OFFICE OF SEA GRANT

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EXECUTIVE SUMMARY

Subject-Area Assessment Reports

of

Sea Grant Activities

for

Fiscal Year 1979

This volume documents individual assessment of the various categories of activities supported by SG during FY79. Each report is authored separately by the individual carrying responsibility for stewardship of the subject area(s) covered. Level of effort, areas of emphasis, trends, and highlights in each discipline are addressed.

REPORT ABSTRACTS

Marine Advisory Service

MAS helps industries, communities, and citizens use knowledge to solve problems related to the marine and Great Lakes environment. There are now 30 MAS programs, one in each of the coastal states except Indiana, Illinois, and Pennsylvania. The most recent trend is toward the employment of specialists to augment the marine agent staff with needed strength in key subject areas. The majority of MAS programs receive more than one-third of their funding from non-federal sources ($9.2 million vs. $5.8 million) -- solid evidence of substantial local, state, and industrial support.

Education and Training

The target audience for Sea Grant education and training activities is wide -- from graduate school to kindergarten. Higher education projects aim to develop personnel with skills to ensure the wise use of the marine environment. Emphasis this year has been in pre-college education, to infuse marine affairs into all discipline areas, at all levels, toward the goal of creating a marine literate populace. Excluding International Cooperation grants, funding for education and training in FY79 was $2.9 million. This represents a downward trend for the past three fiscal years. Some $0.9 million was devoted to international projects.

During FY79, Sea Grant activities helped to sensitize other federal education agencies to the need to support marine education. Most significantly, a Marine Education Unit was established in the U.S. Office of Education. This makes FY80 an appropriate time to stress efforts to develop marine education for the general public by emphasizing K-12 projects, in-service and pre-service teacher training, and graduate level training for planners and implementors of marine education on statewide bases.

Marine Transportation Systems

In FY79, Sea Grant supported eleven research projects in this field. Grants totaled $230,300; matching funds were $85,600. This was an increase over FY78, and indications are that FY80 will show a further increase. A typical project investigated the risks involved because of traffic density in Puget Sound. Other projects look at the advisability of widening ship channels.

Fisheries

Fisheries in the Sea Grant Program embraces activities in economics, engineering, and law, as well as fisheries categories per se. Projects directly related to fisheries range from studies of life histories to environmental interactions and pathology. In all some $4.7 million with $2.8 million match are directed toward fisheries.

There were 18% more fisheries projects in FY79 than in FY78, while funding increased by 37%. The largest increases were in general fish biology, population dynamics, and environmental interactions. These are the research areas which contribute most to our understanding of any species, what its potential is for extended harvest, and what effect that harvest might have on the species and on other species in its food chain. Research of this type is expected to continue in importance for some time.

Animal Aquaculture

Sea Grant is the major supporter of research in marine animal aquaculture. In FY79 there were 85 projects funded at $3.2 million in federal and $2.9 million in matching non-federal dollars. Main efforts continued to be on marine shrimp, freshwater prawn, American lobster, and oysters. In addition, small projects examined the potential of culturing bait worms, leeches, frogs, hard clams, manila clams, and mussels.

Research toward development of commercially viable aquaculture industries has had some successes. A viable oyster and mussel industry is now operating in Maine; freshwater prawns are commercially cultured in Hawaii; salmon culture industries are found in Oregon and Washington; and the research conducted on marine shrimp has led to successful shrimp farms in such countries as Costa Rica and Panama.

Plant Aquaculture

This subject area includes the culture of marine or salt-tolerant plants for human use, for commercially important products, including energy, or for the purpose of resource enhancement or conservation.

Over the last decade Sea Grant has been a primary source of funding for plant aquaculture research. There are now two commercial algae farms in operation -- supported in large part by Sea Grant research. In FY79 Sea Grant federal funds of $405,000 were awarded to five universities for ten projects. This was matched by $289,000 from non-federal sources including industry.

Ocean Engineering

In FY79 106 projects were supported in ocean engineering or engineering-related subjects at 22 institutions at a level of $3.2 million with $1.7 million matching. Disappointingly few Sea Grant institutions have attracted the interest and participation of their engineering facilities. When the most creative faculty members can be induced to turn their attention to ocean development and its problems, then we might expect an increase of projects in what MIT calls "Technology Development for Ocean Uses."

Encouraging signs include the efforts by LSU to develop a biofouling and corrosion group and cooperation with the MIT Marine Industry Collegium. The Department of Naval Architecture and Marine Engineering at the University of Michigan had several projects this past year; and Oregon State University and the University of Washington have consistently presented strong efforts in civil engineering and acoustics for fishery assessment respectively.

Engineering education projects were perhaps the most encouraging, because this category has increased significantly in the past year. This may well act as a catalyst for future research within some of the university programs.

Social Science

The social sciences, broadly conceived, were recognized to have a vital role in the Sea Grant concept since its inception. A review of funding and publication data for 1974-78 suggests that the place of the social sciences in the overall program has changed little. Research support has fluctuated between 10 and 13 percent, and level funding has obtained against inflation. Projects relating to coastal zone law and management have decreased in number, while support remains relatively constant for projects in international law, related law projects, and recreation research.

An examination of how the social sciences have been brought into the Sea Grant Program suggests shortcomings. Individuals instrumental in developing and administering the programs have come largely from backgrounds in the natural and physical sciences. To the extent that their trained perspectives limit appreciation of social sciences as "sciences," there is a shortfall in realizing their contribution to Sea Grant objectives. Until recently the review process itself neglected to include appropriate social sciences.

This report concludes that social scientists must take the initiative in demonstrating they have a contribution to make to the Sea Grant mission, e.g., in identification of the values at issue in marine affairs, formulation of better policies and planning, and in training individuals competent in ocean affairs.

Marine Minerals and Physical Processes

The report in this subject area provides a listing of over 70 projects, funded at $3,482,038 with $1,121,960 match. Seven address extraction and assessment questions related to marine minerals. The remainder are investigations of oceanographic and physical processes as they related to improved understanding of erosion, circulation, sediment transport, prediction techniques, economic impacts, and engineering design of structures in the marine environment. Embodied also are activities oriented toward data management and acquisition. This includes the establishment of data banks, the preparation of atlases, and the development of new measurement techniques and methodologies. The most significant effort in this category is the continuing Nearshore Sediment Transport Study, a coordinated multi-institutional National Project funded at approximately $1,000,000 annually.

Marine Economics

Twenty Sea Grant programs employing economists in research or advisory capacities direct $1.7 million with $0.8 match toward marine economics. Current efforts are heavily weighted toward traditional issues in fisheries management and development, with smaller efforts in aquaculture, marine recreation, coastal zone resources, marine minerals and energy, marine transportation, and marine pollution.

Next year Sea Grant directors will be encouraged to try to attract economists and other social scientists into their programs, perhaps in new areas of inquiry not traditionally supported by Sea Grant.

Ocean and Coastal Law

"Law" projects must be broadly defined because legal analysis cuts across social, political, and management issues. There were 36 projects in FY79 which related to a large extent on legal analysis. The current funding level of $961,000 and $850,000 match for legal projects is an increase of 80 percent since FY77, but much of this increase has been due to greater non-federal matching funds. Recent projects show a broadening of legal analysis into areas such as pollution, environmental modeling, and transportation. No projects, however, are funded to study important interfaces between economics and the law.

Sea Grant will continue to encourage a balance between national and state oriented legal projects, that legal advisory services be careful not to play an advocacy role, and that legal researchers be encouraged to demonstrate the importance of their research and advisory service within local Sea Grant programs. Affirmative action in law programs will also be stressed.

International Cooperation Assistance Program

The primary goals of Sea Grant's International Cooperation Assistance Program (ICAP) are to enhance the marine research and development capabilities of developing countries and to promote the international exchange of marine information and data. Grants are made to U.S. universities to support cooperative projects involving U.S. universities and their counterparts in developing countries. These cooperative projects presently emphasize education and training.

During the second year of ICAP, grants totalling $900,000 were awarded to seven universities. Four of these grants were for support of new projects, while three of them were for continued support of projects which had been started in ICAP's first year. At this time ICAP has eleven projects underway in most regions of the developing world. There are as yet no projects in tropical Africa.

Energy-Related Activities

Energy-related research totals $410,500 in federal funds, with non-federal matching of $168,500. Included in this total are 15 projects in five categories: two in power conversion, six in environmental research, two in power plants impacts, three in exploration and production, and two in the social sciences.

Sea Grant's role will continue to be small compared, to that of the Department of Energy's Ocean Systems Branch, the main Federal supporter in this field with its FY80 budget of $44 million. Still, the network of institutions should be alert to opportunities for contributions that are appropriate for universities and provide program balance.

Underseas Research

Twenty-one projects at eight academic institutions dealt with remote sensors and vehicles, human diver physiology and technology, submersibles, and education in underwater methodology. Approximately 38 projects at thirteen institutions used SCUBA and/or submersibles as tools to carry out their research.

The strength of Sea Grant's underseas research lies in physiology-safety investigations which are carried out by top ranking scientists who are doing, timely, relevant, and highly visible work.

Environmental Studies

The program in marine environmental research for FY79 consisted of 164 projects supported by $4.7 million in Sea Grant funds and $2.6 million in non-federal matching funds. These projects can be broken into four categories: ecological research (70 projects), pollution applied research (73 projects), modeling research (14 projects), and applied oceanography (7 projects). All 26 of the Sea Grant College, institutional, and coherent area programs were involved in this research.

There is a new recognition of the importance of more directed research among marine scientists, with the result that better investigators are being attracted to the effort. Sea Grant directors are more willing to focus enough resources on a specific problem to produce useful answers in a reasonable length of time. About one-third of Sea Grant environmental projects are now part of an organized larger effort, though the degree of organization varies widely. Thus, Sea Grant sponsored environmental research is in a better position than ever to contribute to solutions of the problems of development and conservation of marine resources.

Marine Natural Products

Research on marine natural products totalling $711,000 with $389,000 match is divided into two groups -- studies directed toward uses for chitin, a waste product from the processing of crustacean shellfish, and studies to discover novel biochemicals whose biological properties make them of potential use in medicine, medical research, and agriculture.

Drugs for treatment of human illnesses have traditionally come from nature, primarily from terrestrial plants. Inability to synthesize drugs to cure specific diseases makes it certain that nature will continue to be the main source of new medicines or, at least, the inspiration for synthesis of drugs that are chemical analogues of natural bioactive compounds. The sea harbors many types of plants and animals which have no close relatives on land. It thereby represents a huge, relatively untapped source of new natural products, few of which have been evaluated pharmacologically or tested for toxicity.

Seafood Science and Technology

The U.S. trails several European and Asian nations in the science and practice of seafood processing. This technological inferiority is becoming more significant as the fishing industry attempts to harvest and process resources formerly taken by foreign fishing fleets. Along with the opportunities and problems offered by the Fisheries Conservation and Management Act of 1976, the seafood industry faces ever more stringent

restrictions on disposal of wastes and on quality of effluents. These complex issues regarding efficient, competitive, and environmentally sound uses of fisheries resources are compounded by concern about the microbial quality of nearshore waters, particularly in shellfishing areas.

Federal plus non-federal support of Sea Grant research in this field totals $1.4 million. Projects are divided into four main categories: (1) engineering and waste treatment, (2) produce development and by-product recovery, (3) microbial and nutritional quality, and (4) handling and processing.

Public Affairs

Public affairs activities in the past year centered on the promotion of broader public understanding, improved liaison within the Sea Grant network, and intensified internal communications. Major press interest continued on the subject of cold water drowning and on aquaculture; however, a number of other projects also won national attention. Two major publications, "The First Ten Years," and "University Curricula in the Marine Sciences and Related Fields," were widely distributed. "Sea Grant 70's" continued in operation at Virginia Polytechnic Institute and State University. A new internal publication, "Comings and Goings," was started.

Marine Recreation

Recreation research has been very diverse, dealing with sport fishing, boating, safety, economic impacts, and facility planning. There were 14 projects in this area in FY79.

With the growing demand for marine recreational facilities and services, there will be an increasing need for research in planning and resource allocation.

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MARINE ADVISORY SERVICE FY 79

in

THE NATIONAL SEA GRANT COLLEGE PROGRAM

Naida M. Yolen

The Marine Advisory Service (MAS) is the dynamic outreach arm of the Sea Grant Program, and as the latter has evolved so has the advisory service concept. It is commonly recognized that the MAS function includes the informal education of marine audiences through the provision of technical advice and instruction, the identification and communication of user needs to researchers and managers, and the dissemination of research findings aimed at solving user problems. The methods used in attaining these objectives may include publications, conferences and seminars, mass media, and/or personalized extension services.

Although the subject matter may differ, advisory services within Sea Grant closely cooperate with the Cooperative Extension Service of the Department of Agriculture. Currently, the advisory services of 19 Sea Grant programs are closely aligned with the cooperative extension programs of those states (Appendix I).

Current Status

The elements under the Sea Grant Advisory Service umbrella can be categorized as: 1) Marine Advisory Programs and 2) Regional (multi-state) Marine Advisory Programs. The following is a brief discussion of the status of these two advisory service elements.

1. Marine Advisory Programs

"Advisory Service" was identified as a major component of Sea Grant in the National Sea Grant College and Program Act of 1966. As of FY 79, Sea Grant supports 30 marine advisory programs with a Federal funding total of $9,190,969 and $5,827,110 in matching funds.

The MAS is broken down into seven categories and is presented in the OSG proposal guidelines publications as follows:

VI. Advisory Services

A. Extension Programs

71. Extension Agent Services
72. Extension Course Programs
73. Extension Programs -- Other (specify)

B. Other Advisory Services

74. Conferences, Institutes, etc.
75. Public Education Programs
76. Publications, Audio Visuals, etc.
77. Advisory Services -- Other (specify)

The categories containing the participating SG institutions and their funding levels are listed in Appendix II.

Presently there is a MAS in every coastal and Great Lakes state except Indiana, Illinois, and Pennsylvania. Only two marine advisory programs (University of Puerto Rico and University of Connecticut) are not integrated with a comprehensive Sea Grant Program which, by definition, includes the three Sea Grant components of research, education, and advisory service.

Virginia and California each have two Sea Grant-supported advisory programs. Where two programs are present in a state, unique expertise and mutual communication and cooperation are factors which eliminate duplication of effort.

Although advisory service programs vary considerably in size, organization, and administration, they are similar in terms of philosophy and methods or techniques of operation. The advisory programs are oriented to addressing the needs of identified audiences with the common orientation of person-to-person (e.g. on-the-waterfront) communication. While there is no standardization in terms of personnel or job classifications, advisory programs include "specialists" and "field agents." Specialists tend to be responsible for particular subject areas on a state-wide basis with varying degrees of field contact. Field agents have more diverse subject area responsibility, are primarily given geographic responsibility, are located in coastal communities, and interact with specialists when particular expertise is needed. Both specialists and field agents are encouraged to utilize whatever technical or informational resources, both within and outside their parent organizations, that are necessary to meet audience needs.

From a nationwide perspective advisory service programs are involved in many subject areas in which Sea Grant supports research as well as in areas outside the current realm of Sea Grant research. Subject area diversity and emphasis varies from program to program. The broad subject

areas of emphasis nationwide are: commercial fishing and gear technology; seafood processing, marketing, and utilization; marine recreation; marine science education; aquaculture; marine transportation; coastal zone management; and marine mining.

Highlights of individual advisory service accomplishments are presented in Addendum I.

2. Regional Advisory Programs

There are currently (FY 79) three regional Sea Grant Advisory programs: Pacific Sea Grant Advisory Program (PASGAP), the New England Marine Advisory Service (NEMAS), and the Great Lakes Network (Appendix II). PASGAP is administered by a designated state advisory program which changes periodically. NEMAS is administered by a full-time individual who reports to a governing "board of directors" comprised of Sea Grant people and others from the region. The Great Lakes Network has been funded through each of the Great Lakes' institutions, but will change in FY 80 to the same administrative procedure as PASGAP. PASGAP, NEMAS, and the Great Lakes Network were created and are administered with the purpose of marshalling regional expertise to address identified regional needs and providing support to accomplish those projects through such means as talent exchange and regional training.

Discussion

The major emphasis of the Office of Sea Grant in terms of overall advisory service direction, guidance, and financial support is concentrated at the program level. Also the integration of the MAS subject elements (e.g. commercial fisheries, seafood technology, CZM, etc.) into a coherent National Sea Grant Program thrust depends to a great extent on the "health" of the individual Sea Grant advisory service programs.

Advisory service programs are a personnel-intensive component of Sea Grant support. The operation of an advisory service program that is recognized as credible and accepted as beneficial depends heavily on the availability of individuals on a continuing basis with the expertise appropriate for the program's areas of emphasis. This aspect of the advisory service programs provides valuable insights as to the past growth, present orientation, and future needs of Sea Grant advisory services.

The "core" of the MAS are the agents and specialists that implement the outreach dynamics of the program. They are essential components that extend the education and communication efforts to the community and brings the needs of the public and relevant Federal and State agencies to the attention of the scientists and administrators of the Sea Grant institution. The core personnel are viewed as primary and the least expendable to the success of any advisory service operation. Consequently, the MAS is programmatically broken down into: 1) Core Program; 2) Communications and Publications; 3) Education; and 4) Conference and Workshops. These are incorporated into the Office of Sea Grant (OSG) categories 71-77, in the proposal guidelines publication; 71-73 includes the core program and 74-77 includes the "other" advisory services (2-4).

There is a recent trend towards the hiring of "specialists" to augment the capability of the MAS by providing specific subject area knowledge that is relevant to the needs and problems of the region. An advisory service program is strengthened when an agent, who is usually a generalist, has a specialist available as a dynamic and focused information resource. In addition, there is a growing interaction between MAS personnel and academic researchers who are cooperating to help solve local marine-related problems as well as define them. More and more the scientists are turning to advisory people for assistance, and vice-versa. Thus the "feed-back" loop, formerly a weak element, is attaining primary status in MAS function.

The coordination of the MAS with other agencies -- Federal, State, industry, or otherwise -- has resulted in numerous benefits for them as well as the P.I.s: cost-sharing, talent-sharing, non-duplication of effort, and most recently, the opportunity to connect a scientist with a commercial operation that may eventually utilize the results of his research. This latter effort has been formally established via MIDAS at MIT and an industry/research liaison recently hired at the University of Delaware. Current emphasis on MAS/SG investigator communication between the Sea Grant programs in different states is also a significant advance in the evolution of the advisory service.

The expansion of the advisory service in Sea Grant as indicated by the growth in the advisory services portion of the Sea Grant budget is primarily due to increases in personnel and inflationary costs (Table I). There are currently 30 Sea Grant marine advisory programs with approximately 250 full-time equivalents in the advisory service network. While the original areas of emphasis of most programs were commercial fisheries and seafood processing, the expansion of effort into other subject areas has been accomplished through the addition of personnel afforded by Sea Grant's support. Future expansion of both

subject and geographic coverage will also be reflected in requests for additional personnel. Either cutbacks or increases in the budget of an advisory service program must be weighed in light of the effect on the quality of the program. Also, requests for additional personnel must be carefully evaluated due to the long term commitment implied by the funding of new positions.

Evaluation and Future Directions

The Marine Advisory Program is and will continue to be under evaluation by the Office of Sea Grant to insure advisory services keeps pace with Sea Grant objectives. It must be understood that state by state or institution by institution particular needs must be fulfilled in order to evaluate a program nationally.

One criterion for evaluation is the amount of matching support. This gives the Office of Sea Grant a good indication of constituency recognition and acceptance. Currently, the majority of advisory programs receive over ⅓ matching support. This reflects substantial local, State, and industry support.

Seeking other sources of funds, other than matching, is also important to future efforts, and pass-through funding from other Federal agencies has proven advantageous. In FY 79 $575,400 was awarded to MAS via pass-through monies. For example, the National Weather Service (NWS) financed an effective and highly visible Coastal Hazards Program in Florida, designed and implemented by a NWS employee and the SG/MAS director (U.Fla.). MAS programs are becoming increasingly aware that alternative funding sources exist, and OSG will encourage them to follow-up on these possibilities.

The advisory service proposals submitted to the Office of Sea Grant provide valuable information regarding the status of advisory programs. It is mandatory that each program spell out in detail their past accomplishments translated into benefits as well as future plans. The Office of Sea Grant will increase efforts to improve the informational content and overall quality of proposals in consort with the advisory programs.

Another factor that is considered in the evaluation of advisory programs is the extent to which available information and technical resources are utilized. The Office of Sea Grant is and will continue to encourage and assist advisory programs in looking beyond the resources of their parent institution.

In addition to the above, emphasis will be placed on strengthening the weaker programs of the national network and encouraging greater diversification of subject area coverage by the Marine Advisory Service.

A start in that direction has been to place appropriate MAS personnel on site teams at SG institutions where their experience, background, and advice would be most useful in helping a program. Likewise, new or less experienced MAS managers are assigned to site visits from which they could profit most.

In total, a MAS is interdisciplinary, systematic, apolitical, objective,personal, and responsive.

TABLE I.

MAS FUNDING

	SG DOLLARS	PERCENT OF TOTAL SG FUNDS	MATCHING FUNDS
FY 78	$7,936,557	25.7	$4,941,467
FY 79	$9,190,969	27.0	$5,827,110

SEA GRANT MARINE ADVISORY SERVICES
ASSOCIATED WITH COOPERATIVE EXTENSION

ALABAMA*	Mississippi-Alabama Sea Grant Consortium (Miss-Ala)
ALASKA	University of Alaska (UAK)
CALIFORNIA	University of California (UCA)
CONNECTICUT	University of Connecticut (UCONN)
FLORIDA	University of Florida (UFLA)
LOUISIANA	Louisiana State University (LSU)
MAINE	University of Maine/Orono (UMO)
MASSACHUSETTS	Massachusetts Institute of Technology (MIT)
MARYLAND	University of Maryland (UMD)
MICHIGAN	University of Michigan/Michigan State University (UMICH/MSU)
MINNESOTA	University of Minnesota (UMINN)
MISSISSIPPI*	Mississippi-Alabama Sea Grant Comsortium (Miss-Ala)
NEW JERSEY	Rutgers/New Jersey Marine Science Consortium (NJMSC)
NEW YORK	State University System of New York/Cornell (SUNY/Cornell)
OREGON	Oregon State University (ORESU)
PUERTO RICO	University of Puerto Rico (UPR)
SOUTH CAROLINA	South Carolina Sea Grant Program/Clemson (SC SG PGM/Clemson)
VIRGINIA	Virginia Polytechnic Institute and State University (VPI&SU)
TEXAS	Texas A&M University (TAMU)
WASHINGTON	University of Washington (UWASH)

*combined program

PROJECTS CLASSIFIED UNDER:
VI.ADVISORY SERVICES
A.EXTENSION PROGRAMS
71.EXTENSION AGENT SERVICES

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
ALASKA MARINE ADVISORY PROGRAM J.P. DOYLE UNIVERSITY OF ALASKA	$263,012	$355,639
MARINE ADVISORY PROGRAM M.W. CUMMINGS UNIVERSITY OF CALIFORNIA	$495,631	$249,555
MARINE ADVISORY SERVICES STUART A. ROSS/JAMES A. FAWCETT/SHIRLEY HUDGINS UNIVERSITY OF SOUTHERN CALIFORNIA	$102,266	$133,833
SEA GRANT ADVISORY SERVICES PROGRAM GEORGE S. GEER UNIVERSITY OF CONNECTICUT	$93,900	$47,300
MARINE ADVISORY SERVICE-ADMINISTRATION C. THOROUGHGOOD UNIVERSITY OF DELAWARE	$20,681	
MARINE ADVISORY SERVICE - MARINE RESOURCE DEVELOPMENT TO BE NAMED UNIVERSITY OF DELAWARE	$24,039	
MARINE ADVISORY SERVICE - INDUSTRY/RESEARCH INTERACTION R. WAGNER UNIVERSITY OF DELAWARE	$19,395	$22,348
MARINE ADVISORY SERVICE - MARINE EDUCATION AND AWARENESS W. HALL UNIVERSITY OF DELAWARE	$26,535	$1,463

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
MARINE ADVISORY SERVICE - FOOD FROM THE SEA H. SEYMOUR UNIVERSITY OF DELAWARE	$31,036	$1,463
MARINE ADVISORY SERVICE - RECREATION AND TOURISM J. FALK UNIVERSITY OF DELAWARE	$24,815	$1,463
ADVISORY SERVICES: GENERAL WAYNE A. BOUGH UNIVERSITY OF GEORGIA	$222,100	$270,100
MARINE ADVISORY PROGRAM PAUL A. PRATTE UNIVERSITY OF HAWAII	$350,000	$81,967
WESTERN PACIFIC MARINE ADVISORY PROGRAM PAUL A. PRATTE UNIVERSITY OF HAWAII	$49,714	$6,510
MARINE ADVISORY SERVICES IN COOPERATIVE EXTENSION J.F. FOWLER LOUISIANA STATE UNIVERSITY	$159,588	$126,790
UMO MARINE ADVISORY SERVICES R.K. DEARBORN UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$184,711	$41,344
UNH MARINE ADVISORY PROGRAM BRUCE A. MILLER UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$125,964	$37,472
MARINE ADVISORY PROGRAM ANTHONY MAZZACCARO UNIVERSITY OF MARYLAND	$180,000	$122,800

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
MASSACHUSETTS MARINE LIASION SERVICE ARTHUR B. CLIFTON MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$46,800	$24,508
MARINE INDUSTRY ADVISORY SERVICES (MIDAS) N. DOELLING MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$82,900	$69,946
MITSG/CES MARINE EXTENSION SERVICE A.B.CLIFTON MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$67,900	$43,900
UNIVERSITY RESEARCH IN OCEAN ENGINEERING-SOURCES AND RESOURCES NORMAN DOELLING MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$24,000	
SUPPLEMENT TO MARINE ADVISORY SERVICE: MICHIGANS CLIMATIC ASSESSMENT OF LAKE MICHIGANS SHORELINE TOURIST INDUSTRY F. DICE UNIVERSITY OF MICHIGAN	$3,400	
MARINE ADVISORY SERVICE E.F. DICE UNIVERSITY OF MICHIGAN	$232,555	$138,071
MINNESOTA SEA GRANT EXTENSION PROGRAM DALE BAKER UNIVERSITY OF MINNESOTA	$120,106	$62,571
MISSISSIPPI SEA GRANT ADVISORY SERVICES PROGRAM C. VEAL MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM	$102,860	$51,430
ALABAMA SEA GRANT ADVISORY SERVICES PROGRAM R. MCCORD MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM	$66,356	$61,144

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
MARINE ADVISORY SERVICES B.J. COPELAND UNIVERSITY OF NORTH CAROLINA	$244,973	$156,374
EXTENSION MARINE ADVISORY PROGRAM/OREGON K. HILDERBRAND OREGON STATE UNIVERSITY	$125,000	$241,800
EXTENSION MARINE ADVISORY PROGRAM K. HILDERBRAND OREGON STATE UNIVERSITY	$336,000	$253,600
MARINE ADVISORY SERVICES/TAMU WALLACE G. KLUSSMANN TEXAS A&M UNIVERSITY	$380,000	$451,671
WASHINGTON MAP PROJECT - MARINE ECONOMICS; AQUACULTURE. SHELLFISH; PROGRAM MANAGEMENT AND FIELD SUPPORT (DMR, U.W.) ROBERT E. HARRIS UNIVERSITY OF WASHINGTON	$257,900	$40,700
WASHINGTON MAP PROJECT - COASTAL MANAGEMENT (COASTAL RESOURCES PROGRAM, INSTITUTE FOR MARINE STUDIES, U.W.) ROBERT F. GOODWIN UNIVERSITY OF WASHINGTON	$47,800	$17,100
WASHINGTON MAP PROJECT - SEAFOOD PROCESSING (INSTITUTE FOR FODD SCIENCE AND TECHNOLOGY, U.W.) JACK MATCHES UNIVERSITY OF WASHINGTON	$47,000	$20,000
WASHINGTON MAP PROJECT - SOUTH SOUND (COMMERCIAL FISHERMEN) (CLOVER PARK VOCATIONAL - TECHNICAL INSTITUTE) JOHN WILSON UNIVERSITY OF WASHINGTON	$28,800	$20,900
WASHINGTON MAP PROJECT - COAST (WSU COOPERATIVE EXTENSION - GRAYS HARBOR AND PACIFIC COUNTIES) THOMAS R. QUANN UNIVERSITY OF WASHINGTON	$42,100	$28,300

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
COLUMBIA MAP PROJECT (WSU COOPERATIVE EXTENSION - PULLMAN) ARLEN DAVISON UNIVERSITY OF WASHINGTON	$45,600	$27,200
WASHINGTON MAP PROJECT - NORTH SOUND (BELLINGHAM VOCATIONAL-TECHNICAL INSTITUTE SAMUEL LEATHERS UNIVERSITY OF WASHINGTON	$26,300	$29,100
SEA GRANT ADVISORY SERVICES FIELD AGENTS AND ACTIVITIES GENE WOOCK UNIVERSITY OF WISCONSIN	$156,392	$62,754
FOOD SCIENCE AND FISH PROGRAM DAVID A. STUIBER UNIVERSITY OF WISCONSIN	$38,591	$17,154
UNIVERSITY OF PUERTO RICO MARINE ADVISORY SERVICE PROGRAM ALIDA ORTIZ-SOTOMAYOR UNIVERSITY OF PUERTO RICO	$89,900	$60,140

PROJECTS CLASSIFIED UNDER:
VI.ADVISORY SERVICES
A.EXTENSION PROGRAMS
72.EXTENSION COURSE PROGRAMS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
COMMERCIAL FISHERMEN JAMES A. MCGEE UNIVERSITY OF NORTH CAROLINA	$29,080	$15,964

PROJECTS CLASSIFIED UNDER:
VI.ADVISORY SERVICES
A.EXTENSION PROGRAMS
73.EXTENSION PROGRAMS - OTHER

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
A MARINE PUBLIC EDUCATION PROGRAM FOR NEW HAMPSHIRE AND SOUTHERN MAINE BRUCE A. MILLER UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$38,700	$30,600
MARINE FISHERIES EXTENSION SERVICE KENNETH A. HONEY UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$75,000	$37,500
MINNESOTA SEA GRANT EXTENSION PROGRAM DALE BAKER UNIVERSITY OF MINNESOTA	$129,864	$94,375
ADVISORY SERVICES EFFORTS ON CRITICAL ISSUES OF THE NEW YORK BIGHT B.T. WILKINS STATE UNIVERSITY OF NEW YORK, CORNELL	$31,100	$10,445
LAKE ERIE RECREATION CLIMATE BROCHURE MICHAEL W. DUTTWEILER STATE UNIVERSITY OF NEW YORK, CORNELL	$2,000	
DEVELOPMENT OF THE OHIO SEA GRANT EXTENSION PROGRAM JEFFREY M. REUTTER OHIO STATE UNIVERSITY	$47,500	$19,500
MARINE ADVISORY SERVICE SARA S. CALLAHAN UNIVERSITY OF RHODE ISLAND	$380,000	$168,025
EXTENSION MARINE ADVISORY PROGRAM WAYNE O DELL SOUTH CAROLINA SEA GRANT CONSORTIUM	$85,000	$83,900

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
MARINE ADVISORY PROGRAM W.D. DUPAUL VIRGINIA INSTITUTE OF MARINE SCIENCE	$188,800	$133,304
VIRGINIA POLYTECHNIC INSTITUE AND STATE UNIVERSITY MARINE ADVISORY SEA GRANT PROJECT PROPOSAL GEORGE J. FLICK VIRGINIA POLYTECHNIC INSTITUTE	$94,800	$71,100

PROJECTS CLASSIFIED UNDER:
VI.ADVISORY SERVICES
B.OTHER ADVISORY SERVICES
74.CONFERENCES, INSTITUTES, ETC

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
ECOSYSTEM RESEARCH WORKSHOP JOHN W. DAY/JAMES G. GOSSELINK LOUISIANA STATE UNIVERSITY	$20,800	$3,465
1979 NATIONAL SEA GRANT COMMUNICATORS WORKSHOP: THE WASHINGTON CONNECTION MICHAEL W. FINCHAM UNIVERSITY OF MARYLAND	$8,800	
MARINE GEOLOGY IN THE NEXT DECADE DAVID A. ROSS WOODS HOLE OCEANOGRAPHIC INSTITUTION	$17,900	
SUPPORT FOA A MESA SYMPOSIUM ON ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS D.F. SQUIRES STATE UNIVERSITY OF NEW YORK, CORNELL	$26,700	
CONFERENCE ON STATE & INTERSTATE FISHERY JURISDICTION JOHN T. PITTMAN NORTH CAROLINA STATE DEPT. OF ADMIN.	$5,500	$3,864
CENTER FOR OCEAN MANAGEMENT STUDIES VIRGINIA TIPPIE UNIVERSITY OF RHODE ISLAND	$20,000	$62,393
GORDON CONFERENCE ON MARINE NATURAL PRODUCTS FRANCIS J. SCHMITZ GORDON RESEARCH CONFERENCE,U.R.I.	$3,200	$5,500

PROJECTS CLASSIFIED UNDER:
VI.ADVISORY SERVICES
B.OTHER ADVISORY SERVICES
75.PUBLIC EDUCATION PROGRAMS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
PUBLIC INFORMATION SERVICES AND PUBLICATIONS B.R. MELTEFF UNIVERSITY OF ALASKA	$145,916	$92,621
OCEAN EDUCATION FOR THE PUBLIC D.W. WILKIE/D. COON/W.T. DOYLE/M.S. FOSTER UNIVERSITY OF CALIFORNIA	$28,835	$82,311
FLORIDA 4-H MARINE EDUCATION PROGRAM T.C. GREENWALT STATE UNIVERSITY SYSTEM OF FLORIDA	$34,200	$62,100
MARINE YOUTH EDUCATION PROJECT, ECOLOGY VILLAGE, GATEWAY NATIONAL PARK D.F. SQUIRES STATE UNIVERSITY OF NEW YORK, CORNELL	$20,000	
SEA SEARCH - TELEVISION PROGRAMMING LUCILLE FULLER UNIVERSITY OF WASHINGTON	$21,400	$28,300
EARTHWATCH PUBLIC SERVICE RADIO PROGRAM AND NEWSPAPER COLUMN LINDA WEIMER UNIVERSITY OF WISCONSIN	$19,918	$12,649

PROJECTS CLASSIFIED UNDER:
VI.ADVISORY SERVICES
B.OTHER ADVISORY SERVICES
76.PUBLICATIONS, AUDIO VISUALS, ETC.

