.

2. Target for Report Year - The Seminar-Workshop was designed to inform and involve high-level participants concerned with fisheries development in their respective countries. The format was planned to create an atmosphere which would encourage frank discussion, a full exchange of information, and to produce recommendations for the improvement of small-scale fisheries to benefit people throughout the region and LDCs elsewhere.

3. Accomplishments

a. Accumulative - None, because funds were earmarked in the 1974 supplement specifically for the stated purpose of organizing the Seminar-Workshop during the reporting year.

b. Report Year - The Seminar Workshop was held in San Jose, Costa Rica, 13-17 January, 1975. It was attended by 57 administrators and scientists concerned with the improved development of artisanal fisheries. Each Central American country and Panama sent high level representatives from ministries concerned with fisheries--in most cases participants were division or section directors. Additionally, international experts from other regions, universities and aid organizations such as U.S. AID and FAO participated in the meeting.

The Workshop resulted in a coalescence of ideas concerning the needs of artisanal fisheries in Central America and Panama and sharpened the focus of present research work in the area. Other international experience indicates that many of these needs are common to artisanal fisheries on a world-wide basis.

The Conference

Background - Planning* for the conference began in November 1974. URI personnel later reviewed data concerning the artisanal fisheries of Central America and Panama as part of their preparation for this Workshop. In the fall of 1974 a four-member committee was charged with organization and implementation of the Seminar-Workshop, and a member of the faculty visited San Jose to make preliminary arrangements, as did a member of the staff in December.

Program - The conference was opened by statements from international experts and high-level local officials discussing the purpose and rationale of the conference. This was followed by country-by-country presentations by senior representatives of every Central American country present. Each described the development of his country's artisanal fisheries and future plans. As talks progressed, unique national differences in experience and many common developmental problems were described.

Following the country-by-country presentations, international specialists, including URI personnel, talked on a wide range of topics related to artisanal fisheries and coastal aquaculture. Topics included resource availability and assessment, fishing technology, processing, marketing, artisanal and aquaculture fisheries institutions and organizations and technical assistance. Participants were then organized into three workshops, each with regional and international representation, charged with developing recommendations concerning a specific topic. The three topics were (1) policy and strategy for development, (2) institutional framework and development, and (3) changes and technology transfer. Drawing on previous presentations, the three workshops developed a set of important recommendations, agreed upon by all present.**

LDC Impact - The workshops succeeded in bringing together key fisheries personnel from Central America and Panama. There were important exchanges of information wherein failures as well as successes were discussed. Participants began to see the commonality of problems in the development of the small-scale fisheries and attempted to explore reasons for success by others in some areas where they had failed and vice versa. Most important it seemed that the conference, with its international as well as high-level regional participants, succeeded in stimulating increased interest in developing artisanal fisheries.

Reports from the region indicate a resurgence of artisanal fishery-related activities following the conference. For example, Costa Rica conducted a complete survey of the artisanal fisheries including collection

*There was no format for a "workplan" at that time.

**Five copies of the Initial Report of the Findings of the Central American Seminar-Workshop on Artisanal Fisheries Development were sent to Mr. James A. Urano, Chief, Agricultural Inputs Division, AID, on April 2, 1975. English and Spanish versions of this report were prepared and distributed to all conference participants.

of information concerning fishermen locations and types of gear used. Costa Rica is also developing plans for coordinated research with the Institute for Tropical Agriculture concerning the development of artisanal fisheries in northwest Costa Rica. El Salvador is mounting a program to place a considerable number of extension workers from various ministries in the field to work on aquaculture projects. It also appears that their artisanal fisheries cooperative development program has become more active and effectively organized. In Honduras the conference seemed to stimulate a much more active emphasis on small-scale fisheries development. A small boat project which had little support earlier was implemented after the conference. Additionally, it was reported that a new position was created to oversee artisanal fisheries. A FAO-UNDP fisheries cooperative development project has begun in Guatemala with a focus on meeting the needs of the artisanal fishermen through development of marketing systems and infrastructure, but the effects of the workshop, if any, have not been ascertained. Finally, in Panama extension workers have been assigned to fishing communities in an attempt to gain a more complete understanding of the problems of artisanal fishermen. Additionally, a marine resources agency has received an Inter-American Development Bank loan which it will administer for the benefit of artisanal fisheries development. Sociocultural research concerning fishermen's cooperatives suggested by the workshop was conducted in 1975 and the results should facilitate implementation of the IBD-financed project. Overall, the LDC impact appears to be greater than expected.

URI Impact - The workshop resulted in a coalescence of ideas concerning the needs of artisanal fisheries in Central America and Panama and sharpened the focus of present research work in the area. Other international experience suggests that some of these needs are common to artisanal fisheries on a world-wide basis. With the encouragement and assistance of AID, a proposal was developed by URI which was intended to be responsive to these common needs. Eventually, six specific projects were designed for implementation in Central America and in Africa. In September 1975 these projects were approved by AID and the 211(d) grant was extended for another two years, completing the University's transition to the "utilization" phase of the grant's basic purpose.

c. Total Expenditures - The total expenditures through August 5, 1975, were $12,004.87. The University provided all the support services, the cost of which cannot be estimated. There were no other sources of funds for this activity.

Topic Title: Sociocultural Study of Fishery Communities in Western Puerto Rico

Principal Investigator: John J. Poggie, Jr.

Participating Student: James G. Bartee

1. Narrative Description - It has been found that one of the problems associated with artisanal fishery activities is the resistance of the small-scale fisherman to technological changes which would have beneficial results. To understand this resistance to change it is necessary to investigate the sociocultural attitudes of the people within the organization of small fishery communities. This project was conducted in western Puerto Rico and involved administering a questionnaire which was prepared to provide data to serve as the basis for cross-cultural and cross-technological studies of fishing adaptations and change.

2. Target for Reporting Year - In this initial period it was planned to design research and construct the questionnaire, collect data and begin analysis of results.

3. Accomplishments

a/b-Accumulative/Reporting Year - The questionnaire was completed and the principal investigator and his student assistant collected data in Puerto Real, P.R. They completed 111 interview schedules, involving fishermen and factory and cane workers. Data included a range of information on the domains of social, cultural and ideational aspects of these populations. Data was then coded and punched on IBM cards; data quality control checks showed data to be of high quality.

The following publications have been prepared:

"The Sociocultural Correlates of Economic Gratification Patterns Among Small-Scale Fishermen in Puerto Rico and the Republic of Panama," John J. Poggie, Jr., and Richard Pollnac. Paper to be delivered at the annual meetings of the Society of Applied Anthropology, March, 1976, in St. Louis, MO.

"Psychocultural Correlates of Success Among Small-Scale Puerto Rican Fishermen," Richard Pollnac, John J. Poggie, Jr., and James G. Bartee. Paper to be delivered at the Northeastern Anthropological Association annual meeting, March, 1976, Middletown, CT.

c. Expenditures: Accumulative/Report Year: $10,993.33

University and other sources - URI computer facilities were used in processing of data.

Topic Title: An Analysis of Artisan Fishing Development in Mexico Applicable to the Development of Technology Transfer Techniques in Latin America

Principal Investigator: Irving A. Spaulding

1. Narrative Description - The purpose of this project was to observe and compare technological developments and institutional structures of village fisheries operations and to examine resistance by artisanal fishermen to technology transfer and development. Emphasis was placed on evolving measurable indices of developmental and structural change both within and among villages. Planning for this work was based on prior technology transfer work done under ICMRD non-211(d) auspices.

2. Target for Reporting Year - Field work was scheduled to be done in five fishing villages of northwestern Mexico between January 4-14, 1975. In the vicinity of Cuidad Obregon, Sonora, vists were planned to the villages of Guasimas, Isla Lobo, Paradon Colorado, Pardoncito, and Yavaros. Material was then to be evaluated and reports prepared on the basis of the findings.

3. Accomplishments

a. Accumulative - Since the initiation of the project there have been five major accomplishments. First, there has been development of professional contacts in Mexico. These include Dr. Jose Silos, Coordinating Committee for the Agricultural Sector, Mexico City; Dr. Santiago Friedman, Ford Foundation, Mexico City; Dr. William Lord, Resources for the Future, Mexico City; Sr. J. I. Brown-Acosta, Secretaria de Recursos Hydrolicos y Acuacultura, Navojoa, Sonora; and Dr. Henry J. Shaffer-Escamillo, Escuela de Ciencias de Maritimas y Technologia de Alimentos.

Second, an understanding has been developed of the scope of research interests pertaining to rural poverty, as expressed by Drs. Silos, Friedman, and Lord in conference with them in June, 1974, at Mexico City.

Third, an initial working analysis and comparison of five fishing villages in the state of Sonora, Mexico, has been completed, and consideration given to the technological development and institutional structure of their fisheries operations.

Fourth, there has been development of a relevant research problem definition pertaining to quantifiable indices of technological and social change and the systemization of procedures to be used in investigation. These procedures have been planned with respect to the fishing villages in the area of Mexico where field work was done but could also be applied in other geographic areas with artisan fishing populations, especially those in Latin American countries.

Fifth, this research has facilitated an exchange of information on fisheries development with colleagues.

b. Reporting Year - Material has been shared with colleagues in research reviews and planning sessions for further research development,

in seminars, and in classes to which the subject of technology transfer is relevant. In addition, drafts of written analyses of data (working papers) have been placed in the ICMRD Library.

A paper, "A Basis for Technological Innovation," was presented at a Symposium on Human Behavior Aspects of Fisheries Management, held at the Annual Meeting of the American Fisheries Society, Honolulu, Hawaii, September 9, 1974. In addition, one manuscript on indices of change, as related to technological change, has been submitted to Dr. Bruce Crouch, Senior Lecturer in Agricultural Extension, University of Queensland, Brisbane, Australia, for possible inclusion as a chapter in a forthcoming volume on directed social change. A second manuscript on innovation in technological change has been drafted, reviewed, revised, and submitted to a professional journal for possible publication.

c. Total Expenditures - Accumulative: $15,497.41

University and Other Sources: URI Library facilities were used extensively in all phases of the project.

Topic Title: A Study on the Prospects of Marine Resource Development in the Caribbean Region

Principal Investigator: Lewis M. Alexander

Participating Student: Stella Vallejo - Argentina

1. Narrative Description - This project was designed to prepare a report on the interaction of marine-related activities within a single geographic region--namely, the Gulf of Mexico/Caribbean Sea. The region is distinctive in that it is the site of the interplay between developed and developing countries. It has also been the scene of the first successful International Oceanographic Commission Cooperative Investigative Project (CICAR), which has now become a permanent regional program, IOCARIB. The goal of the project was the description of all aspects of the fishing industry (the dominant marine-related activity of the region) as well as other activities such as shipping, recreation, and offshore oil and gas exploration and exploitation (to the limited extent it exists there). It was hoped that the project might serve as a model for the analysis of the regional infrastructure of other distinctive geographic areas, specifically, the Mediterranean, the Gulf of Guinea and the South China Sea.

2. Target for Reporting Year - The compilation of data was to be completed and the report finalized.

3. Accomplishments

a. Accumulative - The problems of data acquisition and analysis pointed up the complexity of the region and the difficulties of using standard methodologies for so many small political units. Also difficult was the identification of forms of interaction among the diverse states and territories of the Gulf of Mexico/Caribbean region. It was discovered that cooperative accomplishments in the area were often the result of personal interactions and that methods of technology transfer at this stage of the region's development were often highly individualized. For these reasons it was difficult to categorize the bases for success and/or failure on the grounds of institutional mechanisms. Nevertheless, the report did identify some general guidelines which could affect not only future cooperative regional actions in this area but might also be transferrable to other regional units of the world as well.

b. Report Year - A 165-page preliminary report, SEADEV, CARIBBEAN: A Study of the Prospects of Marine Resource Development in the Caribbean Region, was completed. It is a comprehensive description of the regional infrastructure in the Gulf of Mexico/Caribbean region and covers the topic under the following headings: (1) the Area of Resources; (2) Economics; (3) Transport Patterns, Infrastructure for Harvesting and Processing Facilities; (4) Science and Technology; and (5) Law of the Sea. It also includes an extensive bibliography, as well as tables, maps, and graphs and contains current data on marine resource use in northern Latin America. At a time when regional approaches to ocean management problems have proven to be one of the most innovative and [illegible]ctive research

methodologies, this report is a contribution to the small but growing field of literature in this area.

c. Expenditures - Accumulative: $21,280.88

Report Year: $ 3,949.88

University and Other Sources - Library facilities were used extensively in the preparation of this report. In addition, URI faculty who had worked in the region contributed personal knowledge and observations as well as material in their personal files.

Topic Title: Sociocultural Change in Maritime Communities with Emphasis on Artisanal Fisheries in the Republic of Panama

Principal Investigator: Richard B. Pollnac

1. Narrative Description - Many regional and national projects in recent years have focused on the development of the small-scale fisheries industries in developing nations throughout the world. Such improvements have been suggested to enhance the economic situation of the local fishermen and increase the supply of low-cost fish for the indigenous population. To implement such plans requires knowledge of the sociocultural attitudes of the local fishermen whose response to innovative changes will determine the success of the programs.

This project was designed to provide information on the sociocultural correlates relative to the fishing mode of subsistence in selected artisanal communities on the east and west coasts of Panama. The results of the analyses of the data obtained from the survey will be used to identify local characteristics, innovative individuals and extant operational techniques and facilities. This knowledge is needed to increase effectiveness of new facilities and techniques designed to improve operations.

2. Target for Reporting Year - A relevant questionnaire was to be designed and constructed and a significant geographic area in Panama chosen as the test area. Upon completion of this preliminary background work, interviews were to be conducted. Once completed, the data would be coded, IBM cards would be punched and preliminary analysis of results would begin.

3. Accomplishments

a/b-Accumulative/Report Year - The questionnaire was designed and constructed. Fourteen areas in Panama were included, one (La Playita) on the Atlantic Coast close to the Canal and thirteen areas on the Pacific Coast located at various points between Panama City and the Costa Rican border (Chorillo, San Carlos, Farallon, Aguadulce, Boca Parita, Guarare, Mensabe, Pocri, Pedasi, Montijo, Remedios, Pedregal, and Puerto Armuelles). A total of 153 artisanal fishermen were interviewed. The data obtained was coded and punched at the University Computer Center. Preliminary computer analyses were begun and a series of reports will be issued on the basis of these assessments.

Publications - In addition to presentations made at international conferences, a number of papers were prepared reflecting various aspects of this problem, and these are cited in the Publication List (Annex 2).

c. Expenditures - Accumulative/Report Year: $16,845.73

University and Other Sources: URI computer facilities were utilized in the analysis of the data.

