NSGO-Q-79-003

OFFICE OF SEA GRANT

ANNUAL RETREAT

Volume 2

CIRCULATING COPY
Sea Grant Depository

DECEMBER 5 - 7, 1979

BELMONT CONFERENCE CENTER

ELKRIDGE, MD. 21227

Overview of Marine Economics in the Sea Grant Program, FY 1979

Francis Schuler

Introduction

Sea Grant economists, both in research and advisory services, are studying a wide range of issues in fisheries management and development, aquaculture, marine recreation, coastal zone resources, marine minerals, and marine pollution. From its beginning Sea Grant has recognized and supported social scientists, and amongst them economists, to work with natural scientists in solving problems of how to make efficient use of our coastal and ocean resources. Using their traditional tools of analysis and developing new ones when needed, economists have made modest progress toward an understanding of the part marine resources play in our economic activities of producing, consuming, and exchanging goods; and managing public resources. Through the Sea Grant advisory service and many other outlets, this knowledge of our economic conduct in a complex physical and social marine environment is given a practical value. By having economic information available, businessmen, entrepreneurs, government leaders, and citizens alike are better equipped to make rational judgements about our ocean and coastal resources. This is the motivation for supporting economists in Sea Grant. And while we tend to think of economics in terms of specific problems like those mentioned in the opening sentence, these are all fragments of the same problem--namely, how can we improve our well being through the use of our material resources. In fact, Sea Grant was founded to help turn our attention to the oceans as a prime resource in the struggle to enhance and secure our economic welfare. Economists will continue to have an important role in pursuing this goal of the Sea Grant program.

This report is only a one year snapshot of the long tradition of Sea Grant research and advisory services in economics. In the two sections immediately following, highlights of several projects and a rundown of projects underway in each of the coastal and Great Lakes states is given. Numbers enclosed in parenthesis are identifiers (SID numbers) which can be used to locate a project and obtain additional information about it in Appendix I. A complete listing of all economics projects is provided in the Statistical Report section.

Project Highlights

F. Bell, Florida State University, in a project (4967) sponsored by the Florida Sea Grant Program and the National Marine Fisheries Service, is analyzing the economic benefits and costs of the Fishery Conservation and Management Act of 1976 (FCMA). By separating the analysis into the short run and long run, Bell hopes to provide an economic perspective to the debate over how well the FCMA is working now and can be expected to perform in the future.

Researchers at five universities, led by W. Griffin of Texas A&M University, are completing the development of a budget simulator for use

in analyzing the economics of aquaculture and fishing operations (4648). The budget simulator is similar in concept to that used extensively in agriculture to analyze the financial details of farm operations. The aquaculture and fishing simulator will accommodate many different users, such as the marine advisory agent helping an individual in making decisions about his operation, the economists using it as a data source in research, and the student learning the detailed framework of operating a business venture. This project is aimed at producing the computer programming and documentation necessary to permit a wide use of the budget simulator. It will also be tested initially using several aquaculture species and fishing operations. The aquaculture simulator will focus on shrimp, lobster, oyster, salmon, and prawn culture operations, while the fishing simulator will center on Atlantic and Pacific groundfish, and Gulf shrimp.

The character of international trade in seafoods is changing with the advent of extended fisheries jurisdiction. Economists at Oregon State University are studying the factors affecting seafood demand in various foreign countries in order to estimate future trade patterns for Pacific salmon and groundfish (4685). The research will be cooperative with researchers in the trading countries under study.

Another change resulting from the extension of national fisheries jurisdiction is the formation of joint ventures between American and foreign fishermen. W. Kaczynski of the University of Washington is analyzing the benefits and constraints for domestic and foreign partners seeking access to economically underutilized species of the Northeastern Pacific fisheries (4306). The study will also include an analysis of joint ventures in world fisheries in order to identify the effects of these operations on the coastal state's fishing industry.

The economics of small-scale commercial fishing, characterized by labor intensive and geographically dispersed fleets of small vessels, is not well known. L. J. Smith and S. B. Peterson of Woods Hole Oceanographic Institution are studying the social and economic role of small-scale fisherman in New England (4668). In particular, they are trying to determine what portion of the groundfish is caught by this group, how that fish is marketed compared to the fish caught by larger commercial operations, and whether these individuals have a substantial impact on the market.

Several fishery biologists have stated their concern that there may be a carrying capacity for salmon spawning in California, Oregon, and Washington and that current production may be near the limit. R. B. Rettig, Oregon State University, is looking at the economic implications of salmon management policies affecting the mix of wild salmon stocks, stocks cultured in public hatcheries, and stocks released into the ocean from private aquaculture (4705). The expected expansion of private aquaculture and public hatcheries for salmon, resulting in increased competition for the ocean's carrying capacity, means that managers will be faced with identifying the values of and trade-offs among salmon related activities. This project will bring together the economic information needed to examine this issue.