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
COMMUNICATIONS, PUBLICATIONS, AND PUBLIC ADVISORY SERVICES JAMES J. SULLIVAN UNIVERSITY OF CALIFORNIA	$129,749	$29,981
MARINE ADVISORY SERVICE - PUBLIC INFORMATION K. DANBERG UNIVERSITY OF DELAWARE	$97,257	
COMMUNICATIONS PROGRAM REITA RIVERS UNIVERSITY OF GEORGIA	$39,100	$20,300
THE PUBLICATIONS PROGRAM ROSE T. PFUND UNIVERSITY OF HAWAII	$101,221	$27,021
PUBLICATIONS AMD INFORMATION DISSEMINATION R.E. BECKER LOUISIANA STATE UNIVERSITY	$66,235	$95,398
COMMUNICATIONS L. LIN UNIVERSITY OF MICHIGAN	$122,123	$17,796
PREPARATION OF CITIZENS GUIDE TO U.S. BARRIER ISLANDS ORRIN H. PILKEY UNIVERSITY OF NORTH CAROLINA	$90,000	
PROGRAM COMMUNICATIONS B.J. COPELAND UNIVERSITY OF NORTH CAROLINA	$78,211	$26,910

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
PUBLICATION AND DISTRIBUTION OF THE FISHES OF OHIO,2ND EDITION BY MILTON B. TRAUTMAN CHARLES E. HERDENDORF OHIO STATE UNIVERSITY	$12,000	
A PROPOSAL FOR SUPPORT OF CURRENT AND NEW ACTIVITIES BY THE NATIONAL SEA GRANT DEPOSITORY BETTY M. EDEL UNIVERSITY OF RHODE ISLAND	$105,000	
COASTAL OCEANOGRAPHY AND CLIMATOLOGY NEWS VIRGINIA K. TIPPIE UNIVERSITY OF RHODE ISLAND	$24,000	
MARINE INFORMATION SERVICES/TAMU LAURA B. COLUNGA TEXAS A&M UNIVERSITY	$125,000	$89,640
SEA GRANT 70S MARY HOLLIMAN VIRGINIA POLYTECHNIC INSTITUTE	$72,250	
COMMUNICATIONS PROGRAM - DISTRIBUTION AND REFERENCE SERVICES PATRICIA PEYTON UNIVERSITY OF WASHINGTON	$35,200	
COMMUNICATIONS PROGRAM - COMMUNICATIONS COORDINATION PATRICIA PEYTON UNIVERSITY OF WASHINGTON	$13,800	
COMMUNICATIONS PROGRAM - PUBLICATION PROGRAM PATRICIA PEYTON UNIVERSITY OF WASHINGTON	$48,900	
COMMUNCIATIONS PROGRAM - PUBLIC INFORMATION PROGRAM PATRICIA PEYTON UNIVERSITY OF WASHINGTON	$41,700	

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
PUGET SOUND PUBLICATION SERIES ALYN C. DUXBURY UNIVERSITY OF WASHINGTON	$225,700	
SEA GRANT COMMUNICATIONS LINDA WEIMER UNIVERSITY OF WISCONSIN	$95,515	$59,628

PROJECTS CLASSIFIED UNDER:
VI.ADVISORY SERVICES
B.OTHER ADVISORY SERVICES
77.ADVISORY SERVICES - OTHER

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
PASGAP PHASE VII D.H. ROSENBERG UNIVERSITY OF ALASKA	$58,500	
MARINE ADVISORY PROGRAM JOHN T WOESTE STATE UNIVERSITY SYSTEM OF FLORIDA	$451,200	$486,800
LEGAL ADVISORY SERVICE JOSEPH T. BOCKRATH LOUISIANA STATE UNIVERSITY	$79,159	$6,890
MARINE ASSISTANCE SERVICE DAVID ROSS WOODS HOLE OCEANOGRAPHIC INSTITUTION	$17,500	
GREAT LAKES INFORMATION CENTER A M BEETON & LEE BOTTS UNIVERSITY OF MICHIGAN	$67,300	$33,652
GREAT LAKES SEA GRANT NETWORK/MINNESOTA WARREN IBELE UNIVERSITY OF MINNESOTA	$6,000	$3,370
NEW ENGLAND MARINE ADVISORY SERVICE JOHN K. HUTCHINSON UNIVERSITY OF NEW HAMPSHIRE	$65,000	$37,400
NEW ENGLAND MARINE ADVISORY SERVICE JOHN K. HUTCHINSON UNIVERSITY OF NEW HAMPSHIRE	$58,100	$29,873

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
NORTHEAST REGIONAL COASTAL INFORMATION CENTER (NERCIC) CHARLENE QUINN DUNN UNIVERSITY OF NEW HAMPSHIRE	$75,000	$18,750
NEW JERSEY MARINE ADVISORY SERVICE JAMES MURRAY NEW JERSEY MARINE SCIENCES CONSORTIUM	$108,200	$65,800
ADVISORY SERVICE: NEW YORK SEA GRANT INSTITUTE MICHAEL W. DUTTWEILER STATE UNIVERSITY OF NEW YORK, CORNELL	$526,400	$238,969
DEVELOPMENT OF A COASTAL STRUCTURES CONSTRUCTION MANUAL FRED KULNAWY STATE UNIVERSITY OF NEW YORK, CORNELL	$16,626	$22,424
ADVISORY SERVICES EFFORTS ON CRITICAL ISSUES OF THE NEW YORK BIGHT B.T. WILKINS STATE UNIVERSITY OF NEW YORK, CORNELL	$10,000	$5,881
NORTHWEST COASTAL INFORMATION CENTER R. HOLTON OREGON STATE UNIVERSITY	$75,000	$31,400
SEAFOOD SCIENCE RESEARCH RESULTS APPLICATION AND INFORMATION TRANSFER D.L. CRAWFORD OREGON STATE UNIVERSITY	$23,700	$43,600
DEVELOPMENT OF PROTOTYPE DATA DISTRIBUTION NETWORK D.A. EVANS/M.P. LYNCH VIRGINIA INSTITUTE OF MARINE SCIENCE	$8,100	
DEVELOPMENT OF PROTOTYPE DATA DISTRIBUTION NETWORK D.A. EVANS/M.P.LYNCH VIRGINIA INSTITUTE OF MARINE SCIENCE	$20,000	

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
ADVISORY SERVICES DIRECTORS OFFICE GREGORY D. HEDDEN UNIVERSITY OF WISCONSIN	$92,490	$49,746

MAS HIGHLIGHTS

WEST COAST

University of Alaska

The MAS assisted in the development of a seafood processing sanitation system which was instituted in 10 Alaska plants and also worked with industry to formulate the first plan for a hard shell clam fishery that was found acceptable by both industry and regulatory agencies.

University of Washington

For several years Washington Sea Grant has supported Bellingham Vocational-Technical Institute (BVTI) in developing a prototype major evening program of marine short courses. This has been very successful, and "Marine Short Courses: a Notebook" has just been published to make BVTI's "how to" information and lesson plans available to other Sea Grant programs.

Oregon State University

ORESU MAS and NASA are involved in a two-year joint effort to determine the best way to provide salmon and coastal fishermen with weather information that they may need to decide when and where to go fishing. The sea-level weather information is obtained from a satellite.

University of California

An unusual and far-reaching affirmative action effort at U.Cal was the production in seven Asian languages of a summary of California

tidepool life protecting regulations. This was produced by area marine advisors for the benefit of the many Asian immigrants now in the state who are accustomed to foraging beaches but unfamiliar with protective regulations for marine life. Translations were obtained from the Long Beach Asian Family Outreach Center and 20,000 copies of the pamphlet were distributed through Asian Refugee Assistance Centers throughout California.

University of Southern California

The USC Marine Advisory Service produced the first publicly available comprehensive review of the regulatory procedures of the California Coastal Commission. Intended for land developers, architects, lawyers, and public officials, the monograph contains extensive legal citations and a large removable flow diagram. Prepared by MAS agents at USC and UCal.

In addition, the USC MAS published the first national directory of Sea Grant projects intended for media personnel -- summarizing the most policy-relevant projects of each Sea Grant program and giving the name and phone number of the Sea Grant communicator. To be used by media personnel either in pursuring general interest stories or in following up on marine-related new items.

University of Hawaii

The MAS program at Hawaii has a cooperative and highly successful program with the Department of Education to instruct teachers in drownproofing techniques.

GULF COAST

Texas A&M University

The Texas Legislature appropriated $300,000 to Texas Parks and Wildlife for the purpose of an interagency contract with the Marine

Advisory Program to conduct a seafood marketing program from commercial fishing licenses fees. In addition, the Marine Advisory staff has remained very active in monitoring not only movements of the Mexican oil spill but the many agencies involved. (Indochinese Refugees -- See Mississippi)

Louisiana State University

A survey by Dr. Ken Roberts revealed that underwater obstructions in Louisiana waters cost shrimpers of the state almost $4 million in lost trawls last year. Roberts' information figured prominently in testimony that contributed to passage of state gear compensation legislation. In addition, a MAS pilot project on location and mapping of underwater obstructions in St. Bernard Parish so impressed the state Office of Coastal Zone Management that they funded a statewide mapping effort through the Louisiana Fisheries Federation.

Mississippi/Alabama Sea Grant Consortium

A major activity which has drawn wide acclaim has been Mississippi (MS) efforts to mesh Indo-Chinese refugees into the existing MS commercial fishing industry. Training programs, offered to both Vietnamese and native American fishermen, have significantly improved relationships between the two vastly different cultures. In Texas, a special project has also been inititated to generate information on the numbers, locations, and problems associated with resettlement of Indochinese refugees in Texas. The Marine Advisory Program staff has cooperated with TransCentury Corporation, the consulting firm involved in developing a report for the Department of Commerce.

In Alabama, the problem of disposal of seafood waste water is a major concern of the City of Bayou La Batre and seafood processors.

The Advisory Services instigated and coordinated the development of a project to provide an alternative treatment system using spray irrigation techniques to spread shrimp waste water over a salt marsh. The pilot system has been reviewed by the staff of the Alabama Office of State Planning and Federal Programs (Governor's Office), and a formal project proposal is being presented to EPA for funding. This waste water treatment project has national implications.

Florida (see East Coast)

GREAT LAKES

University of Minnesota

Over 120,000 people visited the University of Minnesota exhibit at the Minnesota State Fair, many of them learning about Sea Grant and Lake Superior from Lawrence the Talking Lake Trout. Lawrence is an animated, electronic fish whose mouth action is coordinated with the voice of a person coming over a tape recorder or a microphone in a live presentation.

University of Michigan/Michigan State University

The Expanded Nutrition Extension Program, designed to incorporate the representatives of low income households in demonstrating to their peers the advantages of family nutrition, cooperated in developing a MAS supported project to educate and train teams of demonstrators in the nutritional preparation of underutilized species of fish from the Great Lakes. Human Nutritionist Lackey developed materials and presented workshops in west, central, and south east Michigan counties to train minority representatives in use of the underutilized species and to teach demonstration methods which the participants could use in their own neighborhoods. One of the specialties of this program was the use of an interpreter to repeat the lessons in Spanish. The materials

developed for these training experiences will now be used in training additional groups of householders in any county desiring the program.

University of Wisconsin

In 1979 the Wisconsin Department of Natural Resources carried out the first planting of 250,000 Lake Trout fingerlings on a natural spawning reef in Lake Michigan's Green Bay. This work followed the earlier initiatives by Sea Grant Advisory Services, which recommended the procedure based upon Sea Grant research on salmon homing and spawning habitats, and the identification of important spawning sites.

In addition, Sea Grant's first woman marine agent, a licensed charter boat captain, joined University of Wisconsin researchers in underwater travels with a Diver Propulsion Vehicle over Lake Michigan reefs in search of Lake Trout spawning sites.

Ohio State University

Ohio MAS has formed a committee of sport fishermen, commercial fishermen, Sea Grant personnel, and personnel from the Ohio Division of Wildlife (ODW) to attempt to resolve conflicts between sport and commercial fishermen, sport fishermen and ODW, and commercial fishermen and ODW.

New York (see East Coast)

EAST COAST

Florida State University System

The MAS "Hazards Awareness Project" at University of Florida has made considerable headway in promoting interagency cooperation and public awareness in disaster preparedness and public education.

University of Georgia

Clean-up methods developed by Georgia advisory agents for a major shrimp processing plant saved that company approximately $225,000. The procedures and principles were published in a bulletin which was purchased by the National Fisheries Institute for distribution to their member plants. It was also sent to plants on the inspection list of the U.S. Department of Commerce, NMFS, and it has been utilized by several Sea Grant programs.

Virginia Institute of Marine Science

VIMS MAS conducted the first Mid-Atlantic pair-trawling demonstraion designed to employ existing fishing vessels in offshore underutilized fisheries, in addition to providing the fishing industry, potential investors, city planning agencies, and landing institutions with an employment and economic impact of Virginia's offshore trawl and sea scallop fisheries.

They also expanded the Sea Grant sponsored Marine Education Materials System (MEMS) to be used on a national scale. To date there are 21 distribution centers throughout the country capable of distributing marine related educational material.

Virginia Polytechnic Institute and State University

A national program in cooperation with the National Association of Retail Grocers in the United State (NARGUS) was initiated to train seafood managers. Three training programs have been presented in Pennsylvania and others will be added in the future. NARGUS is the largest association of independent feed retail chains in the U.S.

In addition, VPI MAS developed a training manual and series of consumer publications (approximately 50) for EFNEP (Expanded Food

and Nutrition Education Program) technicians on the utilization of fish and shellfish for low-income families. The USDA, which directs the program, had not been able to provide the appropriate support materials in this area.

North Carolina

The "Strange Seafood Spectacular" was a coordinated extravaganza among Hampton Mariners Museum (Beaufort, NC), North Carolina Marine Resources Centers, and the Sea Grant Advisory Services. Approximately 28,000 people participated and enjoyed unusual seafoods such as rock shrimp, octopus, eels, and conch.

South Carolina

South Carolina MAS acted as the link between commercial fishermen and U.S. Public Health Service (PHS) to establish contract facilities in Georgetown and Beaufort for free medical care for fishermen. The SC Sea Grant Advisory bulletin, "Q & A About Free Medical Care," is being considered by PHS in Washington for publication and national distribution as a joint PHS, NMFS, and Sea Grant effort.

State University of New York

Major TV and newspaper coverage of a MAS demonstration on using underutilized fish resulted in soaring demand for shark. With advisory service assistance, the Shinnecock Indians received a $295,000 solar-heated hatchery grant.

New Jersey

The MAS worked with a group of offshore fishermen to set up a telecomputer system that gives fishermen current isotherm charts

from weather satellites. They also produced a report on the findings of the contaminants panel of a major symposium on the ecological stresses of the New York Bight area, which they co-sponsored with MESA and New York Sea Grant.

University of Delaware

Delaware MAS sponsored "Coast Day" at the Marine Science Center in Lewes that highlighted Sea Grant research activities and attracted some 6,000 people from Maryland, Pennsylvania, Virginia as well as Delaware.

University of Maryland

A vocational-educational program aimed at watermen's children was developed in a cooperative effort between U.Md. MAS and the Talbot County School System. This program integrates formal education with hands-on technical courses that prepare students for careers as watermen.

University of Rhode Island

Based on the success of a Scottish seining demonstration and the availability of follow-up information from MAS, an increasing number of East Coast fishermen are adapting the technique. In addition, a Red Tide poster and accompanying fact sheet was written for distribution throughout the New England MAS network. Designed to prevent panic among cruising boaters while still encouraging the eating of shellfish, the popularity and format of the poster and fact sheets have encouraged the Coast Guard to express an interest in having MAS produce a similar publication for them to print and distribute nationally.

Masschusetts Institute of Technology

MIT MAS has been involved in a Joint Marine Fisheries Education and Training Program with the Massachusetts Maritime Academy. Over 200 fishermen have taken courses with great success and as a result of the acceptance of this program, the state has budgeted $92,000 as matching funds. The program is now being expanded to schools in other parts of the state.

The advisory service is also taking the research results of the Red Tide project and getting the screening and identification procedures to the state Public Health Department and local shellfish wardens (see URI).

University of Connecticut

As a result of Marine Advisory Service demonstration on scientific aquaculture techniques, over 200,000 juvenile scallops have been made available to the towns of Stonington, Groton, Madison, and Clinton to enhance natural production and improve recreational shellfish production by the Marine Advisory Service in cooperation with the State Division of Aquaculture and National Marine Fisheries Service, Milford.

University of New Hampshire

The edible blue mussel was all but ignored by the seafood industry and consumers when the project began six years ago. Five years of research coupled with the efforts of the MAS resulted in a 20-fold increase in consumer demand, encouraging entrepreneurs to begin culturing, harvesting, and marketing this abundant and underutilized mollusc.

University of Puerto Rico

Through a very intensive program of education developed by the Marine Agents and with initial help from Texas A&M Sea Grant, PR MAS has introduced recommended sanitary measurements for fish and seafood processing plants. At the moment they are in communication with the Department of Public Health of the Commonwealth to develop sanitary guidelines for these plants.

MARINE EDUCATION IN THE NATIONAL SEA GRANT COLLEGE PROGRAM

Dr. Barbara S. Spector

INTRODUCTION

For the purpose of maintaining the record keeping procedures established prior to 1979 and the continuity of format of previous annual reports, all the projects funded by Sea Grant for 1979 were put into one of the eight established categories.

The categories are:

Group A: This includes college level and graduate level course development efforts. It also includes courses in which students learn to perform research by carrying out their own individual or group projects.

Group B: This includes research assistantship and internship projects. It does not include Sea Grant fellowship projects which are in group F below.

Group C: This includes K-12 curriculum development efforts, together with teacher training.

Group D: This includes education efforts in non-formal settings. These projects typically aim at education of the general public. It should be noted that most such efforts are included under Marine Advisory Service headings and so are not reported here.

Group E: This includes marine technician training, vocational training, and pre-baccalaureate training projects.

Group F: This includes projects under the Sea Grant Fellowship Program established in 1976 by P. L. 94-461. FY78 was the first year in which awards were made under this legislation. Guidelines for the new program were published in final form in the Federal Register for April 11, 1978. The guidelines made clear that the purpose of the program is to provide educational assistance to qualified individuals at undergraduate and graduate levels in fields of study related to ocean and coastal resources. Fellowships are not awarded directly to students by the Office of Sea Grant; rather, the institutions that receive fellowship grants select the fellows and handle administration of the fellowships.

Group G: This includes education and training projects which cannot conveniently be fit under any other heading.

Group I: This includes education and training projects supported under Sea Grant's International Cooperation Assistance Program (ICAP).

The purpose of education is to transmit information from one who knows it to another who will learn it. Thus, the mandate for Sea Grant education and training can be filled by all instructor-learner relationships regardless of who conveys the information or where instruction takes place. Given that this instructor-learner relationship is the criterion for the label education and training, then the projects herein represent only a portion of the education supported by Sea Grant.

For example, much of the effort identified as Marine Advisory Service is spent on education activities. The target audience for these activities usually includes community members outside the formal school structures. Also, projects which serve to educate adults under the auspices of formal schools and outside schools occassionally appear in a listing of projects delineated by subject matter heading rather than in, or in addition to, this record of education projects. An illustration would be an aquaculture development project which might include training aquaculture specialists while setting up the project. Additionally, graduate research assistants might be learning research techniques and aquaculture subject content.

This report lists only those projects explicitly categorized as education and training.

History

A brief history of Sea Grant education and training indicates there have been three program areas under education and training. They are summarized in Figure 1.

At its inception the thrust of the Sea Grant education and training program was toward the development of specialists with skills for the development and management of marine resources. The emphasis was on graduate level professional training, community college technician training, and occasional courses in specialized four year undergraduate areas.

The Marine Advisory Service education thrust followed with emphasis on translating research findings to the user community outside of school-institution settings. The target audience involved adults in marine-related business and industry. Activities to make the general public aware of marine concerns were pursued through public meetings, media, museums, aquariums, etc. Many advisory agents and extension agents directed efforts toward elementary and secondary school age youngsters in groups such as 4H clubs and scouts.

The next education thrust was specific funded material development projects for elementary and secondary levels. Thereafter, Sea Grant began to deliberately explore ways to provide general education about marine affairs to elementary and secondary level students in schools as well as to undergraduate students.

Current activities - FY79

In FY79 most of the Sea Grant education and training dollars continue to support the program area devoted to the development of specialists with skills for marine careers. This is reflected in the list of projects in categories A,B,E,F,G, and I. in Appendix A.

Category C reflects the money that has gone into the support of general education through formal school systems including kindergarten through graduate school. This is section II in Figure 1.

Category D reflects a small portion of the money Sea Grant has spent to educate the general public toward marine literacy. This is section III on Figure 1. The bulk of the money spent on this task is categorized under Marine Advisory Service in another report.

The key activity for the Program Director for Education in the Office of Sea Grant for 1979 has been the nuturing of general education through formal school systems K-12 and related teacher training (section II in Figure 1 and projects related to category C), and to help establish a marine education unit in the U.S. Office of Education.

In order to forward Marine Education in this arena the goal for general education in schools was delineated and a strategy to reach that goal was developed and pursued.

The goal of Marine Education in schools is the development of a marine literate populace through the infusion of marine affairs in all discipline areas, at all grade levels. This means that teachers would teach the same courses and concepts they presently teach, but they would have marine affairs woven in equal fashion to the land affairs that now dominate curricula.

The definition of Marine Education that has been used was coined by Goodwin and Schaadt:

"Marine and aquatic education is that part of the total education process which enables people to develop a sensitivity to and a general understanding of the role of the seas and fresh water in human affairs and the impact of society on the marine and aquatic environments.

Marine and aquatic education is part of environmental education."

The strategy developed is delineated in, The Sea Grant Education Initiative for K-12 and Related Teacher Training, Draft #2. This document is available from the Sea Grant Office. The strategy suggests answers to these three questions:

- How can Marine Education impact American schools?
- What can the Office of Sea Grant do to encourage Marine Education in American schools?
- What can the Sea Grant Network do to enhance Marine Education in American schools?

Figure 1.

Three Program Areas of Sea Grant "Education and Training"*

	Section I	Section II	Section III
Purpose of Education	Develop specialists for marine careers via: a) college degree programs for professionals—graduate degrees including internships and fellowships b) college degree programs for professionals—four year bachelor of arts or sciences degree c) community college in technical training—two-year associate arts degree d) certificate programs in technical job training e) non-degree or certificate granting instructional programs f) vocational training in secondary school**	General education in schools: K—12, community college, undergraduate, graduate.	Public Awareness Consumer Education
Target Population	Adults for earning a living, pre-service and in-service **Teenagers going directly into job market	STUDENTS in schools ... 1. These are people going through normal academic progression regardless of whether they want to learn about Marine affairs. 2. The schools are formal institutions that exist regardless of whether they engage in Marine Education.	General Public
What Content Information	Skill acquisition Ways to apply skills to develop and manage marine resources	Knowledge base to develop sensitivity to oceans and all water environments; interest; awareness; enjoyment. Specific knowledge to enhance life role skills and competencies (exclusive of primary means of earning a living) i.e., family member, consumer, civic participant, recreation	Knowledge base to develop sensitivity to oceans and all water environments; interest; awareness; enjoyment Specific knowledge to enhance life role skills and competencies (exclusive of primary means of earning a living) i.e., family member, consumer, civic participant, recreation
Outcome	Expertise to utilize marine resources wisely – policy making – legislation – industrial application – business application – teaching Facilitates	Results in **Marine Literate Constituency** (by product = increased demand for Marine related careers) Results in increased creative thinking about marine resources Leads to development of ocean policy, legislation, and human behavior compatible with survival of live oceans and other waterways Results in GOAL protection, proper management, and use of ocean and aquatic resources	

*Legislative terminology

**If "f" applies, then the target population is changed as noted.

The strategy has come to fruition through energies devoted to building the human relationships which gave it life.

Functional relationships now exist on three fronts: in Washington, D. C.; within the Sea Grant Network; and with professional educators' organizations. A sampling of the results of development of these relationships follows:

Washington, D.C.: The United States Office of Education/Department of Education created a Marine Education unit. The Federal Interagency Committee on Education Subcommittee on Environmental Education created a Marine Education Task Force which Sea Grant chairs. It is expected that other funding agencies such as the Nation Science Foundation and the United States Office of Education/Department of Education will increase the money they spend on Marine Education. However, that will not eliminate the need for Sea Grant to continue to play its role in catalyzing, developing, and piloting new and unique approaches to Marine Education throughout the educational continuum.

Professional Educators' Organizations: The Council of Chief State School Officers (CCSSO) instituted a policy statement encouraging the states to engage in and forward Marine Education. The CCSSO created a Network of Marine Education Coordinators from State Education Agencies across the Nation.

Sea Grant Network: Communications have been significantly increased among educators within and among Sea Grant programs, and among educators and the advisory and research components of their Sea Grant Programs. Sharing of expertise and mutual projects have been undertaken. The communication and activities within the network are revealed in the Proceedings of National Sea Grant College Program Marine Education Leaders' Meeting-February 21, 22, 1979, and Proceedings of National Sea Grant College Program Marine Educators' Meeting, August 12 and 13, 1979. These documents also serve as a needs assessment for Sea Grant Marine Education and are available in the Sea Grant Office.

A summary of the activities and accomplishments of the Program Director for Education are documented in the transcript of the presentation given at the Sea Grant annual meeting in Athens, Georgia, November 12, 1979. This document is available from the Sea Grant Office.

Recommendations for FY80

How can the education dollar get its longest use? Items to consider in answering this question include, is there a multiplier effect; is there a potential system to take over and continue the growth phase and the maintenance once Sea Grant initiates an activity. Is timing important or can the same thing be accomplished any time in the future?

To answer these questions, it is recommended that funding emphasis for new projects in the immediate future be placed on the development of those projects that will lead to the infusion of Marine Education in general

course curricula in all disciplines toward the goal of creating a marine literate populace in school systems elementary, secondary, and higher education. This is in contrast to projects whose goal is developing skills specific to earning a living related to the marine environment.

By definition, when students become marine literate, they will become aware of the potential for wise use of the marine environment in their daily life roles. In addition they will have the ability, and be encouraged to make realistic assessments of the desirability of seeking training in skills that would prepare them for jobs in the marine field.

Sea Grant activities during 1979 have created an infrastructure in the American education system K-12 that is presently poised to respond to the need for marine education toward a literate populace. Federal and State agencies who fund education have been sensitized to the need for marine education. The structure exists to encourage local education agencies to engage in Marine Education. These groups are the ones to take over the continued growth and maintenance once Sea Grant initiates the activities.

The K-12 thrust needs to be supported energetically by Sea Grant at this time in order to capitalize on the momentum built in 1979. This support should continue until Marine Education reaches its obvious economic conclusion, namely, that state and local education agencies pick up the lead financial responsibility. Then Sea Grant can become one of the several resources for expertise and support of Marine Education. The development of the infrastructure creates the channels for a large multiplier effect for dollars invested by Sea Grant now.

In addition to investing money in projects for use in K-12 school systems themselves, it is necessary to simultaneously invest in teacher training activities, those sponsored by school systems and by institutions of higher learning. Pre-service and in-service teacher education needs attention.

Beyond this area is the issue of planning and coordination of overall Marine Education efforts in a given geographic area. Training of personnel for this task has been neglected to date. There are presently no training programs in Marine Education that will produce professionals who have the necessary combination of marine subject knowledge, interdisciplinary approaches, personnel management skills, systems orientation and education expertise.

My assessment of personnel and staff demands of the field of Marine Education presently and in the future is that there is a paucity of professionals to do the task necessary, in particular, the broad scope designing and implementation of Marine Education programs from needs assessment to curriculum development, to delivery systems and maintenance, to identification and coordination of resources for education toward a marine literate populace in a given geographic area.

I recommend that graduate degrees at both the doctoral and masters level be instituted to fill this void. The few people presently holding such

positions in the U.S. learned their skills through on the job trial and error experience. Many of them express the need to make their own knowledge base more comprehensive and agree that there is a need for a specific Marine Education training program, particularly at the doctoral level.

Minority Education

Since there is little or no Marine Education for the Caucasian population in K-12, there is no need for remedial efforts targeted at minorities to bring them to the same level of familiarity with Marine Education as white youngsters. Consequently, any Marine Education effort targeted at K-12 in general will serve the minority population in K-12 as well.

The investment in K-12 can be thought of as a minority investment in that it will result in more minority students and women being sensitized to marine affairs and more likeliness that they will select to pursue Marine fields in their education at the college and graduate level.

This is not the case in higher education. In higher education predominantly minority schools do not traditionally offer specific marine affairs courses at the undergraduate and graduate levels from which minority students could select courses. A logical question to ask is, will minority students, in fact, choose marine affairs courses even if they are offered? Evidence from the Sea Grant fellowship programs to date would imply that students who have not been sensitized to Marine Education in their K-12 career do not select to study marine affairs even with the availability of fellowships as an enticement. Other specific techniques used to attract minority students in higher education are not noteably successful.

Therefore, the most promising technique to attract minority students in K-12 to marine affairs is time consuming and long range. Namely, sensitize youngsters in K-12 to marine affairs by having them exposed to the world of water as a natural part of their total education. The projection is that youngsters (minority, women, and majority) will then be just as likely to select marine affairs courses in college as any course that is essentially land affairs oriented.

Project areas to support K-12 thrust

It is desirable to give attention to projects in the following four areas related to the K-12 thrust: 1)activities to expand and maintain the National Marine Education Network and cooperative projects that Network undertakes, 2) those unique education projects developed at one institution which provide services and/or resources that are required by all Sea Grant institutions to effectively pursue public education. This should include provisions for the funding of such projects and their interfaces with the other Sea Grant institutions; 3) projects that require cooperative participation from Sea Grant educators from programs in various locations across the country (i.e. quality control effort) and regional education projects; 4) Marine Education endeavors in states without Sea Grant programs who are undertaking Marine Education initiatives as a result of the interface between Sea Grant and the Council of Chief State School Officers.

The Trade-Off Question

What is the best balance of Sea Grant dollars for 1980-81? It has been said that if money is taken from research to support the outreach part of Sea Grant, then there will be no new information developed. Consequently, outreach will have nothing to convey to the users or future users. On the other hand, if new information is developed, but too few dollars are spent to facilitate transmitting this information to users, present and future, then the research is strictly an ivory tower exercise that is futile.

In lieu of an answer to the trade-off question, one way to obtain available resources to accelerate activities for education toward marine literacy would be to concentrate to a lesser extent on Education Categories A (higher education course development) and E (Community College technician training) for FY80 and FY81. This leaves the educational dollar to a manageable growth and yet allows the system to further develop the proposed strategy with little impact on the research dollar.

Funding for Education and Training

The domestic education and training budget presently represents approximately 8% of the total Sea Grant budget. The total education and training budget including international programs represents approximately 11% of the total Sea Grant budget.

In 1976 the total Education and Training budget was $1,998,554. In 1977 it went up to $3,147,603. This was simultaneous to an increase of $4 million from Congress which recommended that Sea Grant encourage more education and training than had previously been done, particularly in the elementary-secondary school area. Since 1977 the total education and training budget has gone down each year. From FY77 to FY78 the total decrease was -$140,902 and from FY78 to FY79 the decrease was $-121,784. See Tables I - IV.

TABLE I

Sea Grant Projects in Education and Training in "FY76"

Group	Number of Projects	Sea Grant	Percent of Total E&T
A	39	$688,344	34
B	9	739,448	37
C	8	161,922	8
D	5	42,846	2
E	20	324,994	16
F	2	40,000	2
G	1	1,000	--
TOTAL		$1,998,554	

TABLE II

Sea Grant Projects in Education and Training in FY77

Group	Number of Projects	Sea Grant	Percent of Total E&T	Change from "FY76"
A	34	$844,468	27	$156,124
B	10	904,735	29	165,287
C	28	688,534	22	526,612
D	5	154,731	5	111,885
E	14	372,935	12	47,885
F	2	40,000	1	-------
G	2	142,200	5	141,200
TOTAL		$3,147,603		$1,148,993

TABLE III

Sea Grant Projects in Education and Training in FY78

Group	Number of Projects	Sea Grant	Percent of Domestic E & T	Change From FY77
A	36	$676,274	22	-168,194
B	11	958,940	32	54,205
C	24	701,879	23	13,345
D	8	190,440	6	35,709
E	11	333,357	11	-39,578
F	6	112,500	4	72,500
G	3	33,311	1	-108,889
	TOTAL DOMESTIC	$3,006,701		$-140,902
I	7	913,400		913,400
	TOTAL	$3,920,101		$772,498

TABLE IV

Sea Grant Projects in Education and Training in FY79

Group	Number of Projects	Sea Grant	Percent of Domestic E & T	Change From FY77
A	34	$692,382	24	$16,108
B	18	931,092	32	-27,848
C	25	685,169	24	-16,710
D	7	143,776	5	-46,664
E	8	280,618	9	-52,739
F	8	147,880	5	35,380
G	1	4,000	.001	-29,311
	TOTAL DOMESTIC	$2,884,917		$-121,784
I	7	907,000		-6,400
	TOTAL	$3,791,917		$-128,184

SEA GRANT PROJECTS IN GROUP A IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
EVALUATION OF A MASTERS OF PUBLIC ADMINISTRATION CURRICULUM SPECIALIZATION IN PORT/HARBOR MANAGEMENT	USC	$ 35,820	$ 20,275
OCEAN ENGINEERING AND THE FUTURE: LONG-RANGE PLANNING	U. OF CALIF.	$ 12,038	$ 9,808
DEVELOPMENT OF A LAW SCHOOL COURSE ON MARINE RESOURCES LAW,POLICY AND MANAGEMENT	U. OF GA.	$ 8,300	$ 21,200
DEVELOPMENT OF A NEW COURSE IN UNDERWATER TECHNOLOGY	U. OF HAWAII	$ 17,956	$ 13,133
MARINE OPTION PROGRAM	U. OF HAWAII	$ 46,617	$ 58,905
WORKING PAPER SERIES AND CASE MATERIALS ON CHESAPEAKE BAY RESOURCE USES	U. OF MARYLAND	$ 5,250	$ 11,000
DEVELOPMENT OF AN INTEGRATED COURSE ON OFFSHORE STRUCTURES	MIT	$ 26,700	$ 34,838
OCEAN ENGINEERING PROJECTS LABORATORY	MIT	$ 29,000	$ 26,321
DEVELOPMENT OF AN INTERCOLLEGIATE INTERDISCIPLINARY COURSE IN MARINE STUDIES	MIT	$ 24,600	$ 13,800
EDUCATION AND TRAINING: DEVELOPMENT, OPERATION, AND MANAGEMENT	MIT	$ 38,600	$ 20,599
OCEAN ENGINEERING CURRICULA	MIT	------	$101,911
INTERDISCIPLINARY SYSTEMS DESIGN SUBJECT	MIT	$ 15,700	$ 5,987

SEA GRANT PROJECTS IN GROUP A IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
ORGANIZATION AND DEVELOPMENT OF AN INTEGRATED AQUATIC SCIENCE CURRICULUM	MICHIGAN	$ 19,821	------
UNDERWATER EDUCATION WORKSHOP PROGRAM	MICHIGAN	------	$ 7,817
GREAT LAKES LIMNOLOGY COURSE	MICHIGAN	$ 22,782	$ 10,000
UNDERGRADUATE OCEAN PROJECTS COURSE	UME/UNH	$ 34,268	$ 31,953
DESALINATION SPECIALIZATION WITHIN B.S. IN ENVIRONMENTAL SCIENCE	FARLEIGH DICKINSON U.	$ 59,900	$ 26,983
AQUAVET: A TRAINING PROGRAM FOR AQUATIC VETERINARIANS	NEW YORK	$ 30,000	------
DEVELOPMENT OF A MARINE ENGINEERING RESEARCH AND EDUCATION PROGRAM	NEW YORK	$ 10,300	$ 32,904
MANAGEMENT-ORIENTED AQUACULTURE TRAINING	OREGON STATE	$ 10,200	$ 14,300
MARINE AND MARITIME STUDIES	OREGON STATE	$ 15,600	$ 12,600
EDUCATION FOR EFFECTIVE MANAGEMENT OF MARINE RESOURCES	OREGON STATE	$ 14,900	$ 8,100
GRADUATE CURRICULUM IN MARINE EXTENSION	OREGON STATE	$ 24,900	$ 17,900
RESOURCE ECONOMICS PH.D. PROGRAM	URI	$ 35,434	$ 73,735

SEA GRANT PROJECTS IN GROUP A IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
MARINE AFFAIRS EDUCATION	URI	$ 26,783	$ 60,471
INCREASING THE PARTICIPATION OF MINORITIES IN THE MARINE SCIENCES AT TEXAS SOUTHERN UNIVERSITY	TEXAS A&M	$ 13,000	$ 6,500
EMBRYOLOGY TO INCREASE ETHNIC MINORITY MANPOWER POOL IN MARINE SCIENCE	VIMS	$ 9,500	$ 7,052
A PILOT PROGRAM IN ENVIRONMENTAL JOURNALISM	VIMS	$ 13,200	$ 8,898
EDUCATION IN OCEAN LAW ENFORCEMENT	U. OF WASH.	$ 13,500	$ 16,300
CURRICULUM DEVELOPMENT: COASTAL ENVIRONMENTAL INFORMATION IN MANAGEMENT DECISIONS	U. OF WASH.	$ 15,900	$ 7,600
RESEARCH SEMINAR IN MARINE RESOURCE MANAGEMENT	U. OF WASH.	$ 16,900	$ 9,100
OCEAN ENGINEERING PROGRAM ENHANCEMENT	U. OF WASH.	$ 15,000	$ 31,600
EXTENDED FISHERIES TRAINING	U. OF WASH.	$ 16,500	$ 21,400
SPECIAL EDUCATION PROGRAM	U. OF WISC.	$ 13,413	$ 16,160
	TOTAL	$692,382	$759,150

SEA GRANT PROJECTS IN GROUP B IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
A HISTORY OF THE SANTA BARBARA CHANNEL	U. OF CALIF.	$ 11,516	$ 7,760
SEA GRANT TRAINEES	U. OF CALIF.	$348,840	$ 42,840
SEA GRANT GRADUATE STUDENT TRAINEE PROGRAM	USC	$ 57,500	$ 5,000
NSTS -- SEA GRANT TRAINELS	U. OF CALIF.	$ 18,500	------
SEA GRANT INTERNSHIP	U. OF DELAWARE	$ 18,500	$ 866
SEA GRANT TRAINEES	U. OF MARYLAND	$ 52,850	$ 27,000
SEA GRANT TRAINEESHIPS	U. OF MINN.	$ 46,672	------
SEA GRANT INTERNSHIP - AREA OF OCEAN ENGINEERING	UME/UNH	$ 20,200	$ 795
SEA GRANT INTERNSHIP - AREA OF MARINE AFFAIRS	UME/UNH	$ 18,700	$ 795
DOCTORAL FELLOWSHIPS FOR STUDIES OF MARINE INDUSTRIES	NEW YORK	$ 14,000	------
SEA GRANT TRAINEESHIPS: NEW YORK SEA GRANT INSTITUTE	NEW YORK	$181,500	------
COASTAL LAW TRAINEESHIPS	NEW YORK	$ 25,400	------

SEA GRANT PROJECTS IN GROUP B IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
SEA GRANT INTERNSHIP (JOHN KOSMARK)	URI	$ 16,900	------
UNDERGRADUATE SUMMER RESEARCH OPPORTUNITIES	SO. CAR.	$ 13,700	$ 9,700
SEA GRANT INTERNSHIPS	TEXAS A&M	$ 22,600	$ 3,066
SEA GRANT INTERNSHIPS	U. OF WASH.	$ 56,500	$ 4,706
INTERNSHIPS IN LAW AND MARINE AFFAIRS	U. OF WASH.	$ 1,814	------
INTERNSHIPS IN LAW AND MARINE AFFAIRS	U. OF WASH.	$ 5,400	------
	TOTAL	$931,092	$102,528