Topic Title: Analysis of Chilean Fisheries Expansion Alternatives

Principal Investigator: Harlan C. Lampe

Participating Student: Luis Adriasola - Chile

1. Narrative Description - The initial objective of this project was the analysis of the locational aspects related to fish processing and distribution in Chile. However, one year of research in the field changed the investigator's perception of the relative importance of the problems relevant to the development of the Chilean fishing industry. Conditions in the industry have been stagnant for over ten years. A locational analysis might have been useful if no greater improvement in the operation of the fisheries could be achieved by focusing on other aspects of fisheries organization. However, it was established as a result of a year of field work that there is a considerable potential for expansion of the Chilean fisheries, in terms both of physical production and of the industry's contribution to the national economy.

Under these circumstances it was deemed more useful to focus the proposed investigation on an analysis of possible fisheries production expansion opportunities, with lesser emphasis placed on capacity and location of processing facilities. At the current stage of Chilean fisheries development, research efforts directed at the optimization of allocative efficiency will pay off considerably more than would efforts to optimize the technical efficiency of a restricted aspect of production.

2. Target for Reporting Year - Background investigation of the fisheries industry in Chile was to be followed by on site collection of data relative to production and distribution of fishery commodities. It was proposed that preliminary analysis of results would begin which would ultimately result in development of mathematical models.

3. Accomplishments

a. Accumulative - During the period of the grant an assessment of the current and potential performance of the fisheries and related activities in Chile was carried out. The results indicate that while the current contribution of the fisheries to the economy amounts to nearly U.S. $100 million per year, there is a considerable potential for improvement, which could raise the contribution to nearly U.S. $300 million per year. As a result the project emphasis was shifted to the development and application of analytical tools that would contribute to the realization of this potential, including models for the analysis of the artisanal and industrial subsectors of the fisheries.

b. Reporting Year - The studies resulting from these investigations will be published in December 1975 in a one-volume report, Situacion Actual Y Desarrollo del Sector Pesquero, by the Centro de Planeamiento, Universidad de Chile, and the Escuela de Pesquerias y Alimentos, Universidad Catolica de Valparaiso. That volume will include the following papers:

Adriasola, L. A. Situacion actual y potencial de desarrollo del sector pesquero en Chile: un analisis preliminar.

_____and A. Gomez. El papel del analisis economico y de sistemas en el estudio de las pesquerias artesanales.

_____and O. Barros. Un modelo para la simulacion del sector pesquero en Chile.

Gomez, A. and F. Raga. Barreras al desarrollo del sector pesquero: un enfoque de analisis de sistemas e ingenieria economica.

Herrera, Pablo. Alternativas tecnologicas de utilizacion de los recursos pesqueros.

The University of Chile and the Catholic University of Valparaiso plan to use this report to solicit support from outside agencies for research in the development of the marine resources in Chile.

c. Expenditures - Accumulative (Report Year):
The cost of this project, and the next two, all under the direction of Dr. Harlan Lampe, totalled $21,762.95. This total included half of Dr. Lampe's salary, tuition & fees for the Participating Students and miscellaneous expenses which cannot be divided exactly among the three projects. Accordingly, an estimate of cost is attributed to each, but the total cost of the three is exact.

University and Other Sources - The project was undertaken in cooperation with the Catholic University of Valparaiso and the University of Chile. Both of these academic institutions contributed with non-reimbursed faculty research, logistic support and some funding.

Topic Title: Surface Water Management for Irrigation and Lagoon Management

Principal Investigator: Harlan C. Lampe

Participating Students: Luis Adriasola - Chile
Lars Vidaeus - Sweden

1. Narrative Description - Irrigated agriculture is undergoing rapid development in many arid areas of the world. There are consequent problems created by this diversion of water and this study focuses on difficulties which arise when surface waters are diverted for irrigation purposes in arid coastal areas with productive lagoon environments. The project was pursued in the northwest region of Mexico; however, hydrologic, bio-ecologic and economic models were to be developed which would have application to other regions.

2. Target for Reporting Year - Field work on this project had been completed in previous years and data assembled. During 1974-75 analyses were completed, models developed and the final report and manuscript prepared.

3. Accomplishments

a. Accumulative - Lagoon environments are important as nursery grounds and as growing areas for shrimp in many parts of the world. The research in Mexico might be regarded as a prototype for similar lagoon environments throughout the world. Data was obtained in field work in Mexico pertaining to production of shrimp, costs of lagoon modification and operation of fishermen's cooperatives on the lagoons. Biological data relative to shrimp development was collected by a marine biologist. Production conditions and costs in the related agricultural sector were also assayed.

Using this data, a conceptual model was developed which incorporated the major physical and economic components. Although the project was based in the coastal area of northwest Mexico the model was designed to have application to a wide range of settings with differing physical, economic and socio-institutional characteristics.

b. Report Year - The computer models were developed and debugged during the project year and the operational optimal control model was developed. Results were presented at international meetings in Bogota, Colombia, Santiago, Chile, and Certagena, Colombia. Researchers in other countries have evidenced interest in using these methodologies in dealing with similar problems in their own countries.

c. Expenditures - Accumulative: $40,007.00
Report Year: $ 8,762.95*

University and Other Sources: The Mexican Government cooperated in the collection of data and field work. Financial support was also received from Resources for the Future. Computer facilities at the University were used in development of models.

*See preceding project report for total cost of three projects under the direction of Dr. Harlan Lampe.

Topic Title: The Development of Methods for Evaluating the Demand for Fish and Fish Products

Principal Investigator: Harlan C. Lampe

Participating Student: Lars Vidaeus - Sweden

1. Narrative Description - The world stocks of small and moderate size pelagic fish (herring, sardines, anchovy and mackerel-like fishes) have come under very severe fishing pressure within the past ten years.

Pelagic species used for food totalled about 12 million m.t. in 1972, or about 18 percent of the world fish catch. The markets for these fishery products are diverse. A large percentage of the catch is used in the production of fish meal; the remainder is used for human consumption in various forms - canned, smoked, salted, dried, fresh or frozen.

It is anticipated that most of the countries of the world will have a 200-mile fisheries limit within the next few years. Within this zone state controls on these pelagic fish will influence world markets and production because these species are important in world trade and heavily exploited by wide-ranging fishing fleets (particularly those of USSR, Japan, Poland, and South Korea).

Herrings, in particular, have been under exceptional fishing pressure within recent years. The herring catch has declined dramatically from approximately 4.6 million m.t. in 1965 to about 2.3 million m.t. in 1972, and herrings now constitute only about 5 percent of the world fish catch. About half of the herring catch is used for non-food purposes. The decline in the herring catch has been accompanied by worldwide dislocations in production and markets. The search for new sources of raw material for reduction purposes has accelerated, particularly in areas around LDCs.

2. Target for Report Year - A survey was to be made of the economic implications of the 200-mile fishery limits with respect to the production and marketing of herring. The relationship between herring and other species in similar use was also investigated. Data was to be collected so that a market model might be developed for herring and competing species and parameters estimated. A production model was to be developed to estimate the parameters of the herring. The market model and production model were to be utilized to assess the impact of various management schemes related to 200-mile limits on the production and prices of herring and competing species.

3. Accomplishments

a. Accumulative - As stated in the 1973-74 Annual Report (p. 42) a preparatory study was undertaken to increase evaluation of implications for the developing countries and application to future specific assessment tasks in areas of Center interest.

b. Report Year - An *a priori* economic model was set up. The proposal f r the development of the market model was completed in the spring of 1975

and this led to subsequent collection of data for the empirical verification of the model.

Sufficient interest was generated by this background investigation to attract funding for the continuation of the project from FAO and Sea Grant. Work will continue and it is hoped to produce a model for general use.

c. Expenditures - Accumulative: $26,788
Report Year: $10,000 (Estimate)*

University and other sources: University Library facilities were used in background work on this project. As noted above, continuation of the work was made possible by FAO and Sea Grant funding.

*See preceding Chilean Fisheries Project for the total cost of the three projects under the direction of Dr. Harlan C. Lampe.

Topic Title: Evaluation of Factors Limiting the Establishment of Artisan Prawn Aquaculture

Principal Investigators: Tung-Ching Lee
K. L. Simpson
C. O. Chichester

Participating Student: Tadashi Kamata - Japan

1. Narrative Description - This project was designed to establish the rationale for raising prawn under conditions of aquaculture by artisan fishermen in areas where prawn artisan fisheries might be pursued as a protein source for the indigenous population or as a high quality export item. The prawn species chosen was the giant Malaysian prawn, Macrobrachium rosenbergii, which have been cultured in fresh water and appear to be a suitable organism for artisan aquaculture fisheries. This giant prawn reaches marketable size in approximately five months. At that time the male is about 25 cm. in length and the female 15 cm. Both sexes bring extremely high prices relative to other species. A number of U.S. corporations have looked into the commercial feasibility of freshwater prawn farming. In addition, various companies in Latin and Central America, Hawaii and South East Asia are studying production of prawn.

The two principal factors that would appear to limit the development of such an artisanal aquaculture fishery would be the source of protein used for feed and the source of pigment. Indigenous protein sources would have to be developed so that the correct amino acid profile is obtained for maximum prawn growth. The other limiting factor is pigment, since market price for prawn in Japan and elsewhere is directly related to the hue and level of pigment in the prawn flesh. This red color is derived primarily from astaxanthin, and its source is either diet or a preformed compound used as precursor.

2. Target for Report Year - Experimental work was planned to evaluate both protein sources and pigment sources. (These activities were facilitated because Mr. Kamata, the participating student, had laboratory experience in prawn culture at Kagoshima, Japan.) The first phase of the project would involve experimentation on the use of orange peels as a pigment source for prawn, and developing facilities for culture of prawns.

3. Accomplishments

a/b-Accumulative and Report Year - Accessory facilities were obtained from Japan to raise prawn under laboratory conditions at URI, but prawn culture was limited, since improvements were needed with respect to salinity and temperature problems. Improved facilities were scheduled for 1975-76 so that prawn or shrimp culture would be more efficient. In addition, arrangements were made to conduct further experiments at shrimp farms in Florida administered by the Weyerhauser Corporation.

Pigment Study - Experiments were conducted on the use of orange peels as a source of pigment. The test organism used for the study was Rainbow Trout, which were available at the test facility. (It is anticipated that all of the work done with Rainbow Trout will be applicable to the prawn system.)

The trout were fed orange peels that had been extracted for their pigment, and it was determined that the trout were capable of depositing these peels. When the peels were deposited the flesh of the fish became yellow and their eggs were also highly pigmented. Since the prawn has greater biological capability than does the trout of converting the yellow pigment to red, this experiment indicates that pigments derived from orange peels would be suitable for this purpose.

The second phase of the orange peel work involves use of peels that have been treated with bioregulators that use the enzyme systems presently available in the orange peel to convert the peels from yellow xanthophylls to red ketocarotenoids. (This is a new procedure currently being developed by Sunkist, the USDA Laboratory in Pasadena and the laboratory at the University of Rhode Island.) These extracts of the red peels are presently being fed to trout and will be evaluated.

To date, using trout as the test organism, there has been no problem with mortality rates as compared with those of the controls, nor have there been problems with growth rates due to rejection of the food by the trout.

Future work planned involves continuation of experiments using Rainbow Trout as the test organism for the bioregulator-inhibited orange peel and related investigations. In addition, further investigation of the giant prawn relative to protein and pigment sources will continue.

The following publications (in print and in press) have resulted from this and related work:

Simpson, K. L. and C. O. Chichester. 1976. Carotenoids in Fish Feeds. In J. C. Bauernfeind (ed.), Carotenoid Technology. Academic Press, New York. (in press)

Kuo, H-C., Tung-Ching Lee and K. L. Simpson. 1975. Red Crab Waste as a Pigment Resource for Salmonids. In Proceedings. IV International Symposium on Carotenoids, Berne, Switzerland. August 1975. (in press)

Kuo, H-C., Tung-Ching Lee, T. Kamata and K. L. Simpson. 1976. Red Crab Processing Waste as a Carotenoid Source for Rainbow Trout. Alimenta, Switzerland. (in press)

c. Expenditures - Accumulative: $ -0-
Report Year: $10,099.05

University and Other Sources: In addition to the direct financial support, URI provided institutional support in the laboratory and fish raising facilities available in the Department of Food and Resource Chemistry. Sunkist Corporation of California provided a small grant-in-aid and in addition Sunkist will supply orange peel extracts which have been treated with bioregulators to make the extracts more suitable for prawn artisan aquaculture. The Weyerhauser Corporation will also be involved in the project and further experimentation will be conducted at their shrimp farms in Florida.

Sub-Topic Title: Use of Waste Products as a Source of Protein Enrichment in Aquaculture of Prawn

Principal Investigators: Tung-Ching Lee
K. L. Simpson
C. O. Chichester

Foreign Research Specialist: Teruhisa Katayama - Japan

1. Narrative Description - See narrative description of preceding project.

2. Target for Report Year - A survey was made of projects involving use of waste products as a nutritional supplement in the feeding of farmed organisms such as prawn. Basic research was conducted specifically on the use of citrus waste products for protein enrichment purposes.

3. Accomplishments

a. Accumulative - See previous project

b. Report Year - The survey of the literature and initial research involving citrus waste proved the feasibility of the project.

Dr. Katayama's work both in the laboratory and as a consultant contributed to the establishment of the University's capability in this area. This preliminary work led to several industrial as well as Government grants.

The following publication was prepared as a consequence of background work on this project:

Tanaka, Y., H. Matsuguchi, T. Katayama, K. L. Simpson and C. O. Chichester. The Metabolism of Carotenoids in the Prawn. Jap. Soc. Sci. Fish. (in press)

c. Expenditures - Accumulative and Report Year: $2,614.65

University and Other Sources - The fish raising facilities of the Department of Animal Science and the laboratories of the Department of Food and Resource Chemistry were utilized.

Topic Title: The Effects of Water Motion on the Growth of the Algal Species Ulva lactucu and Gracialaria verrucesa

Principal Investigator: Nelson Marshall

Participating Student: Henry S. Parker

1. Narrative Description - These two species grow luxuriantly in polluted and non-polluted waters world-wide and are sometimes regarded as nuisance species since they contribute to the eutrophication process. However, Ulva lactucu is of value commercially as a fertilizer and Gracialaria verrucesa is a source of agar. The project was designed to investigate the feasibility of farming these two species so that they would be removed through harvest and not left to rot, thereby cleansing the water and also having the beneficial effect of converting excess pollution nutrients into some available commercial form which might be of economic benefit to coastal communities.