SEA GRANT PROJECTS IN GROUP C IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
ALASKA TIDELINES, A MARINE EDUCATIONAL PERIODICAL FOR SECONDARY SCHOOLS	U. OF ALASKA	$ 33,254	$ 9,822
ALASKA SEA WEEK	U. OF ALASKA	$ 18,840	$ 5,924
OCEANOGRAPHY SUMMER COURSE FOR TEACHERS	U. OF ALASKA	$ 9,326	$ 10,235
MARINE EDUCATION IN CALIFORNIA	USC	$ 58,517	$ 20,494
HOI ANA I KE KAI--RETURN TO THE SEA	U. OF HAWAII	$ 16,000	$ 7,162
MARINE EDUCATION	LSU	$ 27,631	$ 21,669
MARINE EDUCATION WORKSHOP FOR K-12 SCIENCE TEACHER STAFF DEVELOPMENT	U. OF MARYLAND	$ 5,200	$ 3,100
DEVELOPMENT OF TEACHING MATERIAL FOR PRE-UNIVERSITY MARINE EDUCATION	MIT	$ 73,000	$ 37,061
GREAT LAKES ENVIRONMENT: A CURRICULUM PACKAGE	MICHIGAN	$ 52,045	------
SECONDARY SCHOOL MINORITY, UNDERPRIVILEGED AND HANDICAPPED STUDENT EXPOSURE TO MARINE EDUCATION	MISS/ALA	$ 14,000	$ 8,402
MAN AND THE GULF OF MEXICO	MISS/ALA	$ 31,966	$ 17,025
SEACOAST SCIENCES AND OUR MARITIME HERITAGE	UME/UNH	$ 29,200	$ 26,046

SEA GRANT PROJECTS IN GROUP C IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
NORTHERN NEW ENGLAND MARINE EDUCATION PROJECT	UME/UNH	$ 33,466	$ 11,226
DEVELOPING AND MODEL K-12 MARINE EDUCATION CURRICULUM WITH CONCOMMITANT ANNOTATED BIBLIOGRAPHY	NEW YORK	$ 13,057	$ 17,238
DEVELOPMENT AND IMPLEMENTATION OF MARINE-RELATED INFUSION MATERIALS FOR SECONDARY SCHOOL CURRICULUM	NEW YORK	$ 7,846	$ 21,600
PROGRAM FOR THE DEVELOPMENT OF LEADERSHIP IN MARINE EDUCATION	UNC	$ 10,321	$ 5,932
OCEANIC EDUCATION ACTIVITIES FOR GREAT LAKES SCHOOLS(OEAGLS)	OHIO ST. U.	$ 36,900	$ 7,800
MARINE EDUCATION MATERIALS IDENTIFICATION, PREPARATION AND IMPLEMENTATION FOR CLASSROOM USE	OREGON STATE	$ 30,000	$ 13,800
DEVELOPMENT AND DISSEMINATION OF MARINE EDUCATION MATERIALS, K-12	TEXAS A&M	$ 34,400	$ 15,074
MARINE RESOURCES REFERENCE CENTER	TEXAS A&M	$ 17,500	$ 8,807
MARINE-RELATED CHILDRENS LITERATURE	TEXAS A&M	$ 8,600	$ 9,493
MARINE EDUCATION PROPOSAL FOR MATERIALS AND COURSE DEVELOPMENT	VIMS	$ 6,100	$ 3,851
SEAFOOD PRODUCTS EDUCATION PROGRAM FOR INTERMEDIATE,SECONDARY AND COLLEGE STUDENTS AND FACULTY	VPI	$ 20,200	$ 13,100

SEA GRANT PROJECTS IN GROUP C IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
MARINE EDUCATION PROJECT - PACIFIC SCIENCE CENTER	U. OF WASH.	$ 38,000	$ 21,500
MARINE EDUCATION SECTION, MARINE ADVISORY SERVICES	VIMS	$ 59,800	$ 15,921
	TOTAL	$685,169	$332,282

SEA GRANT PROJECTS IN GROUP D IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
COASTAL AWARENESS & EDUCATION PROGRAM	SUS FLORIDA	$ 19,600	$ 6,000
MARINE RESOURCES EDUCATION	U. OF GA.	$ 85,200	$267,100
ANNUAL SEA GRANT LECTURESHIP	MIT	------	$ 13,027
PUBLIC EDUCATION AND TRAINING SHORT COURSES	MIT	------	$ 49,479
SUPERIOR EXPERIENCE, SEE THE INLAND SEA	U. OF MINN.	$ 12,976	$ 14,339
MARINE AQUATIC AWARENESS PROJECT	NEW JERSEY	$ 12,000	$ 9,800
COASTAL MANAGEMENT AWARENESS: EXHIBITS AND PROGRAMS	U. OF WASH.	$ 14,000	$ 5,200
	TOTAL	$143,776	$364,945

SEA GRANT PROJECTS IN GROUP E IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
MARINE PROPULSION SYSTEMS TRAINING	SUS FLORIDA	$ 62,000	$ 58,700
DEVELOPMENT AND PILOT TESTING OF FISHING AND RELATED INSTRUCTIONAL MATERIALS	U. OF HAWAII	$ 7,500	$ 18,851
MASSACHUSETTS MARINE FISHERIES EDUCATION AND TRAINING PROGRAM	MIT	$ 46,000	$ 92,056
DEVELOPMENT PROGRAM FOR PROFESSIONAL FISHERMEN	OREGON STATE	$ 62,600	$ 37,900
MARITIME TRAINING MATERIALS DEVELOPMENT	OREGON STATE	$ 12,000	$ 6,000
FISHERIES AND MARINE TECHNOLOGY	URI	$ 45,518	$104,473
TECHNICAL VOCATIONAL TRAINING IN MARINE RELATED OCCUPATIONS	TEXAS A&M	$ 25,000	$ 13,253
SATURATION DIVING PROGRAM	U. OF WASH.	$ 20,000	$ 18,300
	TOTAL	$280,618	$349,533

SEA GRANT PROJECTS IN GROUP F IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
SEA GRANT FELLOWSHIPS	U. OF ALASKA	$ 20,000	------
SEA GRANT FELLOWSHIPS FOR MINORITY STUDENTS PURSUING EDUCATIONAL PROGRAMS IN THE AREA OF MARINE SCIENCE	AM. GEOPHY. UNION	$ 4,000	$ 2,000
SEA GRANT FELLOWSHIPS	U. OF GA.	$ 18,000	------
SEA GRANT MARINE SCIENCE FELLOWSHIP PROGRAM - TALLADEGA COLLEGE	MISS/ALA	$ 22,805	$ 12,292
THE SNAME SCHOLARSHIP FUND	SOC. OF NAVAL ARCH. & MAR. ENG. (NY)	$ 24,000	$ 42,000
SEA GRANT FELLOWSHIPS	UNC	$ 15,875	------
MARINE FELLOWSHIP PROGRAM	TEXAS A&M	$ 6,000	$ 24,000
SEA GRANT INTERNSHIP	VIMS	$ 37,200	$ 10,867
	TOTAL	$147,880	$91,159

SEA GRANT PROJECTS IN GROUP G IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
COOPERATIVE RESEARCH PROGRAM--UNIVERSITY OF MARSEILLES AND UNIV. OF MARYLAND	U. OF MARYLAND	$ 4,000	$ 7,700
	TOTAL	$4,000	$7,700

SEA GRANT PROJECTS IN GROUP I IN FY79

PROJECT	INSTITUTION	SEA_GRANT	MATCHING
INFORMATIONAL AND EDUCATIONAL ASSISTANCE TO MARINE SCIENCE INSTITUTIONS IN MEXICO	U. OF CALIF.	$240,000	------
A SHORT COURSE ON SMALL HARBOR ENGINEERING IN INDIA	SUS FLORIDA	$ 18,000	$ 1,300
UNIVERSITY OF SOUTH PACIFIC/UNIVERSITY OF HAWAII SEA GRANT INTERNATIONAL COOPERATIVE PROGRAM	U. OF HAWAII	$ 92,800	$ 4,059
AN ECOLOGICAL PROGRAM FOR THE LAGUNA DE TERMINOS (CAMPECHE, MEXICO)	LSU	$ 46,800	------
STRENGTHENING ENVIRONMENTAL MICROBIOLOGY AND POLLUTION MONITORING CAPABILITIES AT THE HIGH INSTITUTE OF PUBLIC HEALTH,ALEXANDRIA,EGYPT	U. OF MARYLAND	$134,400	$ 13,960
AN INTERNATIONAL COOPERATIVE ASSISTANCE PROGRAM FOR LATIN AMERICAN COUNTRIES (WITH EMPHASIS IN CHILE AND MEXICO)	OREGON STATE	$190,000	------
COOPERATIVE DEVELOPMENT OF MARINE RESOURCES CAPABILITY IN MALAYSIA:TWO YEAR EXTENSION	URI	$185,000	------
		---------	---------
	TOTAL	$907,000	$19,319

MARINE TRANSPORTATION SYSTEMS

LEO S. CRAIG

INTRODUCTION: This report provides a brief summary of eleven Sea Grant research projects awarded in the year ended September 30, 1979 (FY 79) under two Sea Grant classifications relating primarily to Marine Transportation Systems. A very few (two or three) related projects, either in Education or in, for example, Physical Oceanography (Harbors) are supported by Sea Grant, but neither the funding nor details are covered, in order to avoid redundancy (duplicate inclusion) of dollars with other disciplines, which are being reported on elsewhere.

DISCUSSION: Sea Grant support in FY 79 was awarded to six universities covering eleven research projects classified under Marine Transportation Systems, in the total amount of $230,300, with an additional $85,600 furnished by the universities as non-Federal matching funds. Of these, three projects in the (Federal) amount of $33,200 are classified under #36: Ports, Harbors, and Offshore Terminals, and eight in the amount of $197,100 under #37: Transportation Systems-Other. The projects are summarized in Tables I and II (pp. 2-7).

This funding shows a sizable increase over the FY 78 Sea Grant funding of $131,400, covering six projects, and indications are that the FY 80 funding will continue this trend. This is, however, quite small compared to the overall FY 79 Sea Grant Research Funding ($18,400,000) and that of the related funding by other more specialized civilian agencies, such as MARAD's Office of Commercial Development (approximately $20 million) and the Coast Guard's Office of Research and Development (approximately $5,000,000). Interestingly enough, both of these agencies have exhibited this past year an increasing interest in the involvement of several of the Sea Grant universities in Marine Transportation Systems studies, either with direct funding or by means of pass-through funding to Sea Grant.

In analyzing possible future trends in the Sea Grant network, it has been noted that there is an increased activity in problems involving Marine Transportation Systems. Some examples of this are:

1) University of California: At the last University of California Sea Grant Committee meeting in June, Marine Transportation and Ports and Harbors were identified as one of the major subject areas needing further coordinated development to provide a better research base to strengthen the advisory capability in the California coastal area.

2) University of Southern California: It is expected that a Center for Marine Transportation will soon be established at the University's Institute for Marine and Coastal Studies. The Center will be responsible for developing a comprehensive, interdisciplinary program in ocean trade and transportation, and in port and harbor planning, development and management. Of particular concern will be the economic, management and policy aspects of the marine transportation field.

TABLE I

SUMMARY OF FY 79 SEA GRANT RESEARCH PROJECTS AWARDED

CLASSIFICATION #36: PORTS, HARBORS AND OFFSHORE TERMINALS

Grantee University	Project No.	Title	Funding: Sea Grant	Funding: Non-Federal Matching	Principal Investigator
Minnesota	R/C-3	The Recreational Demand for Development of Harbors of Refuge in Western Lake Superior	$ 2,377	$ 3,157	L. McAvoy, Jr.
	Objective: 1. To determine recreational boating use patterns for ramp launched, berthed, and transient boats at four North Shore harbors of refuge. 2. To determine boating user satisfaction levels with existing harbor facilities and demands for future facility development. 3. To determine recreational needs of boaters which may be satisfied by development of nearby facilities by local and state agencies. 4. To determine boating user demographic information. 5. To determine recreational use, other than boating, taking place at the harbors, i.e. fishing, picnicking, etc. 6. To examine the impact recent boating facility developments on the North Shore have had on recreational boating patterns.				
Southern California	R/CM-12	The Port Authority as a Public Enterprise: Organizational Adjustment to the Conflicting Demands for Economic Versus Environmental Quality Goals	$ 23,282	$16,155	H. Boschken L. Weschler
	Objective: The focus of this study will be on port authorities and their changing role in the regional economy and environmental setting in which they are placed. The goal is to make a comparative examination and analysis of port authority policies, patterns of administration, levels of effectiveness regarding multiple				

Grantee University	Project No.	Title	Funding: Sea Grant	Non-Federal Matching	Principal Investigator
		goal attainment, causes for administrative failure, and potential avenues for improvement. Specific inquiry will be devoted to the legal mandates, authorities, and roles of port authorities; policy formation and implementation; and port operations within an intergovernmental setting.			
Washington	R/MS-7	General Cargo Forecast for U.S. West Coast Ports	$ 7,500	$ 4,200	S. Gibbs
		Objectives: 1. To assist U. S. West Coast port managers to plan pricing levels and port capacity by providing an accurage forecast of containerized cargo business demand as a function of future Panama Canal toll levels. 2. To estimate the probable effect on longshore and community employment levels brought about by the anticipated increase in containerized cargo business at the termini of the U.S. Mini-bridge ship-rail transport system. 3. To provide significant research experience for a graduate marine affairs student who would be employed to assist in the research.			

TABLE II

SUMMARY OF FY 79 SEA GRANT RESEARCH PROJECTS AWARDED

CLASSIFICATION #37: TRANSPORTATION SYSTEMS-OTHER

Washington	R/E-8	Marine Transportation Management and Risk Reduction-Applications to Puget Sound	$ 39,500	$ 22,600	E. Wenk, Jr.
		Objectives: 1. To perform a gross hazards analysis of the marine transportation system. This analysis will identify critical paths that lead to various vessel casualty types. It will also provide a general methodology for performing site-specific hazard analyses of marine transportation systems. 2. Based on the gross hazards analysis, causal relationships between elements of the marine transportation system and casualty types will be identified. These elements include			

Grantee University	Project No.	Title	Funding: Sea Grant	Funding: Non-Federal Matching	Principal Investigator
		shipboard men and equipment, ship design, environmental, geographic and meteorological factors, other waterway users, aid to navigation and existing mitigating measures. 3. Following identification of critical path system elements, general and local casualty and near-miss data will be collected and analyzed to evaluate existing and potential casualty mitigating measures. An evaluation of costs and benefits of such measures will be used to recommend a risk reduction program for marine transportation in Puget Sound.			
Michigan	R/T-1	Great Lakes Marine Transportation	$ 11,545	$ 5,994	T. Ogilvie
		Objectives: 1. To identify those problems of Great Lakes marine transportation to which the Michigan Sea Grant Program can help to find solutions. 2. To locate the resources (people, facilities, funding) for solving these problems. 3. To transmit research results in usable form to the Great Lakes marine industry, government agencies, and the public. 4. To develop a program to bring undergraduates into direct contact with industry operations, both for immediate educational benefits and as a means of collecting data on marine transportation operations.			
Michigan	R/T-3	Path Control System for Surface Ship in Channels	$ 34,679	-0-	M. Parsons
		Objectives: 1. Development of a suitable nonlinear hydrodynamic model for a large Great Lakes bulk carrier. 2. Investigation of alternative multi-variable techniques for regulator control with non-zero set points and with constant and stochastic disturbances. 3. Development of ship path control system(s) using the most promising concepts. 4. Evaluation of ship path control system feasibility and performance using complete nonlinear simulation.			

Grantee University	Project No.	Title	Funding: Sea Grant	Funding: Non-Federal Matching	Principal Investigator
Michigan	R/T-4	Effects of Control Systems on Optimization of Ship Size for Navigation in Restricted Waters of the Great Lakes	$ 30,552	-0-	H. Bunch
		Objectives: 1. Determine the costs associated with establishing and maintaining increased channel dimensions for the restricted-passage waterways in the Great Lakes. 2. Determine the benefits associated with making transits through the restricted waters with vessels optimally sized for passage under different control-system assumptions. 3. Relate the determined costs to the resulting benefits so that optimum investment concepts may be determined.			
Michigan	R/T-6	Shoreline Effects of Vessel Transit of the St. Mary River	$ 17,111	-0-	R. Scher
		Objectives: The objective of this one-year project is to solve a number of underlying hydrodynamic problems related to the pressure field (and consequent shallow-water waves) generated by a vessel moving in a dredged channel with shallow-water areas adjacent to it. The physical effects that will be derived from the solution of these problems include: 1. Shallow-water save heights incident on the shoreline. 2. Variation of the current velocity vector near the shore. 3. Drawdown in tributary streams. The modelling will concentrate on known problem areas on the St. Marys River, with idealized channel sections approximating these areas. Theoretical results will be compared with previously obtained observations.			
Oregon	R/UI-4	Mathematical Programming Models for Projecting Cargo Movements via Snake-Columbia River Ports	$ 23,800	$ 13,100	K. Lindeborg

Grantee University	Project No.	Title	Funding: Sea Grant	Funding: Non-Federal Matching	Principal Investigator
	Objectives:	Develop mathematical programming models to delineate the areas in Oregon, Washington, and Idaho from which commodities may be transported on the Columbia-Snake navigation system. Then the models will be applied to evaluate the effects of rate changes and changing supply demand conditions of the commodities on future cargo flow through the ports of the system. The first year's objective, will be to establish a linear programming algorithm for the computer system at the University of Idaho, and gather data for the study. The second year's objective is to apply the transportation models to evaluate the effects of rate changes and changing supply-demand conditions of the commodities on future cargo flows on the Snake-Columbia River ports.			
Oregon	R/W-U-2	Improving Transportation of Maritime Commerce on the Columbia-Snake System	$ 12,900	$ 9,200	K. Casavant
	Objectives:	Transportation on the Columbia-Snake rivers system affects the economic development and stability of a major portion of a three state area. Use of the rivers system will increase as new transportation systems are developed, and as fuel costs and availability force business and industry to shift to more economical transportation systems. The potential bottleneck to this expected growth is the undersized lock at Bonneville Dam. In this study we will: 1) review the history of shipping on the Columbia; 2) develop a time-cost-delay-model for barge traffic on the river; 3) identify cost savings of enlarging the locks; and 4) identify the level of traffic that would generate economic feasibility (B/C ratio grater than one) for enlarging the lock; 5) review cargo projections in conjunction with the University of Idaho programming model; and combine the University of Idaho's projection model with the feasibility levels obtained by this investigation to specify the feasibility and accompanying distributional impacts of modification of the locks.			

Grantee University	Project No.	Title	Funding: Sea Grant	Funding: Non-Federal Matching	Principal Investigator
Wisconsin	R/PS-25	Great Lakes International Trade: Hinterland Served and Shippers' Route Options	$ 26,671	$ 11,153	E. Schenker

C-7

Objectives: To provide information that will promote knowledgeable decision-making on both the planning and operational levels among those responsible for the future of Great Lakes ports. Specifically:

1. To compile origin/destination (O/D) information for the international movement of goods through Great Lakes ports and for international movements to and from the Great Lakes' 19-state hinterland (using tapes from the Bureau of Census Survey of Domestic and International Transportation of U. S. Foreign Trade).
2. To develop and calibrate a model of shipper choice for cargo routing of overseas trade.
3. To use information obtained to identify any significant strengths and weaknesses of Great Lakes ports in terms of shipment characteristics and their impacts.

3) Massachusetts Institute of Technology: The University has proposed an extensive two-year Boston Harbor Management Study, with participatory Coastal Zone Management funds, whose objectives are:

1. To design a management scheme to improve environmental conditions, public access conditions and economic development in the Boston Harbor area.

2. To define to the extent possible a working philosophy for the Harbor which represents an acceptable consensus of the principal constituents with interests in the Harbor regarding environmental conditions, public access and economic development.

3. To devise a public access plan based on identified opportunities for varieties of access and recommended modes of implementation.

4. To prepare a land and water use atlas of the Boston Harbor as it is legally defined by the Massachusetts Office of Coastal Zone Management, which could serve as a public information tool for understanding the current nature of activities and uses of the Harbor as well as a graphic description of the institutional framework currently functioning for decision-making for the Harbor.

CONCLUSION: Although the involvement of the Sea Grant Institutions in research on Marine Transportation Systems is increasing, it is quite small in comparison with overall Sea Grant Research Funding and to that by specialized agencies such as MARAD, Department of Commerce, and the Coast Guard, Department of Transportation. Indications are that this involvement will continue to increase and become a greater segment of the Sea Grant Program, including possible participation of the referenced agencies.

FISHERIES

By

Robert D. Wildman

INTRODUCTION

The field of fisheries in the Sea Grant Program falls under many subject area categories, and many projects, which are defined as being in other categories, are related to or involve fish. The fisheries program described and discussed in this report is limited to those projects which involve studies of the natural stocks, their interactions with the environment, socio-economic and management problems, gear technology, education and extension programs solely related to fisheries. This report does not include Sea Grant efforts on seafood science and technology, aquaculture, nor general programs in environmental sciences, education and advisory services, even though projects in these latter areas may well have fisheries components. Thus, to obtain a picture, including the funding level of the total Sea Grant program related to fisheries, the other reports for FY 1979 must be reviewed. It is not possible to categorize each project into a single subject area. Therefore, considerable overlap between the different subject area reports occurs and should be expected. An arbitrary but educated decision has been made on what to include in each report. Please note that due to this overlap in coverage, it would be very misleading to add the number of projects and funding found in the various reports and expect it to equal the totals for the entire program. The totals from these reports would far exceed that for the whole program.

CURRENT FISHERIES ACTIVITIES

For the purposes of this report, the fisheries program has been subdivided into 10 major areas or groups. However, it should be recognized that many of the projects cover more than one area and could have been listed as being a different group. A particular project was included in a specific group because the author considered its principal purpose dictated that categorization. A list of the projects, divided into the following groups, is attached as an addendum.

Group A: This includes research projects on general fisheries biology, physiology, life history, growth, reproduction, ecology of an organism, etc. In other words, this group of projects are those which involve research in the animal itself rather than as a population of organisms.

Group B: These projects are all related to studies of populations of animals, rather than of the individual animal. Included are research efforts on stock assessment, population biology, etc.

Group C: In this group of projects are all of those involving studies of the environment as it affects or is affected by fish. This includes work in biological oceanography, disposal of organisms, especially planktonic forms, etc.

Group D: Included in this group are those projects in the broadly defined areas of mortality, fish pathology and human pathological organisms in fish.

Group E: This group of studies is in the field of fisheries technology and consists of efforts to improve our ability to identify, assess and harvest fish.

Group F: This category is comprised of research projects on the economics of development and management of fisheries.

Group G: In this group are those efforts in the different social science fields, including sociology, anthropology and general policy studies.

Group H: This includes both studies in fisheries law and general fisheries management studies.

Group I: These projects are those in the field of education and training of people in fisheries.

Group J: This group includes the advisory or extension projects limited to work in fisheries. Most Sea Grant advisory programs include efforts on fisheries. These are discussed in the report on Sea Grant Marine Advisory Services.

Table 1 indicates the distribution of projects and funds for FY 1979 and FY 1978. This Table shows a sizeable increase in effort in fisheries occurred in one year's time. Although the increase in absolute number may be somewhat distorted due to discretionary selection of projects by the author, there has been an increase of the order suggested by the totals. This is an indication of the program's response to the urgent needs of the fields of both fisheries development and fisheries management. However, it should be noted that the 25 percent of the total research funds going into fisheries-related work (in addition to seafood technology) in FY 1979 represents no increase over the percentage for FY 1978.

TABLE 1

Sea Grant Projects in Fisheries - FY 1978 and FY 1979

	FY 1978			FY 1979		
Groups	Number of Projects	Sea Grant (in K)	Matching (in K)	Number of Projects	Sea Grant (in K)	Matching (in K)
A	16	355	159	21	582	284
B	21	655	308	30	1010	426
C	15	513	480	25	897	660
D	11	358	173	13	328	200
E	14	292	198	8	158	106
F	19	689	332	23	778	415
G	3	46	22	4	90	46
H	15	453	204	15	461	283
I	7	190	177	7	224	291
J	5	117	54	3	133	65
TOTAL	126	3668	2107	149	4661	2786

DISCUSSION

United States commercial fisheries continue to expand in 1979 in terms of volume and value. In 1976, U.S. fishermen harvested 5.4 billion pounds of fish at a total value of $1.35 billion. The harvests in 1977 were 5.2 billion pounds and $1.52 billion, and in 1978 they were 6 billion pounds and $1.85 billion. This increase is expected to continue for several years due primarily to the harvest by U.S. fishermen of fish that were caught formerly by foreign fishermen. Record catches were recorded in 1978 for flounder, menhaden, pollock, rockfishes, sable fish, sharks, crabs, scallops, squid and the American lobster.

In connection with this increase in harvest, the U.S. is experiencing a rapid expansion in the construction of fishing vessels. In 1977 there were 1183 new vessels constructed, as compared with 706 in 1976.

These and other factors have produced renewed interest in fisheries development at the same time that fisheries management occupies the thinking of most of the same organizations. Thus, the National Marine Fisheries Service, the State fishery agencies, and the Regional Fishery Management Councils are all facing these dual major, and in some ways conflicting, interests simultaneously. In the last few years, organizations, whose primary objective is fishery development, have been established in each coastal region of the country. These groups are called either foundations or corporations and are attempting to fund and conduct those activities which will lead to greater harvest and sale of seafood products from their regions of the country.

Sea Grant programs have been and continue to be involved heavily with all of these organizations in both fisheries development and fisheries management. Sea Grant efforts in fisheries development are concentrated in two areas; enhancement of stocks now heavily harvested, such as salmon and abalone, and exploitation of what are now called non-traditional species (often referred to as under-utilized species). Efforts in this latter area of cephalopods (squids, octopus, etc.), elasmobranchs (sharks, rays, etc.), Herring eggs and sea urchins on the West Coast, to the deep sea red crab, sand launce, the Rangia clam and spiny dogfish on the East Coast, to carp and sucker in the Great Lakes. Also, some exploratory work is underway in some states to develop a fishery for a species that is heavily fished elsewhere, such as the project in Georgia on the hard clam.

Research being conducted to provide information for fisheries management purposes has three principal foci; (1) stock assessment, including work on herring, salmon, pleuronectids (includes ground fish such as the Doversole) and neritic reef fish on the West Coast, spiny lobster and snapper/groupers in Hawaii; tilefish, shellfish (oysters and clams), herring, swordfish on the East Coast, and whitefish, salmon, smelt, lake trout and yellow perch in the Great Lakes; (2) Recruitment

of new fish into a population, including work on blue and red crabs, spiny lobster and oyster; and (3) socio-economic and management/policy studies, including work to develop and test bio-economic fishery management models, analyze the effectiveness of the Fishery Management and Conservation Act, analyze the economic potential of new fishery ventures and to develop a body of information to improve our understanding of all groups involved in the fishing business.

Several Sea Grant programs deserve special attention due to their relatively unique nature; for example, the multi-institutional effort to obtain growth and longevity data on the Ocean Quahog which the industry is very interested in fishing more heavily. However, early studies indicated a very slow growth rate which would result in it being a candidate for over-harvesting. The University of Hawaii, in cooperation with state and federal agencies, is involved in a large, multi-faceted program which will attempt to obtain all the information necessary to intelligently expand fisheries in the Northwestern Hawaiian Islands. The Sea Grant efforts to develop new tools, techniques, etc. should be noted, such as the University of Washington's efforts in the development and use of acoustic systems for identifying fish populations and the NORFISH fishery management system. Lastly, the program in fisheries education, though limited, is providing two-year training options at two institutions on each of the East and West Coasts, a specialized program to train veterinarians in aquatic animal disease problems, and other special curricula for fishery professionals.

SEA GRANT PROJECTS IN GROUP A IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Genetic Interaction of Auke Creek Hatchery Pink Salmon with Natural Spawning Stocks in Auke Creek	Gharrett U. Alaska	$35,238	$13,516
Early Life Stages and Distribution of Gonatid and Ommastrephid Cephalopods from Alaskan Waters	Nishiyama U. Alaska	$22,230	$14,230
Growth of Pink Salmon Fry at Several Temperatures	Smoker U. Alaska	$14,609	$ 880
Reproductive Biology of the Snow Crab, Chinoecetes bairdi	Feder U. Alaska	$60,833	$10,617
Assessment of Aging Techniques and Their Application to Elasmobranch Fisheries	Cailliet U. Calif., San Diego	$21,148	$16,233
Artificial Imprinting of Chinook Salmon in a Multispecies Hatchery	Hassler U. Calif., San Diego	$ 9,297	$ 5,804
Endincrinology of Normal and Abnormal Salmon Smoltification and Adaptation to Seawater	Bern U. Calif., San Diego	$33,862	$11,233
Management Biology of the Northwest Florida Snapper and Grouper Fishery	Bortone U. System Fla.	$41,000	$37,700
Studies of Hard Clams as a Potential Resource in Georgia Coastal Waters	Tenore U. Georgia	$31,700	$13,300
The Ecology of Mya arenaria in the Tidal Flat Environment	Watling U. Maine/U. New. Hamp.	$50,000	$35,590
Factors Affecting Growth and Body Size in the Blue Crab	Reaka U. Maryland	$11,100	$ 3,150
The Biology of the Ocean Quahog (Arctica islandica)	Ross Woods Hole Oceano. Inst.	$50,000	$ -0-

SEA GRANT PROJECTS IN GROUP A IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Biological Analysis of the Age and Growth Rate of the Ocean Quahog, Arctica islandica	Lutz Rutgers U.	$24,600	$14,100
Contributions to the Biology of the Rock Shrimp Sicyonia Off South Carolina	Chamberlain So. Carolina Consortium	$ 5,200	$ 3,300
Habitat Identification, Samplings and Biological Investigation of Juvenile Snappers and Groupers in the South Atlantic Bight	Johnson So. Carolina Consortium	$16,800	$ 8,700
Life History Studies on Redfish (Sciaenops ocellata) and Red Snapper (Lutjanus campechanus)	Arnold U. Texas	$38,900	$19,471
Distribution, Abundance, Growth and Residence Time of Juvenile Salmon in the Skagit Salt Marsh	Congleton U. Washington	$15,000	$11,700
Factors Influencing the Reestablishment of Self-Sustaining Stocks of Lake Trout in Lake Michigan with Special Reference to Green Bay	Magnuson/Horrall U. Wisconsin	$27,681	$16,537
Food Requirements, Growth and Metabolism of Young Alewives (Alosa pseudoharengus)	Norden U. Wisconsin	$18,047	$ 7,623
Assessment of Long-Line Fishing Potential of the Broadbill Swordfish in Southwestern Puerto Rico	Shapiro U. Puerto Rico	$19,200	$10,400
Biological Analysis of the Age and Growth Rate of the Ocean Quahog, Arctica islandica	Rhoads Yale U.	$35,300	$18,724

SEA GRANT PROJECTS IN GROUP B IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Herring Stocks in Prince William Sound	Gharrett U. Alaska	$24,927	$ 1,600
Multiple Species Utilization of the Herring Eggs-on-Seaweed Fishery	Abbott U. Calif., San Diego	$37,249	$43,801
Fishery and Biology of Swordfish in Southeast Florida	Houde U. System Fla.	$21,000	$ 6,000
Population Biology of Spiny Lobsters Throughout the Hawaiian Archipelago	MacDonald/Stimson U. Hawaii	$36,466	$16,802
Development of a Biological Basis for Managing the Handline Fishery for Snapper and Grouper Populations in the Hawaiian Archipelago	Helfrich U. Hawaii	$30,590	$ 8,527
Genetic Aspects of Population Structure of Four Species in the Northwestern Hawaiian Islands	Shaklee U. Hawaii	$45,348	$26,687
Northwestern Hawaiian Islands	Balazs U. Hawaii	$26,785	$ 8,317
Trophic Analysis of Shallow-Water Fish Communities in the Northwestern Hawaiian Islands: Effects of Natural and Human Predation	Parrish/Taylor U. Hawaii	$44,598	$16,445
Prediction of Annual Fisheries Yields in the Northern Gulf Region	Turner Louisiana St. U.	$19,579	$ 7,805
The Regulation of Intertidal Soft-Bottom Community Structure and the Population Dynamics of *Mya arenaria*, Nereis	Commito U. Maine/U. New Hamp.	$19,847	$10,176
Genetic Variation and Population Definition in Atlantic Herring	Kornfield/Sidell U. Maine/U. New Hamp.	$32,989	$30,557

SEA GRANT PROJECTS IN GROUP B IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Vital Parameters for the Development of a Sand Launce (Ammodytidae) Fishery off the Coast of New England	Smith U. Maine/U. New Hamp.	$55,543	$22,154
Compensatory Response of Lake Trout and Lake Whitefish to Exploitation	Jensen U. Michigan	$11,580	$ -0-
Identification of Current Spawning Grounds and Prediction of Potential Spawning Areas for Yellow Perch in Southeastern Lake Michigan	Dorr/Jude U. Michigan	$17,690	$ -0-
Competition Between Juvenile Salmon and Trout in Great Lakes Spawning Streams	White U. Michigan	$ -0-	$22,960
Population Characteristics and Stock Identification of Western Lake Superior Smelt	Adelman U. Minnesota	$ 5,432	$ 7,900
Life History and Population Dynamics of Tilefish, Lopholatilus chamaeleonticeps	Able New Jersey Mar. Sci. Consortium	$19,000	$13,300
Population Dynamics of the Great South Bay Shell-Fishery	Malouf SUNY/Cornell U.	$12,725	$ -0-
Basic Population and Biological Data for Spiny Dogfish, Squalus acanthias	Woodhead SUNY/Cornell U.	$19,371	$ 2,492
Determined Movement Patterns of Salmonids to Aid Sport Fishing and Stock Assessment	Winter SUNY/Cornell U.	$24,465	$19,487
The Biology and Biomass of Juvenile Sciaenid Fishes and Their Food in the Pamlico River Estuary	Miller U. North Carolina	$19,678	$15,543

SEA GRANT PROJECTS IN GROUP B IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Pleuronectid Production System and its Fishery	Carey/Pearcy/Tyler Oregon St. U.	$156,300	$54,900
Biology and Conservation of Neritic Reef Fishes	Horton Oregon St. U.	$ 30,400	$14,100
System Dynamic Model of the Fishery for Pacific Hake	Bernard/Stander Oregon St. U.	$ 94,000	$ -0-
A Comparative Study of Seasonal Distribution and Abundance for Fishes and Decapod Crustacea Within South Carolina	Wenner So. Carolina Consortium	$ 21,000	$10,400
Development of Yield Model Assessments and Population Dynamics and Effects of Fishing on Gulf of Mexico Fishes	Chittenden Texas A&M U.	$ 59,000	$18,430
Vital Statistics and Population Structure of the Wisconsin Whitefish Fishery of Lake Michigan	Brooke U. Wisconsin	$ 19,000	$10,020
Optimizing Yield From Western Lake Superior Commercial Fisheries Through Smelt Stock Assessment	Swenson U. Wisconsin	$ 21,493	$10,839
Dynamics of Sucker Populations of Green Bay and Adjacent Waters of Lake Michigan	Magnuson U. Wisconsin	$ 41,103	$18,691
Dynamics of Herbivore Populations and First-Year Yellow Perch in Lower Green Bay	Richman/Sager U. Wisconsin	$ 43,085	$ 8,448

SEA GRANT PROJECTS IN GROUP C IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Effect of Commercial Harvesting Techniques on Two Species of Hardshell Clams in Prince William Sound, Alaska	Feder U. Alaska	$34,950	$11,319
Relationship Between the Distribution of Pink Shrimp, *Pandalus borealis* and Oceanographic Parameters	Niebauer U. Alaska	$33,935	$34,160
Experimental Abalone Enhancement Program	Tegner U. Calif., San Diego	$78,627	$120,966
Sensory and Behavioral Effects of Pollutants on the Crab and Lobster Fishery	Case U. Calif., San Diego	$16,290	$ 8,607
Southern Californias Near-shore Environment: A Significant Fish Nursery	Brewer U. So. Calif.	$55,087	$130,198
Influence of Tides and Habitat Restrictions on Fundulus Reproduction	Taylor U. Delaware	$23,189	$ 4,011
The Role of Fundulus Herteroclitus in Tide Marsh Dynamics	Lotrich U. Delaware	$26,811	$ 13,762
Dispersal and Recruitment of Blue Crab Larvae	Epifanio U. Delaware	$57,620	$ 7,053
Spiny Lobster (*Panulirus argus*) Larval Recruitment in the Florida Keys	Menzies U. System Fla.	$69,300	$ 33,900
Reef and Shelf Ecology of the Hawaiian Archipelago	Grigg U. Hawaii	$29,895	$100,222
Primary and Secondary Plankton Productivity and Potential Fishery Yields in the Hawaiian Archipelago	Hirota U. Hawaii	$99,804	$ 46,899

SEA GRANT PROJECTS IN GROUP C IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Growth, Development, and Dispersal Characteristics of the Larval and Post-Larval Stages of the Deep Sea Red Crab, Geryon quinquedens	Van Heukelem/Sulkin U. Maryland	$32,000	$ 5,950
Source of Blue Crab Recruitment in Mid-Atlantic Est.: Larval Behav. and Genetic Variation as Indic. of Larval Exchange Among Estuarine Systems	Sulkin/Van Heukelem U. Maryland	$40,000	$11,900
Role of Isopycnal Mixing, Convergences, and Exchange Patterns in the Distribution of Oyster Beds	Seliger U. Maryland	$20,000	$ 4,100
The Role of Advection and Dispersion in Determing the Success of Oyster Spat Settlement in Two Adjacent Tributaries of the Chesapeake Bay	Boicourt/Kennedy U. Maryland	$40,000	$11,600
Bicrobial Biofouling and the Role of Microorganisms in Attachment and Development of Sessile Invertebrate	Colwell U. Maryland	$ 5,000	$ 7,550
Role of Chitin in the Accumulation of Heavy Metals in the American Oyster (Crassostrea virginica)	Smucker U. Maryland	$18,000	$13,850
Effects of Environmental Variables on Uptake of Cadium in the Tissues of American Oyster, Crassostrea virginica	Hung U. Maryland	$11,000	$ 1,500
Dormant Cysts and Trace Metal Sensitivity: Key Factors in Initiation, Development, and Geographic Spreading of the Toxic Dinoflagellate Blooms	Guillard Woods Hole Oceano. Inst.	$30,000	$ 5,860

SEA GRANT PROJECTS IN GROUP C IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
PCBS, DDT Compounds and Dieldrin Levels in Carp	Zabik U. Michigan	$ -0-	$14,287
The Role of Mississippi Sound in Recruitment to Sport and Commercial Fish Stocks	Richardson Miss/Alabama Consortium	$19,815	$10,774
Reproduction and Tissue Response in Prairie Vole Red Mirex and Lake Ontario Coho Salmon	Martin SUNY/Cornell U.	$13,061	$ 9,978
Assessment and Control of Viral Pollution of Marine Resources	Melnick Texas A&M U.	$23,000	$11,700
Distribution and Migration of Blue Crab Larvae in the Lower Chesapeake Bay and Adjacent Coastal Waters	Provenzano VIMS	$51,800	$26,568
Competition for Resources Among Planktivorous Fishes in Lake Michigan	Magnuson U. Wisconsin	$34,812	$18,939

SEA GRANT PROJECTS IN GROUP D IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Chemical Ecology of Feeding, Reproduction, and Fright Behaviors of Oyster Drills as a Means for Drill Control	Carriker U. Delaware	$51,638	$43,363
Ecological Studies on Vibrio Cholerae in Waters of Louisiana	Siebeling Louisiana St. U.	$ -0-	$40,525
Study of the Ecology of Bdellovibrio in the Chesapeake Bay and Its Sub-Estuaries	Falkler/Williams U. Maryland	$ 5,000	$ 7,550
Viral Evaluation of Prohibited Oyster Growing Waters	Ellender Miss/Alabama Consortium	$19,815	$10,774
Assessment and Control of Virus Contamination of Shellfish	Sobsey U. North Carolina	$41,171	$20,045
Investigations of the Microbiology of Rangia Clam with Emphasis on Solution to Marketability Problems	Kane U. North Carolina	$11,840	$ 5,336
The Life Cycle, Transmission and Pathology of Eustrongylides tubifex	Crites Ohio St. U.	$ 8,600	$ 4,100
Detection, Prevention and Control of Diseases in Fish	Fryer Oregon St. U.	$78,700	$28,400
Marine Pathology	Wolke U. Rhode Island	$45,838	$ 9,112
Nutrition and Biology of the Oyster Parasite-Perkinsus Marinus (Dermocystidium marinum)	Loeblich Texas A&M U	$ 7,600	$ 4,287
Investigations of the Cause and Epizootiology of Mortalities in Soft and Shedding Blue Crabs	Van Engel VIMS	$39,000	$19,461
The Effects of Hemoflagellates of Commercially Important Estuarine Fishes	Burreson VIMS	$10,900	$ 7,515

SEA GRANT PROJECTS IN GROUP D IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	MATCHING
Plasmid Contribution to the Virulence of Marine Vibrios (Supplement)	Crosa U. Washington	$ 5,026	$ 900

SEA GRANT PROJECTS IN GROUP E IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Evaluation of Small-Mesh Trap Nets for the Harvest of Round Whitefish (Prosopium cylindraceum), An Underutilized Species	Miller U. Michigan	$ 9,929	$ 4,356
The Impact of Netting and Sport Fishing on Economically Important Estuarine Species	Lorio Miss/Alabama Consortium	$12,745	$11,625
Control of Corrosion and Deterioriation of Trawling Cables	Kilbe Oregon St. U.	$22,200	$25,900
Tank Testing URI Series Trawl	Hillier U. Rhode Island	$13,955	$ 6,825
Hydroacoustic Resource Assessment Techniques	Thorne U. Washington	$30,100	$22,000
Evaluation of Acoustic Techniques of Resource Assessment	Thorne U. Washington	$26,200	$16,400
Acoustic Estimation of Salmon in Terminal Areas	Mathisen U. Washington	$22,500	$12,500
In Situ Measurement of the Acoustic Target Strength of Fish	Ehrenberg U. Washington	$20,900	$ 5,800

SEA GRANT PROJECTS IN GROUP F IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Alaska Underutilized Species - World Use International Trade and Processing Techniques	Gorham U. Alaska	$30,886	$ 5,697
Forecasting Ex-Vessel and Wholesale Prices for Selected Alaskan Fisheries Using Linear Time Series Model	Gorham U. Alaska	$ 1,300	$35,767
Economics of Fisheries and Aquaculture Development	Johnston/Hand U. Calif., San Diego	$63,269	$16,806
An Economic Analysis of the California Abalone Fishery and the Experimental Enhancement Program	Deason U. Calif., San Diego	$ 4,420	$ 8,307
Simulation of Unified and Multi-Purpose Fleets in Milti-Stock Fisheries	Anderson U. Delaware	$70,981	$24,376
Economic Benefits and Costs of the Fishery Conservation and Management Act of 1976	Bell U. System Fla.	$12,500	$ -0-
Economic Analysis of Commercial Fishing and Seafood Marketing	Prochaska U. System Fla.	$46,500	$57,700
Risk Analysis of the Fishing Vessel as an Investment	Lyda U. Georgia	$16,200	$10,300
Economics of Fisheries Development for the Hawaiian Archipelago	Davidson/Comitini U. Hawaii	$18,209	$21,801
Economic Analyses of Seafood Production in Louisiana for Use in Firm and Public Resource Management	Roberts Louisiana St. U.	$18,076	$10,179
An Economic Evaluation of the Chesapeake Bay Sport and Commercial Striped Bass Fisheries	Norton/Strand U. Maryland	$21,200	$29,000

SEA GRANT PROJECTS IN GROUP F IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	MATCHING
Small-Scale Commercial Fisheries in New England	Smith/Peterson Woods Hole Oceano. Inst.	$20,000	$20,255
Fishery Economics and Marketing	Talhelm U. Michigan	$34,000	$ -0-
Oyster Depuration Facility: Economic Assessments	Williams Miss./Alabama Consortium	$12,159	$ 6,080
Structure of the Market for Finfish and Shellfish in New York State, and Market Potential for New Processed Finfish and Shellfish	Goodrich SUNY/Cornell U.	$32,717	$19,218
The Socioeconomic Impact of Depuration on the Great South Bay Watermen	Goodman SUNY/Cornell U.	$ 6,867	$ 6,491
Economic Implications of the International Marketing of Pacific Coast Seafoods	Johnston Oregon St. U.	$56,000	$18,900
Analysis of Changes in Capacity in New England Fisheries	Bockstael/McConnell U. Rhode Island	$34,910	$ 6,111
Economics of Production and Marketing in the Commercial Fish Industry	Griffin Texas A&M U.	$80,000	$40,000
Development of a General Budget Simulator for Aquaculture Systems and Fishing Vessels	Griffin Texas A&M U.	$137,500	$70,591
Economic Impact of Joint Venture Operations on the U.S. Northeastern Pacific Fisheries	Kaczynski U. Washington	$17,500	$ -0-
Economics of Rehabilitating the Lake Michigan Fishery: A Case Study	Bishop U. Wisconsin	$24,424	$ 7,903

SEA GRANT PROJECTS IN GROUP F IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	MATCHING
Recreational and Commercial Fishing in Wisconsin's Lake Michigan Waters	Bishop U. Wisconsin	$17,671	$ 5,674

SEA GRANT PROJECTS IN GROUP G IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Human Ecology of New Jersey Fisheries	McCay New Jersey Mar. Sci. Consortium	$ 8,100	$ 4,200
The Sociocultural Organization of Fishing in a North Carolina Coastal Community - Perspectives for Economic Development	Sabella U. North Carolina	$18,259	$ 9,532
Social and Economic Characteristics of Texas Gulf Coast Fishermen	Yetley Texas A&M U.	$35,000	$18,205
Saltwater Boat Fishermen: A Statewide Survey of Activity Patterns, Characteristics and Motivation	Ditton Texas A&M U.	$28,700	$14,233

SEA GRANT PROJECTS IN GROUP H IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Analysis of Coordination Among Federal, Regional, and State Policies for Managing Marine Fisheries	Moore/Wyner Cincin-Sain U. Calif., San Diego	$30,564	$20,397
Development of Multispecies Management for Kelp Bed Resources with an Emphasis on Sea Urchins	Tegner U. Calif., San Diego	$48,915	$10,296
International Trade and Investment Law Aspects of the Development of a Fisheries Product Export Industry in Louisiana	Wascom Louisiana St. U.	$18,743	$ 1,642
Predicting Annual Success and Possible Effects of Various Management Strategies in Louisiana's Brown and White Shrimp Fisheries	Condrey Louisiana St. U.	$15,945	$15,143
Developing a Model Commercial Fisheries Statute for the Great Lakes States	Bronstein U. Michigan	$ -0-	$20,000
Application of Management Strategies to the Mid-Atlantic Extended Jurisdiction Recreational Fisheries	Wilkins SUNY/Cornell U.	$12,936	$13,710
Is Extended Jurisdiction Working?	McHugh SUNY/Cornell U.	$24,356	$14,455
A Multiple Species Fishery Model: An Output-Input Approach (Pilot Study)	Roppensteadt SUNY/Cornell U.	$28,436	$24,585
Development of Policy Alternatives for Shrimp Fishery Management	Fishman U. North Carolina	$13,519	$ 6,528

SEA GRANT PROJECTS IN GROUP H IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Legal and Institutional Approach to the Columbia River Basins Anadromous Fishery Crisis: A Guide for Action	Blumm Oregon St. U.	$20,500	$12,200
Implementation of the Fisheries Conservation and Management Act in the Pacific Northwest: Legal Information and Education Services	Jacobson Oregon St. U.	$71,100	$36,400
An Evaluation of the Effects of the 1976 FCMA on Fisheries Management in the Northeastern Pacific Ocean	McKernan U. Washington	$26,700	$21,400
Fishing Vessel Safety Analysis Center	Adee U. Washington	$11,400	$12,900
NORFISH 11-A Joint Sea Grant - National Marine Fisheries Service Project in Aid of Regional Fisheries Management	Bledsoe U. Washington	$115,000	$64,400
Alternative Management Strategies for Minimizing PCBs in Lake Michigan Fishes	Kitchell U. Wisconsin	$21,979	$ 9,522

SEA GRANT PROJECTS IN GROUP I IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Development and Pilot Testing of Fishing and Related Instructional Materials	Naughton U. Hawaii	$ 7,500	$18,851
Massachusetts Marine Fisheries Education and Training Program	Kan/Clifton MIT	$46,000	$92,056
Aquavet: A Training Program for Aquatic Veterinarians	Abt SUNY/Cornell U.	$30,000	$ -0-
Development Program for Professional Fishermen	Phillips Oregon St. U.	$62,600	$37,900
Fisheries and Marine Technology	Motte U. Rhode Island	$45,518	$104,473
Education in Ocean Law Enforcement	Burke U. Washington	$13,500	$16,300
Extended Fisheries Training	Chapman U. Washington	$16,500	$21,400

SEA GRANT PROJECTS IN GROUP J IN FY 79

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Marine Fisheries Extension Service	Honey U. Maine/U. New Hamp.	$75,000	$37,500
Commercial Fishermen	McGee U. North Carolina	$29,080	$15,964
Washington Map Project - South Sound (Commercial Fishermen) (Clover Park Vocational - Technical Institute)	Wilson U. Washington	$28,800	$20,900

THE SEA GRANT ANIMAL AQUACULTURE PROGRAM

by

William N. Shaw

The National Sea Grant Program has been supporting aquaculture research since 1968. When Sea Grant was established in 1966, Congress declared, "that aquaculture, as with agriculture on land, and the gainful use of marine resources can substantially benefit the United States, and ultimately the people of the world, by providing greater economic opportunities, including expanded employment and commerce, the enjoyment and use of our marine resources, new sources of food, and new means for the development of marine resources."

The three principal activities of the Sea Grant Program are research, education, and advisory services. In fiscal year (FY) 1978, for example, federal support for the above activities totaled $34.1 million. In addition, $21.4 million were spent in matching funds (non-federal money). The highest percentage of Sea Grant support is directed towards research, approximately 50%. This research is divided into four broad categories: 1) Marine Resources Development, 2) Marine Socio-Economics and Legal Research, 3) Marine Technology Research Development, and 4) Marine Environmental Research. Although aquaculture research projects are found in all of the above four categories, the majority are in Marine Resources Development.

The following will describe the types of research Sea Grant is supporting in animal aquaculture. In FY 79 there were 85 projects related to animal aquaculture. These were funded at a level of $3.2 million federal funds and $2.9 million matching, non-federal dollars (see Table 1 for breakdown). Because Sea Grant is directed to conduct research related to the marine resources, emphasis is on species that are found in this environment. In the NOAA Aquaculture Plan, which was prepared by the National Marine Fisheries Service and the Office of Sea Grant, species were divided into high-priority, medium priority, and low priority. Sea Grant's effort is directed towards the high priority species -- salmon, marine shrimp, freshwater prawn, American lobster and oysters.

FINFISH

Salmon Projects

The greatest amount of Sea Grant's effort in finfish culture is centered around salmon. At the University of Alaska, researchers are examining the genetic interactions of Auke Creek hatchery Pink salmon with natural spawning stocks. In another project, the investigator is

TABLE 1 BREAKDOWN OF SEA GRANT FUNDING IN ANIMAL AQUACULTURE

AS OF OCTOBER 1, 1979

PHYLUM	NO. OF PROJECTS	SG FUNDING	MATCHING
I. Crustacean			
Macrobrachium	5	342,993	388,467
Lobster	4	287,464	353,363
Marine shrimp	7	289,626	279,603
Crawfish	2	63,302	48,068
Brine shrimp	2	105,921	60,590
Sub-total Crustacean	20	1,089,306	1,130,091
II. Finfish			
Pacific salmon	19	728,527	536,544
Atlantic salmon	3	122,560	40,640
Finfish - Other (Sturgeon, baitfish, Yellow perch, eel, striped bass, Red fish, etc.)	13	307,416	260,785
Sub-total Finfish	35	1,158,503	837,969
III. Mollusks			
Oyster	13	366,317	533,496
Clam	5	152,108	97,193
Abalone	3	158,312	152,733
Scallop	1	25,944	18,744
Sub-total Mollusks	22	702,681	802,166

TABLE 1 (CONT'D)

PHYLUM	NO. OF PROJECTS	SG FUNDING	MATCHING
IV. Aquaculture (Other)			
Bait worm	1	16,812	30,156
Bait leech	1	11,177	9,404
Frog	1	27,439	11,274
Seafood wastes for feeds	1	4,600	2,300
Budget simulator	1	137,500	70,591
Compartmental models	1	17,000	6,217
Upwelling-economic analysis	1	33,286	16,643
AQUAVET	1	30,000	-0-
Sub-total (Aquaculture-Other)	8	277,814	146,585
GRAND TOTAL	85	3,228,304	2,916,811

developing and testing an economical dry salmon ration comprised of readily available, locally-produced dry ingredients and a species of abundant, underutilized fresh fish. Also at the University of Alaska, researchers are determining the effects of oil contaminated food on the growth of young pink salmon. The University of Alaska is establishing a training program which will provide hatchery technicians to work in the many new state and private salmon hatcheries. A unique part of this program is that a production hatchery is being established on campus which will produce fish for the common-property fishery and serve as a source of self-sustaining funds from the sale of returning salmon.

A major effort in salmon stock enhancement is being conducted at the University of Washington. This project is subdivided into four subproject objectives:

1. To develop management strategies for increased survival of wild and hatchery stocks of Puget Sound salmon based on alterations of behavior and quality of smolts.

2. To determine the effects of various hatchery incubation systems on chum salmon fry quality and migration timing.

3. To develop an improved production diet for young salmon.

4. To recover and analyze the 1978 and 1979 adult salmon returns from experimental lots of coho and chinook marked and released in 1975, 1976, and 1977.

A major salmon pen rearing industry (DomSea Farms) has developed in Puget Sound. In an effort to help this industry, researchers are: 1) attempting to develop a coho salmon broodstock with desired characteristics for marine pen culture, and 2) looking at thyroid endocrine control of salmon smoltification to reduce parr-reversion.

Also at the University of Washington nutritionists and food scientists are attempting to develop nutritional - balanced feeds that are readily acceptable, not only for young salmon but also other larval fishes reared throughout the world.

Oregon State University has a diversity of salmon related projects covering the areas of research and training. Investigators are studying the interrelationships of dietary lipid and protein on the growth, quality and production of cold water cultured fish. In addition, researchers are attempting to bring back the Oregon chum salmon resources. Present objectives are: 1) to continue artificial propagations of the Whisky Creek stock to accelerate development of an Oregon chum salmon brood stock and 2) to develop and demonstrate a post-incubation strategy that maximizes return per unit of hatchery production.

University pathologists are: 1) providing an inspection service for Pacific Northwest aquaculturists that will facilitate their compliance with fish health regulations and their ability to maintain healthy fish; and 2) improving techniques of immunization and developing new or more effective vaccines for the control of infections deseases.

Agricultural and resource economists are: 1) gathering historical data on government regulations in the U.S. and abroad, and relating these data to historical development of aquaculture in different regions; and 2) analyzing production and cost relationships in various kinds of aquaculture to make possible prediction of how changes in these relationships affect the viability of aquaculture operations. Salmon is one of the principal species that is being affected by regulations in Oregon and other areas of Northwest.

Because of the concern of industry related to the effect of harbor seals as a predator on salmon releases as part of their ocean ranching operation, researchers at Oregon State University are assessing the population growth and feeding characteristics of harbor seals to determine their current and future impact on aquaculture. Another project at OSU is identifying the economic consequences of public policy affecting the mix of wild salmon stocks, stocks which are cultured in public hatcheries, and stocks released into the ocean from private aquaculture.

Because of the expansion of aquaculture in the Pacific Northwest, there is a need for technical personnel capable of dealing with the complex interplay between disciplines -- personnel prepared to act with proficiency in several specialized roles. A program of Oregon State University, to meet this demand, offers graduate-level opportunities for study in several aquaculture-oriented disciplines combined with opportunities for practical experience in salmon aquaculture production.

At the University of Idaho, a study is underway to abolish the carry states of furuculosis and bacterial kidney disease in andromous Pacific salmon.

As part of the University of California Sea Grant College Program, researchers at Humboldt State University are investigation the possibility of increasing chinook salmon returns by artificial imprinting. At the University of California, Berkeley, researchers, by employing environmental or hormonal methods, are trying to alter the endocrine system and its control of salmon smoltification and sea water adaptation with the aim of reducing or eliminating initial mortality and subsequent stunting (parr-reversal) when young, incompletely smoltified coho salmon are transferred to sea water pens.

At the Universities of Maine and New Hampshire, studies are being conducted on the antigenic and genetic characterization of infections

pancreatic necrosis (IPN) virus of salmonid. Hopefully, the results will facilitate the development of an effective vaccine, and facilitate detection and identification of the virus.

A project related to Atlantic salmon is now underway at the University of Rhode Island. The objectives of the project are:

1. To minimize stress in salmonid production operations through environmental optimization, in order to reduce the incidence of infectious and non-infectious diseases.

2. To adapt European practices for the intensive culture of salmonids in acidic low ionic concentration waters.

3. To establish a quantitative relationship between critical environmental parameters and blood factors affecting respiration.

In addition, URI economists are assessing the commercial viability of Atlantic salmon aquaculture to water reuse systems and ocean ranching in New England.

Supporting the salmon aquaculture program, URI pathologists routinely examine fish for diseases and suggest prevention and treatment.

Other Finfish Projects

Sea Grant has several projects dealing with finfish culture other than salmon. Researchers at Cornell University are looking at the intensive culture of walleys. Major effort is in the development and testing of suitable diets.

Over the past seven years, researchers at the University of Wisconsin have been studying the economic potential of culturing yellow perch. Presently, there are four projects centered around this species: 1) the modeling of perch aquaculture systems; 2) energy requirements of yellow perch; 3) evaluation of water reuse systems for yellow perch aquaculture, and 4) development of aquaculture systems for yellow perch (includes developing diets, improving reproductive efficiency, developing techniques for obtaining dependable supply of fingerlings, and developing methods for controlling sex and producing faster-growing females or sterile fish).

Studies on the potential of culturing eels continues at North Carolina. Emphasis is on nutrition studies and pond production dynamics. Also in North Carolina a project is being conducted on evaluating the potential of striped bass females crossed with white bass males and striped bass females crossed with white perch males hybrids for aquaculture. Major objectives are: 1) to determine food preference of larvae hybrids; 2) to determine comparative survival, growth and

adaptability of the two hybrids to pond and cage culture in both fresh and brackish water; and 3) to determine which of the hybrids would be more suitable for continuing experiments.

Studies continue at the University of Minnesota on the preservation of gametes from freshwater fishes. To date, the investigators have been able to freeze salmonid spermatozoa and obtain near normal fertility percentages upon thawing. Also, they have successfully frozen fertilized salmonoid eggs without terminating development upon thawing. Also at Minnesota, investigators are looking at the role of fatty acids in the reproduction of fish.

Researchers at the University of Hawaii are developing a cost-effective top minnow culture system capable of producing quantities of live baitfish required for the tuna fishery. At Hawaii's Oceanic Institute, attempts are being made to culture marine finfish in open sea cages. A mini-project has been initiated at the University of California, Davis, looking at the technology necessary for a prototype sturgeon hatchery for two native species -- the white and green sturgeon.

CRUSTACEAN

Major emphasis in crustacean aquaculture is centered around three species -- marine shrimp, Macrobrachium or freshwater prawn, and lobster. In addition, a small amount of effort is going into crawfish and brine shrimp culture.

Marine Shrimp

Research in marine shrimp is centered at Texas A&M University. For a number of years, investigators have been studying the commercial feasibility of culturing this species in the U.S. Emphasis has been directed towards production systems and determining which species can be grown successfully in ponds along the Texas coast. Jointly, with the NMFS, researchers at Texas A&M and the University of Houston are attempting to increase their understanding of penaeid shrimp maturation and reproduction with goals to be able to spawn a number of speices in captivity. To back up this multidiscipline program, economic data is being collected to improve models of commercial shrimp mariculture. Microbiologists are developing immunoprophylactic techniques for protecting shrimp against certain acute and chronic bacterial disease agents.

There are two other disease related projects on marine shrimp. At the University of Arizona, researchers are examining the toxic effects of certain marine blue-green algae that have been circumstantially linked to disease. Also, jointly with the University of Arizona and San Diego State University, attempts are being made to develop an easily administered vaccine for Fusarium disease in shrimp.

Freshwater Prawn

The Marine Resources Research Institute in South Carolina is in their final year of studies on developing Macrobrachium culture in the State. The program has been evaluating open pond culture by defining pond stocking strategies, monitoring pond environment conditions, developing feed management practices and examining methods of reducing labor costs associated with feed, water quality monitoring and harvesting. In conjunction with this program, economists at Clemson University are examining grow-out costs, designated research needs to cut costs, and providing projections of cash flow and investment information.

There are two major programs on Macrobrachium culture in Hawaii; one is with the University; the other is with the Department of Land and Natural Resources (DLNR). At the University of Hawaii, the program is contributing to increase production reliability and efficiency through determination and manipulation of the significant biological bases of the commercial pond culture of prawns. Of significant importance is the work related to improving genetic stocks.

The DLNR program is: 1) providing extension service, consulting service, training and acting as an information center to public and private sectors in the prawn industry or prawn research; 2) through investigative research and application of available research information at cooperating prawn farms, developing methods of increasing production in prawn farming and reducing costs and risks of crop losses and through our experiences in field situations, identifying the needs for further research in specific areas of prawn industry development and cooperating with other investigators in prawn research; 3) conducting research on methods to improve the cost effectiveness of rearing M. rosenbergii larvae; 4) producing juvenile prawns and providing to new and existing farmers; and 5) producing and providing prawns (juveniles and breeders) to the public sector engaged in research activities relating to farming to freshwater prawns.

Finally, at Rutgers University, investigators are trying to improve the water stability and nutrient retention in commercially prepared diets.

Lobster

A center for the development of the science and technology of crustacean aquaculture is now located at the University of California-Davis with the marine laboratory at Bodega Bay. The objective of this program is to develop crustacean aquaculture by researching selected species and providing technology that will lead to domestication of these animals. In the past, major effort has been with lobsters but the program plans to expand into shrimp and crab. A multidisciplinary

approach will be used to identify and solve problems common to crustacean aquaculture in reproduction, larval development, physiology, genetics, engineering, nutrition, and pathology.

A separate project at the University of California-Riverside is acquiring an understanding of the basic mechanisms involved in decapod fertilization and to develop methods to control fertilization in commercial important crustaceans, initially lobsters.

At Woods Hole Oceanographic Institution, investigators are evaluating the utilization of carbohydrate and protein by postlarval lobsters in order to define an optimum protein: carbohydrate and protein: energy ratio.

Researchers at the University of Maine are attempting to formulate and evaluate minimal cost lobster rations based on analysis of lobster natural dietary intake and metabolic studies.

Crawfish

For a number of years, research on crawfish has been conducted at Louisiana State University. Recently, the priority areas of research were identified and a project was initiated to answer these areas of need which are: 1) to develop methods for double cropping rice/crawfish; 2) to determine the acute and chronic toxicity of selected pesticides to crawfish; 3) to determine the best methology for growing forages in crawfish ponds; 4) to develop an artificial bait for crawfish; and (5) to improve trap design and harvesting methods.

A second project at Louisiana State University is evaluating wastes from the Louisiana crawfish industry in terms of its pigment-value in aquatic diets, especially those for the tropical fish industry.

Brine Shrimp

There are two projects related to brine shrimp aquaculture. The first is a continuing project as the University of Rhode Island where investigators are examining 5 strains of brine shrimp related to the biochemical composition and biological effectiveness of brine shrimp to support growth and survival of marine fish and crabs. The second project at the University of Texas is establishing the technical and economic feasibility of producing brine shrimp in the St. Croix "Artificial Upwelling" mariculture system.

MOLLUSKS

Presently, Sea Grant is supporting 21 projects related to molluscan aquaculture. Species being examined include oysters (the Eastern

Pacific, and Olympia), clams (hard, manila, cockle, and gaper), abalone, rock scallop, and mussel.

Oyster

Experiments at the University of Washington continue on the development of hybrid strains of oysters that demonstrate resistance to summer mortalities that occur along the West Coast and in Japan. Selected hybrids have been place in areas where summer mortalities have occurred in the past; i.e., Puget Sound and Japan. Results to date indicate that these strains of hybrid oysters have improved resistance to summer mortality. Also at the University of Washington, the marine advisory is attempting to determine possible causes of two-year reproductive failure of the Olympia oyster.

At Oregon State, significant technological advances have been made in oyster culture. Presently, the investigators are encouraging commercial growers to adopt these new techniques. Specific objectives include: 1) to demonstrate to growers culture techniques for raising cultchless seed supplied by hatcheries; 2) to conduct in a commercial hatchery a year-long experimental demonstration of selective breeding and brood stock management of Pacific oysters; 3) to identify optimum conditions for producing kumanoto see oysters 4) to determine the commercial potential of Crassostrea rivularis by evaluating methods of growing out of these oysters to market size; 5) to demonstrate in Tillamook and Yaquina Bays techniques for setting and growing out eyed oyster larvae; and 6) to meet with established and potential oyster growers and to publish research results in order to extend recent advances in oyster production technology.

The largest major effort in oyster culture that is supported by Sea Grant is the development of the controlled mariculture system by researchers at the University of Delaware. The program is dealing with many facets: nutrition, engineering, microbiology, and water quality. Several industries are partners in this program. Presently, a $1.2 million mariculture laboratory is being constructed. Their main emphasis is to construct, continuously operate, evaluate and document a controlled environment oyster production prototype system in the new laboratory. In addition, a major effort will be directed towards developing a reliable mass cultivation of marine algae at a reasonable cost.

At Virginia Institute of Marine Science, studies continue on the development of oyster strains that are resistant to the disease Perkinsus marinus. These stocks, if developed, will be made available to hatcheries for the production of resistant seed.

At the University of Maryland, biologists are comparing the relative efficiency and cost effectiveness of several "off bottom" spat collecting techniques. The off-bottom technique is being compared to collectors

placed on the bottom. Survival of newly collected oysters is being examined in protected environments.

A second project is examining larval population in a shellfish hatchery to determine whether specific sub-classes of individual spawns have better development potential than others. In reference to stock enhancement, studies are underway to determine why certain rivers in the Chesapeake Bay have a good history of oyster setting while others do not. The results could assist managers to concentrate on conservation and/or rehabilitation of the oyster resources in regions with suitable dispersive conditions to provide larval retention and higher chances of good spat settlement. Also at the University of Maryland nutritionists are attempting to determine the oyster's requirements for sterols.

Studies continue at SUNY/Cornell to develop methology to provide aid to the industry related to their shellfish disease problems. A manual of shellfish pathology and a report on bacterial flora is being developed that can be used throughout the shellfish industry.

Clam

Researchers at Oregon State University are developing methods for supplementing or rehabilitating natural clam resources through hatchery and planting programs. To achieve these goals, they are: 1) developing spawning methods for the cockle (Clinocardium corbus) and gaper clam (Tresus capax); 2) developing techniques to rear cockle and gaper clam larvae to planting size; and 3) determining the planting time and clam size that will maximize field survival and growth to harvest size of several varieties of bay clams.

At the University of Washington, researchers are developing methods for large scale application of plastic netting for Manila clam stock enhancement. They are measuring the effectiveness of the netting as an attractant for clam setting and increasing survival of planted clams.

Sea Grant is supporting two projects related to clam genetics. Researchers at George Mason University are determining the genetics and breeding structure of clams, Mercenaria spp. The results of this project will furnish basic information required for the development of breeding programs for producing superior breeds and hybrids of clams.

At the University of Georgia, protein gel electrophoresis is being used to mark genetically distinct strains of hard clams. This research will provide basic genetic data to facilitate stocking and management efforts for the clam fishery on the Georgia coast.

The Marine Resources Research Institute in South Carolina is looking at the economic feasibility of hard clam mariculture. They are examining

specific culture systems and the formation of legislation and permitting regulations to incite, manage, and regulate mariculture in South Carolina.

As a part of a study related to hard clams as a potential resource in Georgia coastal waters, investigators are determining the necessity and feasibility for augmenting production by seeding and using various protective techniques.

Abalone

The University of California Sea Grant program is examining experimental abalone enhancement. The overall objective of this joint project with California's Department of Fish and Game and industry is to determine the scientific and economic feasibilities of enhancement abalone populations in depleted areas of southern California. These studies could establish the technological basis for seafloor farming of abalones by private enterprise.

Also in California, attempts are being made to develop a fundamental understanding of the remaining unknown biochemical and genetic control mechanisms governing the critical physiological process of metamorphosis, development and growth of abalone. Recently, the chemical called GABA was developed that cause abalone to undergo metamorphosis when added to the culture. Plans are to use GABA as a bioassay tool.

A third project in California is creating methods of providing interspecific hybridization in abalones. The purpose of this work is to improve strains which might possess qualities desirable for culture.

Scallop

Studies to refine hatchery and ocean rearing methods for purple-hinge rock scallop continue in California. The results of this project will hopefully establish procedures for commercial aquaculture of this shellfish.

Mussel

In order to determine the potential of commercially culturing mussels in Puget Sound, researchers at the University of Washington are comparing the intensity and timing of mussel larval recruitment in selected areas of the Sound. Comparisons are being conducted between natural mussel setting with those that set on artificial substrates.

AQUACULTURE - OTHER

Baitworm

Sea Grant has initiated a project with the University of Maine on studies to provide a better basis for the management of Maine's baitworm industry. Investigators are looking into the possibility of growing bloodworms in mass culture for restocking depleted tidal flats.

Leech

At the University of Minnesota, investigators are developing a method to culture the leech, Nephelopsis osbcura, a bait used by local fishermen. Attempts will be made to rear them through all life stages and provide young leeches for stocking depleted ponds.

Frog

A project on the selective breeding and disease control in the development of prepared diets for Rana catesbeiana is underway at Louisiana State University. Objectives of this project are: 1) identify and clarify the role of environmental stress on the interactions between bacterial pathogens and aquatic animals using Rana catesbeiana as the model; and 2) development of defined diets and genetically defined strains of Rana catesteiana for laboratory and commercial production of anuran amphibians, using the bullfrog as the model.

Research efforts will stress the role of proteins and carbohydrates on bacterial activities leading to diseases in the bullfrog. Diet development will involve genetic selection of bullfrogs for acceptability of non-living diets.

Seafood Wastes

A project at Virginia Polytechnical Institute and State University is trying to determine the feasibility of using various seafood wastes as dietary fish meal substitute in pelleted channel feeds by: 1) identifying the supply of seafood wastes with regard to type, quantity, location, seasonality, and protein yield; 2) evaluating the economic feasibility of processing identified products with existing equipment, construction of new facilities, development of new technologies, and transportation costs; 3) evaluating any promising product chemically and biologically; and 4) defining technology to process scrap fish or waste into a fish feed ingredient where prior evaluation indicates economic potential.

Budget Simulator

Economists at five universities -- Texas A&M, Oregon State University, University of Rhode Island, University of Massachusetts, and Louisiana State University -- are developing a general budget simulator for aquaculture systems and fishing vessels. Their objectives are: 1) to construct a model similar to the existing OSU enterprise budget simulator for use in generating budgetary predictions for aquaculture systems and fishing vessles; 2) to establish an extension data bank of technical data for high priority species for both aquaculture systems and fishing vessels; and 3) to conduct economic analysis for these high priority species on problems most relevant to a particular region.

Artificial Upwelling

A three-month study is underway by the University of Texas to do the reduction, analysis, interpretation, and reporting of data collected in the pilot-level "Artificial Upwelling" project at St. Croix, Virgin Islands. The end product will be a full report on "Artificial Upwelling" mariculture using the food chain: deep-sea water nutrients phytoplankton clams and will include an economic analysis substantiated by actual operational data and will indicate commercial feasibility.

Compartment Models

At Woods Hole Oceanographic Institution a project is providing a methodology, the design of nonlinear experiments, for using existing system models in aquaculture and environmental management to design efficient cost effective survey programs and experimental trials.

Aquavet

As part of the SUNY/Cornell Sea Grant program, veterinarians at the University of Pennsylvania are developing a graduate level course and research experience in aquatic veterinary medicine. This experience will provide for a significant interaction between the veterinarian and the marine biologist so that the skills of both may be applied to the problem of aquaculture animals.

Summary

Sea Grant has made a major commitment to support research in aquaculture. The results from this research are providing the base necessary to develop viable aquaculture industries. For example, oysters and mussels are now cultured commecially in Maine. The development of these industries are a direct result of Sea Grant's efforts.

The same can be said for the growing Macrobrachium industry in Hawaii. Because of Sea Grant's role in research, education, and advisory services, pond culture of the freshwater prawn is growing at a rapid rate.

On the West Coast, new salmon culture industries have been developed, both in the area of pen-rearing and ocean-ranching. Sea Grant has in the past supported research that is now being utilized by these industries. Presently, a number of salmon projects, funded by Sea Grant, are attempting to answer problems the salmon growers are facing today.

Future research needs in aquaculture will be prioritized in the National Aquaculture Plan, which is now being prepared by the Joint Subcommittee on Aquaculture. In this plan, a number of species have been designated as high priority, i.e., these with the greatest possibility for commercial success. A species plan is being prepared for each and the types of research needs are being prioritized. These plans will give the Sea Grant Office guidance on the types of research we will be supporting in the future.

In this article, I have attempted to describe briefly the present projects the Sea Grant Office is supporting in animal aquaculture. If the reader would like more detailed information, he/she can write or call the National Sea Grant College Program, 6010 Executive Boulevard, Rockville, Maryland 20852 (301/443-8290).

APPENDIX I

Breakdown of Projects Related to Animal Aquaculture

As stated earlier (see Table I), Sea Grant is supporting 85 projects related to animal aquaculture. Of these, 61 are in categories 01-04 and are broken down as follows:

	No. of Projects	SG Funds	Matching Funds
01 Aquaculture - Crustaceans	15	$927,395	$1,041,003
02 Aquaculture - Finfish	23	$671,167	$ 581,565
03 Aquaculture - Mollusks	16	$479,561	$ 607,165
04 Aquaculture - Other Animals	7	$230,137	$ 202,742
TOTAL	61	$2,308,260	$2,432,475

Note: These figures are based on latest computer run and does not necessarily agree with the amounts I have used in the main text.

The following are other classifications I have drawn from where projects are related to aquaculture:

	No. of Projects	SG Funds	Matching Funds
06 Commercial Fisheries - Biology	8	$267,784	$192,078
08 Pathology of Marine Organisms	4	$190,599	$ 94,652
14 Marine Economics	8	$176,091	$86,528
18 Recreation - Sports Fisheries	1	$ 31,600	$ 26,500
20 Socio-Political Studies	1	$ 63,100	$ 35,000
26 Engineering - Aquaculture	1	$ 65,000	$ 32,500
35 Seafood Science & Technology	3	$ 49,852	$ 25,731

		No. of Projects	SG Funds	Matching Funds
38	CZM - Social Sciences	2	$ 75,800	$ 50,400
39	CZM - Natural Sciences	1	$ 17,000	$ 6,217
60	Course Development	2	$ 40,200	$ 14,300
77	Advisory Services - Problem Definition	1	$ 16,000	$ 5,900
TOTAL		27	$993,026	$569,806

APPENDIX II

Highlights, Significant Achievements or Major Advances

Molluscs

As a result of Sea Grant's effort in Maine, an oyster industry and a mussel industry are now ongoing. In 1978, there were 25 oyster companies and 4 mussel companies.