2. Target for Report Year - The initial phase of the test was the evaluation of the effects of water motion on growth rates. Normally, farming of these species is done in protected waters safe from the destructive action of storms. However, in such areas there is generally not sufficient water motion to facilitate growth. Through experiments, attempts were to be made to determine whether the factor of reduced water motion could be balanced by location in areas of high nutrient content resulting from heavy concentrations of pollutants, i.e., sewage outfalls and catchment basins.

3. Accomplishments

a. Accumulative - none

b. Report Year - A literature search was completed on the value of seaweed as a fertilizer. The information obtained indicated that seaweed's potential as a fertilizer is multifold: Tests show that it is not only a good source of organic nitrogen but is also an important source of trace elements and vitamins needed for productive crop growth. In addition, its proven ability to improve the crumb structure and moisture-retaining properties of soil and to extend a certain disease-resistance and hardiness to some crops gives it a further value as a fertilizer. Finally, the technology already exists to process seaweed into liquid or powder form for easier transport and application. This could be of major importance to coastal and even inland LDCs where a ready source of inexpensive fertilizer is a necessity.

Tests were devised which involved the monitoring of growth rates of test plants under different conditions of water movement and different depths. A suitable site was selected where water movement was restricted and there was a heavy concentration of pollutants. A portable chamber was designed to test water motion, and initial experiments were run with respect to the effect of water action.

Tests will be continued and results monitored.

c. Expenditures - Accumulative and Report Year: $1,995.76

University and Other Sources: The equipment and facilities of the marine laboratories, as well as a boat, were made available for thi project. The Principal Investigator's salary was funded by a sourc other than a 211(d) grant.

Topic Title: Improved Utilization, Handling and Preservation of Marine Food

Principal Investigator: Spiros M. Constantinides

Participating Students: Li-Dong Grace Chang - Taiwan
Sudip Jhaveri - India
Pavlos Karakoltsidis - Greece
Suh-Ling Cindy Chen - Taiwan
Wei-Ching Eileen Hao - Taiwan

1. Narrative Description - There are many marine species of potential value as protein sources for developing nations which are not utilized because of traditional consumption patterns or technological problems associated with their usage. Experiments conducted in the Food and Nutritional Science Department of the University of Rhode Island have been designed to maximize the utilization of such resources. These have involved: (1) research in methods of utilizing waste products of specific marine industries (such as shrimp and crab); (2) introducing species not previously consumed in local areas (mussels, krill); (3) developing techniques of processing marine resources to make them more palatable, as for example utilizing minced flesh technology or producing fish pastes of high protein content to which spices or flavoring can be added thereby making them acceptable for local consumption; (4) experimenting with techniques of salting and drying to extend the shelf life of various marine foods.

2. Target for Report Year - Specific experiments were concerned with the following projects: (1) Minced flesh technology, involving preparation of seafood products from underutilized species. (2) Research into sea mussels and krill, both species of substantial importance which are not generally exploited.

3. Accomplishments

a. Accumulative - These projects are of particular interest to developing nations since they utilize marine resources which are accessible. Under the direction of the Principal Investigator a research group in Chile has introduced the technology of minced flesh and, in addition, various other products are being prepared and used locally. A program is being planned in Costa Rica which will use waste products of the fisheries industry.

The graduate program in marine food technology has attracted numerous students from developing nations to URI. In addition, Dr. Constantinides has assisted directly in the development of a program in marine food science at the Catholic University of Valparaiso and has also advised numerous individuals and governments on specific research projects and on the organization of academic programs.

b. Report Year -

Sub-Topic: Minced Flesh Technology

Experiments were conducted on the production of seafood products from

species such as the skate, red hake, dogfish and ocean pout. Factors such as water activity, shelf life and organoleptic characteristics were determined. It was established that the ground flesh of mixed species produced acceptable food products.

Another approach involved the use of a simple and practical salting method in combination with sun drying or air drying to produce a dry, salted, stable, intermediate product which upon reconstitution with water produces fish products of all kinds. Various recipes were developed which utilized this product. In addition, all the waste (frames, viscera, etc.) was used in this process, and a dry, stable product was developed which could be utilized as feed.

Sub-Topic: Underutilized Species

A two-volume report, "The Edible Sea Mussel" was compiled. This 600-page manuscript covers all aspects of the subject. It is the result of an in-depth literature search which located all the widely-scattered material available.

A survey article has been prepared, "Krill: Its Potential as Seafood," which indicates the vast potential of krill as a source of protein in developing nations and suggests techniques to be utilized in its processing for consumption.

During part of the academic year 1975-76, Dr. Constantinides will be in Chile and plans to initiate a program which will increase consumption of krill, as the species is particularly abundant in the waters off that country.

Publications: Presentations of research results were made at various conferences and were published in professional journals. (See Annex 2 for specific citations.)

Expenditures - Accumulative: $30,650.42
Report Year: $14,399.42

University and Other Sources: Laboratory facilities of the Food and Nutritional Science Department have been used extensively, as were the various Library collections at the University.

Topic Title: Coral Reef and Lagoon Studies, with Particular Reference to Development Stress

Principal Investigator: Nelson Marshall

Participating Student: Thierry Jacques - Belgium

1. Narrative Description - The reef environment is the foundation for much of the fisheries potential of tropical coasts. Development stresses having adverse impacts on the reefs could undermine this potential. However, a fundamental question exists about the productivity of coral reef communities, both normally and stressed with silt, freshwater runoff and pollution resulting from land utilization and development of tropical coastal areas. The sustenance of this productivity is inseparable from the sustenance of the fisheries harvests and related food returns to the people inhabiting these areas.

2. Target for Report Year - Funding was provided for the development of a methodology for concurrently measuring photosynthesis, respiration and calcification, all interpreted from changes in alkalinity. The sensitivity and precision of the method would be the index of its success.

3. Accomplishments

a. Accumulative - During the first year of funding, effort was focused on testing applicable techniques of production measurement, rate of carbonate formation as assayed by alkalinity changes, and rate of productivity as assayed both by oxygen and carbon dioxide changes. It was determined that these techniques could be used to discriminate ecological differences. This on-site work was followed by the reporting year's project, involving laboratory testing which proved to be highly successful.

b. Report Year - The results of this year's project are indicated in the following tables:

TABLE I. Incubation in the light, for three hours, of two microcosms of Astrangia danae, each in about 450 ml of seawater. Water samples drawn in triplicate; the standard deviations are shown. Incubation temperature: 18°C.
Light source: one 100W incandescent bulb, 20 cm from the corals.

WATER SAMPLE	TOTAL ALKALINITY uEq/l	TOTAL CO_2 uM/l	CALCIUM FIXED uM/l	ORGANIC CARBON FIXED, uM/l
Initial	2169±1	2028±1		
Final (Symbiotic corals)	2104±4	1946±3	33	50
Final (Aposymbiotic)	2127±2	2038±1	21	30

TABLE II. Effect of light and algal symbiosis on metabolic functions of microcosms of Astrangia danae. Averages obtained from the results of ten incubations.
Light source: one 100W incandescent bulb, 20 cm from the corals.

MICROCOSM	CALCIFICATION RATE uM Ca fixed/30g of fresh weight/hr LIGHT	DARK	RESPIRATION IN THE DARK uM organic CO_2 released/30 g fresh weight/hr	NET PRODUCTION IN THE LIGHT uM organic CO_2 fixed/30 g fresh weight/hr
Symbiotic corals	3.24	0.88	10.65	2.76
Aposymbiotic corals	2.08	0.71	8.95	-5.05

c. Expenditures - Accumulative: $32,209.72
Report Year: $ 5,214.72 (non-salary items)

University and Other Sources - In addition to contributing a portion of the salary of the Principal Investigator and the Research Assistant's stipend, URI institutional contributions also included the use of laboratories, the Experimental Aquarium Building, computer facilities, and the collaboration of other faculty members with expertise and interest in the topic.

Topic Title: Studies on the Culture of Green Sea Turtles

Principal Investigators: C. Robert Shoop

Participating Student: Phillip Lemkau

1. Narrative Description - The green sea turtles (Chelonia mydas) are the only large marine animals in most tropical areas and are especially valuable because they contain approximately 40 percent edible, high protein, low cholesterol meat. In addition to their value as a food source, other edible or marketable products can be derived from these turtles, such as leather, belly cartilage for soup, liver for paté, fat for oil, shells for decoration and tortoise-shell materials. Adults are essentially herbivorous and graze in tropical marine pastures not used for human food production.

The green sea turtle has a potential importance as a farmed species; however, there is insufficient knowledge of its habits. Especially needed is an effective method of tagging hatchling turtles in sufficient number to determine natural survival and movements. Knowledge of the life cycle of the green sea turtle is important to insure survival of the species and for improvement of farming methods.

Various tagging techniques have been used and proved unsuccessful (i.e., mutilation, identification plates, radioactive tagging). The URI effort has concentrated on a tagging technique which involves injection of a europium chloride-citrate complex in varying concentrations. Europium deposited in liver and bone can be identified in extremely small amounts by neutron activation analysis. As the animals grow they are monitored through activation analysis for bone europium levels to confirm the validity of the technique.

2. Target for Report Year - Various types of injection methods have been designed. Experiments will be pursued to determine which technique does least tissue damage and would be most suitable for marking large numbers of turtles in the field. Studies are being conducted on the physiological effects of europium; normal sea turtle tissue is also being examined for comparative purposes.

3. Accomplishments

a. Accumulative - At its inception the project involved the establishment of suitable culture facilities at the seawater aquarium building on the Narragansett Bay Campus of URI. Turtles were successfully hatched and reared there, fed a diet which included fresh fish, algae and trout food pellets, and have experienced normal rapid growth.

Neutron activation techniques were investigated and perfected. The equipment used for analysis was available at the Rhode Island Nuclear Science Center Reactor operated at two megawatts.

Preliminary studies on europium tolerance and permanence of the tag have been completed (Frobes, 1972). With the cooperation of the Animal Pathology Laboratory, procedures for injection and study of tissue changes

associated with europium tagging have been developed. Several animals which were tagged as hatchlings in 1972 now weigh over 70 pounds and are being monitored through activation analysis for bone europium levels to confirm the validity of the technique.

b. Report Year - Experiments continued on injection methods, and substantial improvements have evolved in the use of a gun injector for intraperitoneal injection. The physiological effects of europium on turtle tissues continued to be monitored.

c. Expenditures - Accumulative: $15,452.79
Report Year: $ 4,850.79

University and Other Sources: The following institutional facilities were essential for this experiment: Aquarium Building at the Narragansett Bay Campus, R.I. Nuclear Science Center Reactor equipment, and the facilities of the Animal Pathology Laboratory on the Main Campus at URI.

Topic Title: A Low-Cost Boat for Artisan Fishing in Developing Countries

Principal Investigator: John Sainsbury

Participating Student: Robert Stone - Fiji

1. Narrative Description - A need exists in developing countries for a simple, cheap, but seaworthy small boat, around 22 to 26 feet in length. Such a craft must have the following characteristics:

(a) - Be of simple construction, so that it can be built by relatively unskilled labor under rather primitive conditions.

(b) - Be inexpensive, so that its cost, with or without a subsidy arrangement, is low enough to encourage adoption by fishermen. (In other words, it must be as cheap as, or cheaper than, existing vessels.)

(c) - Be able to work at least as effectively as existing local craft in the various areas and countries. In areas such as West Africa and on the west coast of Central and South America this means that it must be capable of working from exposed surf beaches. In other areas, such as the Pacific Islands, it would work from sheltered areas but must be able to operate under the local sea conditions which include a fairly short chop.

(d) - Be versatile and simply adaptable, using inexpensive equipment to handle the various artisanal fishing techniques of different areas.

The plywood-constructed "Oregon Dory" type of boats have been suggested as suitable for artisanal fishing, and such craft are being introduced in the Pacific Islands. However, they are not entirely suitable for the sea conditions involved. They are relatively inexpensive to build, but unskilled fishermen boat builders might have difficulty with their construction.

Fiberglass has the necessary flexibility and is suitable for use by unskilled builders. This is especially true of a new product, C-FLEX, a flexible plank consisting of parallel rods of fiberglass-reinforced polyester and bundles of continuous fiberglass rovings held together between two layers of lightweight fiberglass cloth. It is an entirely self-supporting material, capable of conforming to compound curves without stretching or deformation. These characteristics make it suitable as a base for additional fiberglass layers, allowing a boat to be constructed using only the most simple procedures and tools.

The material meets all the requirements for use by artisanal fishermen in developing countries. It is simple, strong, virtually foolproof in use and relatively inexpensive. (For instance, it was estimated in the summer, 1974, that materials for a 24-foot boat would cost approximately $500. In comparison, it has been estimated that a 30-foot dug-out canoe used in West Africa costs about $1,000 (Ghana, 1971).) Construction time would be one day for two men working from simple supporting members over which C-FLEX is placed. For construction, only a shaded, fairly level base (such as a beach) is needed with a simple cover (cotton sheet or leaves) to protect the materials (and workers) from the direct

heat of the sun.

2. Target for Report Year - It was planned to design, construct and evaluate a fiberglass boat using unskilled labor and replicating local conditions (i.e., such as those typical of developing countries) as far as possible. Results and problems consequent upon this stage would be assessed and further plans formulated.

3. Accomplishments

a. Accumulative - Initial planning only.

b. Report Year - A 24-foot craft was designed for beach landing under surf conditions; its appearance was similar to that of the Oregon Dory but with a modified forward end to provide improved sea-kindliness. The boat was built of C-FLEX using simple tools and by labor unskilled in such work. In the process of construction various patterns of framing and interior stiffening were tried and valuable experience was gained in the use of the material. The work on the boat demonstrated the feasibility of the material for boat construction under primitive conditions and the advantages in the ease of manipulation of the material by unskilled labor. However, the testing of the boat in water conditions similar to those that might be encountered in localities where such boats would be used has not been completed. It is projected that testing will be conducted by students in the Fisheries and Marine Technology curriculum and that further modifications will be devised.

The petroleum shortage and subsequent price increases occurred during the inception and development of the project. One of the original attractions of the construction technique was the low cost; however, since fiberglass is manufactured from petroleum derivatives this competitive advantage has been lost as the price has doubled. With respect to this aspect there are not yet sufficient data to assess the advantages; the value of the project has diminished because of this problem.

c. Expenditures - Accumulative: $4,832.65
Report Year: $4,482.65

University and Other Sources - The facilities and equipment of the Fisheries and Marine Technology program were used extensively in the construction of this craft.

Topic Title: Hot Smoke Fish Curing

Principal Investigators: M. Salomon
T. C. Lee
C. O. Chichester

Participating Student: Matthew Caurie - Ghana (now Dr. Caurie)

1. Narrative Description - Traditional West African systems of smoking fish in wood fires produce hot smoked fish of poor quality. Research financed by this project involved fabrication of smoking ovens from existing barbecue machines and development of a method for fish smoking based on traditional West African woodfiring techniques. A number of designs were fabricated and the most acceptable used to evaluate the factors known to be responsible for high quality hot smoke fish curing: humidity, smoke velocity, smoking temperature, and drying temerature (separately and in combination). Quality was assessed with regard to physical factors--color of the smoked fish by extraction and colorimetric estimation and fragility by estimation of free hydroxyproline content, and chemical factors--smoke deposition by phenol estimate, total protein estimation, and breakdown of protein during processing (presence of free-SH groups and hydroxyproline).

2. Target for Report Year - In the period 1974-75 experiments were concluded, data analysed and the final report prepared.

3. Accomplishments

a. Accumulative - An easily dismantled portable oven fabricated during 1973/74 was used to smoke butterfish (Poronotus triacanthus Peck 1800). The effect of smoke movement through the oven on smoke deposition (measured as phenol) on the fish was studied.

It was demonstrated that in this oven, more smoke was deposited on the fish when the smoke was retained in the chamber and not allowed to escape. The amount of smoke deposited on the fish increased between 45° and 60°C.

The amount of nutritional damage caused in the smoking process measured as the loss of protein solubility was related to the interaction of protein -SH side groups and smoke carbonyl constitutents. It was observed that this kind of damage was statistically the same at 45° as at 60°C.

Amino nitrogen diminished under all conditions of the curve indicating that the loss of protein solubility was not due to a breakage of peptide bonds during the smoking process. The effect of pre-smoking treatment of boiling and salting was investigated. Results indicated that boiling the fish before smoking resulted in the greatest reduction in soluble proteins. Immersion of the fish in 20% brine resulted in the least reduction of soluble proteins. High temperatures (60°C) reduced protein solubility to a great extent. The use of high temperature (60°C) during any part of the smoke curing process, to fall within regulatory limits, must therefore be reserved to the end of the process to retain the greatest amount of soluble proteins.

b. Report Year - The final report was completed and published. The results of this investigation were used as part of the Ph.D. degree disserta tion by the participating student, Matthew Caurie, at URI in 1975. Dr. Caurie will return to Ghana to conduct one of three 211(d) projects funded by AID under the 1975-77 Grant extension. This is an outstanding example of the utilization of expertise developed under the original 211(d) grant which financed part of Dr. Caurie's studies at URI.

In addition to the publication cited in Annex 2, the following have been accepted or submitted for publication based on this work:

Caurie, M., T.-C. Lee, M. Salomon and C. O. Chichester. 1976. Studies on Hot Smoke Fish Curing: I. A portable oven for smoking fish and some factors affecting smoke deposition on fish flesh. J. Food Science (submitted).

_____, T.-C. Lee, M. Salomon and C.O. Chichester. 1976. Studies on Hot Smoke Fish Curing: II. The effect of smoking temperature, smoke movement and drying temperature on the quality of hot smoke cured butterfish (Poronotus triacanthus, Peck 1800). J. Food Science (submitted).

_____, T.-C. Lee, M. Salomon and C. O. Chichester. 1976. Studies on Hot Smoke Fish Curing: III. Effect of pretreatment, salting and cooking on the protein content of hot smoked butterfish (Poronotus triacanthus, Peck 1800). J. Food Science (submitted).

_____, T.-C. Lee, M. Salomon and C. O. Chichester. 1976. A description of equilibrium moisture in dehydrated foods. J. Food Science (submitted).

_____, T.-C. Lee, M. Salomon and C. O. Chichester. 1976. A simplified equation for the prediction of the packaging compatibility in dehydrated foods. J. Food Technology (England) (submitted).

_____, T.-C. Lee, M. Salomon and C. O. Chichester. 1976. A rearranged BET plot for a more direct estimation of BET constants. J. Food Science (in press).

_____, T.-C. Lee, M. Salomon and C. O. Chichester. 1974. Hot smoke fish curing - a review. J. Natl. Sci. Council, Sri Lanka 2:77-86.

c. Expenditures - Accumulative: $27,330.75
Report Year: $ 4,202.75

University and Other Sources: none

Topic Title: Master of Marine Affairs Program

Program Chairman: Lewis M. Alexander

1. Narrative Description - The Marine Affairs Program is a thirty-credit, nonthesis, masters degree program designed to provide specialists in various marine disciplines with a broad overall perspective on marine environmental policy and decision making. The Program began in 1970 as a result of the recognition of the need for a marine studies program that would fill the gap left by increasing specialization in other courses of study. The Program was designed to align academic training with the situation existing in the real world, where rational decision-making and policy formulation require consideration of many diverse and complex factors--economic, legal, political, scientific, and technological. To meet this need the Program provides a unique interdisciplinary educational approach to marine environmental management on a state, regional, national, and international level.

2. Target for Report Year - Each student is required to take core courses in all the relevant areas of interest--marine geography, marine resource economics, oceanography, ocean engineering, and political science--as well as the Marine Affairs Seminar. The latter is a six-credit course designed to interrelate and integrate the various disciplines involved and to emphasize their relationship to contemporary marine policy issues. The Seminar is structured around guest lectures by national and international experts from government, industry, and academia. In addition to their discussions during lectures, the students conduct simulations dealing with topical local, state, national, and international problems. For example, recent simulations have dealt with the issues involved in the proposal to site a nuclear power plant at Charlestown, Rhode Island, and with the current Law of the Sea Treaty negotiations. These student simulations have provided useful information and perspectives to industries and governmental organizations involved in the actual problem situations that were the basis for the simulations.

A basic element of the Seminar and the Program itself is the major research paper on a contemporary marine resources management problem, required for completion of the Master of Marine Affairs degree. The major paper allows the student to investigate a particular area in depth, as well as to learn concise, comprehensive and imaginative writing and research. This research is often conducted to meet the specific needs of local and national government and industry. Through the major paper, students have met the research needs of the University's Coastal Resources Center, the Rhode Island Coastal Resource Management Council, the Marine Advisory Service, Save Our Seas, New England River Basins Commission, the New England Electric Power System, the International Center for Marine Resource Development, and the National Ocean Policy Study. The best of these papers are published in the Marine Affairs Journal, which has a nationwide distribution. This student-operated journal is the first and only one of its kind in the country; it has done much to increase the exposure of the Marine Affairs Program, the University of Rhode Island, and of the entire area of "marine affairs" itself.

The Program also offers electives such as coastal zone law and policy, fisheries law and management, and the control and prevention of marine pollution (not only to the Marine Affairs students but also to the entire University community). Students in the Program take various "outside" electives in such subjects as resource economics, community planning, ocean engineering, oceanography, geology and political science, and students from these disciplines have enrolled in increasing numbers in electives offered by the Marine Affairs Program. The Program also maintains an excellent library of marine resource management materials which is used by Marine Affairs and other students and faculty at the University, but also receives wide use by students and government officials from the entire New England region.

Enrollment Profile - As of June, 1975, 126 students had completed the Program. The composition of any one class reflects and enhances the interdisciplinary nature of the Program. Students might be grouped in three categories. There are, first of all, personnel from marine-oriented industry and government agencies seeking to acquire marine resource management skills in preparation for a new position or project within their organization. Secondly, it attracts specialists (Masters or Ph.D.) in fields such as law, economics, planning, sociology, journalism, oceanography, and engineering, who are seeking professional opportunities in marine resource management. These students receive funding assistance through the Jessie Noyes Smith Foundation, which has established two annual fellowships for the Program, and through research assistantships established by government organizations and industry as well as those generated by faculty research. Thirdly, an increasing number of international students (mainly from the developing countries) have enrolled and have been funded through special fellowships established for the Marine Affairs Program by the Intergovernmental Oceanographic Commission or by the student's government. Past students have come from Ghana, Ethiopia, Argentina, Uruguay, Chile, France, New Zealand, and Israel. It is noteworthy that most of these applicants hold significant ocean management responsibilities in their own countries.

3. Accomplishments

Placement of Graduates - The employment success of Marine Affairs graduates has been extremely high. This not only reflects the high quality of the graduates, but also the appreciation by government and industry of the value of interdisciplinary training in marine fields. The high employment rate has had a "multiplier" effect in that these past graduates provide information on many new positions available to current graduates.

Curriculum Growth - In order to provide a broader range of service to the University community and to those outside the University, the Marine Affairs Program has been developing several areas of expansion. In the Fall semester of the 1975-76 academic year, a new course will be offered, Human Use and Control of the Marine Environment. This course will provide an introduction to the various aspects and activities of the marine environment, including natural processes, distribution of resources, and the legal/political means available for resource management. It is hoped that through this course, which provides the interface between the social and natural sciences, the Marine Affairs Program can make a valuable

contribution to undergraduate education at the University.

University Linkages - The Program is also expanding into the area of cooperative ventures with other departments and colleges at the University, to meet the requirements of particular groups of students. Recently instituted in cooperation with the Fisheries and Marine Technology Department of the College of Resource Development was a Master of Marine Affairs Degree with a Certificate in Commercial Fisheries. This Certificate Program is designed to provide resource management skills to students in Fisheries and Marine Technology, particularly those from developing countries. These international students are being trained to develop the fishery resources in their particular countries and need a broader educational experience than that based solely on the technical aspects of fishery development. A course has been developed, Fisheries Law and Management, as one input to this new program. This course, however, will serve a much broader need than just those of the students in the certificate program, with expected enrollment of students from many other marine disciplines as well. A cooperative effort has also been instituted with the Community Planning Department of the College of Resource Development. Community Planning students with an interest in coastal zone management and planning will now be able to "minor" in this field with Community Planning through administrative arrangements made with the Marine Affairs Program.

International Linkages - The Program has also been pursuing initiatives in the international field. Much interest has developed recently in the concept of coastal zone management on the international level. Personnel from developing countries are in critical need of the skills necessary to pursue economic development possibilities geared to the coastal areas of their country, but with environmental planning integrated into this process. The Marine Affairs Program, after preliminary discussions with United Nations personnel, is submitting a proposal to the United Nations Environmental Program, to establish an eight-week coastal zone management training program at the University for personnel from the developing world. This program would utilize the skills of the various departments and organizations of the University to provide interdisciplinary training in the scientific, economic, legal/political, and planning aspects of coastal zone management. It is hoped that this program will begin in the spring of 1976.

c. Expenditures - Accumulative: $3,699.00
Report Year: -0-

University and Other Sources - Scholarship funding has been received from the Jessie Noyes Smith Foundation, the International Oceanographic Commission, and from foreign governments for specific students in the program. Sea Grant funding has been received for staff expenses and library materials.

Topic Title: ICMRD Technical Library

Principal Investigator: Jacqueline P. Alexander

1. Narrative Description - Obtaining up-to-date factual and statistical literature for evaluating existing situations and developing plans for future activities is particularly important for the creation of relevant development programs. However, formal published literature in the marine field, especially that relating to conditions in developing countries, is limited. Some reasons for this situation are as follows: Material produced through internal agencies within the countries is usually limited in number and its distribition often erratic. (It should be noted that since basic infrastructures within many of these countries are poor it is understandable that more sophisticated linkages--such as those required for report distribution--are often non-existent.) Secondly, much of the work in the field is funded by international agencies, private foundations, regional bodies, or non-governmental national groups, such as universities or private companies, which do not utilize normal channels of distribution. And, lastly, valuable data is often presented at conferences and symposia with initial distribution limited to participants and printed versions appearing many years after the event. Recognizing these problems, a special technical library was organized at the University of Rhode Island whose function is to procure and make accessible material which was relevant to the requirements of research work in the field.

2. Target for Report Year - Acquisition and organizational work was continued. Greater emphasis was placed on the establishment of contacts with country agencies (such as Fisheries Departments and Central Planning Offices) and efforts were to be specifically directed toward establishment of exchange arrangements with appropriate agencies, national and international, to guarantee procurement of material on a regular basis.

3. Accomplishments

a. Accumulative - An important collection of basic documents has been developed. Acquisition of material has been effectuated in several ways: through exchange arrangements; through personal collection by faculty and staff members on assignment in the field or attending conferences; through donations from other users of the collection (faculty, staff and students at the University and non-University patrons), involving actual material or source information; and through an active program of bibliographic searching of sources followed by purchase or direct solicitation of documents.

The use of the collection has increased, reflecting the growing value of the collection and the greater involvement of University personnel and students in the marine fields. The following indicates the activities of the ICMRD Library:

Size: When established in July 1973, there were approximately 200 documents and 50 books. As of August 1975, there were 2,000 documents, 75 books and 100 microfiches.

Usage: Over 900 documents and other material were circulated.

Users: Within the University Community-
Faculty and Staff of ICMRD
Students at URI, including graduate students in oceanography, resource development, marine affairs, zoology, political science, geography, and anthropology. Also undergraduate students in fisheries and marine technology, geography, political science, zoology.
Faculty at URI, including marine affairs, zoology, oceanography, ocean engineering, sociology, and economics.
Support Staff at URI - including Coastal Resources Center, Publications Office, New England Marine Resources Information Program, University Library Departments (Inter-Library Loan Office, Reference Department, Documents Office)

Outside Individuals and Agencies-
Government Agencies - Environmental Protection Agency.
Other U.S. University/Colleges - Harvard, Wheaton, Woods Hole Oceanographic Institute, Providence College, Rhode Island College, Villanova.
Foreign Sources - Inquiries have been received from agencies in Cuba, Jamaica, Chile, Malaysia, and from individuals in New Zealand and Tanzania. (These are in addition to gift and exchange arrangements mentioned below.)
International Agencies - FAO, South China Sea Fisheries Development and Coordinating Programme, Indo-Pacific Fisheries Council, Southeast Asian Fisheries Development Center.
Other - Requests for information have been received from Providence Journal, Fortune Magazine, and UNIPUB, Inc.

Exchange/Gift Arrangements:
Exchange arrangements have been set up with over 50 agencies, international organizations and foundations.

The increasing amounts of material acquired, and the greater usage, have necessitated a slowdown in the formal cataloging and classification procedures. A substantial problem is posed by the absence of published subject classification guidelines for material of this nature. Only through usage has it been possible to devise a system which accurately reflects the information and the needs of the users. In addition, because much of the material is published in proceedings or symposia which cover broad topics, more than one entry is needed in cataloging to make the information accessible.

b. Report Year - In addition to the continuing operation of the Library, the Librarian has worked with Center Associates on specific problems and provided in-depth research assistance in many areas. The increased use of the collection has been itemized above. It might be noted that in this report year materials in the following areas have been frequently requested: (a) Information on the aquaculture of species not commonly cultured in the U.S. (such as mussels, eels, ocean clams) including data on foreign centers and production statistics. (b) Current background information on specific world fisheries and estimated potentials. The forthcoming jurisdictional changes with respect to fisheries (i.e., 200 miles, economic zones) has generated considerable need for catch statistics. (c) Environmental information on offshore oil and gas pollution

problems and the effects of artificial offshore installations (ports, wellheads, reefs). (d) Requests for assistance from students from developing nations in setting up basic collections for their "home" institutions. Of particular interest are acquisition sources for information relative to boat design, gear, fisheries processing and preservation.