Sea Grant has contributed substantially in the development of commercial hatcheries. Major support has come in the areas of algae improvements and brood stock maintenance.

Sea Grant's research effort in Delaware led to EDA supporting the construction of $1.2 million mariculture center at Lewes. The center will be used to pilot test controlled system mariculture.

Freshwater Prawn

The development of a commercial freshwater prawn industry in Hawaii is a direct result of Sea Grant's research and advisory service effort. In the last two years, the number of acres under production has increased from 38.46 to 240 acres and the number of farmers has increased to 20.

South Carolina has had uniformly good production in their ponds with levels ranging from 900 to approximately 1170 lb./acre. Feed conversion ratios have been reduced from 2:1 to 1.2:1 which translates to a 40% reduction in costs. The program is now ready to begin working with the private sector in a more or less extension mode to establish small-scale prawn farming in South Carolina. As in Delaware, Sea Grant's activities have led to the State's legislature authorization of a 1.5 million capital improvement bond issue for the construction of a Mariculture Research and Development Center.

Marine Shrimp

The University of Arizona's association with Coca Cola Company has led to the construction of a 1 acre intensive shrimp farm. This pilot farm has been highly successful, producing 2.3 crops per year at a level of 50,000/lb./acre/year.

Researchers at Texas A&M University, working in cooperation with Marifarms Inc., have successfully spawned the white shrimp, Penaeus setiferus. Also, major breakthroughs have developed in the spawning of P. stylirostris in captivity.

Salmon

The past effort of Sea Grant has contributed to the development of both ocean ranching and pen rearing of salmon. Researchers at the University of Washington found that heated water increases the growth of yound salmon to smoltification. The results of this research have been adapted by Weyerhaeuser Co. in their Springfield hatchery.

The expansion of the Dom-Sea operation (pen rearing) in Puget Sound is a direct result of both NMFS and Sea Grant's efforts. Sea Grant continues to work directly with this company in improving their brood stocks and developing improved diets.

Lobster

Previous Sea Grant effort in lobster research has shown that heated water from power plants speeds up growth. The program has reached a stage where pilot testing is the next step. It is possible, in the very near future, that a national project to support a pilot farm will be submitted to our office. This will be a cooperative effort of both the University and industry.

APPENDIX III

Support of Aquaculture From Other Federal Agencies
Source: The National Aquaculture Plan Draft

USDA

SEA-E = $1 million
SEA-LR = $1.5 million
SCS = $900,000
APHIS = $25,000
ESCS = $50,000
FMHA = $2 million oustanding loans related to fish production and harvesting
TOTAL = $5,475,000

COMMERCE, OTHER THAN SEA GRANT

NMFS (Inhouse) = $4,415,000
NMFS (Grants-in-Aid) - $756,000 Federal $488,000 State Match
EDA = $316,000
TOTAL = $4,487,000

INTERIOR-FISH AND WILDLIFE SERVICE

Fish production, hatchery biology and development = $18,677,000
Fish research (aquaculture) = $5,558,000
TOTAL = $24,235,000

NSF

$1,092,527

DEPARTMENT OF ENERGY

$2,000,000

EPA

$1,300,000

NIEHS

$1,179,195

TVA

$495,000

PROJECTS CLASSIFIED UNDER:
I.MARINE RESOURCES DEVELOPMENT
A.AQUACULTURE
1.AQUACULTURE - CRUSTACEANS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
CONTROL OF REPRODUCTION IN THE DECAPOD CRUSTACEANS P. TALBOT UNIVERSITY OF CALIFORNIA	$22,788	$9,466
PROTECTIVE MEASURES AGAINST FUSARIUM DISEASE IN SHRIMP J.F. STEENBERGEN UNIVERSITY OF CALIFORNIA	$17,586	$21,647
DEVELOPMENT OF THE SCIENCE AND TECHNOLOGY OF CRUSTACEAN AQUACULTURE W.H. CLARK/C. HAND UNIVERSITY OF CALIFORNIA	$191,778	$326,560
HAWAIIAN PRAWN AQUACULTURE PROGRAM--BIOLOGICAL BASES OF PRODUCTION D. KARL/E. LAWS/S. MALECHA/R. NAKAMURA UNIVERSITY OF HAWAII	$150,193	$226,567
DEVELOPMENT OF A FRESHWATER PRAWN, MACROBRACHIIUM ROSENBERGII. FARMING INDUSTRY TAKUJI FUJIMURA HAWAII DEPT. OF LAND AND NATURAL RES.	$100,000	$100,000
PRIORITY RESEARCH IN CRAWFISH FARMING JAMES W. AVAULT LOUISIANA STATE UNIVERSITY	$45,550	$42,637
CARBOHYDRATE AND PROTEIN UTILIZATION BY THE AMERICAN LOBSTER (HOMARUS AMERICANUS) JUDITH CAPUZZO WOODS HOLE OCEANOGRAPHIC INSTITUTION	$33,300	$10,183
IMPROVEMENT OF WATER STABILITY AND NUTRIENT RETENTION BY BINDERS IN COMMERCIAL FEED PELLETS USED IN THE AQUACULTURE OF SHRIMP A. FARMAIAN NEW JERSEY MARINE SCIENCES CONSORTIUM	$18,300	$22,100

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
ECONOMICS OF POND CULTURE OF PRAWNS IN SOUTH CAROLINA LARRY L. BAUER SOUTH CAROLINA SEA GRANT CONSORTIUM	$6,800	$2,500
DEVELOPMENT OF MACROBACHIUM AQUACULTURE IN SOUTH CAROLINA P.A. SANDIFER SOUTH CAROLINA SEA GRANT CONSORTIUM	$67,700	$37,300
MICROBIAL DISEASES OF SHRIMP DONALD H. LEWIS TEXAS A&M UNIVERSITY	$40,000	$22,000
MATURATION OF PENAEID SHRIMP: DIETARY LIPIDS BIRAN S. MIDDLEDITCH TEXAS A&M UNIVERSITY	$34,500	$17,250
PENAEID SHRIMP MATURATION AND REPRODUCTION: NUTRITIONAL AND CULTURE REQUIREMENTS ADDISON LEE LAWRENCE TEXAS A&M UNIVERSITY	$80,000	$110,656
SHRIMP PRODUCTION SYSTEMS JACK C. PARKER TEXAS A&M UNIVERSITY	$80,000	$72,666
LIFE HISTORY STUDIES ON REDFISH (SCIAENOPS OCELLATA) AND RED SNAPPER (LUTJANUS CAMPECHANUS) C.R.ARNOLD UNIVERSITY OF TEXAS AT AUSTIN	$38,900	$19,471

PROJECTS CLASSIFIED UNDER:
I.MARINE RESOURCES DEVELOPMENT
A.AQUACULTURE
2.AQUACULTURE - FINFISH

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
EFFECTS OF OIL ON THE GROWTH AND ENERGY UTILIZATION OF JUVENILE PINK SALMON D.G. SHAW UNIVERSITY OF ALASKA	$23,384	$11,254
GENETIC INTERACTION OF AUKE CREEK HATCHERY PINK SALMON WITH NATURAL SPAWNING STOCKS IN AUKE CREEK A.J. GHARRETT UNIVERSITY OF ALASKA	$35,238	$13,516
A STUDY TO ABOLISH THE CARRIER STATES OF FURUNCULOSIS AND BACTERIAL KIDNEY DISEASE IN ANADROMOUS PACIFIC SALMON: YEAR 1 G.W. KLONTZ UNIVERSITY OF IDAHO	$36,500	$28,416
ANTIGENIC AND GENETIC CHARACTERIZATION OF INFECTIOUS PANCREATIC NECROSIS VIRUS OF SALMONID FISHES BRUCE L. NICHOLSON UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$21,271	$18,107
PRESERVATION OF GAMETES OF FRESHWATER FISH E.F. GRAHAM/J.E.WHEATON UNIVERSITY OF MINNESOTA	$7,300	$26,910
THE ROLE OF FATTY ACIDS IN THE REPRODUCTION OF FISH ROBERT L. GLASS UNIVERSITY OF MINNESOTA	$10,454	$5,514
PRESERVATION OF GAMETES OF FRESHWATER FISH EDMUND F. GRAHAM UNIVERSITY OF MINNESOTA	$21,267	$15,660
THE ROLE OF FATTY ACIDS IN THE REPRODUCTION OF FISH ROBERT L. GLASS UNIVERSITY OF MINNESOTA	$15,471	$16,545

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
INTENSIVE CULTURE OF THE WALLEYE (PERCIDAE: STIZOSTEDION VITREUM) JOHN G. NICKUM STATE UNIVERSITY OF NEW YORK, CORNELL	$7,477	$8,850
AN EVALUATION OF STRIPED BASS X WHITE BASS HYBRIDS AND STRIPED BASS X WHITE PERCH HYBRIDS FOR USE IN AQUACULTURE J. HOWARD KERBY UNIVERSITY OF NORTH CAROLINA	$21,861	$9,298
EEL CULTURE GROW-OUT AND NUTRITION STUDIES WILLIAM L. RICKARDS UNIVERSITY OF NORTH CAROLINA	$33,923	$18,277
ENHANCEMENT OF COASTAL CHUM SALMON RESOURCES J. E. LANNAN OREGON STATE UNIVERSITY	$54,800	$79,800
INTERRELATIONSHIPS OF DIETARY LIPID AND PROTEIN ON THE GROWTH, QUALITY, AND PRODUCTION OF COLD WATER CULTURED FISH R.O. SINNHUBER OREGON STATE UNIVERSITY	$18,600	$53,900
SALMONID PRODUCTION--A PROGRAM IN ENVIRONMENTAL PHYSIOLOGY L.T. SMITH UNIVERSITY OF RHODE ISLAND	$42,131	$23,191
PLASMID CONTRIBUTION TO THE VIRULENCE OF MARINE VIBRIOS (SUPPLEMENT) JORGE H. CROSA UNIVERSITY OF WASHINGTON	$5,026	$900
THYROID ENDOCRINE CONTROL OF SALMON SMOLTIFICATION WALTON W. DICKHOFF UNIVERSITY OF WASHINGTON	$27,800	$14,500
COHO SALMON STOCK DEVELOPMENT FOR MARINE PEN CULTURE WILLIAM K. HERSHBERGER UNIVERSITY OF WASHINGTON	$41,000	$99,600

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
SALMONID STOCK ENHANCEMENT ROY E. NAKATANI UNIVERSITY OF WASHINGTON	$133,000	$52,700
MOLECULAR STUDIES ON THE GENETICS,ECOLOGY AND MECHANISMS OF VIRULENCE OF MARINE VIBRIOS(SUPPLEMENT) JORGE H. CROSA UNIVERSITY OF WASHINGTON	$11,800	
DEVELOPMENT OF AQUACULTURE SYSTEMS FOR COOL WATER FISH SPECIES HAROLD CALBERT UNIVERSITY OF WISCONSIN	$81,648	$60,330
ENERGY REQUIREMENTS OF YELLOW PERCH C.H. MORTIMER UNIVERSITY OF WISCONSIN	$13,250	$6,825
EVALUATION OF WATER RESUE SYSTEMS FOR YELLOW PERCH AQUACULTURE JOHN T. QUIGLEY UNIVERSITY OF WISCONSIN	$5,675	$15,581
PERCH AQUACULTURE SYSTEMS STUDY ERHARD JOERES/P.M. BERTHOUEX UNIVERSITY OF WISCONSIN	$2,291	$1,891

PROJECTS CLASSIFIED UNDER:
I.MARINE RESOURCES DEVELOPMENT
A.AQUACULTURE
3.AQUACULTURE - MOLLUSKS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
STUDIES TO REFINE HATCHERY AND OCEAN REARING METHODS FOR THE PURPLE-HINGE ROCK SCALLOP C.F. PHLEGER UNIVERSITY OF CALIFORNIA	$25,944	$18,744
BIOCHEMICAL AND GENETIC CONTROL OF CRITICAL PHYSIOLOGICAL PROCESSES IN MOLLUSCAN LIFE-CYCLES D.E. MORSE UNIVERSITY OF CALIFORNIA	$60,523	$19,967
ASSESSMENT OF SPERM-EGG INTERACTIONS DURING FERTILIZATION AND HYBRID FORMATION OF CALIFORNIA ABALONES V. VACQUIER UNIVERSITY OF CALIFORNIA	$19,162	$11,800
CONTROLLED ENVIRONMENT MARICULTURE--MANAGEMENT AND SUPPORTIVE SERVICES E. BOLTON UNIVERSITY OF DELAWARE	$26,840	$170,731
CONTROLLED ENVIRONMENT MARICULTURE--THE PRODUCTION OF ALGAE G. PRUDER UNIVERSITY OF DELAWARE	$17,100	$105,210
CONTROLLED ENVIRONMENT MARICULTURE--PROTOTYPE SYSTEM J. THIELKER UNIVERSITY OF DELAWARE	$27,580	$82,075
STUDIES OF HARD CLAMS AS A POTENTIAL RESOURCE IN GEORGIA COASTAL WATERS KENNETH R. TENORE UNIVERSITY OF GEORGIA	$31,700	$13,300
HARD CLAM GENETICS JAMES W. PORTER UNIVERSITY OF GEORGIA	$26,500	$8,200

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
STUDIES TO PROVIDE A BETTER BASIS FOR MANAGEMENT OF MAINE'S BAITWORM INDUSTRY DAVID DEAN UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$16,812	$30,156
BIOLOGICAL EFFICIENCY OF OFF-BOTTOM OYSTER COLLECTION DEVICES PLACED ON OYSTER SEED AREAS GEORGE KRANTZ UNIVERSITY OF MARYLAND	$10,000	$8,900
COMMERCIALIZATION OF RECENT ADVANCES IN OYSTER TECHNOLOGY W.P. BREESE OREGON STATE UNIVERSITY	$39,300	$25,900
HARD CLAM CULTURE IN SOUTH CAROLINA - A PILOT SCALE ANALYSIS FOR AN ALTERNATIVE FISHERY J.J. MANZI SOUTH CAROLINA SEA GRANT CONSORTIUM	$20,000	$29,000
GENETICS AND BREEDING STRUCTURE OF CLAMS, MERCENARIA SPP. J.R. WALL VIRGINIA INSTITUTE OF MARINE SCIENCE	$30,100	$15,993
MARICULTURE OF SHELLFISH - DISEASE RESISTANCE JOHN L. DUPUY VIRGINIA INSTITUTE OF MARINE SCIENCE	$26,900	$34,689
MOLLUSCAN CULTURE STUDIES ROY E. NAKATANI UNIVERSITY OF WASHINGTON	$43,900	$17,500
EXPERIMENTAL OYSTER HATCHERY AND GENETICS STUDY ROY E. NAKATANI UNIVERSITY OF WASHINGTON	$57,200	$15,000

PROJECTS CLASSIFIED UNDER:
I.MARINE RESOURCES DEVELOPMENT
A.AQUACULTURE
4.AQUACULTURE - OTHER ANIMALS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
INDUSTRIAL, ECONOMIC, AND ENVIRONMENTAL BENEFITS OF APICULTURE IN THE COASTAL ZONE OF GEORGIA ALFRED DIETZ UNIVERSITY OF GEORGIA	$38,300	$52,300
CULTURE OF BAITFISH WAYNE J. BALDWIN UNIVERSITY OF HAWAII	$14,000	$52,531
SELECTIVE BREEDING AND DISEASE CONTROL IN THE DEVELOPMENT OF PREPARED DIETS FOR RANA CATESBEIANA DUDLEY D. CULLEY LOUISIANA STATE UNIVERSITY	$27,439	$11,274
BAIT LEECH, NEPHELOPSIS OBSCURA, CULTURE AND MANAGEMENT HOLLIE L. COLLINS UNIVERSITY OF MINNESOTA	$11,177	$9,404
THE BIOCHEMICAL COMPOSITION AND BIOLOGICAL EFFECTIVENESS OF BRINE SHRIMP IN AQUACULTURE KENNETH L. SIMPSON UNIVERSITY OF RHODE ISLAND	$30,921	$23,090
ARTIFICIAL UPWELLING: DATA ANALYSIS AND INTERPRETATION FOR FINAL REPORT D.A. ROELS UNIVERSITY OF TEXAS AT AUSTIN	$33,300	$16,643
ARTIFICIAL UPWELLING MARICULTURE: THE PRODUCTION OF THE BRINE SHRIMP, ARTEMIA SALINA Q. A. ROELS UNIVERSITY OF TEXAS AT AUSTIN	$75,000	$37,500

PROJECTS CLASSIFIED UNDER:
I.MARINE RESOURCES DEVELOPMENT
B.LIVING RESOURCES OTHER THAN AQUACULTURE
6.COMMERCIAL FISHERIES - BIOLOGY

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
STEROL BIOSYNTHESIS AND REQUIREMENT IN THE OYSTER GLENN W. PATTERSON UNIVERSITY OF MARYLAND	$7,500	$9,600
ECONOMICS OF FISHERIES AND AQUACULTURE DEVELOPMENT W. JOHNSTON/C. HAND UNIVERSITY OF CALIFORNIA	$63,269	$16,806
MORPHOLOGICAL, PHYSIOLOGICAL, AND BIOCHEMICAL ASPECTS OF VARIABLE DEVELOPMENTAL/GROWTH RATES IN OYSTER LARVAE DALE E. BONAR UNIVERSITY OF MARYLAND	$20,000	$6,250
ENDINCRINOLOGY OF NORMAL AND ABNORMAL SALMON SMOLTIFICATION AND ADAPTATION TO SEAWATER H.A. BERN UNIVERSITY OF CALIFORNIA	$33,862	$11,233
ARTIFICIAL IMPRINTING OF CHINOOK SALMON IN A MULTISPECIES HATCHERY T.J. HASSLER UNIVERSITY OF CALIFORNIA	$9,297	$5,804
EXPERIMENTAL ABALONE ENHANCEMENT PROGRAM M.J. TEGNER UNIVERSITY OF CALIFORNIA	$78,627	$120,966
THE ROLE OF ADVECTION AND DISPERSION IN DETERMINING THE SUCCESS OF OYSTER SPAT SETTLEMENT IN TWO ADJACENT TRIBUTARIES OF THE CHESAPEAKE BAY W.C. BOICOURT UNIVERSITY OF MARYLAND	$40,000	$11,600

PROJECTS CLASSIFIED UNDER:
I.MARINE RESOURCES DEVELOPMENT
B.LIVING RESOURCES OTHER THAN AQUACULTURE
8.PATHOLOGY OF MARINE ORGANISMS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
TOXIC EFFECTS OF CERTAIN MARINE BLUE-GREEN ALGAE ON PENAEID SHRIMP DONALD LIGHTNER UNIVERSITY OF ARIZONA	$33,500	$27,784
DETECTION, PREVENTION, AND CONTROL OF DISEASES IN FISH J.L. FRYER OREGON STATE UNIVERSITY	$78,700	$28,400
MARINE PATHOLOGY R.E. WOLKE UNIVERSITY OF RHODE ISLAND	$45,838	$9,112
PATHOLOGIC AND IMMUNOLOGIC RESPONSES OF COMMERCIALLY IMPORTANT SPECIES OF LONG ISLAND SHELLFISH L. LEIDOVITZ STATE UNIVERSITY OF NEW YORK, CORNELL	$32,521	$29,356

PROJECTS CLASSIFIED UNDER:
II.MARINE SOCIO-ECONOMICS AND LEGAL RESEARCH
A.MARINE ECONOMICS
14.MARINE ECONOMICS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
SALMONID AQUACULTURE IN NEW ENGLAND: AN ECONOMIC ANALYSIS J.M. GATES UNIVERSITY OF RHODE ISLAND	$34,591	$8,337
ECONOMICS OF PRODUCTION AND MARKETING IN THE COMMERCIAL FISH INDUSTRY WADE L. GRIFFIN TEXAS A&M UNIVERSITY	$80,000	$40,000
SHRIMP MARICULTURE DATA DOCUMENTATION AND ECONOMICS WADE L. GRIFFIN TEXAS A&M UNIVERSITY	$4,000	$7,600

PROJECTS CLASSIFIED UNDER:
II.MARINE SOCIO-ECONOMICS AND LEGAL RESEARCH
C.MARINE RECREATION
18.RECREATION - SPORTS FISHERIES

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
BIOLOGICAL FEASIBILITY OF CLAM HATCHERIES FOR RECREATIONAL HARVEST IN THE PACIFIC NORTHWEST W.P. BREESE OREGON STATE UNIVERSITY	$31,600	$26,500

PROJECTS CLASSIFIED UNDER:
II.MARINE SOCIO-ECONOMICS AND LEGAL RESEARCH
D.SOCIO-POLITICAL STUDIES
20.SOCIO-POLITICAL STUDIES

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
RELATIONSHIPS BETWEEN INSTITUTIONAL ARRANGEMENTS AND AQUACULTURAL DEVELOPMENTS R.S. JOHNSTON OREGON STATE UNIVERSITY	$63,100	$35,500

PROJECTS CLASSIFIED UNDER:
III.MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT
A.OCEAN ENGINEERING
26.ENGINEERING - AQUACULTURE

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
AQUACULTURE IN TROPICAL OCEANS GUY N. ROTHWELL OCEANIC INSTITUTE, HAWAII	$65,000	$32,500
DESIGN AND DEVELOPMENT OF MECHANIZED PROCESSING EQUIPMENT FOR THE GRADING, CLEANING & PACKING OF CULTIVATED EUROPEAN OYSTERS JOHN G. RILEY UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$45,405	$28,285

PROJECTS CLASSIFIED UNDER
III. MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT
B. RESOURCES RECOVERY AND UTILIZATION
35. SEAFOOD SCIENCE AND TECHNOLOGY

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
APPLICATION OF ASTAXANTHIN-CONTAINING CRAWFISH WASTES IN AQUATIC DIETS SAMUEL P. MEYERS LOUISIANA STATE UNIVERSITY	$ 17,752	$ 5,431
SEAFOOD WASTES IN PELLATED FISH RATIONS AS FISH MEAL SUBSTITUTES DONALD L. GARLING VIRGINIA POLYTECHNIC INSTITUTE	4,600	2,300
LARVAL FEED DEVELOPMENT - TECHNOLOGICAL AND ENGINEERING ASPECTS G. PIGOTT UNIVERSITY OF WASHINGTON	27,500	18,000

PROJECTS CLASSIFIED UNDER:
IV.MARINE ENVIRONMENTAL RESEARCH
A.RESEARCH AND STUDIES IN DIRECT SUPPORT OF COASTAL MGT DECISIONS
38.COASTAL ZONE MGT SOCIAL SCIENCES

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
POPULATION GROWTH AND FEEDING HABITS OF HARBOR SEALS IN AN AQUACULTURAL-ENHANCED ENVIRONMENT B.R. MATE OREGON STATE UNIVERSITY	$46,000	$12,400

PROJECTS CLASSIFIED UNDER:
IV.MARINE ENVIRONMENTAL RESEARCH
A.RESEARCH AND STUDIES IN DIRECT SUPPORT OF COASTAL MGMNT DECISIONS
39.COASTAL ZONE MGT-NATURAL SCIENCES AND ENGINEERING

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
THE ROLE OF COMPARTMENTAL MODELS IN THE DESIGNS OF AQUACULTURE AND ECOSYSTEMS EXPERIMENTS WOOLLCOTT SMITH WOODS HOLE OCEANOGRAPHIC INSTITUTION	$17,000	$6,217

PROJECTS CLASSIFIED UNDER:
V.MARINE EDUCATION AND TRAINING
A.COLLEGE LEVEL
60.COURSE DEVELOPMENT - AQUACULTURE

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
AQUAVET: A TRAINING PROGRAM FOR AQUATIC VETERINARIANS DONALD A. ABT STATE UNIVERSITY OF NEW YORK, CORNELL	$30,000	
MANAGEMENT-ORIENTED AQUACULTURE TRAINING C.E. BOND OREGON STATE UNIVERSITY	$10,200	$14,300

the underpinning to the growth of a solid seaweed culture industry. In addition, Sea Grant should take steps to support activities or proposals which contribute to Sea Grant's role as the "lead agency" for seaweed culture.

Accomplishments

Supported in large part by the cumulative results of several years of Sea Grant - supported, biological research, at least two demonstration-scale algal farms have been started in the United States. The most technologically complex of the farms is located approximately five miles off the coast of Corona Del Mar, California. Moored in 600 meters of water, the test farm is designed to accommodate at least 100 adult Macrocystis plants fertilized by upwelled deep water. Supported by the Gas Research Institute and the Department of Energy, the Marine Biomass Program is directed to the production of kelp to be anaerobically digested to produce natural gas. In contrast to this offshore program, a nearshore prototype farm also has been established along California's coast. In this case the farm is off Santa Barbara and is being developed by Neushul Mariculture, Inc., with support from the National Science Foundation's Problem Focused Research Applications program. NMI's effort is focused on developing techniques for nearshore farming of algal species which can be utilized as renewable sources of industrial chemicals. Of interest is the possibility that such shallow water farms might utilize natural upwelling as a nutrient source, or upwelling in conjunction with other fertilizing techniques.

Utilizing techniques developed through Sea Grant research at the University of Hawaii, an experimental seaweed growing project has been started off Semporna on the eastern coast of Malaysia with an initial investment of $2.3 million. The project represents a portion of Malaysia's economic development plan and is intended to introduce a new industry for fishermen.

Table I

SEA GRANT PLANT AQUACULTURE PROJECTS

Project Group	FY78 Number of Projects	FY78 Funding (K) Sea Grant	FY78 Funding (K) Matching	FY79 Number of Projects	FY79 Funding (K) Sea Grant	FY79 Funding (K) Matching
Halophyte Research	3	125	109	2	98	69
Kelp Research	2	79	35	2	80	42
Seagrass Research	1	38	18	0	0	0
Red Algae Research	7	191	178	6	227	178
	13	433	340	10	405	289

Mike D. McKenzie
Program Director for
Plant Aquaculture
December, 1979

PLANT AQUACULTURE

IN

THE NATIONAL SEA GRANT PROGRAM

Introduction

For the purpose of this report, plant aquaculture has been defined narrowly: specifically, the culture of marine or salt-tolerant plants for human use, for commercially important products, including energy, or for the purpose of resource enhancement or conservation. Neither projects on the culture of marine or freshwater plants for the purpose of providing food for aquaculture, nor ecological projects involving algae or salt-tolerant plants are included in this report.

It should be noted that there is overlap between some Sea Grant Program subject area reports, and the possibility also exists that other projects might not be included in any report. As a consequence, an aggregation of all subject area reports could provide a misleading picture of the total Sea Grant Program in terms of dollars of support and number of projects.

Discussion

Sea Grant has been providing support for plant aquaculture research since 1968. During this period Sea Grant represented a principal source of support for researchers conducting studies on plant aquaculture, particularly seaweed culture. The results of previous Sea Grant research are being utilized, and continuing studies offer strong prospects for utilization as subjects such as energy from biomass and renewable biological sources of materials are explored in greater depth.

Since FY75, the magnitude and focus of Sea Grant support for plant aquaculture has remained consistent. During this time period, federal support has averaged approximately $475,000 per year for projects which can be grouped into four categories: halophyte research, kelp research, seagrass research, and red algae research.

Table I presents the level of funding in each of the four categories for FY78 and FY79. In FY79 support totaling $405,000 was awarded to five universities for ten projects. Matching funds of $289,000 were provided from non-federal sources, including industry. All but two of the projects funded in FY79 are continuing efforts initiated in previous years. Of note is the increase in support for red algae research of 19% and the absence of even a single seagrass project for the first time in several years. A complete listing of projects can be found in Table II.

A few additional comments about the algal portion of Sea Grant's plant aquaculture program may be appropriate. Although the halophyte research being supported by Sea Grant is of high quality, the researchers involved are well-respected, and the possibility of substantial long-term benefits exists, the need to give immediate attention to this area of research does not appear critical to continued progress or future success. The same opinion can be offered about seagrass research. The situation is somewhat different in algal research.

Although projects in seaweed culture represent only a small portion of Sea Grant research in terms of dollars and number of projects, they offer some unique opportunities and problems. Factors involved include:

1. Sea Grant's record of providing support in the past - Commitment of resources to algal research in the past has created a situation where "Sea Grant" is associated with "seaweed culture" in the minds of many. The results of previous Sea Grant research are being put to use, and the merit of providing continuing support to "directed, user-oriented" basic research is being demonstrated.

2. The small number of researchers in the subject area - The size of the research community is relatively small and as a consequence, meetings to develop coordinated research programs are feasible. Several of the researchers have a long involvement with Sea Grant and are interested in maintaining the association. The reputation of Sea Grant algal researchers among other phycologists is outstanding. As additional funding sources become available, demands for the time of these researchers will increase.

3. A small industry with established links to university researchers and Sea Grant - Since we are attempting to increase innovation by encouraging university/industry linkages, it seems logical to take advantage of those linkages which already exist.

4. Increasing interest in the subject - Increased interest in seaweed culture is a critical factor. The interest is increasing on several fronts in government and industry. The possibilities for seaweed culture are increasing rapidly. At least two other government agencies provide substantial funding to seaweed researchers, sometimes far in excess of the amount available from Sea Grant. On the industry side, several of the phycocolloid firms recently have been purchased by large multinationals, and some new firms have been formed to initiate farming activities.

Given Sea Grant's previous investment in the field and its reputation among researchers and industries as the "lead agency" in the field, it is important that Sea Grant take steps to maintain that leadership position. As possible, Sea Grant should encourage the continuation of existing research efforts. The continued involvement of quality researchers in the seaweed culture program associated with Sea Grant is very important. Studies on nutrient requirements, productivity, genetics, and algal diseases provide

Table II

SEA GRANT PROJECTS IN PLANT AQUACULTURE, FY1979

PROJECT TITLE	INVESTIGATOR INSTITUTION	FUNDING SEA GRANT	FUNDING MATCHING
Food and fiber from seawater, sand, and solar energy	E. Epstein U. of Calif.	$31,840	$29,258
An exploratory study of the vegatative propagation of benthic marine algae	A. Gibor U. of Calif.	$35,894	$14,130
Aquaculture of red algae	I.A. Abbott U. of Calif.	$19,910	$22,576
Domestication and improvement of salt-tolerant plants, especially those from tidewaters	G.F. Somers U. of Del.	$65,669	$39,815
The application of genetic studies to seaweed cultivation: seed stock selection and improvement in Chondrus crispus	A.C. Mathieson/ D.P. Cheney U. of N. Hamp.	$45,831	$14,714
Aquaculture of seaweeds on artificial substrates	T.F. Mumford U. of Wash.	$25,000	$64,200
Enhancement of primary production by seaweeds	J.R. Waland U. of Wash.	$63,500	$18,600
An experimental program to develop methods for kelp bed expansion and enhancement	M. Neushul U. of Calif.	$27,988	$15,541
Multiple species utilization of the herring eggs-on-seaweed fishery	I.A. Abbott U. of Calif.	$37,249	$43,801
Dissolved nutrients as an aid to kelp bed management and terminal studies of kelp beds undergoing rehabilitation	W. North Calif. Institute of Technology	$52,500	$26,250

THE NATIONAL SEA GRANT PROGRAM IN OCEAN ENGINEERING

Richard C. Kolf

INTRODUCTION

This analysis of the National Sea Grant Program in Ocean Engineering is based on the listing of current projects as of October 1, 1979. There has been no attempt to avoid multiple listing with other reports being prepared at this time, and the choice of including or excluding subject matter in this regard is arbitrary. Thus education projects have been included, and also ocean engineering projects under the International Cooperation Assistance Program. Ecosystem modelling projects, however, although they commonly involve engineering faculty investigators, have been excluded. Twenty-one coherent or institutional programs are represented. A total of 106 projects are listed at a Federal funding level of $3,177,250.

RELATIONSHIP TO OTHER FEDERAL PROGRAMS

Since Sea Grant objectives include development and wise use of marine resources, engineering would be expected to be a prominent part of the overall effort, i.e. new technology is key to competitiveness in "development" as contrasted to "understanding" or "management." With two exceptions, however, Sea Grant is not a major source of funding for Ocean Engineering projects. One of the exceptions is the area of coastal engineering, i.e. sediment transport, erosion and deposition, and erosion control. In this area, the large effort of the Corps of Engineers must also be recognized. The other exception is the Sea Grant College Program at MIT, which is heavily oriented toward ocean engineering.

Besides the Corps of Engineers, NSF, DOI, Navy, NOAA/OOE, Maritime Administration, and DOE support ocean engineering research. NSF does not have a specific program in Ocean Engineering, but, for example, an investigator studying structural dynamics may have the ocean environment in mind when submitting his proposal. The other agencies have activities focussed to particular agency interests. Ocean Engineering at the Federal level appears to be neglected in the sense of a substantial program which attempts to encourage the best among academic engineering researchers to turn their attention toward marine problems.

PASS-THROUGH

This listing of projects includes nine awards made by pass-through of funds from other agencies. The total Federal funds from these other agencies is $381,760, and four different Sea Grant institutions were involved as follows:

MIT

1. Robot Vehicles (Carmichael), Navy, $34,900.
2. Deep Seabed Mining (Nyhart), NOAA-OMM, $80,000.
3. Brine Disposal (Stolzenbach), NOAA/DOE, $62,700.
4. University Research (Doelling), NOAA/OOE, $24,000.

Minnesota
1. Triangulation System (Gifford), NOAA/OOE, $7,000.

Texas
1. GPS Navigation System (Rhyne), USCG, $150,000.

Washington
1. Radiation Detector (Kotzer), NOAA/OOE, $ 8,660.
2. Radiation Detector (Kotzer), NOAA/OOE, $ 4,500.
3. Radiation Detector (Kotzer), NOAA/OOE, $10,000.

CHARACTERISTICS AND TRENDS

The same categories and selection criteria were utilized as for FY 1978, and comparison is therefore possible. Given the nature of the National Sea Grant Program, however,(i.e., local initiative and response to unsolicited proposals) significant variations from year to year might be expected, and two years is not enough to point out trends. The total Federal funds committed last year were nearly 30% less, $2,489,459, and the matching funds almost the same as this year, $1,718,560.

It should be noted that some of the studies listed are not engineering per se, but are included because they relate directly to engineering problems or, in other words, the utilization phase would involve engineering. For example, the coastal studies category is largely oriented toward current and sediment transport projects, and heavily duplicates the coastal processes analysis. This category alone shows more than a $300,000 increase from last year, which is approximately half of the increase included in this entire report.

Another increase which may be significant and should be watched is the education category. Interest in ocean engineering as a part of the undergraduate curricula may act as a catalyst in attracting the interest and attention of the engineering faculties, but this has yet to happen except at MIT. If the most creative faculty members, whose knowledge of recent advances in mathematics, science, and technology is current, turn their attention to ocean development and its problems, an increase in projects in what MIT calls "Technology Development for Ocean Uses" would be expected. This has not happened, but developments at several institutions are encouraging.

Several projects at the University of Michigan mark the entry of its Department of Naval Architecture and Marine Engineering into the Sea Grant Program.

Louisiana State University continues to develop its embryonic biofouling and corrosion group.

The University of Washington, of course, continues its excellent studies of acoustics as applied to fisheries assessment.

Oregon State University has consistently shown broad interest in ocean engineering, particularly by its Civil Engineering faculty.

RECOMMENDATIONS

It still must be said that very few Sea Grant institutions devote a significant part of their program to ocean engineering. More attention to the problems and interests of industry as contrasted to studies of "management" or environmental constraints to development is probably a necessary condition for developing industry interest and support of the Sea Grant Program. Although most Sea Grant Programs can point to examples of industrial interest, support, and cooperation, in general these cases are isolated and related to the personal efforts and contacts of the investigator and/or his or her department at the university. Probably the lessons learned by the MIT Marine Industry Collegium should be studied carefully, and efforts made to extend the benefits to other geographic regions.

Commentary

A. Education

Our support in this category is, I think, generally very good, and effective in terms of influencing career option decisions. Three of these are aimed directly at undergraduate engineering students; Murdock in New Hampshire, "Undergraduate Ocean Projects Course"; Seifert at MIT, "Interdisciplinary Systems Design Subject"; Dyer at MIT, "Ocean Engineering Projects Laboratory." The first two involve assignment of groups of students to complex problem situations (not restricted to engineers), and expecting them to do the analysis, design, and report writing. Courses like this are educationally excellent, but probably too expensive on a "per student" basis for most institutions to support them as regular parts of the curriculum. From our standpoint, however, this is probably an inexpensive way to interest students in ocean oriented careers. The Dyer project is similar, but more exclusively laboratory or hardware oriented.

Three others have the objective of developing ocean engineering interest within their respective engineering colleges; Liu at Cornell, "Development of a Marine Engineering Research and Education Program"; Adee in Washington, "Ocean Engineering Program Enhancement"; Webster and Tulin in Washington, "Ocean Engineering and the Future: Long Range Planning." These have worthwhile objectives, but should have finite duration. After a few years, the expected result should be more specific proposals in ocean engineering course development or research.

B. Fisheries and Seafood Processing

The acoustic fishery assessment work at the University of Washington has been active for many years and very successful. Currently new applications of the technique are being studied.

The other listings in this category are not high technology and are not research. They fall either into machine design or, in the case of the gear development efforts, advisory service type activities. In either case, if utilization is hoped for, industrial interest and cooperation should be expected in the early stages.

C. Aquaculture

This is not an impressive listing, given the importance of aquaculture within the National Sea Grant Program. Delaware has in the past tried to incorporate Chemical Engineering faculty into the process design for algae culture, but generally it seems that aquaculturists see the need for engineering support only for more or less routine plumbing design, etc., and therefore do not find interested faculty support.

D. Wave Studies

I consider our support in this area to be generally good work, but not strongly problem oriented. The aim is either to produce incremental improved

understanding, or provide information which should be useful locally or applicable to a certain class of situations. The support level has remained fairly level for several years.

E. Erosion and Control Structures

It seems to me that projects in this category need careful scrutiny. Obviously erosion is a serious concern in many coastal areas, and advisory service activities to inform the public of the realities of nature are necessary and worthwhile. Sometimes it is necessary to gather local information, and perhaps also a faculty research project may provide a better access for the MAS to faculty expertise. Generally, however, the "solution" is elusive and the projects are not truly problem oriented.

F. Remote Sensing

Our support in this area has always been moderate, and considerable support is available through other agencies, e.g. USGS. The few projects included in the Sea Grant program are well chosen and include very competent investigators.

G. Coastal Studies

Our support in this category is $573 K, and to this amount should be added the $1.0 M NSTS. Some of these projects aim at bringing present knowledge quickly to a useable stage, e.g. Bedford at Ohio State, ".....Lake Erie Storm Surge...," and Wilson at MIT, "Sea Water Intrusion...," but mostly what we have are local studies which could only be expected to achieve a significant advance in our "design" capability after a long time and in a larger context. That is the basis for NSTS as I understand it, i.e. a major advance can best be expected after an extended (5 year) and heavily funded effort of the very best investigators. Even then it may be difficult to show value in economic terms. These are plodding efforts in a sense, but they respond to local constituencies as in the case of category E. My own preference is to encourage a greater emphasis on development of new technologies for ocean uses. This probably will not happen, however, unless we find a way to increase the voice of ocean industry as one of the Sea Grant constituencies.

H. Coastal Construction

As a group, these projects are far more problem oriented than those in categories E and G, and a high percentage should provide tangible benefits over a few year period. Perhaps one measure of a legitimate "rationale" for category E and G projects would be that the investigator and Sea Grant Director could show an orderly progression to this type project after a few years time.

I. Ship Design, Construction and Safety

I have already commented on the entry of the School of Naval Architecture and Marine Engineering of the University of Michigan. I consider that to be a

very encouraging sign, and our support in this area to be mostly well chosen. The robot vehicle work at MIT has attracted the attention of other agencies and industry, and it is now pass-through.

J. Sewerage

I do not expect that we will have strong proposal pressure in this area. Our best contribution in the past was the electron radiation project (Trump) at MIT. The brine disposal project is pass-through. EPA is the usual funding source for sewage treatment methods except in the very early feasibility study stage.

K. Offshore Structure Design and Analysis

We have been supporting very good people in this area, and a positive effect has been to begin a working relationship between the investigator and industry in several cases. In most engineering fields, such as this, the investigators can apply their knowledge and skills to terrestrial problems just as easily, and without a reasonable funding source in ocean engineering, that is what they will do (we are not dealing here with faculty from ocean engineering departments for the most part). An added advantage therefore is the effect on graduate student career choices. Manpower needs in ocean engineering have been high and should remain so. Students involved in such projects are in demand.

L. Biofouling and Metal Corrosion

We are supporting several excellent people here, e.g. Good and Mitchell. It is an important problem area and one in which we should be contributing, I believe. It is also a difficult, long term proposition, and in order to make a recognizable contribution, probably the best bets are "networking" or local area emphasis and coordination. Both of these options are being attempted. Dr. S. Dexter at the University of Delaware is currently organizing researchers from MIT, Delaware, URI, and Florida to submit a combined proposal which would include provision for industrial oversight and cooperation. Dr. M. Good at LSU is attempting to organize a corrosion group in the Materials Science Department at her institution. These efforts will be worth watching for the next several years.

M. Material Degradation (other)

This is not an area of strong past or anticipated future interest.

N. Acoustics

Although our support in this area has been modest, it has been significant. The University of Washington fishery assessment work has already been mentioned, and the MIT (Baggeroer) study is also promising.

O. Oil Spill

At present, this is a single project category, but this work has already attracted attention of other agencies. In FY 1980 Navy and Coast Guard will each make a pass-through for augmentation to make the total effort several times as large as this first year level.

P. Miscellaneous

This is a "catch-all" category but includes many of the new advanced technology ideas presented to us. In this grouping there is Sheridan, who is working on man-machine interactions, i.e. control problems relevant to remote vehicle technology, and Modell, who is doing a feasibility study of decontamination of dredge spoils using water at near critical conditions. Pleass at Delaware and his plastic high pressure pump may also turn out to be a long shot that paid off.

Also in this category is the MIT MIDAS program which is an excellent experiment at university/industry interaction, and a recent similar project at the University of Delaware (Wagner). Norm Doelling and MIDAS are a Sea Grant asset which can have significant effect on a national scale. During the next year we will be working toward that end, encouraging other Sea Grant institutions to work in cooperation with MIT.

SUMMARY BY SUBJECT

Subject Area	No. of Project	$ Fed	$ Match
Education	12	$ 255,062	$ 316,233
Fisheries and Seafood Processing	8	183,848	120,213
Aquaculture	3	35,466	35,472
Wave Studies	4	95,605	49,690
Erosion and Control Structures	5	139,046	83,221
Remote Sensing	3	76,166	54,789
Coastal Studies	18	573,491	298,895
Coastal Construction	10	309,498	211,108
Ship Design, Construction and Safety	9	335,585	73,689
Sewerage	2	107,685	20,935
Offshore Structure Design & Analysis	6	208,768	169,068
Biofouling and Metal Corrosion	5	187,915	71,584
Material Degradation (Other)	1	50,200	14,400
Acoustics	4	139,821	52,475
Oil Spill	1	45,000	39,997
Miscellaneous	15	434,094	127,724
TOTAL	106	$3,177,250	$1,739,493

SUMMARY BY INSTITUTION

Institution	No. of Projects	$ Fed	$ Match
Alaska	2	$ 62,463	$ 32,116
California	9	197,578	168,981
Delaware	7	206,238	138,662
Florida	3	95,400	62,400
Hawaii	3	63,328	31,293
Louisiana	3	101,515	25,293
Maine/New Hampshire	3	99,873	61,033
Harvard	1	64,200	20,391
MIT	18	724,300	443,501
WHOI	4	136,000	27,379
Michigan	3	80,077	- 0 -
Minnesota	2	22,514	11,117
New Jersey	3	141,200	69,385
New York	7	155,927	135,219
North Carolina	3	63,904	28,932
Ohio	1	26,600	16,300
Oregon	9	330,000	192,400
Rhode Island	3	37,150	6,825
South Carolina	1	31,200	27,000
Texas	2	175,000	- 0 -
Washington	12	233,760	162,900
Wisconsin	7	129,023	78,366
TOTAL	106	$3,177,250	$1,739,493

	FED FUNDS	MATCHING FUNDS
ALASKA		
TITLE: WAVE CLIMATE ASSESSMENT FOR ALASKAN COASTAL REGIONS	$31,177	$17,400
INVES: J.M. COLONELL		
STARTING DATE: 11/01/1978 COMPLETION DATE: 10/31/1981		
INSTITUTION: UNIVERSITY OF ALASKA		
TITLE: SOLID-LIQUID SEPARATION AND WATER CONSERVATION IN THE SHELLFISH AND FISH PROCESSING INDUSTRY	$31,286	$14,716
INVES: R.A. JOHNSON		
STARTING DATE: 11/01/1978 COMPLETION DATE: 10/31/1980		
INSTITUTION: UNIVERSITY OF ALASKA		
TOTAL	$62,463	$32,116
CALIFORNIA		
TITLE: EARTHQUAKE LOADING ON LARGE OFFSHORE STRUCTURES-AN APPLICATION OFEXPERIMENTAL DATA TO PRACTICAL STRUCTURE FORMS	$17,191	$18,591
INVES: JOSEPH PENZIEN		
STARTING DATE: 10/01/1976 COMPLETION DATE: 9/30/1980		
INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO		
TITLE: A CONDENSING CENTRIFUGAL COMPRESSOR FOR THE DISTILLATION OF SEAWATER	$19,416	$9,301
INVES: M.S. MANALIS/P.H. LEE		
STARTING DATE: 10/01/1978 COMPLETION DATE: 9/30/1980		
INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO		
TITLE: DESIGN AND DEVELOPMENT OF A SQUID-PROCESSING MACHINE	$7,302	$5,187
INVES: R.P. SINGH		
STARTING DATE: 10/01/1977 COMPLETION DATE: 9/30/1980		
INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO		

	FED FUNDS	MATCHING FUNDS
TITLE: OCEAN ENGINEERING AND THE FUTURE: LONG-RANGE PLANNING INVES: W.C. WEBSTER/M.P. TULIN STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$12,038	$9,808
TITLE: A STUDY OF THE ENTRANCE PROBLEMS AT HUMBOLT BAY INVES: J.D. ISAACS STARTING DATE: 10/01/1978 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$46,343	$20,450
TITLE: INVESTIGATIONS OF COASTAL BLUFF RETREAT FOR THE TRINIDAD HEADLAND AREA OF NORTHERN CALIFORNIA INVES: G.A. CARVER STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$24,856	$7,020
TITLE: SIDE-SCAN SONAR MAPPING AND COMPUTER-AIDED INTERPRETATION OF THE GEOLOGY OF THE SANTA BARBARA CHANNEL INVES: B.P. LUYENDYK/D.S. SIMONETT STARTING DATE: 10/01/1977 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$21,521	$31,161
TITLE: OFFSHORE SAND AND GRAVEL RESOURCES, ORANGE COUNTY, CALIFORNIA INVES: ROBERT H. OSBORNE STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF SOUTHERN CALIFORNIA	$15,749	$44,982
TITLE: PROBLEMS OF HARBOR MODELING INVES: JIIN J. LEE/LANDON C. SELLFORD STARTING DATE: 10/01/1978 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF SOUTHERN CALIFORNIA	$33,162	$22,481
TOTAL	$197,578	$168,981

DELAWARE	FED FUNDS	MATCHING FUNDS
TITLE: REMOTE SENSING OF ESTUARINE DETRITAL FLOW AND SURFACE WATER PRODUCTIVITY INVES: V. KLEMAS STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$21,910	$36,277
TITLE: EROSION AND DEPOSITION PROCESSES AND PATTERNS IN THE NEARSHORE ZONE OF WESTERN DELAWARE BAY INVES: J.C. KRAFT STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$37,650	$24,855
TITLE: DEVELOPMENT AND APPLICATION OF A METHOD TO SIMULATE SHORELINE RESPONSE INVES: R. DEAN STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$31,311	$17,632
TITLE: DEVELOPMENTS ON THE RAY THEORY FOR OCEAN WAVES INVES: C. LOZANO STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$24,378	$12,390
TITLE: CONSTRUCTION AND DEPLOYMENT OF A PROTOTYPE 1500 GALLON PER DAY SEA WAVE POWERED DESALINATION BUOY INVES: C.M. PLEAS STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$60,194	$25,160
TITLE: MARINE ADVISORY SERVICE - INDUSTRY/RESEARCH INTERACTION INVES: R. WAGNER STARTING DATE: 7/01/1976 COMPLETION DATE: INSTITUTION: UNIVERSITY OF DELAWARE	$19,395	$22,348

	FED FUNDS	MATCHING FUNDS
TITLE: ENGINEERING DESIGN AND SPECIFICATIONS FOR A HIGH-PRESSURE SEAWATERR PUMP	$11,400	
INVES: C.M. PLEASS		
STARTING DATE: 6/01/1979 COMPLETION DATE: 8/31/1980		
INSTITUTION: UNIVERSITY OF DELAWARE		
TOTAL	$206,238	$138,662

FLORIDA

TITLE: FATIGUE OF WELDED STRUCTURAL STEEL IN SEA WATER	$33,600	$17,100
INVES: WILLIAM H HARTT OCEAN ENGINEERING		
STARTING DATE: 1/01/1978 COMPLETION DATE: 12/01/1979		
INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA		
TITLE: BEACH & DUNE EROSION CAUSED BY STORM TIDES & WAVES	$43,800	$44,000
INVES: T Y CHIU		
STARTING DATE: 1/01/1978 COMPLETION DATE: 12/01/1979		
INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA		
TITLE: A SHORT COURSE ON SMALL HARBOR ENGINEERING IN INDIA	$18,000	$1,300
INVES: A.J. MEHTA		
STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980		
INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA		
TOTAL	$95,400	$62,400

HAWAII

TITLE: THE EFFECT OF TERRAIN ROUGHNESS ON TSUNAMI RUN-UP AND INUNDATION	$32,795	$15,982
INVES: CHARLES L. BRETSCHNEIDER		
STARTING DATE: 9/01/1978 COMPLETION DATE: 5/31/1981		
INSTITUTION: UNIVERSITY OF HAWAII		
TITLE: A SLANTED LOOK AT OCEAN WAVE FORCES ON PIPES	$12,577	$2,178
INVES: ROBERT A. GRACE		
STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1979		
INSTITUTION: UNIVERSITY OF HAWAII		

	FED FUNDS	MATCHING FUNDS
TITLE: DEVELOPMENT OF A NEW COURSE IN UNDERWATER TECHNOLOGY	$17,956	$13,133
INVES: EDWARD K. NODA		
STARTING DATE: 9/01/1978 COMPLETION DATE: 5/31/1980		
INSTITUTION: UNIVERSITY OF HAWAII		
TOTAL	$63,328	$31,293

LOUISIANA

TITLE: EFFECTS OF SURFACE CONDITIONS AND HEAT TREATMENT ON THE CORROSION CHARACTERISTICS OF TITANIUM ALLOYS AND COATINGS IN SEA WATER	$32,867	$12,691
INVES: A. RAMAN		
STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1981		
INSTITUTION: LOUISIANA STATE UNIVERSITY		
TITLE: INVESTIGATION OF MARINE ANTIFOULING MATERIALS AND MARINE CORROSION	$40,743	$3,219
INVES: MARY L. GOOD		
STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1982		
INSTITUTION: LOUISIANA STATE UNIVERSITY		
TITLE: THE EFFECT OF HYDROGEN CONCENTRATION AND IMPURITY ELEMENTS ON THE HYDROGEN EMBRITTLEMENT OF IRON	$27,905	$9,383
INVES: THOMAS C. SHELTON		
STARTING DATE: 1/01/1979 COMPLETION DATE: 8/31/1982		
INSTITUTION: LOUISIANA STATE UNIVERSITY		
TOTAL	$101,515	$25,293

MASSACHUSETTS

TITLE: ROBOT VEHICLES FOR SEARCH & SURVEY APPLICATIONS	$34,900	
INVES: A.D. CARMICHAEL, PROF. OCEAN ENGR.		
STARTING DATE: COMPLETION DATE: 6/30/1980		
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		
TITLE: STUDY OF A COST MODEL OF DEEP SEABED MINING (SUPPLEMENT)	$80,000	
INVES: J.D. NYHART, SLOAN SCHOOL OF MANAGEMENT & DEPT. OF OCEAN ENGINEERING		
STARTING DATE: 7/01/1996 COMPLETION DATE: 8/31/1979		
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		

	FED FUNDS	MATCHING FUNDS
TITLE: AN ANALYSIS OF OFFSHORE BRINE DISPOSAL TECHNIQUES INVES: DR K D STOLZENBACH STARTING DATE: 1/01/1977 COMPLETION DATE: 12/30/1979 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$62,700	
TITLE: INTERDISCIPLINARY SYSTEMS DESIGN SUBJECT INVES: WILLIAM W. SEIFERT STARTING DATE: 6/01/1970 COMPLETION DATE: 7/01/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$15,700	$5,987
TITLE: OCEAN ENGINEERING PROJECTS LABORATORY INVES: IRA DYER STARTING DATE: 6/30/1970 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$29,000	$26,321
TITLE: OCEAN ENGINEERING CURRICULA INVES: IRA DYER STARTING DATE: 7/01/1973 COMPLETION DATE: 7/01/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		$101,911
TITLE: DEVELOPMENT OF AN INTEGRATED COURSE ON OFFSHORE STRUCTURES INVES: ORAL BUYUKOZTURK STARTING DATE: 7/01/1977 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$26,700	$34,838
TITLE: DEVELOPMENT OF JOINING AND CUTTING TECHNIQUES FOR DEEP SEA APPLICATIONS INVES: KOICHI MASUBUCHI STARTING DATE: 7/01/1976 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$21,400	$10,519

	FED FUNDS	MATCHING FUNDS
TITLE: QUALITY CONTROL OF FIBERGLASS BOAT HULLS USING THERMAL TESTING AND LIQUID CRYSTALS INVES: J.H. WILLIAMS STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$36,900	$22,201
TITLE: IMPLEMENTATION OF A NEW METHOD FOR EVALUATING THE WAVE RESISTANCE OF A SHIP INVES: FRANCIS NOBLESSE STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$15,000	$30,075
TITLE: OIL SPILL CLEAN-UP AND LIABILITY MODELS INVES: J.D.NYHART/HARILAOS N. PSARAFTIS STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$45,000	$39,997
TITLE: DECONTAMINATION OF DREDGE SPOILS BY EXTRACTION WITH WATER UNDER NEAR CRITICAL CONDITIONS INVES: MICHAEL MODELL STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1982 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$45,000	$6,639
TITLE: APPLICATION OF TELEOPERATORS TO UNDERSEA TASKS INVES: THOMAS B. SHERIDAN STARTING DATE: 7/01/1976 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$42,000	$18,645
TITLE: UNDERWATER COMMUNICATION SYSTEMS FOR UNTETHERED VEHICLES AND SENSORS INVES: A.B. BAGGEROER STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$82,200	$12,521

	FED FUNDS	MATCHING FUNDS
TITLE: METHOD TO PREDICT FOUNDATION DISPLACEMENT OF AN OFFSHORE FACILITY INVES: A. ALLEN MARR/T. WILLIAM LAMBE STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$49,000	$60,680
TITLE: IN SITU EVALUATION OF GEOTECHNICAL PROPERTIES OF MARINE SEDIMENT INVES: MOHSEN M. BALIGH STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$75,000	$60,000
TITLE: SEA WATER INTRUSION IN OFFSHORE ISLANDS INVES: JOHN L. WILSON STARTING DATE: 7/01/1977 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$39,800	$13,167
TITLE: THE HYDROGRAPHY AND CIRCULATION OVER AND AROUND NANTUCKET SHOALS INVES: ROBERT C. BEARDSLEY STARTING DATE: COMPLETION DATE: 6/30/1980 INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.	$42,000	
TITLE: MOVABLE BED ROUGHNESS IN THE COASTAL ZONE: A FIELD STUDY AND MODEL DESIGN INVES: WILLIAM D. GRANT/ALBERT J. WILLIAMS STARTING DATE: 10/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.	$42,000	$17,848
TITLE: SEDIMENT TRANSPORT IN A TIDAL INLET INVES: DAVID G. AUBREY STARTING DATE: 7/01/1979 COMPLETION DATE: 7/01/1982 INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.	$25,000	$9,531

	FED FUNDS	MATCHING FUNDS
TITLE: DESIGN, CONSTRUCTION, AND TESTING OF LORAN-C TELEMETRY FROM A DRIFTING BUOY	$27,000	
INVES: ROBERT G. WALDEN		
STARTING DATE: 11/10/1977 COMPLETION DATE: 6/30/1980		
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.		
TITLE: NEW APPROACHES TO CONTROL OF MARINE FOULING AND BORING ORGANISMS	$64,200	$20,391
INVES: RALPH MITCHELL		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980		
INSTITUTION: HARVARD UNIVERSITY		
TITLE: UNIVERSITY RESEARCH IN OCEAN ENGINEERING-SOURCES AND RESOURCES	$24,000	
INVES: NORMAN DOELLING		
STARTING DATE: 6/01/1979 COMPLETION DATE: 10/01/1980		
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		
TOTAL	$924,500	$491,271

MICHIGAN

TITLE: PATH CONTROL SYSTEM FOR SURFACE SHIP IN CHANNELS	$33,747	
INVES: MICHAEL G. PARSONS		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980		
INSTITUTION: UNIVERSITY OF MICHIGAN		
TITLE: EFFECTS OF CONTROL SYSTEMS ON OPTIMIZATION OF SHIP SIZE FOR NAVIGATION IN RESTRICTED WATERS OF THE GREAT LAKES	$29,710	
INVES: HOWARD M. BUNCH		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980		
INSTITUTION: UNIVERSITY OF MICHIGAN		
TITLE: SHORELINE EFFECTS OF VESSEL TRANSIT OF THE ST. MARYS RIVER	$16,620	
INVES: R. SCHER		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980		
INSTITUTION: UNIVERSITY OF MICHIGAN		
TOTAL	$80,077	

MINNESOTA

	FED FUNDS	MATCHING FUNDS
TITLE: DEVELOPMENT, TESTING, AND EVALUATION OF HIGH-RESOLUTION ELECTRONIC/ACOUSTIC TRIANGULATION SYSTEM FOR UNDERWATER SURVEY APPLICATION	$15,200	$2,993
INVES: JOHN GIFFORD STARTING DATE: 6/01/1979 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIVERSITY OF MINNESOTA		
TITLE: SEDIMENTATION IN DULUTH-SUPERIOR HARBOR	$7,314	$8,124
INVES: THOMAS C. JOHNSON STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1981 INSTITUTION: UNIVERSITY OF MINNESOTA		
TOTAL	$22,514	$11,117

NEW HAMPSHIRE

TITLE: SEA GRANT INTERNSHIP - AREA OF OCEAN ENGINEERING	$20,200	$795
INVES: K.U. SIVAPRASAD STARTING DATE: 1/01/1979 COMPLETION DATE: 1/31/1980 INSTITUTION: UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE		
TITLE: DESIGN AND DEVELOPMENT OF MECHANIZED PROCESSING EQUIPMENT FOR THE GRADING, CLEANING & PACKING OF CULTIVATED EUROPEAN OYSTERS	$45,405	$28,285
INVES: JOHN G. RILEY STARTING DATE: 1/01/1978 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE		
TITLE: UNDERGRADUATE OCEAN PROJECTS COURSE	$34,268	$31,953
INVES: JOSEPH B. MURDOCH STARTING DATE: 7/01/1969 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE		
TOTAL	$99,873	$61,033

NEW JERSEY

TITLE: STABILIZATION OF TIDAL INLET CHANNELS FOR IMPROVED BOAT TRAFFICABILITY BY FLUIDIZATION OF BOTTOM SEDIMENTS	$20,000	$10,800
INVES: J.M. PARKS, GEOLOGICAL SCI., LEHIGH AND W.A. MURRAY, CIVIL ENG. LEHIGH STARTING DATE: COMPLETION DATE: 1/01/1982 INSTITUTION: NEW JERSEY MARINE SCIENCES CONSORTIUM		

	FED FUNDS	MATCHING FUNDS
TITLE: DESALINATION SPECIALIZATION WITHIN B.S. IN ENVIRONMENTAL SCIENCE INVES: ROBERT BAKISH STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1982 INSTITUTION: FAIRLEIGH DICKINSON UNIVERSITY	$59,900	$26,983
TITLE: THE DYNAMICS OF MARINE SAND PRODUCTION,TRANSPORT AND DEPOSITION OFF ST. CROIX,USVI INVES: D.K. HUBBARD STARTING DATE: 9/01/1978 COMPLETION DATE: 9/01/1980 INSTITUTION: FAIRLEIGH DICKINSON UNIVERSITY	$61,300	$31,602
TOTAL	$141,200	$69,385

NEW YORK

TITLE: THE IMPACT OF OFFSHORE SAND AND GRAVEL MINING ON THE AVAILABILITY AND COSTS OF CONSTRUCTION MINERALS IN THE GREATER N.Y. METROPOLITAN AREA INVES: WILLIAM A. WALLACE, R.P.I. MANAGEMENT SCIENCE STARTING DATE: COMPLETION DATE: 12/31/1979 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$23,845	$16,922
TITLE: DEVELOPMENT OF DESIGN CRITERIA FOR FLOATING BREAKWATERS INVES: VOLKER W. HARMS, BUFFALO CIVIL ENGINEERING STARTING DATE: COMPLETION DATE: 12/31/1979 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$45,586	$34,074
TITLE: COASTAL CURRENTS AND SEDIMENT TRANSPORT ON GREAT LAKES SHORELINE INVES: PHILLIP LIU, CORNELL DEPT. OF ENV. ENGR. STARTING DATE: 11/01/1976 COMPLETION DATE: 12/31/1980 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$26,966	$20,478
TITLE: A CRITICAL ASSESSMENT OF THE PRESSURES ON NEW YORK MARINE COASTAL ZONE FROM PHYSICAL ALTERATIONS INVES: J.R. SCHUBEL, SUNY-STONY BROOK MARINE SCIENCES RESEARCH CENTER STARTING DATE: COMPLETION DATE: 12/31/1979 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$18,604	$8,417

	FED FUNDS	MATCHING FUNDS
TITLE: DEVELOPMENT OF A MARINE ENGINEERING RESEARCH AND EDUCATION PROGRAM INVES: P. L-F. LIU, ENVIRON. ENGIN., CORNELL UNIV. STARTING DATE: COMPLETION DATE: 12/31/1979 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$10,300	$32,904
TITLE: DOCTORAL FELLOWSHIPS FOR STUDIES OF MARINE INDUSTRIES INVES: EDWARD BOLLINGER, NY SEA GRANT NEW YORK SEA GRANT INSTITUTE STARTING DATE: 11/01/1975 COMPLETION DATE: 12/31/1981 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$14,000	
TITLE: DEVELOPMENT OF A COASTAL STRUCTURES CONSTRUCTION MANUAL INVES: FRED KULNAWY, CORNELL-ENGINEER, DEPT. OF CIVIL & ENV. ENG. STARTING DATE: COMPLETION DATE: 12/31/1982 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$16,626	$22,424
TOTAL	$155,927	$135,219

NORTH CAROLINA

TITLE: BUILDING SCIENCE TECHNOLOGY FOR RESIDENTIAL AND COMMERCIAL STRUCTURES IN COASTAL HAZARD ZONES INVES: JERRY L. MACHEMEHL, NCSU DEPTS. OF MARINE SCI. & ENG. STARTING DATE: 1/01/1978 COMPLETION DATE: 12/01/1979 INSTITUTION: UNIVERSITY OF NORTH CAROLINA	$10,369	$5,597
TITLE: DEVELOPMENT OF ALTERNATIVE ON-SITE SEPTIC WASTE DISPOSAL SYSTEMS FOR THE COASTAL ZONE OF NORTH CAROLINA INVES: R. L. CARLILE, NCSU SOIL SCIENCE DEPT. STARTING DATE: 4/01/1976 COMPLETION DATE: 12/01/1980 INSTITUTION: UNIVERSITY OF NORTH CAROLINA	$44,985	$20,935
TITLE: ANALYSIS AND PREDICTION OF OCEAN SURFACE GRAVITY WAVES ON N.C. COAST INVES: C.E. KNOWLES, NCSU DEPT. OF MARINE SCIENCE & ENG STARTING DATE: COMPLETION DATE: 12/01/1981 INSTITUTION: UNIVERSITY OF NORTH CAROLINA	$8,550	$2,400
TOTAL	$63,904	$28,932

OHIO	FED FUNDS	MATCHING FUNDS
TITLE: PRELIMINARY DEVELOPMENT OF AN OPERATIONAL LAKE ERIE STORM SURGE FLOOD FORECASTING PROGRAM	$26,600	$16,300
INVES: K.W. BEDFORD		
STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1982		
INSTITUTION: OHIO STATE UNIVERSITY		
TOTAL	$26,600	$16,300

OREGON		
TITLE: AN EVALUATION OF COASTAL SAND AND GRAVEL AND MARGINAL ROCK AS CONSTRUCTION MATERIALS	$53,900	$5,000
INVES: R.G. HICKS		
STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980		
INSTITUTION: OREGON STATE UNIVERSITY		
TITLE: WAVES AND CURRENTS ON A BEACH IN THE PRESENCE OF A JETTY	$41,900	$11,200
INVES: R.T. HUDSPETH		
STARTING DATE: 7/01/1977 COMPLETION DATE: 6/30/1980		
INSTITUTION: OREGON STATE UNIVERSITY		
TITLE: PREVENTING AND STOPPING DETERIORATION OF WOOD IN THE MARINE ENVIRONMENT	$50,200	$14,400
INVES: R.D. GRAHAM		
STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981		
INSTITUTION: OREGON STATE UNIVERSITY		
TITLE: SUBMERGED OFFSHORE ARTIFICIAL REEF STUDY	$27,900	$49,900
INVES: C.K. SOLLITT/D. HANCOCK		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980		
INSTITUTION: OREGON STATE UNIVERSITY		
TITLE: SYNTHETIC FABRIC APPLICATION IN OCEAN AND COASTAL ENGINEERING	$79,000	$16,700
INVES: C.K. SOLLITT/T.S. VINSON/J.R. BELL		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1981		
INSTITUTION: OREGON STATE UNIVERSITY		

	FED FUNDS	MATCHING FUNDS
TITLE: FISHERIES ENGINEERING INVES: E. KOLBE STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: OREGON STATE UNIVERSITY	$7,100	$14,300
TITLE: CONTROL OF CORROSION AND DETERIATION OF TRAWLING CABLES INVES: E. KOLBE STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1981 INSTITUTION: OREGON STATE UNIVERSITY	$22,200	$25,900
TITLE: HARBOR ENTRANCE VISIBILITY INVES: W.H. QUINN STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: OREGON STATE UNIVERSITY	$17,400	$42,600
TITLE: SEDIMENT TRANSPORT AND DEPOSITION IN OREGON ESTUARIES INVES: P.D. KOMAR STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: OREGON STATE UNIVERSITY	$30,400	$12,400
TOTAL	$330,000	$192,400
RHODE ISLAND		
TITLE: TANK TESTING U.R.I. SERIES TRAWL INVES: A.J. HILLIER STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: UNIVERSITY OF RHODE ISLAND	$13,955	$6,825
TITLE: COASTAL ZONE MANAGEMENT AND MARINE ADVISORY SERVICE APPLICATIONS OF REMOTE SENSING INVES: PETER CORNILLON STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: UNIVERSITY OF RHODE ISLAND	$17,258	

	FED FUNDS	MATCHING FUNDS
TITLE: AN ECONOMIC ANALYSIS OF PROPULSION NOZZLE EXPERIMENT	$5,937	
INVES: ANDREAS HOLMSEN		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980		
INSTITUTION: UNIVERSITY OF RHODE ISLAND		
TOTAL	$37,150	$6,825

SOUTH CAROLINA

TITLE: STABILITY OF NAVIGATIONAL CHANNELS AND SHOALING IN SOUND ENTRANCES, SOUTHERN HALF OF THE SOUTH CAROLINA COAST, YEAR 3	$31,200	$27,000
INVES: MILES O. HAYES		
STARTING DATE: 7/01/1977 COMPLETION DATE: 8/31/1980		
INSTITUTION: SOUTH CAROLINA SEA GRANT CONSORTIUM		
TOTAL	$31,200	$27,000

TEXAS

TITLE: THE COST OF DEEP OCEAN MINING ENVIRONMENTAL REGULATION	$25,000	
INVES: JOHN E. FLIPSE, CIVIL ENGR.		
STARTING DATE: COMPLETION DATE: 5/15/1979		
INSTITUTION: TEXAS A&M UNIVERSITY		
TITLE: EVALUATION OF THE GPS SYSTEM AS A CIVIL MARINE NAVIGATION SYSTEM IN THE COASTAL ZONE	$150,000	
INVES: TOM RHYNE		
STARTING DATE: 5/16/1979 COMPLETION DATE: 5/31/1980		
INSTITUTION: TEXAS A&M UNIVERSITY		
TOTAL	$175,000	

WASHINGTON

TITLE: DEVELOPMENT OF MINIATURIZED UNDERSEAS RADIATION DETECTOR INSTRUMENTS FOR MANNED SUBMERSIBLE OPERATIONSAT 460 METERS UNDERSEAS (SUPPLEMENT)	$8,660	
INVES: PETER KOTZER, BUR. OF FAC. RESEARCH, WWU		
STARTING DATE: 4/18/1977 COMPLETION DATE: 1/01/1979		
INSTITUTION: UNIVERSITY OF WASHINGTON		

	FED FUNDS	MATCHING FUNDS
TITLE: EVALUATION OF ACOUSTIC TECHNIQUES OF RESOURCE ASSESSMENT INVES: RICHARD E. THORNE STARTING DATE: 1/01/1972 COMPLETION DATE: 1/01/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$26,200	$16,400
TITLE: FISHING VESSEL SAFETY ANALYSIS CENTER INVES: BRUCE H. ADEE STARTING DATE: 1/01/1978 COMPLETION DATE: 1/01/1982 INSTITUTION: UNIVERSITY OF WASHINGTON	$11,400	$12,900
TITLE: OCEAN SYSTEMS DESIGN INVES: KARL H. VESPER STARTING DATE: 1/01/1978 COMPLETION DATE: 1/01/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$18,000	$26,200
TITLE: IN SITU MEASUREMENT OF THE ACOUSTIC TARGET STRENGTH OF FISH INVES: J. EHRENBERG STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$20,900	$5,800
TITLE: ACOUSTIC ESTIMATION OF SALMON IN TERMINAL AREAS INVES: OLE A. MATHISEN STARTING DATE: COMPLETION DATE: 1/01/1981 INSTITUTION: UNIVERSITY OF WASHINGTON	$22,500	$12,500
TITLE: LARVAL FEED DEVELOPMENT - TECHNOLOGICAL AND ENGINEERING ASPECTS INVES: G. PIGOTT STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$27,500	$18,000
TITLE: HYDROACOUSTIC RESOURCE ASSESSMENT TECHNIQUES INVES: RICHARD E. THORNE STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$30,100	$22,000

	FED FUNDS	MATCHING FUNDS
TITLE: WAVE MOTION IN HARBORS AND MARINAS INVES: DONALD F. WINTER STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$31,500	$17,500
TITLE: OCEAN ENGINEERING PROGRAM ENHANCEMENT INVES: BRUCE H. ADEE STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$15,000	$31,600
TITLE: DEV MINIATURIZED UNDERSEAS RADIATION INSTRUMENTS INVES: PETER KOTZER WWU STARTING DATE: 4/18/1977 COMPLETION DATE: 6/30/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$4,500	
TITLE: DEVELOPMENT OF MINIATURIZED UNDERSEAS RADIATION DETECTOR INSTRUMENTS FOR MANNED SUBMERSIBLE OPERATIONS AT 460 METERS UNDERSEAS INVES: PETER KOTZER STARTING DATE: 4/18/1977 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$17,500	
TOTAL	$233,760	$162,900

WISCONSIN

TITLE: EVALUATION OF WATER RESUE SYSTEMS FOR YELLOW PERCH AQUACULTURE INVES: JOHN T. QUIGLEY STARTING DATE: 9/01/1978 COMPLETION DATE: 2/28/1980 INSTITUTION: UNIVERSITY OF WISCONSIN	$5,675	$15,581
TITLE: PERCH AQUACULTURE SYSTEMS STUDY INVES: ERHARD JOERES/P.M. BERTHOUEX STARTING DATE: 9/01/1979 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIVERSITY OF WISCONSIN	$2,291	$1,891

	FED FUNDS	MATCHING FUNDS
TITLE: REMOTE SENSING OF THE GREEN BAY WATERSHED TO ESTIMATE THE IMPACT OF LAND DEVELOPMENT ON THE BAYS WATER QUALITY INVES: FRANK SCARPACE STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF WISCONSIN	$36,998	$18,512
TITLE: DETAILED ANALYSIS OF FACTORS INFLUENCING SHORELINE EROSION ON THE GREAT LAKES INVES: R.B. EDIL STARTING DATE: 9/01/1977 COMPLETION DATE: 8/31/1980 INSTITUTION: UNIVERSITY OF WISCONSIN	$16,120	$7,346
TITLE: IMPULSIVE RESPONSE AND RESONANCE OF GREAT LAKES SHIPS INVES: T.C. HUANG STARTING DATE: 9/01/1977 COMPLETION DATE: 8/31/1980 INSTITUTION: UNIVERSITY OF WISCONSIN	$17,991	$8,513
TITLE: DEVELOPMENT OF UNDERWATER DEVICES INVES: ALI SEIREG STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1982 INSTITUTION: UNIVERSITY OF WISCONSIN	$32,029	$19,431
TITLE: ICE ENGINEERING FOR SMALL CRAFT HARBORS INVES: C. ALLEN WORTLEY STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1982 INSTITUTION: UNIVERSITY OF WISCONSIN	$17,919	$7,092
TOTAL	$129,023	$78,366

EDUCATION

	FED FUNDS	MATCHING FUNDS
TITLE: DEVELOPMENT OF A MARINE ENGINEERING RESEARCH AND EDUCATION PROGRAM INVES: P. L-F. LIU, ENVIRON. ENGIN., CORNELL UNIV. STARTING DATE: COMPLETION DATE: 12/31/1979 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$10,300	$32,904
TITLE: DOCTORAL FELLOWSHIPS FOR STUDIES OF MARINE INDUSTRIES INVES: EDWARD BOLLINGER, NY SEA GRANT NEW YORK SEA GRANT INSTITUTE STARTING DATE: 11/01/1975 COMPLETION DATE: 12/31/1981 INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL	$14,000	
TITLE: OCEAN ENGINEERING PROGRAM ENHANCEMENT INVES: BRUCE H. ADEE STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$15,000	$31,600
TITLE: SEA GRANT INTERNSHIP - AREA OF OCEAN ENGINEERING INVES: K.U. SIVAPRASAD STARTING DATE: 1/01/1979 COMPLETION DATE: 1/31/1980 INSTITUTION: UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$20,200	$795
TITLE: UNDERGRADUATE OCEAN PROJECTS COURSE INVES: JOSEPH B. MURDOCH STARTING DATE: 7/01/1969 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$34,268	$31,953
TITLE: INTERDISCIPLINARY SYSTEMS DESIGN SUBJECT INVES: WILLIAM W. SEIFERT STARTING DATE: 6/01/1970 COMPLETION DATE: 7/01/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$15,700	$5,987