Consideration is being given to the preparation of bibliographies in subject areas of increasing significance--i.e., artisanal fisheries, underutilized species and innovative fisheries techniques--for distribution to small libraries in developing countries. In addition, preliminary plans have been made for the organization of a marine resource information specialist group whose goal would be mutual input to problems of acquisition and bibliographic control.

c. Expenditures - Accumulative: $30,817.26
Report Year: $15,528.26

University and Other Sources - The University Library reference collection is utilized extensively.

VI Impact of Grant-Supported Activities in Achieving Grant Purposes

The projects reported in the preceding section were the tangible activities designed to implement the purpose of the original 211(d) grant to URI, "for. . . the strengthening (of) its research, training, consultation, and service capacities in marine resources, especially fisheries, and. . . expand(ing) current ongoing University marine resource capabilities to an international dimension." The variety and complexity of the undertakings listed in that section illustrate the level of expertise available at URI. All of the projects were related to the goal of contributing to the improved utilization of marine resources by the poor of the LDCs and of other countries throughout the world. Some had immediate applied value; others were more theoretical--designed to understand basic economic situations or provide scientific background information--whose applications were no less significant but whose results were posited in a longer time frame. These projects were terminated toward the end of the reporting period as the University completed the transition from primarily research-oriented activities to the problem/project type of activity involving detailed workplans which call for specified objectives within a stated period at a realistically estimated cost.

A strong response capability is a major objective of the 211(d) grant, and evidence that the University has successfully developed that capability is seen in the three Task Orders executed during the reporting period for US AID under Basic Ordering Agreement AID/ta-BOA-1079 dated June 1, 1974. These are described in detail in attachments to Table III, but in summary they involved: (1) an evaluation of US AID technical assistance to the EAFFRO Lake Victoria Fisheries Project, in cooperation with Auburn University; (2) development and testing of a preliminary mathematical simulation model of phytoplankton production off the coast of Peru; and (3) an assessment of the feasibility of expanding the production of a fisheries cooperative, Lake Tanganyika, Zaire.

Further evidence of the University's highly developed response capability is provided below in a discussion of an Artisanal Fisheries Conference in Central America.

In addition to specific projects and response capability, institutional strengths were further developed within the various marine-related disciplines. In the College of Resource Development (originally the College of Agriculture of Rhode Island), the resource economics department was expanded and the emphasis in faculty recruitment was on personnel with marine and international interests; the food science faculty was enforced, special programs in marine foods were initiated, and a specialist in marine anthropology was added to the staff.

A number of new programs in marine fields were instituted and others enlarged,and these are attracting increasing numbers of students, including many from developing nations. Among the available courses of instruction are the following:

Master's degrees in Resource Economics (marine option) and Marine Geography
M.S. and Ph.D. program in Food Chemistry and Nutrition

Two-year vocational degree in Fisheries and Marine Technology
Master of Marine Affairs
Master's degree in Community Planning
M.S. and Ph.D. programs in Oceanography, Ocean Engineering, and related and supporting fields

During the period covered by this report, reassessment of the role of ICMRD was in progress and involved Agency input as well as University analysis. As a result, ICMRD shifted its focus from the original multi-disciplinary institutional objective to the specific investigation of activities relative to small-scale fisheries and aquaculture in LDC's.

The Seminar-Workshop on Artisanal Fisheries in Central America, held in San Jose, Costa Rica, 13-17 January 1975, had a dual significance. First, it reflected the cumulative values for ICMRD of 211(d) funding from 1969. The many strengths developed during that period at URI were utilized by staff members at the conference not only in practical approaches, but to present concepts and ideas which were the product of AID-assisted marine specialization. Secondly, the meeting also represented the beginning--a redirection of the activities of the ICMRD staff, involving the unification of research efforts by concentrating on a problem utilizing multidisciplinary appraoch. The project, an investigation of the economic and cultural aspects of small-scale fisheries and aquaculture in Central America and Africa, had as its goal an integrated study, which would be transferable to other regions of the world. The end result of the conference was the development of six projects responsive to the recommendations made by Conference-working groups for the improvement of artisan fisheries. These six projects represent further evidence of the University's achievement of a high level of response capability as a consequence of its grant-supported activities.

Reorganization of Administrative Structure

In addition to redirecting the investigative aspects of the program, the administrative structure has been reorganized to reflect the changed focus. The operation was transferred from the Graduate School of Oceanography to the College of Resource Development. A Committee on ICMRD Policy was organized, chaired by Dr. John Knauss, Provost for Marine Affairs and Dean, Graduate School of Oceanography; the membership consists of the Deans of Arts and Science, Engineering, and Resource Development; the Coordinator of Research; and the Vice President for Academic Affairs. The Dean of the College of Resource Development, Dr. Gerald A. Donavan, serves as the Director of ICMRD.

There continues to be an informal organization of faculty and staff which functions as the Center Associates* The members of this group represent the various disciplines at the University which are involved in marine-related work and they have their academic homes in various departments which cut across the established university structure. As Center Associates they cooperate on the projects generated or coordinated by ICMRD. The effectiveness of the linkages has been demonstrated in the cooperative programs in which they have been involved, and the requests received for assistance in marine areas.

*See Annex III for listing of current Center Associates

To summarize, grant supported activities have enabled the University to develop a high degree of marine expertise which is now being applied to a major study of the small scale fishermen and the contribution he can make toward a solution to the problem of world food shortages which will be prevalent in several LDCs in the next ten to fifteen years.

VII. Other Resources for Grant-Related Activities

The principal increase in funds for the support of grant-supported activities and for several projects to which the grant contributes comes from the University itself, and was on the order of $57,000 in direct funding of salaries and projects. This does not include other indirect contributions in services and the use of facilities.

Previous annual reports have dealt in detail with a variety of programs, which were funded by other than 211(d) grant funds but which support the general program to which the grant contributes. In this report selected non-211(d) supported but related programs which were being implemented during the year will be listed by descriptive title with the amount of non-211(d) funds appropriated for their support:

Program Title	Principal Investigator	Source	Amount
Carbonyl Accumulation During Browning of Fruit	C. O. Chichester	HEW	$ 41,591.00
Essays in Toxicology (Dec. 1, 1972-Dec. 31, 1975)	C. O. Chichester	Nutrition Foundation	11,206.00
Consortium for the Development of Technology	C. O. Chichester		
Brazil (ITAL)		State of Sao Paulo	1,970,000.00
Central America (ICAITI)		ICAITI/AID	40,900.00
Water Resource Management	R. Cummings	URI	6,965.75
Economic Analysis of Salmonid Aquaculture in New England	J. M. Gates	Hatch Act	8,000.00
Economics of Salmonid Culture in New England ("farm" cost data)	J. M. Gates	Sea Grant	26,000.00
Marine Mineral Management Issues	T. A. Grigalunas	URI	3,298.00
Ph.D. in Economics Marine Resource Option	D. L. Hueth	Sea Grant	1,500.00
Capacity of Salt Marsh Vegetation to Modify the Quality of Estuarine Waters	R. J. Hull	DOI-OWRT	19,230.00

Program Title	Principal Investigator	Source	Amount
Physiological Basis for Managing Tidal Marsh Vegetation	R. J. Hull	Hatch R. I. State	5,672.00 5,450.00
Lagoon Study Integrated Water Management Models	H. C. Lampe	R.I. State	3,000.00
Effect of Processing Variables on Nutritive Quality Produced in Extrusion Cooking	T. C. Lee	Nutrition Foundation	30,000.00
Management of Salmonids in a Closed Circulating Controlled Environment System - (culture salmon production)	T. L. Meade	Sea Grant	45,481.00
Domestic/Foreign Allocation of U.S. Fishery Resources	V. Norton	Sea Grant	26,000.00
Economic Impacts of Extended U.S. Fishery Jurisdiction under Alternative Institutional and Fisheries Management Policies	V. Norton	Sea Grant	69,579.00
Transport of Chlorinated Hydrocarbons from Continental Sources to the Ocean	C. E. Olney	Hatch	12,000.00
Simplified Method of Assessing Marine Food Quality (detection of incipient spoilage at dockside)	A. G. Rand	Sea Grant	23,109.00
Fisheries & Marine Technology (2-year program in commercial fisheries at associate degree level, preparing students for work in marine industry)	J. C. Sainsbury	Sea Grant	26,907.00
Evaluate Present Techniques in the Cooking of Red Crab as it Affects Subsequent Processing	K. L. Simpson	DOC & N.E. Fisheries Development	7,700.00

Program Title	Principal Investigator	Source	Amount
Nutritional Requirements of Marine & Juvenile Fish (nutritional requirements for "fish farming.")	K. L. Simpson	EPA	75,000.00
Transformation of Carotenoids (URI-Rumania Coop. Science Program - study of pigmentation in "fish farming.")	K. L. Simpson	NSF	19,600.00
Ichthopathology - development of a histopathology laboratory offering diagnostic service to aquaculture projects	R. E. Walke	NSF R.I. State	33,198.00 3,521.00
Marine Pathology	R. E. Walke	Sea Grant	36,916.00
Atmospheric Pollutant Transport and Deposition on the Sea Surface	R. Duce	NSF	741,200.00
Conference on Law of the Sea	J. K. Gamble	Sea Grant	8,000.00
Law of the Sea Institute- a neutral communications medium on management, control and utilization of marine environment, national and international	J. K. Gamble	Sea Grant	8,000.00
Trophic Regimes in Coral Atoll Lagoons	N. Marshall	NSF	6,500.00
Coral Reef & Lagoon Studies	N. Marshall	URI	5,362.50

It will be noted that several of the above programs were funded by Sea Grant, URI being one of the first four educational institutions designated as a Sea Grant institution. There are other programs funded by Sea Grant that could also be related under various circumstances and conditions to 211(d) grant programs. These include: Marine Resource Development (aquaculture, non-aquaculture and biomedicinals); Socioeconomic and Legal Studies (marine economics, socio-political studies); Marine Technology Research (ocean engineering, resource recovery and utilization); Marine Environmental Research; Marine Education and Training; Advisory Services (extension programs).

Likewise, the broad scope of research at the Graduate School of Oceanography includes many programs and projects that could also be related to the 211(d)

program. Support for "distant water" programs (as opposed to local waters) comes primarily from the National Science Foundation and the Office of Naval Research. For example, the National Science Foundation provided $4,000,000 to replace the University's research vessel, R/V Trident; $121,000 to provide partial support for shipboard technicians and $49,400 for scientific equipment, in addition to other amounts for projects not connected with the R/V Trident. ONR provided $327,997 for a number of ocean research projects including the mixing process in the Gulf Stream.

While the National Sea Grant funds are primarily for the support of "local waters" projects, there are obvious relationships with 211(d) grant projects, such as aquaculture and lagoon/research projects.

Thus, the University of Rhode Island undertakes a wide variety of ocean and local waters projects which are or could be related to the development of fisheries for food. Those that are of primarily U.S. interests have international spin-offs that can be beneficial in the artisanal fisheries projects that were developed during the reporting period for implementation in the next two years.

In short, "other resources" activities constitute a most important relationship to the 211(d) grant support program.

VIII. Utilization of Institutional Response Capabilities in Development Programs

A. Summary

The University responded to three U.S. AID-Mission requests for development assistance under its Basic Ordering Agreement, AID/ta-BOA-1079.

Task Order No. 1 of October 25, 1974 called for a review and evaluation of on-going and proposed freshwater fisheries projects within the East African Freshwater Fisheries Research Organization (EAFFRO), for the purpose of providing recommendations relative to present and future research activities. The project was undertaken in collaboration with Auburn University and was completed at a cost of $3,784.31.

Task Order No. 2 of January 1, 1975, required URI to provide "technical services to increase the knowledge of factors that govern productivity of the sea and their effects on commercial fishing." This involved the development of an ecosystem model applicable off Ilo, Peru; the collection of cruise data to test the model, and evaluation of supporting economic problems, particularly as related to artisan fishing and fish for human consumption. The project was completed at a cost of $9,717.72.

Task Order No. 3 of February 28, 1975, required the processing of technical services to assess the feasibility of expanding the production of the Cooperative des Pecheurs du Lac Tanganyika, Zaire. Recommendations were submitted to AID regarding an expansion program in the UVIRA-FIZI zone of Zaire, with information on the harvest, distribution and consumption of fish. The project was completed at a cost of $7,438.92.

Detailed descriptions of the above three projects follow Table III.

In addition to the above requests for assistance in LDC development programs, there were numerous requests for information regarding ICMRD activities, courses of study for prospective international students, and for publications and reports listed by the ICMRD Library. Also, a number of the faculty received private requests for information or advice regarding the University's marine programs, which did not call for more than a letter response and did not materialize as funded assistance projects.

There were no unfulfilled requests for assistance in LDC development programs.

B. Additional Response Capability

1. Number of Graduate Students from LDCs; Country Identification

There were 38 LDC graduate students from the following countries involved in marine studies:

Argentina
Chile
China, Republic (Taiwan)
Egypt
Fiji
Ghana
Greece
Guatemala
Hong Kong
India
Korea
Spain
Sudan
Thailand
Turkey
Uganda
Uruguay
Yugoslavia

*See Annex I for a detailed list of LDC graduate students engaged in marine-related studies at URI.

2. Number of visitors or on-campus consultations

Evidence of the international interest generated by the various programs and projects sponsored by the International Center of Marine Resource Development is demonstrated by the numerous letters of inquiry received from foreign nationals, governments, international organizations and educational/research institutions. In addition, a number of foreign visitors come to the campus to visit the facilities and talk with faculty and staff. These visits served to establish and reinforce linkages in the international areas of marine development.

There were 15 recorded visitors during the reporting period who were concerned with development programs in LDCs with particular reference to the 211(d) grant. There were probably a substantial additional number of visitors also concerned with development programs regarding whom ICMRD was not advised since the 211(d) grant was not involved.

3. Personnel of the grantee institution working on development programs if not reported in "A" above

The following projects, not reported in A above, have some relationship to LDC development programs:

Barnett, Stanley M. - Assoc. Prof., Chemical Engineering

Conversion of food wastes into feed or food products. A study project to increase the food supply in underdeveloped countries.
(Agency of International Development, League for International Food Education, American Institute of Chemical Engineering: $95,000)

Palm, William J. - Asst. Prof. of Mechanical Engineering and Applied Mechanics.

Optimization of fishery management.
Research to develop methods for calculating optimal catch quotas and levels of fishing effort.
(National Science Foundation: $10,000)

Constantinides, Spiros - Prof., Food and Nutritional Science and Biochemistry.

Utilization of the ocean pout.
Application of food technology to develop acceptable products for human consumption. (New England Regional Commission: $19,110)

Saila, Saul - Prof., Oceanography.

Commission's Fisheries Development Program.
Funds to create and/or expand markets for underutilized species of fish. (New England Regional Commission: $67,510)

4. Known use of research, teaching materials, methodologies, etc., initiated, performed or developed under the grant

As evidenced by the accomplishments listed under each specific objective in Section V., much of the work performed has been disseminated through publications which have national and international distribution, through presentations at professional meetings, and through exchanges with other professionals. The graduate students working on the projects have benefitted from the experience and knowledge gained by their work on specific activities. Since most of the researchers were also teaching faculty, much of the work was ultimately transmitted to students in formal and informal teaching situations. It is difficult to quantify such information transfer, but undoubtedly teaching is one of the maximum means of data dissemination.

In addition to such theoretical and traditional consequences, direct applications of expertise in developing countries can also be cited. For instance, the long-term involvement in Chilean marine resource appraisal activated an involvement by the Catholic University of Valparaiso and the University of Chile in the evaluation of the fisheries industry in the country, and a joint plan is being prepared for the development of the fisheries industry in that country. An ICMRD staff member has advised Catholic University of Valparaiso officials on the academic program at the School of Fisheries and Marine Food Science. The school has since been designated a multi-national Center for Marine Food Science by the Organization of American States and now offers its own graduate program.

There have been practical applications of many of the theoretical studies--most particularly the work in food chemistry on problems associated with the aquaculture of crustaceans. It should also be emphasized that techniques designed for utilizing waste products from the fishing industry, of converting underutilized species to edible forms and of improving fish preservation methods were designed for use in developing nations and do not involve sophisticated materials and skills.

Ultimately, one of the most important contributions may well be the development of the multi-disciplinary approach to regional problems. The program at the Central American Seminar-Workshop was one embodiment of this, another is the program for the next year as outlined in Section IX.

5. Significant roles in development played by graduates of URI

Complete records have never been maintained on the activities of students upon their graduation. Many, particularly the foreign students, pursue further education and more advanced degrees at other institutions. The following list is, therefore, not comprehensive, but rather it is representative of the types of activities that have been pursued by various graduates:

Marine Affairs Graduates:

Elias Ayisi (Ghana) - Staff, Nautical College, Accra

David BonVouloir (USA) - Staff, Territorial Planning Commission, Government

of Guam, Agana, Guam

Aldo Brussoni (Uruguay) - Staff, National Commission on Oceanography. He is currently helping prepare a Master Plan for Development of Marine Resources in Uruguay.

Victor Gallardo (Chile) - Received a Fellowship in Woods Hole Oceanographic Institute Post-Doctoral Program, 1973-75. Will return to Chile in Summer, 1976, to resume his position at the University of Concepcion, where he will assist in organization of a Marine Science Center.

Henry Parker (USA) - Staff, Marine Colloids, Inc., Philippines. Staff responsibilities included work on farming of sea weeds.

Stella Vallejos (Argentina) - Staff, Economic and Social Council, United Nations Headquarters, N.Y.

Fisheries and Marine Technology Graduates:

Miguel Fierro (Ecuador) - Staff, Escuela Superior Polytecnica del Littoral, Guayaquil, Ecuador

Robert Stone (Fiji) - Chief Fisheries Officer, Fiji

Food and Resource Chemistry Graduates:

J. Amaya (Colombia) - Staff, School in Campinas, Brazil.

Matthew Caurie (Ghana) - Staff, Food Research Institute, Ghana. (Also engaged to do URI Project research in Ghana.)

Oceanography Graduates:

Mahn Bhovichitra (Thailand) - Faculty, Department of Marine Science, College of Fisheries, Kasetsart University, Bangkok

Resource Economics Graduates:

Luis Adriasola (Chile) - Staff, Universidad Catolica de Valparaiso and Universidad de Chile, Santiago

Ernest Molokozi (Tanzania) - General Manager, Tanzania National Development Corporation

Lars Vidaeus (Sweden) - FAO Consultant. Most recent project was appraisal of fisheries in Zambia.

Peter Wadsworth (USA) - Consultant to FAO and Government of Mexico on Mexican fisheries. Consultant to AID on fisheries projects in Chile. Consultant to FAO on fisheries projects in Peru.

6. Other Activities

Because of the varied activities in the international field in which the

staff and faculty of the University of Rhode Island are engaged, an informal program was organized in which various members of the campus community or invited experts discuss projects they are pursuing. These sessions are open to students, faculty, staff and visitors and they serve many functions: they inform and educate, they allow for dialogue and input from representatives of other disciplines, and they provide insight into the problems involved in working in the international field.

Topics covered in this year's series were:

October 1974 Dr. Timothy Joyner
Northwest Fisheries Center, NMFS, Seattle, Washington

"Toward a Planetary Aquaculture - the Seas as Range and Cropland"

November 1974 - Dr. John K. Gamble, Director
URI Law of the Sea Institute

"The Law of the Sea, Caracas, 1974"

December 1974 - James Bartee, Department of Sociology/Anthropology, URI

"The Human Ecology of the Guanano Indians of Southeastern Colombia: A Case Study in Riparian Adaptations"

April 1975 - Dr. Irving A. Spaulding, Department of Resource Economics, URI

"Creative Innovations in Fisheries Technology - A Case Study"

May 1975 - Dr. Tadeusz Kowalski, Department of Ocean Engineering, URI

"Artisanal Fisheries in Lake Tanganyika, Zaire"

C. Progress in Establishing and Maintaining Linkages, Domestic and International, for Purposes of Facilitating Utilization Not Already Reported in Section V

Whenever possible, ICMRD has linked its efforts with other national and international organizations interested in the common goal of marine resource development. Shared activities on the national level have involved foundations, such as Resources for the Future, or governmental agencies, including, Sea Grant, the Department of Agriculture and the National Marine Fisheries Service. On the international level there has been input from the Food and Agriculture Organization, and the International Oceanographic Commission. Private development groups such as DIAKONIA (the German development agency) have also been involved.

In addition to the many departmental curriculums and research programs which relate in some way to the Center's interests, there are certain specific institutes at the University which function in close partnership with ICMRD, such as the Law of the Sea Institute. The Consortium for the Development of Technology operates under the general supervision of the Director of ICMRD, and involves the Universities of California, Washington, Wisconsin and Michigan State.

Strong linkages are being formed or enhanced with other off-campus institutions such as Auburn University and the Hawaiian-based International Center for Living Aquatic Resources Management (ICLARM).

Increasingly, foreign universities and colleges have requested assistance with their programs in the marine field. The program developed for the Catholic University of Valparaiso in marine foods was mentioned above. Also, as management problems in the marine fields grow in complexity, help has been requested in the organization of programs such as that offered in the Marine Affairs curriculum. Inquiries have been received from universities in Mexico, Uruguay and Chile, and it is expected that the successful implementation of these requests will involve input from international organizations as well. As this report was being prepared, another inquiry was received from Ecuador which is expected to result in the development of a special Marine Affairs Program for young marine administrators from that country.

D. Plans for Utilization of Institutional Response Capacities on Solution of LDC Problems During Remainder of Grant Terms and After Grant Expiration

The institutional response capacities of the University of Rhode Island fall into the following three categories: faculty and staff expertise; marine-oriented programs and specializations; and facilities, including laboratories and specialized equipment, computer capacities, and library materials.

Because of increased institutional investments since 1969, made possible through larger state contributions, grant funding such as that provided by AID, and contractural arrangements, there is available at the University of Rhode Island sufficient faculty and staff to allow for participation in short-term and long-term commitments to development projects, including overseas assignments. Secondly, there has been an increase in the types and scope of the programs available at the University on both the undergraduate and graduate level which permit increased enrollment and involvement of students; these curriculum offerings have attracted many nationals from developing countries. This training makes accessible the disciplines essential for the continued development of many marine fields.

The third area of institutional rssponse, that involving available facilities, is, of course, closely interrelated with the other two. Laboratory facilities and other physical plant necessities (such as engineering shops and specialized fisheries equipment repair tools) are of a high order of excellence; they have been developed in response to past projects and can handle difficult requirements. Computer capacities have been enlarged and the sophisticated electronic tools needed for modeling analysis and data synthesis are in existence. Equally important, qualified computer specialists are available for consultation on technical problems. Library holdings have been augmented through the specialized ICMRD collection of international fisheries statistics and development data and in the related fields of marine policy and fisheries technology. It is anticipated that these materials will be placed in the new addition to the University Library; in any event, they will be retained as a specialized collection.

The utilization of all these cited institutional capacities will continue in the activities planned for the remainder of the grant (see the detailed description in Section IX). In addition, intra-university cooperation has been fostered through past programs and the availability of intra-disciplinary teams of experts has received sufficient publicity that requests for input in development projects are being received from individual countries, international organizations, and other government agencies. Staff members from the Food Science and Nutrition Department and the Resource Economics Department have worked with their counterparts at the University of Chile and the Catholic University of Valparaiso for many years and this relationship will be continuing. CODOT, the Consortium for the Development of Technology, the joint effort of the food science departments of five universities in the U.S., has its headquarters at the University of Rhode Island and relies heavily on the administrative capacities at the University in the operation of its projects in developing countries.

With the increased emphasis nationally, evidenced by the International Development and Food Assistance Act of 1975, and internationally, i.e., in the World Food Programme objectives, requests for assistance and the responsibility to meet them will involve the increasing utilization of URI institutional response capacities in the solution of LDC problems.

IX. Next Year's Plan of Work and Anticipated Expenditures

The purpose of the 211(d) grant extension dated August 5, 1975, was "to strengthen the new focus of the University's institutional response capability in the economic and cultural aspects of small-scale fisheries and aquaculture in the LDCs."

To that end, during June and July of 1975, AID officials met with University faculty and administrative personnel at the International Center for Marine Resource Development, College of Resource Development, to discuss the kinds of projects that should be undertaken to achieve the above purpose as contained in the Grant Project Statement.

The Grant Extension Budget called for an expenditure of $200,000 during the first year of the two-year extension, as follows:

Inputs

Salaries & Wages	$120,455
Travel	24,000
Graduate research assistants	33,545
Equipment & Supplies	5,000
Library & Publications	17,000
	$200,000

Outputs

Expanded knowledge base	$173,000
Response capability	10,000
Specialized training	2,000
Information capacity	15,000
	$200,000

To achieve the purpose of the extension and meet the budgetary expectations, workplans were developed for the following five projects (the original six proposed projects were consolidated):

1. Assessment of Resource Base for Small-Scale Fisheries (Extended Knowledge Base)

Year One - State of the Arts Study of theoretical bases for stock assessments; preliminary trip to Costa Rica; develop several data collection schemes and analysis techniques; transfer Research Associate to Costa Rica in May/June for one year resident research-data collection and development/testing of suitable model

Target: First Year: complete State of the Art analysis by June 1, 1976. $9,485

2A. Sociocultural Correlates of Developmental Change (Extended Knowledge Base) - Ghana

Year One - State of the Arts paper concerning sociocultural correlates of

developmental change among artisanal fishermen.

Target: First Year: complete above paper 15 July, 1976. (To Ghana 1 Sept., 1976). $11,110

2B. Lack of Knowledge About Effective Message Design in Communication for Technology Transfer (Extended Knowledge Base)

Year One - State-of-the-Arts paper

Target: First Year: April 1, 1976, Completion of paper; May 1, 1976, Completion of research design and construction of research instrument; June 30, 1976, Arrange collection of research data in selected LDC. $6,664

3. Underutilization of Food Technology Resulting in Losses of Available Food (Extended Knowledge Base)

Year One - State-of-the-Arts in West Africa (Ghana base); ultimate aim is to improve nutrition of peoples in survey area and other LDCs.

Target: First Year: Jan-March 1976: Literature survey; collect supplies and equipment; May-July 1976: On-site data collection in field and in laboratory. $24,555 (Note: This project had not received Government of Ghana approval as of time report completed. Final efforts were being made to provide the Government of Ghana with further information which, it was hoped, would result in agreement to conduct research there.)

4. Knowledge Transfer Methodology for Small-Scale Fisheries (Extended Knowledge Base) - Ghana

Year One - Establish data base regarding technology transfer techniques and then effectiveness in Small-Scale Fisheries Development

Target: First Year: Above, from December 1, 1975, through December 1, 1976. As of December 1, 1976, completion of State-of-the-Art paper which provides analytical review of existing knowledge and thought with regard to direction, techniques procedures and mediums utilized during small-scale fisheries development programs. $11,808

5. Economics of Small-Scale Fisheries in Less Developed Countries (Extended Knowledge Base) - Central America

Year One - (1) State-of-the-Art study of the economics of small-scale fisheries in LDCs, including: (a) assessment of demand analysis for fish products; (b) survey of fish marketing systems and assessment of techniques for evaluating fish marketing systems; (c) survey of costs and returns information and assessment of methods commonly used for collection and analysis of cost and returns information; (d) assessment of costs and extent of high prices and bottlenecks in the markets for fishermen's supplies; (2) Develop practical and expeditious techniques for analyzing: (a) consumer demand; (b) effectiveness of fish marketing systems; (c) costs and returns information; (d) extent to which fishermen's supplies are overpriced.

Target: First Year: Survey of literature on consumer demand, market

organization and production--March 15, 1976; State-of-the-Art paper and design research efforts--June 15, 1976; Application and testing of research techniques (amended schedule--June 1976). $103,658

No research projects were continued from 1974-75.

X. Involvement of Minority Personnel and Women

In the operation of ICMRD every attempt has been made to involve women and minorities in the structure and functioning of the various projects and programs. An American Oriental (naturalized) scientist and a woman scientist have been deeply involved in 211(d) related activities and serve as Center Associates. Several women student assistants took part in the projects described in Section V. A woman Research Assistant, (Resource Economist) has already been selected to go abroad next year to work on one of the 211(d) artisanal fisheries projects. The ICMRD Technical Librarian is a woman, there are women working in the Center in administrative assistant and clerical/secretarial jobs.

The University of Rhode Island is an Affirmative Action employer and thus is committed to the maximum effort in the hiring of minorities and women. All ICMRD recruitment efforts follow the guidelines established by the Affirmative Action Office and are rigorously pursued. All principal investigators are instructed to seek out minorities and women for project work. It should be noted, however, that there are a limited number of women with professional training in many of the specialized fields in which ICMRD works and consequently recruitment on the professional level is hampered by competition. In those fields and at those levels where there are more applicants available and qualified, judgments are weighted to the hiring of these groups.