	FED FUNDS	MATCHING FUNDS
TITLE: OCEAN ENGINEERING PROJECTS LABORATORY INVES: IRA DYER STARTING DATE: 6/30/1970 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$29,000	$26,321
TITLE: OCEAN ENGINEERING CURRICULA INVES: IRA DYER STARTING DATE: 7/01/1973 COMPLETION DATE: 7/01/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		$101,911
TITLE: DEVELOPMENT OF AN INTEGRATED COURSE ON OFFSHORE STRUCTURES INVES: ORAL BUYUKOZTURK STARTING DATE: 7/01/1977 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$26,700	$34,838
TITLE: DEVELOPMENT OF A NEW COURSE IN UNDERWATER TECHNOLOGY INVES: EDWARD K. NODA STARTING DATE: 9/01/1978 COMPLETION DATE: 5/31/1980 INSTITUTION: UNIVERSITY OF HAWAII	$17,956	$13,133
TITLE: OCEAN ENGINEERING AND THE FUTURE: LONG-RANGE PLANNING INVES: W.C. WEBSTER/M.P. TULIN STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$12,038	$9,808
TITLE: DESALINATION SPECIALIZATION WITHIN B.S. IN ENVIRONMENTAL SCIENCE INVES: ROBERT BAKISH STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1982 INSTITUTION: FAIRLEIGH DICKINSON UNIVERSITY	$59,900	$26,983
TOTAL	$255,062	$316,233

FISHERIES AND SEAFOOD PROCESSING

	FED FUNDS	MATCHING FUNDS
TITLE: HYDROACOUSTIC RESOURCE ASSESSMENT TECHNIQUES INVES: RICHARD E. THORNE STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$30,100	$22,000
TITLE: EVALUATION OF ACOUSTIC TECHNIQUES OF RESOURCE ASSESSMENT INVES: RICHARD E. THORNE STARTING DATE: 1/01/1972 COMPLETION DATE: 1/01/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$26,200	$16,400
TITLE: ACOUSTIC ESTIMATION OF SALMON IN TERMINAL AREAS INVES: OLE A. MATHISEN STARTING DATE: COMPLETION DATE: 1/01/1981 INSTITUTION: UNIVERSITY OF WASHINGTON	$22,500	$12,500
TITLE: DESIGN AND DEVELOPMENT OF MECHANIZED PROCESSING EQUIPMENT FOR THE GRADING, CLEANING & PACKING OF CULTIVATED EUROPEAN OYSTERS INVES: JOHN G. RILEY STARTING DATE: 1/01/1978 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$45,405	$28,285
TITLE: TANK TESTING U.R.I. SERIES TRAWL INVES: A.J. HILLIER STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: UNIVERSITY OF RHODE ISLAND	$13,955	$6,825
TITLE: FISHERIES ENGINEERING INVES: E. KOLBE STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: OREGON STATE UNIVERSITY	$7,100	$14,300

	FED FUNDS	MATCHING FUNDS
TITLE: DESIGN AND DEVELOPMENT OF A SQUID-PROCESSING MACHINE	$7,302	$5,187
INVES: R.P. SINGH		
STARTING DATE: 10/01/1977 COMPLETION DATE: 9/30/1980		
INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO		
TITLE: SOLID-LIQUID SEPARATION AND WATER CONSERVATION IN THE SHELLFISH AND FISH PROCESSING INDUSTRY	$31,286	$14,716
INVES: R.A. JOHNSON		
STARTING DATE: 11/01/1978 COMPLETION DATE: 10/31/1980		
INSTITUTION: UNIVERSITY OF ALASKA		
TOTAL	$183,848	$120,213

AQUACULTURE

	FED FUNDS	MATCHING FUNDS
TITLE: LARVAL FEED DEVELOPMENT - TECHNOLOGICAL AND ENGINEERING ASPECTS INVES: G. PIGOTT STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$27,500	$18,000
TITLE: EVALUATION OF WATER RESUE SYSTEMS FOR YELLOW PERCH AQUACULTURE INVES: JOHN T. QUIGLEY STARTING DATE: 9/01/1978 COMPLETION DATE: 2/28/1980 INSTITUTION: UNIVERSITY OF WISCONSIN	$5,675	$15,581
TITLE: PERCH AQUACULTURE SYSTEMS STUDY INVES: ERHARD JOERES/P.M. BERTHOUEX STARTING DATE: 9/01/1979 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIVERSITY OF WISCONSIN	$2,291	$1,891
TOTAL	$35,466	$35,472

WAVE STUDIES

	FED FUNDS	MATCHING FUNDS
TITLE: ANALYSIS AND PREDICTION OF OCEAN SURFACE GRAVITY WAVES ON N.C. COAST INVES: C.E. KNOWLES, NCSU DEPT. OF MARINE SCIENCE & ENG STARTING DATE: COMPLETION DATE: 12/01/1981 INSTITUTION: UNIVERSITY OF NORTH CAROLINA	$8,550	$2,400
TITLE: WAVE MOTION IN HARBORS AND MARINAS INVES: DONALD F. WINTER STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$31,500	$17,500
TITLE: DEVELOPMENTS ON THE RAY THEORY FOR OCEAN WAVES INVES: C. LOZANO STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$24,378	$12,390
TITLE: WAVE CLIMATE ASSESSMENT FOR ALASKAN COASTAL REGIONS INVES: J.M. COLONELL STARTING DATE: 11/01/1978 COMPLETION DATE: 10/31/1981 INSTITUTION: UNIVERSITY OF ALASKA	$31,177	$17,400
TOTAL	$95,605	$49,690

EROSION AND CONTROL STRUCTURES

	FED FUNDS	MATCHING FUNDS
TITLE: BEACH & DUNE EROSION CAUSED BY STORM TIDES & WAVES INVES: T Y CHIU STARTING DATE: 1/01/1978 COMPLETION DATE: 12/01/1979 INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA	$43,800	$44,000
TITLE: SHORELINE EFFECTS OF VESSEL TRANSIT OF THE ST. MARYS RIVER INVES: R. SCHER STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: UNIVERSITY OF MICHIGAN	$16,620	
TITLE: DETAILED ANALYSIS OF FACTORS INFLUENCING SHORELINE EROSION ON THE GREAT LAKES INVES: R.B. EDIL STARTING DATE: 9/01/1977 COMPLETION DATE: 8/31/1980 INSTITUTION: UNIVERSITY OF WISCONSIN	$16,120	$7,346
TITLE: EROSION AND DEPOSITION PROCESSES AND PATTERNS IN THE NEARSHORE ZONE OF WESTERN DELAWARE BAY INVES: J.C. KRAFT STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$37,650	$24,855
TITLE: INVESTIGATIONS OF COASTAL BLUFF RETREAT FOR THE TRINIDAD HEADLAND AREA OF NORTHERN CALIFORNIA INVES: G.A. CARVER STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$24,856	$7,020
TOTAL	$139,046	$83,221

REMOTE SENSING

	FED FUNDS	MATCHING FUNDS
TITLE: COASTAL ZONE MANAGEMENT AND MARINE ADVISORY SERVICE APPLICATIONS OF REMOTE SENSING INVES: PETER CORNILLON STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: UNIVERSITY OF RHODE ISLAND	$17,258	
TITLE: REMOTE SENSING OF THE GREEN BAY WATERSHED TO ESTIMATE THE IMPACT OF LAND DEVELOPMENT ON THE BAYS WATER QUALITY INVES: FRANK SCARPACE STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF WISCONSIN	$36,998	$18,512
TITLE: REMOTE SENSING OF ESTUARINE DETRITAL FLOW AND SURFACE WATER PRODUCTIVITY INVES: V. KLEMAS STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$21,910	$36,277
TOTAL	$76,166	$54,789

COASTAL STUDIES

	FED FUNDS	MATCHING FUNDS
TITLE: COASTAL CURRENTS AND SEDIMENT TRANSPORT ON GREAT LAKES SHORELINE	$26,966	$20,478
INVES: PHILLIP LIU, CORNELL DEPT. OF ENV. ENGR.		
STARTING DATE: 11/01/1976 COMPLETION DATE: 12/31/1980		
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL		
TITLE: STABILIZATION OF TIDAL INLET CHANNELS FOR IMPROVED BOAT TRAFFICABILITY BY FLUIDIZATION OF BOTTOM SEDIMENTS	$20,000	$10,800
INVES: J.M. PARKS, GEOLOGICAL SCI., LEHIGH AND W.A. MURRAY, CIVIL ENG. LEHIGH		
STARTING DATE: COMPLETION DATE: 1/01/1982		
INSTITUTION: NEW JERSEY MARINE SCIENCES CONSORTIUM		
TITLE: SEA WATER INTRUSION IN OFFSHORE ISLANDS	$39,800	$13,167
INVES: JOHN L. WILSON		
STARTING DATE: 7/01/1977 COMPLETION DATE: 6/30/1981		
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		
TITLE: THE EFFECT OF TERRAIN ROUGHNESS ON TSUNAMI RUN-UP AND INUNDATION	$32,795	$15,982
INVES: CHARLES L. BRETSCHNEIDER		
STARTING DATE: 9/01/1978 COMPLETION DATE: 5/31/1981		
INSTITUTION: UNIVERSITY OF HAWAII		
TITLE: THE HYDROGRAPHY AND CIRCULATION OVER AND AROUND NANTUCKET SHOALS	$42,000	
INVES: ROBERT C. BEARDSLEY		
STARTING DATE: COMPLETION DATE: 6/30/1980		
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.		
TITLE: MOVABLE BED ROUGHNESS IN THE COASTAL ZONE: A FIELD STUDY AND MODEL DESIGN	$42,000	$17,848
INVES: WILLIAM D. GRANT/ALBERT J. WILLIAMS		
STARTING DATE: 10/01/1978 COMPLETION DATE: 6/30/1981		
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.		

	FED FUNDS	MATCHING FUNDS
TITLE: SEDIMENT TRANSPORT IN A TIDAL INLET INVES: DAVID G. AUBREY STARTING DATE: 7/01/1979 COMPLETION DATE: 7/01/1982 INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.	$25,000	$9,531
TITLE: WAVES AND CURRENTS ON A BEACH IN THE PRESENCE OF A JETTY INVES: R.T. HUDSPETH STARTING DATE: 7/01/1977 COMPLETION DATE: 6/30/1980 INSTITUTION: OREGON STATE UNIVERSITY	$41,900	$11,200
TITLE: HARBOR ENTRANCE VISIBILITY INVES: W.H. QUINN STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: OREGON STATE UNIVERSITY	$17,400	$42,600
TITLE: SEDIMENT TRANSPORT AND DEPOSITION IN OREGON ESTUARIES INVES: P.D. KOMAR STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: OREGON STATE UNIVERSITY	$30,400	$12,400
TITLE: PRELIMINARY DEVELOPMENT OF AN OPERATIONAL LAKE ERIE STORM SURGE FLOOD FORECASTING PROGRAM INVES: K.W. BEDFORD STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1982 INSTITUTION: OHIO STATE UNIVERSITY	$26,600	$16,300
TITLE: DEVELOPMENT AND APPLICATION OF A METHOD TO SIMULATE SHORELINE RESPONSE INVES: R. DEAN STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$31,311	$17,632
TITLE: A STUDY OF THE ENTRANCE PROBLEMS AT HUMBOLT BAY INVES: J.D. ISAACS STARTING DATE: 10/01/1978 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$46,343	$20,450

	FED FUNDS	MATCHING FUNDS
TITLE: PROBLEMS OF HARBOR MODELING INVES: JIIN J. LEE/LANDON C. WELLFORD STARTING DATE: 10/01/1978 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF SOUTHERN CALIFORNIA	$33,162	$22,481
TITLE: STABILITY OF NAVIGATIONAL CHANNELS AND SHOALING IN SOUND ENTRANCES, SOUTHERN HALF OF THE SOUTH CAROLINA COAST, YEAR 3 INVES: MILES O. HAYES STARTING DATE: 7/01/1977 COMPLETION DATE: 8/31/1980 INSTITUTION: SOUTH CAROLINA SEA GRANT CONSORTIUM	$31,200	$27,000
TITLE: A SHORT COURSE ON SMALL HARBOR ENGINEERING IN INDIA INVES: A.J. MEHTA STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980 INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA	$18,000	$1,300
TITLE: SEDIMENTATION IN DULUTH-SUPERIOR HARBOR INVES: THOMAS C. JOHNSON STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1981 INSTITUTION: UNIVERSITY OF MINNESOTA	$7,314	$8,124
TITLE: THE DYNAMICS OF MARINE SAND PRODUCTION,TRANSPORT AND DEPOSITION OFF ST. CROIX,USVI INVES: D.K. HUBBARD STARTING DATE: 9/01/1978 COMPLETION DATE: 9/01/1980 INSTITUTION: FAIRLEIGH DICKINSON UNIVERSITY	$61,300	$31,602
TOTAL	$573,491	$298,895

COASTAL CONSTRUCTION

	FED FUNDS	MATCHING FUNDS
TITLE: BUILDING SCIENCE TECHNOLOGY FOR RESIDENTIAL AND COMMERCIAL STRUCTURES IN COASTAL HAZARD ZONES	$10,369	$5,597
INVES: JERRY L. MACHEMEHL, NCSU DEPTS. OF MARINE SCI. & ENG.		
STARTING DATE: 1/01/1978 COMPLETION DATE: 12/01/1979		
INSTITUTION: UNIVERSITY OF NORTH CAROLINA		
TITLE: THE IMPACT OF OFFSHORE SAND AND GRAVEL MINING ON THE AVAILABILITY AND COSTS OF CONSTRUCTION MINERALS IN THE GREATER N.Y. METROPOLITAN AREA	$23,845	$16,922
INVES: WILLIAM A. WALLACE, R.P.I. MANAGEMENT SCIENCE		
STARTING DATE: COMPLETION DATE: 12/31/1979		
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL		
TITLE: DEVELOPMENT OF DESIGN CRITERIA FOR FLOATING BREAKWATERS	$45,586	$34,074
INVES: VOLKER W. HARMS, BUFFALO CIVIL ENGINEERING		
STARTING DATE: COMPLETION DATE: 12/31/1979		
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL		
TITLE: A CRITICAL ASSESSMENT OF THE PRESSURES ON NEW YORK MARINE COASTAL ZONE FROM PHYSICAL ALTERATIONS	$18,604	$8,417
INVES: J.R. SCHUBEL, SUNY-STONY BROOK MARINE SCIENCES RESEARCH CENTER		
STARTING DATE: COMPLETION DATE: 12/31/1979		
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL		
TITLE: DEVELOPMENT OF A COASTAL STRUCTURES CONSTRUCTION MANUAL	$16,626	$22,424
INVES: FRED KULNAWY, CORNELL-ENGINEER, DEPT. OF CIVIL & ENV. ENG.		
STARTING DATE: COMPLETION DATE: 12/31/1982		
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL		
TITLE: AN EVALUATION OF COASTAL SAND AND GRAVEL AND MARGINAL ROCK AS CONSTRUCTION MATERIALS	$53,900	$5,000
INVES: R.G. HICKS		
STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980		
INSTITUTION: OREGON STATE UNIVERSIIY		

	FED FUNDS	MATCHING FUNDS
TITLE: SUBMERGED OFFSHORE ARTIFICIAL REEF STUDY INVES: C.K. SOLLITT/D. HANCOCK STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: OREGON STATE UNIVERSITY	$27,900	$49,900
TITLE: SYNTHETIC FABRIC APPLICATION IN OCEAN AND COASTAL ENGINEERING INVES: C.K. SOLLITT/T.S. VINSON/J.R. BELL STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1981 INSTITUTION: OREGON STATE UNIVERSITY	$79,000	$16,700
TITLE: ICE ENGINEERING FOR SMALL CRAFT HARBORS INVES: C. ALLEN WORTLEY STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1982 INSTITUTION: UNIVERSITY OF WISCONSIN	$17,919	$7,092
TITLE: OFFSHORE SAND AND GRAVEL RESOURCES, ORANGE COUNTY, CALIFORNIA INVES: ROBERT H. OSBORNE STARTING DATE: 10/01/1979 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF SOUTHERN CALIFORNIA	$15,749	$44,982
TOTAL	$309,498	$211,108

SHIP DESIGN,CONSTRUCTION AND SAFETY

	FED FUNDS	MATCHING FUNDS
TITLE: ROBOT VEHICLES FOR SEARCH & SURVEY APPLICATIONS INVES: A.D. CARMICHAEL, PROF. OCEAN ENGR. STARTING DATE: COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$34,900	
TITLE: FISHING VESSEL SAFETY ANALYSIS CENTER INVES: BRUCE H. ADEE STARTING DATE: 1/01/1978 COMPLETION DATE: 1/01/1982 INSTITUTION: UNIVERSITY OF WASHINGTON	$11,400	$12,900
TITLE: QUALITY CONTROL OF FIBERGLASS BOAT HULLS USING THERMAL TESTING AND LIQUID CRYSTALS INVES: J.H. WILLIAMS STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$36,900	$22,201
TITLE: IMPLEMENTATION OF A NEW METHOD FOR EVALUATING THE WAVE RESISTANCE OF A SHIP INVES: FRANCIS NOBLESSE STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$15,000	$30,075
TITLE: PATH CONTROL SYSTEM FOR SURFACE SHIP IN CHANNELS INVES: MICHAEL G. PARSONS STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: UNIVERSITY OF MICHIGAN	$33,747	
TITLE: EFFECTS OF CONTROL SYSTEMS ON OPTIMIZATION OF SHIP SIZE FOR NAVIGATION IN RESTRICTED WATERS OF THE GREAT LAKES INVES: HOWARD M. BUNCH STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: UNIVERSITY OF MICHIGAN	$29,710	

	FED FUNDS	MATCHING FUNDS
TITLE: AN ECONOMIC ANALYSIS OF PROPULSION NOZZLE EXPERIMENT	$5,937	
INVES: ANDREAS HOLMSEN		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980		
INSTITUTION: UNIVERSITY OF RHODE ISLAND		
TITLE: EVALUATION OF THE GPS SYSTEM AS A CIVIL MARINE NAVIGATION SYSTEM IN THE COASTAL ZONE	$150,000	
INVES: TOM RHYNE		
STARTING DATE: 5/16/1979 COMPLETION DATE: 5/31/1980		
INSTITUTION: TEXAS A&M UNIVERSITY		
TITLE: IMPULSIVE RESPONSE AND RESONANCE OF GREAT LAKES SHIPS	$17,991	$8,513
INVES: T.C. HUANG		
STARTING DATE: 9/01/1977 COMPLETION DATE: 8/31/1980		
INSTITUTION: UNIVERSITY OF WISCONSIN		
TOTAL	$335,585	$73,689

SEWERAGE

	FED FUNDS	MATCHING FUNDS
TITLE: DEVELOPMENT OF ALTERNATIVE ON-SITE SEPTIC WASTE DISPOSAL SYSTEMS FOR THE COASTAL ZONE OF NORTH CAROLINA	$44,985	$20,935
INVES: B. L. CARLILE, NCSU SOIL SCIENCE DEPT.		
STARTING DATE: 4/01/1976 COMPLETION DATE: 12/01/1980		
INSTITUTION: UNIVERSITY OF NORTH CAROLINA		
TITLE: AN ANALYSIS OF OFFSHORE BRINE DISPOSAL TECHNIQUES	$62,700	
INVES: DR K D STOLZENBACH		
STARTING DATE: 1/01/1977 COMPLETION DATE: 12/30/1979		
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		
TOTAL	$107,685	$20,935

OFFSHORE STRUCTURE DESIGN AND ANALYSIS

	FED FUNDS	MATCHING FUNDS
TITLE: FATIGUE OF WELDED STRUCTURAL STEEL IN SEA WATER INVES: WILLIAM H HARTT OCEAN ENGINEERING STARTING DATE: 1/01/1978 COMPLETION DATE: 12/01/1979 INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA	$33,600	$17,100
TITLE: DEVELOPMENT OF JOINING AND CUTTING TECHNIQUES FOR DEEP SEA APPLICATIONS INVES: KOICHI MASUBUCHI STARTING DATE: 7/01/1976 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$21,400	$10,519
TITLE: METHOD TO PREDICT FOUNDATION DISPLACEMENT OF AN OFFSHORE FACILITY INVES: W. ALLEN MARR/T. WILLIAM LAMBE STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$49,000	$60,680
TITLE: IN SITU EVALUATION OF GEOTECHNICAL PROPERTIES OF MARINE SEDIMENT INVES: MOHSEN M. BALIGH STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$75,000	$60,000
TITLE: A SLANTED LOOK AT OCEAN WAVE FORCES ON PIPES INVES: ROBERT A. GRACE STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1979 INSTITUTION: UNIVERSITY OF HAWAII	$12,577	$2,178
TITLE: EARTHQUAKE LOADING ON LARGE OFFSHORE STRUCTURES-AN APPLICATION OFEXPERIMENTAL DATA TO PRACTICAL STRUCTURE FORMS INVES: JOSEPH PENZIEN STARTING DATE: 10/01/1976 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$17,191	$18,591
TOTAL	$208,768	$169,068

BIOFOULING AND METAL CORROSION

	FED FUNDS	MATCHING FUNDS
TITLE: CONTROL OF CORROSION AND DETERIATION OF TRAWLING CABLES INVES: E. KOLBE STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1981 INSTITUTION: OREGON STATE UNIVERSITY	$22,200	$25,900
TITLE: EFFECTS OF SURFACE CONDITIONS AND HEAT TREATMENT ON THE CORROSION CHARACTERISTICS OF TITANIUM ALLOYS AND COATINGS IN SEA WATER INVES: A. RAMAN STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1981 INSTITUTION: LOUISIANA STATE UNIVERSITY	$32,867	$12,691
TITLE: INVESTIGATION OF MARINE ANTIFOULING MATERIALS AND MARINE CORROSION INVES: MARY L. GOOD STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1982 INSTITUTION: LOUISIANA STATE UNIVERSITY	$40,743	$3,219
TITLE: THE EFFECT OF HYDROGEN CONCENTRATION AND IMPURITY ELEMENTS ON THE HYDROGEN EMBRITTLEMENT OF IRON INVES: THOMAS C. SHELTON STARTING DATE: 1/01/1979 COMPLETION DATE: 8/31/1982 INSTITUTION: LOUISIANA STATE UNIVERSITY	$27,905	$9,383
TITLE: NEW APPROACHES TO CONTROL OF MARINE FOULING AND BORING ORGANISMS INVES: RALPH MITCHELL STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1980 INSTITUTION: HARVARD UNIVERSITY	$64,200	$20,391
TOTAL	$187,915	$71,584

MATERIAL DEGRADATION(OTHER)

		FED FUNDS	MATCHING FUNDS
TITLE: PREVENTING AND STOPPING DETERIORATION OF WOOD IN THE MARINE ENVIRONMENT		$50,200	$14,400
INVES: R.D. GRAHAM			
STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981			
INSTITUTION: OREGON STATE UNIVERSITY			
	TOTAL	$50,200	$14,400

ACOUSTICS

	FED FUNDS	MATCHING FUNDS
TITLE: IN SITU MEASUREMENT OF THE ACOUSTIC TARGET STRENGTH OF FISH INVES: J. EHRENBERG STARTING DATE: COMPLETION DATE: 1/01/1980 INSTITUTION: UNIVERSITY OF WASHINGTON	$20,900	$5,800
TITLE: UNDERWATER COMMUNICATION SYSTEMS FOR UNTETHERED VEHICLES AND SENSORS INVES: A.B. BAGGEROER STARTING DATE: 7/01/1978 COMPLETION DATE: 6/30/1981 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$82,200	$12,521
TITLE: DEVELOPMENT, TESTING, AND EVALUATION OF HIGH-RESOLUTION ELECTRONIC/ACOUSTIC TRIANGULATION SYSTEM FOR UNDERWATER SURVEY APPLICATION INVES: JOHN GIFFORD STARTING DATE: 6/01/1979 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIVERSITY OF MINNESOTA	$15,200	$2,993
TITLE: SIDE-SCAN SONAR MAPPING AND COMPUTER-AIDED INTERPRETATION OF THE GEOLOGY OF THE SANTA BARBARA CHANNEL INVES: B.P. LUYENDYK/D.S. SIMONETT STARTING DATE: 10/01/1977 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$21,521	$31,161
TOTAL	$139,821	$52,475

OIL SPILL

	FED FUNDS	MATCHING FUNDS
TITLE: OIL SPILL CLEAN-UP AND LIABILITY MODELS	$45,000	$39,997
INVES: J.D.NYHART/HARILAOS N. PSARAFTIS		
STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1981		
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		
TOTAL	$45,000	$39,997

MISCELLANEOUS

	FED FUNDS	MATCHING FUNDS
TITLE: STUDY OF A COST MODEL OF DEEP SEABED MINING (SUPPLEMENT) INVES: J.D. NYHART, SLOAN SCHOOL OF MANAGEMENT & DEPT. OF OCEAN ENGINEERING STARTING DATE: 7/01/1996 COMPLETION DATE: 8/31/1979 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$80,000	
TITLE: THE COST OF DEEP OCEAN MINING ENVIRONMENTAL REGULATION INVES: JOHN E. FLIPSE, CIVIL ENGR. STARTING DATE: COMPLETION DATE: 5/15/1979 INSTITUTION: TEXAS A&M UNIVERSITY	$25,000	
TITLE: DEVELOPMENT OF MINIATURIZED UNDERSEAS RADIATION DETECTOR INSTRUMENTS FOR MANNED SUBMERSIBLE OPERATIONSAT 460 METERS UNDERSEAS (SUPPLEMENT) INVES: PETER KOTZER, BUR. OF FAC. RESEARCH, WWU STARTING DATE: 4/18/1977 COMPLETION DATE: 1/01/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$8,660	
TITLE: OCEAN SYSTEMS DESIGN INVES: KARL H. VESPER STARTING DATE: 1/01/1978 COMPLETION DATE: 1/01/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$18,000	$26,200
TITLE: DEV MINIATURIZED UNDERSEAS RADIATION INSTRUMENTS INVES: PETER KOTZER WWU STARTING DATE: 4/18/1977 COMPLETION DATE: 6/30/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$4,500	
TITLE: DECONTAMINATION OF DREDGE SPOILS BY EXTRACTION WITH WATER UNDER NEAR CRITICAL CONDITIONS INVES: MICHAEL MODELL STARTING DATE: 7/01/1979 COMPLETION DATE: 6/30/1982 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$45,000	$6,639

	FED FUNDS	MATCHING FUNDS
TITLE: APPLICATION OF TELEOPERATORS TO UNDERSEA TASKS INVES: THOMAS B. SHERIDAN STARTING DATE: 7/01/1976 COMPLETION DATE: 6/30/1980 INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$42,000	$18,645
TITLE: DEVELOPMENT OF MINIATURIZED UNDERSEAS RADIATION DETECTOR INSTRUMENTS FOR MANNED SUBMERSIBLE OPERATIONS AT 460 METERS UNDERSEAS INVES: PETER KOTZER STARTING DATE: 4/18/1977 COMPLETION DATE: 12/31/1979 INSTITUTION: UNIVERSITY OF WASHINGTON	$17,500	
TITLE: DESIGN, CONSTRUCTION, AND TESTING OF LORAN-C TELEMETRY FROM A DRIFTING BUOY INVES: ROBERT G. WALDEN STARTING DATE: 11/10/1977 COMPLETION DATE: 6/30/1980 INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.	$27,000	
TITLE: DEVELOPMENT OF UNDERWATER DEVICES INVES: ALI SEIREG STARTING DATE: 9/01/1978 COMPLETION DATE: 8/31/1982 INSTITUTION: UNIVERSITY OF WISCONSIN	$32,029	$19,431
TITLE: CONSTRUCTION AND DEPLOYMENT OF A PROTOTYPE 1500 GALLON PER DAY SEA WAVE POWERED DESALINATION BUOY INVES: C.M. PLEAS STARTING DATE: 9/01/1979 COMPLETION DATE: 8/31/1981 INSTITUTION: UNIVERSITY OF DELAWARE	$60,194	$25,160
TITLE: MARINE ADVISORY SERVICE - INDUSTRY/RESEARCH INTERACTION INVES: R. WAGNER STARTING DATE: 7/01/1976 COMPLETION DATE: INSTITUTION: UNIVERSITY OF DELAWARE	$19,395	$22,348
TITLE: A CONDENSING CENTRIFUGAL COMPRESSOR FOR THE DISTILLATION OF SEAWATER INVES: M.S. MANALIS/P.H. LEE STARTING DATE: 10/01/1978 COMPLETION DATE: 9/30/1980 INSTITUTION: UNIVERSITY OF CALIFORNIA, SAN DIEGO	$19,416	$9,301

	FED FUNDS	MATCHING FUNDS
TITLE: ENGINEERING DESIGN AND SPECIFICATIONS FOR A HIGH-PRESSURE SEAWATERR PUMP	$11,400	
INVES: C.M. PLEASS		
STARTING DATE: 6/01/1979 COMPLETION DATE: 8/31/1980		
INSTITUTION: UNIVERSITY OF DELAWARE		
TITLE: UNIVERSITY RESEARCH IN OCEAN ENGINEERING-SOURCES AND RESOURCES	$24,000	
INVES: NORMAN DOELLING		
STARTING DATE: 6/01/1979 COMPLETION DATE: 10/01/1980		
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY		
TOTAL	$434,094	$127,724

THE SOCIAL SCIENCES IN THE SEA GRANT PROGRAM

by Michael K. Orbach
and
Lauriston King

Preface

In December 1978, the Sea Grant Association Executive Committee requested that the Association's Committee on Research focus on how to incorporate the social sciences more effectively in marine research. Shortly after the committee began to explore the scope of its activities, we learned that Dr. Michael K. Orbach, then Social Science Advisor to the National Marine Fisheries Service and Sea Grant Program, was compiling a report covering many of the points we anticipated addressing in our review.

We quickly agreed to consolidate our efforts. Drs. Orbach and King prepared the initial draft of the report, which was then reviewed by the Committee. This draft incorporates the comments and suggestions of the committee members. Although we still consider this a draft report subject to additional revision and elaboration based on discussions at the annual meeting of the Sea Grant Association in Orlando, Florida, October 22 - 26, 1979, we feel it provides a useful overview of the place of the social sciences in the Sea Grant program. It also presents several recommendations for developing this important dimension of the program.

Feenan D. Jennings, Chairman

Texas A&M University
College Station, TX
September, 1979

List of Sea Grant Research Committee

Mr. Feenan D. Jennings, Chairman
Director
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University of Southern California

Dr. Lauriston R. King
Deputy Director
Sea Grant Program
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Social Science Advisor
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Dr. Courtland Smith
Department of Anthropology
Oregon State University

*As of September 1, 1979, Center for Coastal Marine Studies, University of California, Santa Cruz.

Introduction

This report addresses the patterns of social science activity within the Sea Grant Program. It is not a review of social science research on marine problems, nor does it contain a literature review for any of the many substantive areas of social science research related to ocean, coastal, or other social, economica, biological, or physical environments with which Sea Grant is concerned. Drawing on the legislative history surrounding the program's creation and specific fiscal and publication data from 1974-1978 we have tried to identify trends in social science activity within Sea Grant and comment on the working relationships and perceptions which have existed among various participants in the Sea Grant system.

In the broadest sense, social science embraces the study of any phenomena which involve human behavior, either in individual (i.e., personal decision-making) or aggregate (i.e., social impact) perspective. It encompasses sociology, public administration, anthropology, international relations, economics, political science,psychology, recreation and leisure studies, history, geography, and many other fields of study. Throughout this discussion, we use the term in its most general sense, in part because the Sea Grant classification categories for the social sciences are more inclusive than exclusive, and in part because this report does not address problems or situations specific to any one of the social science disciplines.

The Social Sciences in the Sea Grant Program -- Early Perspectives

The social sciences were considered integral parts of the Sea Grant concept during the years prior to passage of the legislation establishing the program in 1966. Athelstan Spilhaus, a key proponent of the Sea Grant idea, described his vision at the 1965 National Conference on "The Concept of a Sea Grant University". These colleges, he argued, not only would

> concentrate on applications of science to the sea, such as prospecting underwater, mining, developing the food resources, marine pharmacology and medicine, shipping and navigation, weather and climate, but they would relate these to the natural sciences, which underlie them; to the social sciences, economics, sociology, psychology, politics and law, as they are affected by and, in turn, affect the occupation of the sea. They would also be associated with the liberal arts--literature, art, and history--which describe man's relation to the sea and enhance his enjoyment of it. (Proceedings, p. 11 1965, emphasis added.)

Spilhaus also acknowledged the role of law, economics, public administration, and national and international politics in any effort at widespread exploitation of the seas. (Proceedings, 1965, p. 12).

These calls for directing a variety of disciplinary skills towards expanded use and management of ocean resources were general. There was little explicit attention to how and in what way these disciplines might contribute to the nation's goals for the oceans. Few participants at the Newport Conference had substantial professional experience in a social science discipline. Nontheless, participants continued to emphasize that the prudent and orderly development of the nation's water resources could no longer depend solely on the traditional natural and physical sciences. This sentiment was captured by University of Wisconsin meteorologist Dr. Robert Ragotzkie, who observed that:

> The economic, social, and political aspects of major water problems are becoming increasingly critical. In the oceans and the Great Lakes the development of management techniques and plans for multiple use of water resources is already seriously lagging because of non-scientific problems. In the water resources center at our university we are making a special effort to bring the talents of economists, rural and urban planners and lawyers, as well as sanitary engineers and natural scientist to bear on water problems. This subject should receive special emphasis in a sea grant college. (Sea Grant Colleges, 1966, p. 216.)

Another spokesman for the sea grant concept, Dr. Francis Horn, president of the University of Rhode Island, argued that the mission of the proposed sea grant institutions "would be to train the scientists, engineers, economists, political scientists, lawyer (sic), doctors, and hundreds of others who will be needed if we are going to live and work on and under the sea". (Sea Grant Colleges, 1966, p. 13.)

This emphasis on the variety of skills and disciplines required to make a major move to the oceans and the exploitation and management of marine resource was pressed through the legislative drafting stages of the program. The National Committee for a Sea Grant College, a group formed from the participants at the October 1965 conference on "The Concept of a Sea Grant University", recommended clarification of the sea grant idea by changing the wording of the proposed legislation to define the concept as

> an institution of higher learning devoted to increasing our nation's utilization of the world's marine resources through activities in the area of education, public service, and research; and would relate these activities to the natural sciences which underlie them; to the social sciences, economics, sociology, psychology, political science and law, as they are affected by and, in turn, affect the occupation of the sea... (Sea Grant Colleges, 1966, p. 22 emphasis added.)

These recommendations survived the legislative process largely intact and became written in the 1966 legislation establishing the program. The law specified in its explication of definitions that

> the term 'development of marine resources' means scientific endeavors relating to the marine environment, including, but not limited to, the fields oriented toward the development, conservation, or economic utilization of the physical, chemical, geological, and biological resources of the marine environment; the fields of marine commerce and marine engineering; the fields relating to exploration or research in, the recovery of natural resources from, and the transmission of energy in, the marine environment; the fields of oceanography and oceanology; and the fields with respect to the study of the economic, legal, medical, or sociological problems arising out of the management, use, development, recovery, and control of the natural resources of the marine environment...

Subsequent amendments modified and expanded this multidisciplinary perspective even further, as reflected in the 1976 changes to the enabling legislation. Here,

> the term field related to ocean and coastal resources means any discipline or field (including marine science [and the physical, natural, and biological sciences, and engineering, included therein], marine technology, education, economics, sociology, communications, planning, law, international affairs, and public administration) which is concerned with or likely to improve the understanding, assessment, development, utilization, or conservation of ocean and coastal resources.[2]

In an additional qualifying statement, the Act made clear that the term "includes" was to read as if the phrase 'but is not limited to' were also stated.

Trends In Implementation

Publication and financial data from 1974-1978 compiled by the Office of Sea Grant makes it possible to track some trends and changes in support for the social sciences in the program. This data has been compiled according to research classifications established at the outset of the program. The categories used to collect data for this report are summarized in Figure 1.

Figure 1: Sea Grant Research Classifications Relating to the Social Sciences

II. Socio-Economic & Legal Studies

- A. Marine Economics
  - 14. Marine Economics
- B. Ocean Law
  - 15. Ocean Law - coastal
  - 16. Ocean Law - international
  - 17. Ocean Law - other (specify)
- C. Marine Recreation
  - 18. Recreation - sports fisheries
  - 19. Recreation - other specify
- D. Socio-Political Studies

IV. Marine Environmental Research

- A. Research and Studies in Direct Support of Coastal Management Decisions
  - 38. Coastal Zone Management-Social Sciences

The numbers of projects, funding, and publications between 1974 and 1978 in these classifications provide a reasonably good picture of recent trends in social science activity within Sea Grant.[3]

There are no dramatic trends that emerge, perhaps because the available data does not span the history of the program. A more likely explanation is that the place of the social sciences within the overall program has not changed very much. For example, it is clear from Table I that support for social science research across all categories was an extremely modest part of Sea Grant's overall budget during these years; amounting to no more than 15 percent of the research for any given year. Typically, the percentage has been even smaller, fluctuating between 10 and 13 percent of the total research budget. Although there has been an increase of nearly 9 percent in the funds allocated to social science projects between 1974 and 1978 (Table 2), the constant erosion by inflation makes this apparent gain illusory. Along with this decline in actual purchasing power has come a decline in the number of projects supported (Table 3), as well as in the number of publications resulting from these projects (Table 4).