Table I

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

Reporting Period July 1, 1974 to August 5, 1975

Topic Titles	211(d) Expenditures				Non-211(d) Funding
	Period Under Review	Cumulative Total	Projected Next Year	Projected to End of Grant	
Seminar-Workshop on Coastal Artisanal Fisheries and Aquaculture in Central America and Panama	$ 12,004.87	$ 21,935.87	$ 5,000.00	$ 26,935.87	
Sociocultural Study of Fishery Communities in Western Puerto Rico	10,993.33	10,993.33		10,993.33	
An Analysis of Artisan Fishing Development in Mexico Applicable to the Development of Technology Transfer Techniques in Latin America	15,497.41	15,497.41		15,497.41	
A Study on the Prospects of Marine Resource Development in the Caribbean Region	3,949.88	21,280.88		21,280.88	Sea Grant 5,000.00
Sociocultural Change in Maritime Communities with Emphasis on Artisanal Fisheries in the Republic of Panama	16,845.73	16,845.73		16,845.73	
Analysis of Chilean Fisheries Expansion Alternatives	3,000.00	3,000.00		3,000.00	URI- 2,000.00
Surface Water Management for Irrigation and Lagoon Management	8,762.95	40,007.00		40,007.00	URI, RFF- 18,077.75
SUB-TOTAL (forwarded to next page)	$ 71,054.17	129,560.22	$ 5,000.00	$134,560.22	25,077.75

Table I

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

Reporting Period July 1, 1974 to August 5, 1975

	211(d) Expenditures				Non-211(d) Funding Amount	
	Period Under Review	Cumulative Total	Projected Next Year	Projected to End of Grant		
The Development of Methods for Evaluating the Demand for Fish and Fish Products	$ 10,000.00	$ 26,788.00	$	$ 26,788.00		
Evaluation of Factors Limiting the Establishment of Artisan Prawn Aquaculture	10,099.05	10,099.05		10,099.05		
Sub-Topic: Use of Waste Products as a Source of Protein Enrichment in Aquaculture of Prawn	2,614.65	2,614.65		2,614.65		
The Effects of Water Motion on the Growth of the Algal Species Ulva lactucu and Gracialaria verrucesa	1,995.76	1,995.76		1,995.76		
Improved Utilization, Handling and Preservation of Marine Food	14,399.42	30,650.42		30,650.42		
Coral Reef and Lagoon Studies, with Particular Reference to Development Stress	5,214.72	32,209.72		32,209.72	URI-	7,362.50
Studies on the Culture of Green Sea Turtles	4,850.79	15,452.79		15,452.79	URI-	8,000.00
A Low-Cost Boat for Artisan Fishing in Developing Countries	4,482.65	4,832.65		4,832.65	URI-	6,000.00
SUB-TOTAL (forwarded to next page)	$124,711.21	$254,203.26	$ 5,000.00	$259,203.26		46,440.25

Table I

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

Reporting Period July 1, 1974 to August 5, 1975

	211(d) Expenditures				
	Period Under Review	Cumulative Total	Projected Next Year	Projected to End of Grant	Non-211(d) Funding Amount
Hot Smoke Fish Curing	$ 4,202.75	$ 27,330.75		$ 27,330.75	URI,NSF, Nut. Fdtn.13,000.00
Master of Marine Affairs Program	-0-	3,699.00		3,699.00	
ICMRD Technical Library	15,528.26	30,817.26		30,817.26	
Small Grants	15,745.27	15,745.27		15,745.27	URI- 12,594.12
Topic sub-total	$160,187.49	$331,795.54	$ 5,000.00	$336,795.54	72,034.37
Director's Office: ICMRD	50,598.88	234,913.88	2,792.27	237,706.15	URI- 32,441.50
Balance of prior year (6/30/74) tasks not included in above topics		350,498.31		350,498.31	
TOTAL	$210,786.37	$917,207.73	$ 7,792.27	$925,000.00	$104,475.87

Table II - A

211(d) Expenditure Report

Actual and Projected Summary

Under .Institutional Grant #AID/csd-2455

Reporting Period July 1, 1974 to August 5, 1975

	Expenditures* to Date		Projected Expenditures Year				Total
	Reporting Period	Cumulative Total	2	3	4	5	
(Line Items to Conform to Budget in Grant Document)							
Personnel	$106,601.67	$588,826.54					
Graduate Assistants	$ 47,798.54	$152,832.49					
Travel	$ 26,959.04	$ 86,853.54					
Other	$ 29,427.12	$ 88,695.16					
	$210,786.37	$917,207.73					

Table II - B

211(d) Expenditure Report

Reporting Year Detail

Under Institutional Grant #AID/csd-2455

Reporting Period July 1, 1974 to August 5, 1975

I. A. Salaries: Names of Faculty, percentage of time charged against the grant and amount

Hueth, Darrell	14%	$ 2,459.52
Spaulding, Irving A.	40	13,281.00
Pollnac, Richard B.	80	13,275.97
Poggie, John J.	22	2,512.52
Lee, T.-C.	15	6,412.00
Lampe, Harlan C.	50	14,204.50
Sutinen, Jon G.	75	1,125.00
		$53,270.51

B. Other: Percentage of time and amount for each category

Management

Griffin, James J.	100%	16,285.41
Estes, Thomas S.	80	1,078.13

Library

Alexander, Jacqueline	100	12,777.18

Clerical

Tefft, Elizabeth	100	5,841.22
Bowerman, Virginia	100	6,010.99

Other Non-Professional

Jackim, Penelope	100	606.62
Veronesi, Judith	100	2,280.32
Tapia, M.	100	58.10
		$44,937.97

C. Fringe Benefits: As applicable for the above

(Includes Fringe benefit charges on salaries for Student Support and Visitors)	$12,095.88

II. Student Support: Name of student, country of origin, amount of support per student

Name	Country of Origin	Amount
Stone, R.	Fiji	$ 3,938.00
Adriasola, L.	Chile	4,945.00
Stevenson, D.	USA	3,281.29
Crossen, Kevin J.	USA	160.00
Jacobs, W.	USA	787.50
Jhaveri, Sudip	India	2,585.00
Karakoltsidis, Pavlos	Greece	3,699.00
Chang, L.	Taiwan	810.00
Kaplan, Harvery	USA	810.00
Gold, Bettye	USA	475.00
Chen, S.-L. C.	Republic of China	295.00
Feit, L.	USA	262.50
Hao, W. E.	Taiwan	975.00
Harrison, A. P., II	USA	90.00
Smith, Peggy A.	USA	347.50
Vallejo, S. M.	Argentina	3,726.75
Jacques, T.	Belgium	450.00
Staub, Frank	USA	500.00
Lemkau, P.	USA	3,420.44
Vidaeus, L.	Sweden	4,492.96
Caurie, M.	Africa	3,860.00
Bartee, J.	USA	3,250.00
Parker, H.	USA	1,650.00
Kamata, T.	Japanese	2,895.88
		$47,706.82*

*Includes Tuition & Fees

III. A. Consultants: Total number and total amount

3	$ 1,050.30

B. Guest lecturers, Visitors, etc.: Total number and total amount

1	$ 2,056.78

IV. Travel: Total nos. of trips and total amount

A. Domestic	23	$ 3,230.12
B. Foreign	23	$23,728.92

V. Equipment: Nos. and description of items the individual cost of which is $2,500 or over

5	$ 2,756.05

VI. Library Acquisitions: Total amount

$ 1,331.48

VII. Publications: Nos. and total amount

3 $ 5,458.30

VIII. Other (such as telephone, postage, computer): Total amount

Postage	$ 996.65
Communications	579.02
Supplies	7,855.49
Miscellaneous	3,732.08
	$13,163.24

Table III - A

Requests For Assistance Received During Reporting Period 7/1/74 to 8/6/75

A. Requests Attended

Description of Request for Assistance	Whom did you Assist?	Who Requested Assistance	Who Funded Assistance	Size of Effort Dollars	Size of Effort Man Days	Results of Assistance
Task Order No. 1						
Evaluation of U.S. AID Technical Assistance to EAFFRO Lake Victoria Fisheries Project (see attached)	EAFFRO	U. S. AID	U.S. AID	$3,787 (obligated)	88	Report submitted to U.S. AID; extent to which recommendations implemented not known.
Task Order No. 2						
Ecosystems Modeling; Economic Considerations for a Peruvian Coastal Fishery (see attached)	Peru	U. S. AID	U.S. AID	$25,000 (obligated)	492	
Task Order No. 3						
Feasibility of Expanding Production of the Fishery Cooperative, Lake Tanganyika, Zaire	Zaire	U. S. AID	U.S. AID	$7,602 (obligated)	42	

Table III - B

Requests For Assistance Received During Reporting Period 7/1/74 to 8/6/75

B. Requests Not Fulfilled

Description of Request for Assistance	Whom did you Assist?	Who Requested Assistance	Who Funded Assistance	Size of Effort Dollars	Size of Effort Man Days	Why not met?
None						

Topic Title: An Evaluation of U.S. AID Technical Assistance to the EAFFRO Lake Victoria Fisheries Project

Principal Investigator: Jon G. Sutinen, URI
W. D. Davies, Auburn (Alabama) University

Funding: AID-Task Order No. 1, AID/ta-BOA-1079

1. Narrative Description - In response to a request by the U.S. AID/ Regional Development Office, East Africa, an evaluation of existing AID technical assistance to the Lake Victoria Fisheries Project of the East African Freshwater Organization (EAFFRO) was conducted from October 28 to November 15, 1974. The objectives were to provide RDOEA with evaluations of (1) existing research activities and what the likely product of those would be by the end of the project in 1977; (2) personnel requirements for the project; (3) commodity and other support requirements; and (4) the extent of EAFFRO involvement in the development and management of the Lake Victoria fisheries.

2. Accomplishments

An in-depth survey was made of the fisheries, research programs being pursued, facilities available, and the parameters of EAFFRO's planned fisheries project in Lake Victoria with reference to the contributions of U.S. AID technical assistance to the project. The following recommendations resulted from this survey:

(1) For the period 1975-77 the work schedule of U.S. AID biologist should emphasize: (a) evaluating proposals for extending the range and fishing habits of traditional fishermen; (b) monitoring of the expanding trawl fishery to include areas fished, catch per unit-of-effort and species composition of the catch; and (c) expanding the present tagging program to find out if distinct subpopulations exist.

(2) The present U.S. AID positions (three biologists, one bio-statistician) should be continued but additional technical assistance in the areas of limnology-aquatic pollution should be given a low priority.

(3) The services of an experienced fisheries economist should be made available to EAFFRO to assist in making recommendations for the development and management of the fishery. If constraints limit the number of technicians to the present level of four, then the economist should be given preference over the bio-statistician.

(4) Equipment requests for the period 1975-77 should include some indication of the in-country capability for maintenance.

(5) EAFFRO should develop further and strengthen its communication and cooperation with the individual fisheries departments at all levels by encouraging all of its research staff to (a) attend regular meetings of the three countries' fisheries departments, and (b) routinely consult with the departments' personnel on the nature of their research activities. The goal of each researcher is, of course, to produce results relevant to the problems faced by these developers and managers of the fisheries.

Publication - The following contains a detailed description of the project:

Sutinen, J. G. and W. D. Davies, 1975.

An evaluation of U.S. AID technical assistance to the EAFFRO Lake Victoria fisheries project. Kingston, R.I., University of Rhode Island, Marine Memorandum 37.

Topic Title: Ecosystems Modeling: Economic Considerations for a Peruvian Coastal Fishery

Principal Investigators: James N. Kremer
Jon G. Sutinen
Scott Nixon

Participating Investigator: James Griffin

Funding: AID--Task Order No. 2, AID/ta-BOA-1079

I. Mechanistic Ecological Modeling Methods

A. Narrative Description - Mechanistic simulation models of ecological processes are becoming useful tools for the study and management of complex natural systems such as upwelling coastal regions. The CUEA (Coastal Upwelling Ecosystem Analysis) Program in which Peruvian scientists are involved includes the development of such a simulation model as a major objective. The goal of the cooperative project between the Oceanography Division of Peru's Instituto del Mar and the Graduate School of Oceanography of the University of Rhode Island was to develop such a model, which might provide working experience with the methods and serve as a basis for future model development in Peru.

An additional aspect of the project concerned refinement of analytical ATP methods at the Instituto del Mar. Initially, this involved attempts to get the instrument operating properly. Thereafter, it would be possible to provide specific technical assistance in this and other marine productivity methods.

B. Accomplishments - The short duration of this preliminary project meant that (1) only a very simple model could be attempted, and (2) it was desirable to draw heavily on the work of similar models. These included the temperate estuarine model of Narragansett Bay (Nixon and Kremer, in press) and the upwelling model developed by John Walsh (1975). Methods of formulation and numerical methods for the ecological model were based on the Narragansett Bay model, while the ecological assumptions were in most cases very similar to those of Walsh. A physical circulation model also was developed and patterned after the general three-dimensional mixing scheme used by Walsh to simulate a simplified upwelling region.

The preliminary model runs satisfactorily, although its simple nature precludes extensive comparison with detailed, observed data. A number of suggestions for future modifications were presented and should provide direction for continued modeling efforts at the Instituto del Mar. Nevertheless, this primitive model has begun to play a role in suggesting relevant questions, pointing out uncertainties in present knowledge and assisting in the planning of future research.

II. Economic Evaluation of the Fisheries Industry

A. Narrative Description - The goals of the related economic study were: (1) planning with the staff of the Instituto del Mar, Peru (IMARPE)

for an economic analysis of issues of interest, using available data; (2) reviewing fishery economic issues in the Ilo, Peru, area with special reference to (a) artisanal fisheries, and (b) the production, distribution, and marketing of fish for human comsumption; and (3) exploring the possibility of constructing an economic model capable of interfacing with the ecosystem model to be developed.

B. Accomplishments - The general objectives were achieved, though each to a different extent. Primarily activities focused on the first two objectives. Because of the short time allocated and the lack of appropriate data on the food fishery it was decided that the construction of the economic model was not feasible.

Discussions were held with representatives of the Ministry of Fisheries and related entities (EPSEP and Pesca Peru), with artisan fishermen, and with the IMARPE. It involved a study of the artisanal fishery around the port of Ilo (including Villa Villa and Meca) with the objective of making recommendations for the development of the fishery. (Appendix A contains a tentative outline for such a study.) It was hoped that the following recommendations concerning the fishery's development would emerge from this study: The analysis of costs and earnings data on existing and new forms of capital might suggest beneficial changes in the types of vessels, gear and techniques to be used. Similarly with labor, the study will likely assess the manpower needs for developing the fishery, i.e., the number of fishermen and the types of skills required and proposed means of providing this manpower. In the areas of processing, distribution and marketing, the study was designed to identify major problem areas, and suggest the necessary research to resolve these problems.

The second part of the research program is speculative. It is not clear what IMARPE's role will be in fishery economic research in the future. What is clear is that much more economic research is required for the proper development and management of the exploitation of Peru's fishery resources. Inter alia, the monitoring and analysis of costs and earnings in the industry will be an important part of such research. IMARPE may decide to develop the capability to routinely collect and analyze costs and earnings data. If so, the Ilo research program might be regarded as a first step in developing such a capability.

Role of AID in Peruvian Fishery Economic Research

While there appears to be a substantial interest in expanding Peru's fishery economic research capability, no single entity at this time is engaged in developing a comprehensive economic research program. Given that such a program will be developed in the future, some thought and commitment should be made regarding training Peruvian economists and outlining a comprehensive research program. AID could play a meaningful role by funding the training of Peruvian fishery economists at U.S. universities. Although FAO has played a major role in economic research in the past, AID, it seems, can fill a valuable niche by providing skilled advisors to develop the research program and to conduct some of the research.

Publication - The following contains a detailed description of the project:

Kremer, James N. and Jon G. Sutinen. 1975. Ecosystems Modeling, Economic Considerations for a Peruvian Coastal Fishery. Kingston, R.I., University of Rhode Island, Marine Memorandum 39.

Appendix A

A Tentative Outline of an Economic Study of the Ilo Artisanal Fishery

I. Introduction

II. Description of the fishery

- A. The resource (magnitude, location, species, etc.)
- B. The harvesting sector
  1. Output and prices (past and present)
  2. Capital inputs
     - a. description of gear, techniques, and the enterprises' operations
     - b. costs and earnings of the enterprises
     - c. supporting infrastructure (repair and construction, equipment supply facilities, etc.)
  3. Labor Inputs
     - a. description of their skills, education, ethnic and social status, and alternative economic opportunities
     - b. earnings
     - c. supporting infrastructure (schools, housing, hospitals, etc.)
- C. Processing
- D. Distribution
- E. Marketing

III. Prospects for Development

- A. Resource potential
- B. Harvesting sector
  1. New vessels, gear and techniques
  2. Fishermen training
  3. Supporting infrastructure development
- C. Processing
- D. Distribution
- E. Marketing

IV. Recommendations for development and future research

Topic Title: Expansion Feasibility of Production of the Fishing Cooperative, Lake Tanganyika, Zaire

Principal Investigators: Edmond E. Seay, Jr., URI*
Tadeusz Kowalski, URI

Funded by: AID $7,602
AID-Task Order No. 3, AID/ta-BOA-1079

As part of the above-named effort, the University provided technical services to assess the feasibility of expanding the production of the Cooperative des Pecheurs du Lac Tanganyika au Zaire (COOPELAZ) fishing cooperative, making recommendations with respect to implementation of an expansion program involving distribution and consumption of fish in the Uvira-Fizi zone of Zaire.

1. Narrative Description - Specifically, the charge given the team was to evaluate the feasibility of expanding the production capacity of a fishing cooperative on Lake Tanganyika. Simply stated, the task involved (1) assessing, from secondary sources, the productive potential of the lake; (2) assessing the capability of the cooperative members to utilize improved technologies and the probable impact of such technologies on catch rates; and (3) assessing the quality of the cooperative management and the capability of the cooperative to distribute and market increased quantities of fish.

2. Accomplishments - Economic Assessment

Nothing was found to suggest any near-term concern with depletion of the Lake's fish stock. Current estimates of catches in the Zairian portion of the Lake are a small fraction of the estimated MSY's for the same waters. Moreover, the demise of the industrial fishery after nationalization in early 1973 greatly reduced fishing pressure. The MSY estimates are crude. However, cooperative research involving Burundi, Tanzania and Zaire is being planned that should refine these estimates. Such research will parallel or perhaps even lead the revitalization of the industrial fishery, thus permitting controlled growth in that sector.

No serious constraints on moving the membership of the cooperative to the best available technologies were uncovered. Many of the members currently operate with modern (artisanal) methods. The primary restraint appeared to be credit availability for purchasing new gear rather than any reluctance toward adopting new technologies. Implementation of the project should remove this barrier. Current estimates of catch by the cooperative are based on very sketchy reports and appear to be overstated. The team estimated that, based upon the coop's count of each type of fishery unit, i.e., trimaran, catamaran, single canoe, and FAO estimates of annual catch per type of unit, the annual production by coop members is 5,500 metric tons. If the entire "fleet" is converted to trimarans, the annual catch could increase 44 percent to 7,900 metric tons. While less

*See Publication for non-URI personnel

than the initial assessments made by others, these catch estimates and an ex-vessel price of $0.20 per kilogram produce an annual income consistent with returns to similar types of effort in the primary sector.

While upgrading of the cooperative to "best artisanal level" will not eliminate the protein deficit in the region, it will make a first step in that direction, serving as a holding action until the industrial fishery can be revitalized. Moreover, if anything is to be done along these lines in the area, the coop is the only existing entity available to carry on such development. The project impacts on the local economy would be substantial. In addition to the unquantifiable but positive impact on the nutritional level of rural people, there would also be increased incomes to the fishermen and their crews. The upgraded "fleet" could utilize an additional 500 crewmen, thus having a significant employment impact as well.

The major economic needs, in addition to trucks and credit for gear, are (1) an apprentice program for young fishermen to help perpetuate the cooperative, and (2) perhaps three to four man-months of technical assistance in the nuts and bolts of setting up and operating the marketing/distribution system.

Technological Assessment

Present Techniques - The native fishing craft is a wooden pirogue (dugout canoe) about eight meters long. Two or three pirogues are tied together to form catamarans or trimarans equipped with lights for fish attraction. The nets are lift-nets deployed underneath the boats and operated via outriggers with pulleys.

Each catamaran and trimaran unit has two to four single search pirogues working with it to act as scouts. They have three to four lights of 1 o w candlepower which are used for fish detection and attraction. When fish are detected, the net units are signalled and the fish school is transferred to the trimarans by reducing the brightness of the lights in the search pirogues.

Some of the trimarans are propelled by outboard engines with long shafts. There is a constant problem of maintenance, indicating a need for a different system of propulsion.

Beach seines are also employed using a net boat for net deployment. Hauling of the nylon or cotton nets is done by hand from the beach.

The fishermen are using a number of different makes of lamps from German, Chinese, Swiss and local sources. Improvements can be made to the lights to direct more of the light downwards at the surface of the water.

Technological Recommendations

To increase the catch rate of fish substantially, the following conditions need to be fulfilled:

Industrial type of fishing should be re-established and increased above pre-1974 levels.

Fish-finding operations using sonar and other methods (like long-term observations of fish migratory patterns) should be established.

The artisanal fishing equipment and operations should be modernized and standardized.

The training of mechanics to maintain boats and equipment should be organized.

A demonstration fishing unit should be constructed utilizing the most up-to-date equipment to tour all the artisanal fishing beaches to convince the fishermen of the advantages of innovative ideas.

For the immediate (two-year period) increase of fish catch rate in the Uvira-Baraka zone, the effectiveness of the available equipment must be improved. This should be done by help through the existing fishing cooperative, COOPELAZ.

The official report, being prepared by Dr. Gordon Hall of Auburn University who served as team leader, will incorporate these recommendations.

Publication -

Hall, Gordon E., Edmond Seay, Tadeus Kowalski, Luyeye Madimba, and Sokolua Lubanzadio. 1975. An evaluation of proposed U.S. AID project for improvement of Lake Tanganyika's fishery resources in Zaire. (Revised) Auburn, Alabama, International Center for Aquaculture, Auburn University.

Annex

VIII. B LDC Graduate Students at URI Involved In Marine Studies

Department	Student Name	Major Professor	Area of Study or Thesis Title
Animal Science	F. Orach-Meza (Uganda)	T. Meade	Population dynam study on selecte_ marine species
Chemistry	S. Y. Tang (R/China)	D. W. Brown	Marine-Related work, but not in connection with thesis
	P. Mukherji (India)	R. D. Gonzalez	Working with silica surfaces*
	S. C. R. Chen (R/China)	D. Rosie	Gas chromatography*
	A. Krstulovic (Yugoslavia)	D. Rosie	Thesis work in Sept. 1974*
	S. P. Lee (R/China)	C. W. Brown	Infrared spectra of petroleum hydrocarbons in seawater
Electrical Engineering	R. Rao (India)	C. Polk	Marine-related (underwater acoustic) signal processing
Fisheries & Marine Technology	R. Stone (Fiji)	J. Sainsbury	Use of ferrocement technique for artisanal fishery boats
Food and Nutritional Science	Li-Dong Grace Chang (R/China)	S. Constantinides	Enzymatic blackening in crustaceans
	Sudip Jhaveri (India)	S. Constantinides	Chemical composition of marine species
	Pavlos Karakoltsidis (Greece)	S. Constantinides	Utilization of minced mixed flesh from underutilized species
	Suh-Ling Cindy Chen (R/China)	S. Constantinides	Effect of processing on nutrient losses of seafood
	Wei-Ching Eileen Hao (R/China)	S. Constantinides	Utilization of under-

*Work may have marine applications

Department	Student Name	Major Professor	Area of Study or Thesis Title
Food and Nutritional Science (cont'd)	Dr. Soliman Shenouda (postdoctoral) (Egypt)	S. Constantinides	Product development from underutilized marine species
Food and Resource Chemistry	M. Caurie (Ghana) (Awarded Ph.D. in 6/75)	M. Salomon	Improvement in the technology of traditional hot fish smoking
	A. Cheng (R/China)	C. O. Chichester	Effect of age on the utilization of protein (including marine protein)
	T. Chen (R/China)	T.-C. Lee	Effect of processing variables on the nutritive quality of food products produced by extrusion cooking (including marine food products)
	C. Lee (Korea) (Awarded Ph.D. in 1/75)	C. O. Chichester	Physiological consequences of non-enzymatically browned food (previous work done on the use of squid to make protein concentrate)
	H. Mayorga (Guatemala)	C. O. Chichester	The use of cottonseed protein to make a cheese-like product (extension of this product will be in the area of using marine protein to make a cheese-like product)
	D. Thannanunkul (Thailand)	T.-C. Lee	The use of indigenous proteins of Thailand-including marine proteins-to develop new food products
	J. Kuo (R/China) (Awarded M.S. in 1/75)	K. L. Simpson	Working on the utilization of crab waste as a protein and pigment source for trout and salmon
Marine Affairs Program	. Brussoni (Uruguay)	F. X. Cameron	The impact of offshore oil development

Department	Student Name	Major Professor	Area of Study or Thesis Title
Marine Affairs Program (cont'd)	S. M. Vallejo (Argentina)	F. X. Cameron	A planning model for coastal zone management-Jamestown Island case study
Mechanical Engineering and Applied Mathematics	Hsin-Pang Wang (R/China)	F. M. White	A layered finite element model of Block Island Sound
	Shuie-Jin Kuo (R/China)	F. M. White	Statistical analysis of breaking waves and their effect upon structures
Oceanography	A. Ahmed (Sudan)	R. A. Duce	Trace metals in seawater
	S. Akturk (Turkey)	J. Kennett	Geological oceanography
	M. Bhovichitra (Thailand)	E. Swift	Nitrogen metabolism of marine algae
	G. S. Kim (Korea)	J- G. Schilling	Geochemistry
	D. Lai (Hong Kong)	P. Richardson	Search for Gulf Stream rings in the western Sargasso Sea using modern data listings
	Y. J. Liang (R/China)	D. Kester	Chemical oxidation-reduction processes in the marine environment
	P.-T. Shaw (Korea)	D. R. Watts	Physical oceanography
	C. Shen (R/China)	M. Stern	Geophysical oceanography
	M. Tapia (Spain)	J-G. Schilling	Geochemistry of submarine and subaerial rocks from the Azores region
	T-C. Teng (R/China)	T. Smayda	Ecological studies of marine planktonic diatom Asterionella japonica

Department	Student Name	Major Professor	Area of Study or Thesis Title
Oceanography (cont'd)	C. Unni (India)	J-G. Schilling	Geochemistry of Cl and Br in basalts from the Iceland-Reykjanes Ridge System and Hawaii
Pharmacognosy	F. M. Soliman (Egypt)	H. W. Youngken	Microbiological transformation of marine fucosterols
Resource Economics	L. Adriasola (Chile)	H. C. Lampe	A multi-period location analysis for fish food processing facilities in Chile

Annex II

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Annex III

The Center Associates

Lewis M. Alexander, Professor of Geography & Director, Master of Marine Affairs Program

Clinton O. Chichester, Professor of Food & Resource Chemistry and Executive Chairman, Consortium for the Development of Technology

Spiros M. Constantinides, Professor of Food & Nutritional Science and Biochemistry

Joel B. Dirlam, Professor of Economics and Resource Economics

Gerald A. Donovan, Dean of the College of Resource Development and Director, International Center for Marine Resource Development

Thomas S. Estes, Assistant Director, International Center for Marine Resource Development

Howard H. Foster, Jr., Associate Professor of Community Planning & Area Development

John K. Gamble, Assistant Professor of Marine Affairs and Director, Law of the Sea Institute

John M. Gates, Assistant Professor of Resource Economics

James J. Griffin, Project Manager, Graduate School of Oceanography

Andreas A. Holmsen, Professor of Resource Economics

Darrell L. Hueth, Associate Professor and Chairman, Department of Resource Economics

John A. Knauss, Dean of the Graduate School of Oceanography and Provost for Marine Affairs

Harlan C. Lampe, Professor of Resource Economics

Tung-Ching Lee, Associate Professor of Food & Resource Chemistry

Nelson Marshall, Professor of Oceanography and Marine Affairs

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

Foster H. Middleton, Professor of Ocean Engineering

Virgil J. Norton, Professor of Resource Economics and Economics

Candace Oviatt, Research Associate, Graduate School of Oceanography

John J. Poggie, Jr., Professor of Anthropology

Richard B. Pollnac, Associate Professor of Anthropology

Saul B. Saila, Professor of Oceanography and Zoology and Chief Scientist, Division of Marine Resources

John C. Sainsbury, Professor of Fisheries & Marine Technology and Chairman of the Department

Milton Salomon, Professor of Food & Resource Chemistry

C. Robert Shoop, Professor of Zoology

Kenneth L. Simpson, Professor of Food & Resource Chemistry

Irving A. Spaulding, Professor of Resource Economics and Rural Sociology

Thomas F. Weaver, Assistant Professor of Resource Economics