A more detailed look at these tables suggests that projects in marine economics have been supported consistently between 1974 and 1978 as have projects in international law, related law projects, and recreation research. The sharpest declines have come in those projects

TABLE I. Relationship of Social Science Support to Total Office of Sea Grant Funding

(In Millions of Dollars)

Year	Total Sea Grant Funding	Total Research Funding	Total Research Funding-Social Sciences	Social Science Funding as Percentage of Total Research Funding
1974	19.8	13.1	1.9	14.5
1975	23.3	16.4	1.7	10.4
1976	23.1	16.3	1.6	9.8
1977	27.7	15.6	1.8	11.5
1978	31.7	17.0	2.1	12.4

TABLE 2: Funding by Office of Sea Grant Classification, 1974-1978.

	OSG Classification*									
	14	15	16	17	18	19	20	38	20 + 38 Combined	Total All Classifications
1974	426,910	116,005	57,892	30,230	31,422	106,773	176,373	969,184	1,145,557	1,914,789
1975	478,999	166,156	71,425	44,907	26,033	91,788	348,475	433,936	782,411	1,661,719
1976	381,061	260,289	83,521	18,400	82,000	12,683	276,373	494,987	771,360	1,609,314
1977	650,651	181,762	74,790	93,400	87,744	62,468	205,252	483,015	688,267	1,839,082
1978	813,619	126,427	106,253	104,680	155,473	101,608	393,040	282,164	675,204	2,083,264
Total	2,751,240	850,639	393,881	291,617	382,672	375,320	1,399,513	2,663,286	4,062,799	9,108,168

From Office of Sea Grant Computer Listings of Projects by Classification, 1974-1978.

*14 - Marine Economics
15 - Ocean Law - Coastal
16 - Ocean Law - International
17 - Ocean Law - Other
*18 - Recreation - Sports Fisheries
19 - Recreation - Other
20 - Socio-Political Studies
38 - Coastal Zone Management - Social Sciences

TABLE 3: Number of Projects by Office of Sea Grant Classification, 1974-1978

	OSG Classification*									
	14	15	16	17	18	19	20	38	20 + 38 Combined	Total All Classifications
1974	31	6	4	2	2	5	14	29	43	93
1975	22	10	4	2	3	7	12	29	41	89
1976	20	9	5	2	4	2	12	24	36	78
1977	27	8	4	3	5	6	12	23	35	88
1978	26	4	4	3	6	5	16	12	28	76
Total	126	37	21	12	20	25	66	117	183	424

From Office of Sea Grant Computer Listings of Projects by Classification, 1974-1978.

*14 - Marine Economics
15 - Ocean Law - Coastal
16 - Ocean Law - International
17 - Ocean Law - Other
*18 - Recreation - Sports Fisheries
19 - Recreation - Other
20 - Socio-Political Studies
38 - Coastal Zone Management - Social Sciences

TABLE 4: Sea Grant Publications in the Social Sciences, 1974-1978.

	YEAR				
	74	75	76	77	78
Law of the Sea	56	9	19	3	23
International Legal	57	10	16	7	1
National Legal	20	21	13	23	25
State Legal	12	49	30	22	5
Coastal Zone Management	95	113	52	43	43
CZM-Economics	56	100	58	36	48
CZM-Political	1	5	3	1	2
Attitudinal Surveys	5	3	8	9	2
Planning Studies	24	41	8	9	3
Sociology	13	19	8	19	3
Community Studies	4	4	0	0	0
Business Management	27	8	12	2	1
Recreation	28	30	34	80	26
Other	18	15	9	12	13
Totals	416	427	270	266	195

Source: Sea Grant Publications Indexes.

TABLE 5: Sea Grant Publications in the "Core" Social Science Areas, 1974-1978.

	YEAR				
	74	75	76	77	78
Coastal Zone Management	95	113	52	43	43
CZM-Political	1	5	3	1	2
Attitudinal Surveys	5	3	8	9	2
Planning Studies	24	41	8	9	3
Sociology	13	19	8	19	3
Community Studies	4	4	0	0	0
Recreation	28	30	34	80	26
Totals	170	215	113	161	79

relating to coastal zone law (Category 15) and management (Category 38). There has, however, been a slight increase in the number of projects and amount of support for projects based in the social science disciplines (Category 20). The increase and susequent decline in the number of projects and dollar support for projects relating to coastal zone law (Category 15) and coastal zone management (Category 38) is in all likelihood a reflection of the general interest in coastal zone problems following passage of the Coastal Zone Management Act in 1972. As the state programs have moved beyond the planning and into the implementation stages, the kinds of social science projects suitable for the early aspects of the program are no longer appropriate.

It is more difficult to interpret the decline in the number of publications shown in Table 4. It may reflect changing criteria for what constitute publications in this field, or simply the cyclical nature of funding in the early years of the program where projects near completion, publications are released, and new efforts started. Assessments about the importance of this downward trend in number of publications must await a credible explanation of why it has occurred.

Table 6 shows the geographical distribution of Sea Grant work in the social sciences by institution. From 1974 to 1978 only three institutions funded a total of more than 20 projects in classifications 20 and 38 combined: the State Univesity of New York system, Oregon State University, and the University of Wisconsin. Next were the University of Washington and the University of California in the 11 - 13 project range, followed by the University of Delaware, Louisiana State University, the University of Michigan, and the University of Southern California with between 6 and 10 projects each. Sixteen other programs, listed in Table 6, funded between one and five projects in these two classifications during this period.

As with other trends, there are some recognizable factors underlying the distribution shown in Table 6. The majority of the social science projects at the University of Wisconsin and in the State University of New York system in the early seventies, for example, concerned environmental and coastal zone planning and assessment. This coincides to some extent with the high funding in classification 38 in the early seventies. The largest, most diversified and constant support for categories 20 and 38 from 1974 to 1978 occurred on the West Coast, at the University of California, Oregon State University, and the University of Washington. Given the size of their programs, this is not altogether surprising.

The picture that emerges, then, is one of uneven emphasis and fluctuating fortunes. Overall, Sea Grant support for marine-related social science research has remained essentially level-funded (when inflation is taken into account) as a modest proportion of the program's

TABLE 6: Number of Projects Funded in Classifications 20 and 38, by Institution, 1974-1978

Number of Projects

1-5	6-10	11-15	20+
Alaska	Delaware	California	New York
Florida	Louisiana State	Washington	Oregon State
Georgia	Michigan		Wisconsin
Guam	Southern California		
Maryland			
MIT			
Maine/New Hampshire			
Miami			
Mississippi/Alabama			
North Carolina			
Rhode Island			
South Carolina			
Texas A&M			
Virginia Polytechnic			
Woods Hole			
New Jersey			

From Office of Sea Grant Computer Listings of Projects by Classification, 1974-1978.

overall support for research. In that respect it simply mirrors the generally level-funded experience of the Sea Grant program. Some areas, economics in particular, has fared quite well, both in terms of magnitude of support and number of projects during the years for which data was available. The sharpest decline came in those projects relating to coastal zone law and management. For example, funding for social science projects in coastal zone mangement (Category 38) has decreased by more than 70 percent, a decline that in all probability reflects research relating to the early planning stages of the Coastal Zone Management Act in 1972. On the other hand, support for general socio-political studies (Category 20), has more than doubled, from $176,373 in 1974 to $393,040 in 1978, even though the number of projects remained about the same. The increased dollar amount is probably a reflection of inflationary pressures and the increased costs of doing field research, particularly in anthropology, sociology and political science. So, despite a substantial increase in dollar support, the actual size of the socio-economic category has not experienced a significant increase. Finally, the data do not suggest any obvious explanation for the apparent decline in the number of publications reflected in Table 4.

The Social Systems of Ocean Science

The implementation of the Sea Grant program required a rich diversity of professional skills and disciplines But for all the breadth of their conceptualization of the issues, the people who developed and have since administered the Sea Grant Program have come almost exclusively from backgrounds in the physical and natural sciences. Despite their success in developing a multidisciplinary research program on a limited funding base, their professional training in the natural and physical sciences has made comprehension of what social scientists do an oft-times perplexing task. The problem is that because of their academic training, career patterns, and professional experience, scientists bring different perspectives and criteria for determining what constitutes legitimate and interesting avenues of investigation. And situations or hypothesis which constitute important and interesting scientific problems to the social scientists do not always appear attractive or pertinent to those from other disciplines. For example, the population dynamics or life history analysis of a highly migratory fish species are considered interesting scientific problems and amenable to scientific analysis by fisheries biologists. On the other hand, the behaviors and 'life history' of the people who make their living in an industry based on fishing for that species have not until recently been considered problems of intrinsic scientific interest, nor regarded as amenable to 'scientific' analysis.

The question of whether social science is really science at all is a more difficult one. A loose working definition of 'science' might be any activity of controlled data collection and comparison with the general

purpose of developing laws or rules concerning the properties of the systems upon which the data is being collected. Under this definition alone, data on social systems--numbers of people, their behaviors, their perceptions or values, and so on--exist just as does data on any other kind of system. The issue is one of potential for analysis. Is it possible to measure social data precisely? Can we truly make controlled comparison, or is the multiplicity and variability of the data too great? Can we develop laws, or even general rules of social behavior and reponse?

The answer to these questions, is of course, 'yes'--but often to a different degree or using different methods from those in the physical or nautral sciences. Given equivalent research time and money, a properly constructed social scientific research program could yield more rigorous, documented information on a population of fisherman than, for example, most biological research programs could yield on the species of fish those fishermen catch. However, it is true that there are many different brands of social science, some of which use methods and techniques very dissimilar to those of the natural and physical sciences, particularly in their use of quantitative analyses. The conclusion which has unfortunately often been drawn from this is not only that social science is primarily qualitiative, but that it cannot be quantitative to any acceptable degree of scientific rigor. This is not true, as the history of research in psychology, social psychology, sociology, mathematical anthropology, and related fields has shown (see Shepard et al., 1972; Stokey and Zechkhauser, 1978; Blalock, 1962).

We do not wish to overemphasize the quantitative aspect of scientific research. Non-quantitative social science, of both objective and subjective nature, also has an important place in our understanding of the oceans and man's use of marine resources. Non-quantitative work in the ethnographic or political sciences, for example, can form the basis for understanding man's place in the maritime ecosystem, or the capacity of political institutions to cope with the conflicts over marine resource use.

The point is that the torpid character of social scientific activity in Sea Grant has not resulted from active resistance to social science on the part of those in positions of authority. Rather, it is the consequence of differences in the way that those individual conceptualize problems, which in turn is based on differences in background and interests which have hindered their ability to assess the quality and place of social science research.

The nature of the review process is a case in point. Sea Grant uses multiple reviews, including one by the institution, another through the Office of Sea Grant, and a third by the site review team. Thus, every proposal is likely to be reviewed at least three times by three different audiences. The crucial problem is, however, that until recently these

reviewers and review teams did not always--and in some cases, rarely or never--include individuals with a background in the social sciences which would enable them to properly review proposals or programs. This situation is changing rapidly, with more complete lists of potential reviewers becoming available to both the institutions and the Office of Sea Grant, and individuals with social scientific background being included on the site review teams.

This new influx of social science participants is improving the review process, but like their counterparts in the marine sciences, they have been confronted with the ambiguous criteria for distinguishing between basic and applied research in the Sea Grant program. For many researchers in the social sciences, as well as in the physical sciences, "applied" research has been the poor cousin to "basic" research. In anthropology in the 1960's for example, the preferred place of employment for new PhD's was in the university in a teaching/research position, and not in a position where they could use their skills in work on applied problem-solving. Just as a problem-solving position was not preferred employment, applied research was not a preferred activity.

This is a problem because Sea Grant has placed a great emphasis on establishing itself as an applied program. This emphasis has created doubts in the minds of social science researchers about their own status in the eyes of their peers and their ability to publish articles based on Sea Grant research in the established professional social science journals. Along with this doubt there has appeared a concern about focusing research activity on so specific a subject population as fisherman, or other users of marine resources. The problem is not unlike those which have appeared before in discussions of whether oceanography or fisheries science were legitimate foci for coherent investigation. Some social scientists are worried that they will beocme typed as "fisherman-studiers", which they are afraid will set them apart from other, more desirable, categories of social scientists such as social psychologist, industrial sociologist, cognitive anthropologist, or even Africanist or Southeast Asianist. These problems are not unique to the social sciences in the Sea Grant context. Writing of the history of the social sciences in the Marine Science Affairs Program (MSA) within the International Decade of Ocean Exploration Program of the National Science Foundation, Robert Freidheim writes:

> In the first two years of the existence of the MSA program, proposals for social science research that could meet MSA's mandated interests were found lacking in quantity and quality. Several reasons were alleged for the disappointing response to a call for proposals. First was the lack of an "identifiable" marine affairs research community. Second was an unwillingness of many social scientists to transcend the usual boundaries of their discipline and apply their skills to ocean problems. However, the third and fourth reasons for disappiontment are probably more telling. The

> guidelines for MSA proposals were restrictive and required skills, methodological sophistication and substantive interests that are rarely found in the right combination in existing social scientists. Linked to this is the lack of a "tradition of study that attempts to link new scientific or technical knowledge to policy implications.
>
> (Friedheim, n.d., pp. 4-5)

As more and more social science research based on maritime subjects is appearing in the literature, this problem is slowly disappearing. In fact, the category of "maritime anthropologist" is coming into increased use (Smith, 1978).

The applied research problem is evident in another way. In the first years of the Sea Grant program, social science researchers, like their colleagues in oceanography, were often told that they were to make their proposals and projects more relevant and more applicable to issues close to the institution through which they were applying for funding. The energy spent in complying with these demands often meant that the social scientific quality, or at least the presentation of the social scientific aspects of the proposal, suffered. As long as the reviewers and approvers were not themselves social scientists, this did not make a tremendous difference. Now that there is a growing complement of social scientific expertise on the reviewer lists, however, this over-emphasis on application in the writing of the proposals is returning to haunt the researchers. They were told for years to make their proposals more applied, and also more readable to a general, non-social science audience. Having learned to do so, they are now faced with reviews from social scientists which criticize the "non-scientific" content of these same proposals.

What is taking place within Sea Grant is essentially a process of mutual acculturation. The traditional Sea Grant structure on the one hand, and the social scientists on the other, are adapting to each other's scientific jargon, research style, proposal-writing format (a seemingly obvious, but often overlooked and substantial problem), and different perceptions of what constitute interesting and competent scientific activity. It is a learning, and by implication, a teaching process. Some of the "units" in this teaching process may seem mundane, for example, learning a new proposal-writing style. When a social scientist is used to writing a 20-page proposal to the National Science Foundation for a $25,000 project, and finds that he or she is effectively limited to a Form 2 and 5-15 pages in a Sea Grant proposal requesting the same amount of support, the consternation associated with changing from thinking in twenty-page-size bits to thinking in five-page-size bits can be considerable. This is more than a matter of conciseness in communication. It involves degrees of prerequisite explanation of the theoretical and methodological orientation and ability of the researcher; the question of what constitutes adequate justification for the selection

of a particular research problem; and different researchers' perceptions of the minimum amount of material and presentation upon which their scientific and applied merit should be judged. These are important issues, and will only be resolved through further interaction and discussion among all of the researchers, administrators, and others involved in the Sea Grant process.[4]

The Current Situation

The clearly acknowledged role of the social sciences during the creation of the Sea Grant program, the staffing of the office with natural and physical scientists, and the subsequent trends in funding and publications have all been important parts of the character of the Sea Grant system. But there is one paramount fact with which those who wish to develop the role of the social sciences in Sea Grant must contend: that is that the program will in all likelihood continue to operate on, at best, a level budget, and possibly - in real dollar terms - a shrinking funding base. The question of allocation of support threatens to become even more acute as the advisory and education parts of the program continue to grow. According to a recent analysis of grants made during fiscal years 1972, 1975, and 1978, the portion of an average grant spent on research has diminished from 66 percent in Fiscal 1972 to 50 percent in fiscal 1978 (Table 7). Certainly the social sciences have a role to play, though largely untapped at this point, in education, and generally speaking, the research program in social sciences must be viable before it can make a strong systematic contribution to those other areas.

To make a compelling claim to these limited resources, however, requires that social scientists demonstrate that they have a contribution to make to the Sea Grant mission. It is not enough to claim that disciplines of all kinds are important to the wise use and development of ocean resources, but the use and the linkages between marine-related social science and marine matters must be demonstrated. There are three basic areas where systematic social science studies can contribute to the nation's goals in marine affairs: (1) sharpened sensitivity to the values at stake in marine issues; (2) more appropriate policies based on improved program planning and use of research findings; and (3) development of individuals with special competence in ocean affairs.

Whenever scientists report new findings they offer the propsect of affecting society. Research on marine problems, government activity and the availability of resources promise to alter the social and economic welfare of mankind. Rewards and advantages are rarely distributed fairly or equitably. At their best, the social sciences can help clarify the values at stake in selecting particular policies and identify the likely winners and losers stemming from particular decisions.

TABLE 7: Fiscal Year Expenditures by Program Area, 1972, 1975, 1978*
(Millions of Dollars)

Program Area	Fiscal Year					
	1972		1975		1978	
	Dollars	% of Total	Dollars	% of Total	Dollars	% of Total
Research	10.3	66	13.3	61	15.3	50
Education and Training	1.9	12	1.3	6	3.9	13
Advisory Services	2.2	13	4.5	21	7.9	26
Program Management	1.4	9	2.5	12	3.7	12

*From Draft Report on the Sea Grant Program, Office of Sea Grant, 1979.

Social science research conducted with appropriate rigor can also contribute to improved marine policy formation. Thoughtful, prudent decisions are likely to be enhanced to the extent that the issues have been thoroughly and systematically analyzed apart from demands for rapid decisions. Careful problem definition, data collection, and rigorous analysis is a far better basis for making policy than reliance on speculation, guesswork, and gut reaction. But to insure the knowledge base for this kind of analysis requires long-term investments in projects whose ultimate contributions are not readily apparent at the time of the project. In addition, it requires top-quality research, typically assessed by peer review, reliability of knowledge generated, and, ultimately, its contribution to clearer understanding of and prudent behavior toward marine policy issues.

Any vitality in the social science program within Sea Grant, however, is dependent not only on the role of advocates and entrepreneurs of the social sciences, but on the interest and activity of the social scientists themselves. Increased numbers of quality proposal submissions create a competitive atmosphere within which the best possible research may be funded (Bernard, 1972). In general, more first rate proposal submissions make it more likely that more social science research will be funded.

Finally, experience in basic and applied research in marine problems is a critical way to encourage development of researchers and public administrators with some conceptual appreciation for the links between the oceans and human affairs. Support for research on marine-related problems is a modest step in the direction of nuturing these skills. Also, studies conducted by more or less disinterested academic researchers tend to be regarded as more objective and less self-serving than, for example, studies conducted within an agency or directly under contract to that agency. Publications from these projects are also the basic ingredient for strengthening classroom education in marine affairs. The availability of first-rate material is critical for insuring the quality of the educational program for new generations of marine affairs specialists.

It is primarily the responsibility of the social science community to demonstrate specifically the ways in which quality marine-related social science research can clarify values, improve public policy toward the oceans, and educate students with competence in ocean affairs. It is the responsibility of the National Sea Grant Program to insure that the marine affairs community develops to a point where it can effectively fulfill its responsibilities. Sea Grant is the only program specifically designated to support marine-related social science. Although the National Science Foundation has supported specific projects, it has no coherent program in the area. The other federal agencies have supported a few isolated projects over the past decade, most of which were tied

directly to their own mission responsibilities, and have demonstrated no inclination to expand the marine dimensions of their research program.

Prospects and Recommendations

These mutual interests and responsibilities have never been clearly articulated in the context of Sea Grant's program of support for social science research. Still, there has been progress in areas we have discussed in this paper. There has been a process of closer understanding and integration of social scientific activity with the broader goals of the Sea Grant program. The inclusion of social scientists on site review teams, the expansion of social science expertise on reviewer lists, and the stress on scientific rigor in social scientific proposals all fall into this category. There are other areas, however, where we feel increased or more closely coordinated activity would benefit both the substantive development of social science research and the attainment of the goals of Sea Grant. These steps are summarized in the following recommendations:

1. Although the social sciences were perceived as integral parts of the program from its very beginnings, there has been no systematic effort to define, plan, and develop the overall strategy and contribution that these disciplines might make to the goals of the Sea Grant program. We recommend that the office of Sea Grant convene a workshop to address the overall place of the social sciences in Sea Grant. Such a session should address questions of areas of research emphasis, relationship to other federally sponsored marine-related social science research, the role of the social sciences in the education and advisory aspects of the program, and administrative concerns (i.e., review process, site visits, seed money for program development).

2. The development of the social sciences in the Sea Grant Program requires the full-time attention of a social scientist with not only a strong background in his chosen discipline, but with awareness of other social sciences, plus research and teaching experience in marine affairs. We recommend that the Office of Sea Grant use the Intergovernmental Personnel Act (IPA) to recruit a full-time social science advisor to the office. Responsibilities of the advisor would include program development liaison with Sea Grant researchers in the colleges and universities and other federal agencies (including other parts of the National Oceanic and Atmospheric Administration) supporting marine affairs research, seeking sources of joint funding, and improving the review and administrative aspects involved in processing proposals for social science research.

3. To further facilitate program development in the marine-related social sciences, we recommend that each Sea Grant College and Institution appoint, on a voluntary basis, a person with social science background from within their own institution to act as a social science coordinator

for their program. These coordinators would work through the Sea Grant Director, and in conjunction with the Social Science Advisor and, if appropriate, IPA in the Office of Sea Grant.

4. A substantial body of literature and understanding about a wide range of marine issues has already been generated, much of this with Sea Grant support. We recommend that specific efforts be made to make the results of social science research available to various users for applied purposes. One approach would be for the Regional Coastal Information Centers, or other appropriate entities, to institute searches of both existing Sea Grant reports and files and current Sea Grant-sponsored activities for existing or on-going materials and activities which could be of interest or use in marine management issues. A wide variety of organizations would find this informatin valuable. These include the National Marine Fisheries Service (development of Fishery Management Plans, environmental impact statements, or fishery development or joint venture programs), the Office of Coastal Zone Management (EIS of state coastal zone management program development), states requiring social scientific work on specific issues (for example, the State of Alaska and their subsistence-related resource management activity, or the States of California and Florida in their Marine Sanctuary activity), or local governments or groups involved in issues or programs which would benefit from the social scientific perspective (i.e., port or harbor authorities or local education functions). Much of this activity should take place in conjunction with the appropriate Sea Grant Advisory Service entities.

5. No area of scientific endeavor can be judged, developed, or used until concrete results and examples of the work it produces are made available to both specialized and general audiences. One means to improve the exchange of useful information resulting from Sea Grant supported social science projects would be to organize symposia which would address a particular topic of current or prospective interest. These would not be planning workshops, but sessions organized around particular disciplines, subject areas, or marine policy issues. They would be based on research conducted primarily by Sea Grant investigations, and be pulled together in a compendium volume which might be promoted for publication through academic presses or trade publishers to reach a broad audience. Appropriate and timely topics for such a trail symposium could be one outcome of the workshop recommended above.

Marine Minerals and Physical Processes

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December 1979

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Introduction

Sea Grant activities embodied in this report amount to $3,482,038 with $1,121,960 in non-federal match. Included are: (1) research projects addressing marine minerals assessment and extraction; (2) projects aimed at data documentation and data aquisition techniques; and (3) research addressing physical oceanographic and geophysical processes as they relate to improved understanding of erosion, circulation, transport, prediction, economic impact, and engineering design of structures in the marine environment. Most legal aspects, political issues, and environmental questions related to pollution are excluded here but covered in other reports that address these subjects directly. Some overlap, however, does occur with these and other report categories, so that any summation of dollar totals cited herein should take this fact into consideration.

Listing Categories

Due to a prolonged temporary assignment with the U.S. Senate Dr. Duane (who has prime responsibility for this subject matter) this year's report is limited to a simple categorized listing of projects. No evaluations, assessments, trends, or recommendations are included.

More than seventy projects are covered in this report. For convenience they are classified in the following subcategories:

I. Minerals (including hydrocarbons) Assessment and Extraction
These deal with potential resource questions of sand, gravel, magnanese modules, phosphorites and hydrocarbons.

II. Oceanographic and Geophysical Data Documentation and Acquisition Techniques. Projects included in this listing focus on the establishment of data banks, glossaries, atlases, and the like, as well as the development of new measurement techniques and methodology for acquiring data.

III. Circulation Modeling. This group includes those pursuits employing modeling techniques to obtain better understanding of such processes as tidal inlet behaviour, fresh/salt water interactions, water level variations, and estuary and harbor circulations.

IV. Wave and Surge Predictions. This set focuses on methods to develop and improve forecasting methods for storm surges, tsunami run-up, gravity waves, and flooding along the shoreline.

V. Coastal Erosion and Sediment Transport Mechanisms. These projects address the physical processes related to sediment erosion, transport, and deposition; factors influencing those processes; long range trends; and the development of ameliorative technology.

VI. Physical Processes Impacts on Engineering Design. This grouping examines wave forces, earthquake loadings, severe storm hazards, ice conditions, and biologically induced deterioration processes as they affect engineering design of marine structures. Also investigated are technology developments for breakwaters, synthetic fabric applications, and artificial reefs.

VII. Dredge Spoil Research. This group could be considered as a subset of VI above. It deals with the technology for treating dredge spoils -- stabilizing and decontaminating them.

Nearshore Sediment Transport Study

Included under category V are projects (totalling approximately $1,000,000) which identify the tasks being pursued under the Nearshore Sediment Transport Study. This is a multiple-year interinstitutional effort being conducted under National Projects funding (matching not required). Its aim is to provide an improved capability for predicting sediment transport as a function of the forcing physical variables. A complex set of well-instrumented field experiments conducted in the surf zone will acquire the necessary data, over a long enough time scale, to develop and test prediction techniques.

SAND AND GRAVEL MINERALS
(INCLUDING HYDROCARBONS ASSESSMENT AND EXTRACTION)

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Offshore Sand and Gravel Resources, Orange County, California	USC	Osborne, R.	$ 15,749	$ 44,982
An Evaluation of Coastal Sand and Gravel Marginal Rock as Construction Materials	Oregon St. U.	Hicks, R.	53,900	5,000
The Impact of Offshore Sand and Gravel Mining on the Availability and Costs of Construction Minerals in the Greater NY Metropolitan Area	SUNY/Cornell	Wallace, W.	23,845	16,922
The Dynamics of Marine Sand Production, Transport and Deposition off St. Croix, USVI - Possibilities for Sand Exploitation and the Environmental Implications of Off-shore Mining	WIL/FDU	Hubbard, D.	62,000	31,602
Hydrometallurgical Separation of Metals from Ferromanganese Nodules	U. of Hawaii	Zeitlin, H.	45,445	20,263

SAND AND GRAVEL MINERALS
(INCLUDING HYDROCARBONS ASSESSMENT AND EXTRACTION)

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Phosphorites Along the Central California Continental Margin	U. of California	Mullins, H.	$ 18,403	$ 34,600
The Economic Potential of the East Coast Continental Margin: Blake Plateau to Georges Bank: Continental Rise off Southern New England	WHOI	Uchupi, E.	20,900	-0-

OCEANOGRAPHIC AND GEOPHYSICAL DATA DOCUMENTATION
AND DATA ACQUISITION TECHNIQUES

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Wave Data Bank for the Texas Coast	Texas A&M	Herbick, J.	$ 20,000	$ 25,500
Program Development	Miss./Ala. SG Consort.	Eleuterius, C.	28,000	-0-
Glossaries of Tidal Inlets in Florida	U. of Florida	Mehta, A.	14,300	7,100
Wave Climate Assessment for Alaskan Coastal Regions	U. of Alaska	Colonnel, J.	31,177	17,400
Ice Motion in the Barrow Area	U. of Alaska	Shapiro, L.	22,182	1,050
A Critical Assessment of the Pressures on New York's Marine Coastal Zone from Physical Alterations	SUNY/Cornell	Schubel, J.	18,604	8,417
Ice Distribution and Sea Surface Temperature in the Bering Sea	U. of Alaska	Wendler, G.	-0-	14,212
Geophysical Assessment of the Hydraulic Connection between Lake Michigan and the Groundwater Acquifers on its Western Boundry	U. of Wisconsin	Anderson, M.	51,918	15,059

OCEANOGRAPHIC AND GEOPHYSICAL DATA DOCUMENTATION
AND DATA ACQUISITION TECHNIQUES

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Development of Instrumentation and Methodology for Measurement of Nearshore Physical Processes	U. of North Carolina	Curtin, T.	$ 24,765	$ 12,534
Geothermal Studies of Passive Continental Margins	WHOI	von Herzen, R.	15,000	4,948
In Situ Evaluation of Geotechnical Properties of Marine Sediment	MIT	Baligh, M.	75,000	60,000
Side-Scan Sonar Mapping and Computer-Aided Interpretation of the Geology of the Santa Barbara Channel	U. of California	Luyendyk, B.	21,521	31,161

CIRCULATION MODELING

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Tidal Inlet Management and Research in the Chesapeake Bay System	VIMS	Bryne, R.	$ 28,700	$ 28,627
Tidal Induced Transport in Salt Marsh Ecosystems	MIT	Hemond, H.	52,300	15,673
Response of Lake Superior Net Basin Supplies and Great Lakes Water Levels to Climate Variations	U. of Wisconsin	Brinkmann, W.	33,796	14,056
Circulation Dynamics of Narragansett Bay	U. of Rhode Island	White, F.	42,776	17,967
Estuarine Assessment: A Look at the Flow Regime in Marine Estuaries	UNH/ME Joint SG Prog.	Pearce, B.	17,036	12,969
Use of Estuarine Hydrodynamic Models to Describe the Distribution Dynamics of Trace Elements in the Sediments of Maine Estuaries	UNH/ME Joint SG Prog.	Hess, C.	38,534	28,197
Problems of Harbor Modeling	USC	Lee, J.	33,162	22,481
Sea Water Intrusion in Offshore Islands	MIT	Wilson, J.	39,800	13,167

WAVE AND SURGE PREDICTIONS

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Preliminary Development of an Operational Lake Erie Storm Surge Flood Forecasting Program	Ohio St. U.	Bedford, K.	$ 26,600	$ 16,300
The Effect of Terrain Roughness on Tsunami Run-up and Inundation	U. of Hawaii	Bretschneider, C.	32,795	15,982
Developments on the Ray Theory for Ocean Waves	U. of Delaware	Lozano, C.	24,378	12,390
Analysis and Prediction of Ocean Surface Gravity Waves on N.C. Coast	U. of North Carolina	Knowles, C.	8,550	2,400
Wave Motion in Harbors and Marinas	U. of Washington	Winter, D.	31,500	17,500
Physical Studies of Pamlico Sound	U. of North Carolina	Weisberg, R.	45,093	17,540

COASTAL EROSION AND SEDIMENT TRANSPORT MECHANISMS

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
* Stabilization of Tidal Inlet Channels for Improved Boat Trafficability by Fluidization of Bottom Sediments	NJ Marine Sci. Consort.	Parks, J.	$ 20,000	$ 10,800
* Sediment Transport and Deposition in Oregon Estuaries	Oregon St. U.	Komar, P.	30,400	12,400
* Sediment Accumulation and the History of Pollutant Accumulation in San Francisco Bay	USC	Hammond, D.	23,793	11,967
* Growth and Impact of the Atchafalaya Delta	La. St. U.	Adams, R.	70,660	13,040
* Dymanic Forces Controlling Sediment Transport and Delta Growth	La. St. U.	Wells, J.	99,196	5,667
* Factors Affecting Stability and Productivity of Louisiana's Coastal Marsh	La. St. U.	Patrick, W.	42,704	8,627
* A Study of the Entrance Problems at Humboldt Bay	U. of California	Isaacs, J.	46,343	20,450

*Part of the National Sediment Transport Study

COASTAL EROSION AND SEDIMENT TRANSPORT MECHANISMS

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
*Source and Fate of Estuarine Sediments - Boston Harbor	WHOI	Milliman, J.	$ 40,000	$ 9,244
*Sedimentation in Duluth-Superior Harbor	U. of Minn.	Johnson, T.	7,314	8,124
*Coastal Current and Sediment Transport on Great Lakes Shoreline	SUNY/Cornell	Liu, P.	26,966	20,478
*Erosion and Deposition Processes and Patterns in the Nearshore Zone of Western Delaware Bay	U. of Delaware	Kraft, J.	37,650	24,855
*Waves and Currents on a Beach in the Presence of a Jetty	Oregon St. U.	Hudspeth, R.	41,900	11,200
*Investigation of Coastal Bluff Retreat for the Trinidad Headland Areas of No. California	U. of California	Carver, G.	24,856	7,020
*Detailed Analysis of Factors Influencing Shoreline Erosion on The Great Lakes	U. of Wisconsin	Edil, T.	16,120	7,346
*The impact of Off-Road Vehicles on Beach, Dune, and Grassland Ecosystems on the Barrier Islands of N. Carolina	U. of North Carolina	Hosier, P.	18,864	9,751

*Part of the National Sediment Transport Study

COASTAL EROSION AND SEDIMENT TRANSPORT MECHANISMS

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
*Beach and Dune Erosion by Storm Tides and Waves	U. of Florida	Chiu, T.	$ 43,800	$ 44,000
*Development and Application of a Method to Simulate Shoreline Response	U. of Delaware	Dean, R.	31,311	17,632
*Movable Bed Roughness in the Coastal Zone a Field Study and Model Design	WHOI	Grant, W.	42,000	17,848
*Sediment Transport in a Tidal Inlet	WHOI	Aubrey, D.	25,000	9,531
*Past and Present Shoreline Trends of the Mid-Atlantic Coast and Wave Advisory Services	VIMS	Goldsmith, V.	30,900	32,591
*Field Measurement of Rip Currents--NSTS	U. of Delaware	Dalrymple, R.	49,997	-0-
*Review Theory of Tracer Dispersion and Advection in Fluids and Evaluate Present Tracer Use in Sediment Transport Studies	MIT	Madsen, O.	30,700	-0-

*Part of the National Sediment Transport Study

COASTAL EROSION AND SEDIMENT TRANSPORT MECHANISMS

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
*Site Selection and Associated Methodology	U. of Delaware	Dean, R.	$ 30,500	$ -0-
*NSTS: Sediment Transport Studies in the Nearshore Environment	U. of California	Inman, D.	265,301	-0-
*Investigation of Sediment Transport in the Nearshore Environment	U. of Washington	Sternberg, R.	110,499	2,501
*Measurement and Characterization of the Net Accumulation of Sediment in a Trap During the First Major Field Experiment, Santa Barbara Harbor, California	U. of Delaware	Dean, R.	135,925	-0-
*Field Measurements of Surf Zone Energetics	U. of California	Guza, R.	244,416	-0-
*Field Investigations of Beach Profile Changes Nearshore Sediment Transport Study	U. of California	Seymour, R.	85,195	-0-
*Field Investigations of Beach Profile Changes NSTS	WHOI	Aubrey, D.	39,300	-0-

*Part of the National Sediment Transport Study

COASTAL EROSION AND SEDIMENT TRANSPORT MECHANISMS

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
*Characterization of Offshore Wave Climite--NSTS	U. of California	Seymour, R.	$ 42,307	$ -0-
*Field Experiment Management--NSTS	U. of California	Seymour, R.	31,486	-0-

*Part of the National Sediment Transport Study

PHYSICAL PROCESSES IMPACTS ON ENGINEERING DESIGN

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
A Slanted Look at Ocean Wave Forces on Pipes	U. of Hawaii	Grace. R.	$ 12,577	$ 2,178
Earthquake Loading on Large Offshore Structures - An Application of Experimental Data to Practical Structure Forms	U. of California	Penzien, J.	17,191	18,591
Method to Predict Foundation Displacement on an Offshore Facility	MIT	Lambe, T.	49,000	60,680
Building Science Technology for Residential and Commercial Structures in Coastal Hazard Zones	U. of North Carolina	Machemebl, J.	10,369	5,597
Ice Engineering for Small Craft Harbors	U. of Wisconsin	Wortley, C.	17,919	7,092
Preventing and Stopping Deterioration of Wood in the Marine Environment	Oregon St. U.	Graham, R.	50,200	14,400

PHYSICAL PROCESSES IMPACTS ON ENGINEERING DESIGN

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Development of Design Criteria for Floating Breakwaters	SUNY/Cornell	Harms, V.	$ 45,586	$ 34,074
Synthetic Fabric Application in Ocean and Coastal Engineering	Oregon St. U.	Vinson, C.	79,000	16,700
Submerged Offshore Artificial Reef Study	Oregon St. U.	Sollitt, C.	27,900	49,900

DREDGE SPOIL RESEARCH

PROJECT	INSTITUTION	P.I.	SEA GRANT	MATCHING
Decontamination of Dredge Spoils by Extraction with Water Under Near Critical Conditions	MIT	Modell, M.	$ 45,000	$ 6,639
Methods for Large Scale Planting on Dredged Materials	Texas A&M	Oppenheimer, C.	20,000	15,049