When an ecosystem has been badly damaged by human activities, can economically feasible rehabilitation efforts be developed? R. Bishop of the University of Wisconsin is seeking an answer to this question by examining the recovery of the Lake Michigan salmonid fishery, which was virtually destroyed in the early 1960's following the invasion of the sea lamprey (4759). By 1970, the fishery was able to support an annual recreational salmon catch nearly as large as that caught by recreationalists on the Pacific coast from California to Alaska. The research will analyze the total benefits and costs of the rehabilitation, evaluate the present level of effort, and in a broader sense examine the economics of enhancing the productivity of severely disrupted ecosystems.

R. S. Johnson and colleagues at Oregon State University are examining how institutional arrangements affect the development of aquaculture (4690). As an example, private salmon ocean ranching in Alaska takes place under a "non-profit" requirement while in Oregon it operates under "for profit" conditions. These different legal structures have stimulated quite dissimilar development with "cooperative" aquaculture firms emerging in Alaska and "corporate" firms in Oregon. Project researchers will gather data on these and other insititional designs, such as government regulations and property rights prevailing in areas where aquaculture is underway. They will analyze how these arrangements affect species selection, the productivity of the operations, the organization of aquaculture firms, and the structure of the industry.

Researchers at Colombia University, led by G. Pontecorvo, in a cooperative effort with the Bureau of Economic Analyses, are studying the feasibility of constructing an ocean sector in the national income accounts (4466). Initially the methodology will be developed and used to prepare estimates for 1972, the year of the most recently available Economic Census. If successful, the project will result in a basic tool for measuring the value to the economy of the United States of the ocean sector as a whole and of its various subsectors.

The mounting scientific evidence on the importance of wetlands in natural systems has led to an increased interest in wetlands protection. In Wisconsin, the major alteration of wetlands occurs as a result of drainage for agricultural operations. Wetland regulation bills have met stiff opposition from agricultural interests, presumably because of the economic potential of continued wetland drainage. A proposed compromise would combine regulations of wetlands use with economic incentives to the owner to keep the wetlands undeveloped. The basic concept is to provide compensation for the economic return that would have resulted from agricultural drainage. R. Barrows, University of Wisconsin, is addressing this issue by analyzing the factors influencing individuals to drain wetlands, and the benefits and costs of using the drained acerage for agriculture (4791).

Two projects jointly sponsored by Sea Grant and NOAA's Marine Minerals Office are studying aspects of deep seabed mining. D. Nyhart, of M.I.T., is continuing the development of a cost model of deep ocean mining which is being used at the Law of the Sea Conference to evaluate negotiating positions on financial arrangements (4156). The research

will be extended to focus on foreign taxation of income from deep ocean mining. The study will be useful in comparing the relative attractiveness of locating mining operations in various countries, and in estimating the relative positions of these countries in future negotiations on tax treatment under a Law of the Sea treaty (5029). J. Flipse, at Texas A&M University, is extending the M.I.T. work in another direction by including the primary and secondary costs associated with possible environmental regulations. This will allow an analysis of the effects of these regulations on the financial performance of mining firms (4171).

Control of discharges to several rivers in Wisconsin poses a difficult regulatory problem because some industries and municipalities need to increase pollution abatement beyond "best practicable technology" in order to meet water quality standards. M. David, an economist, and E. Jones, an engineer, from the University of Wisconsin are looking at alternative ways of achieving these water quality standards (4790). Specifically, they are investigating the feasibility of implementing a system of transferable discharge permits. Their research suggests that abatement can be achieved at least cost if the additional abatement is undertaken by the most economically efficient treatment plants. This project combines a physical model of discharge patterns and water quality with an economic model of the expected market for discharge rights. The results will provide information about the water quality profile, the total cost of abatement, and the distribution of those costs among dischargers and the general public.

D. Bromley, University of Wisconsin, is studying the effect nonpoint source pollution has on water quality in Green Bay (4772). Agriculture, forestry, urban development, and highway construction are largely responsible for the deposit of nutrient-rich sediments carried by surface water runoff. Bromley's research will analyze the implications that current land use practices have for the receiving waterways in the Green Bay area and evaluate the economics of alternative policies for reducing sediment/nutrient loads.

Almost 12 million gallons of oil were accidentally spilled by vessels on United States waters in 1977. J. Nyhart and colleagues at M.I.T. are studying the cost to society of oil spills of small to moderate size (4536). The evaluation will include a look at the technical capabilities and costs of presently used and alternative clean-up systems. Estimates of the benefits of this technology, measured by damage averted, will be made. A survey will also be done of costs associated with options for reducing the risks of oil spills occurring.

Projects by State

The Sea Grant Program is characterized by its commitment to work on local needs. The following list is a summation of economics research in the different coastal and Great Lakes states.

Alabama - The impact of the coastal zone on the state economy (4234).

Alaska - The use of underutilized fish in international trade (5001). Forecasting fish prices (5002).

California	- Analysis of the abalone fishery (4902). - Fishery and aquaculture development (4896). - Port authorities response to economic/environmental conflicts (4941).
Delaware	- Analysis of multi-purpose fishing fleets in multi-stock fisheries (4827).
Florida	- Commercial fishing and seafood marketing (4446). - Apalachicola Bay coastal economy (4445).
Georgia	- Fishing vessel investment and risk (4844).
Hawaii	- Fisheries development for the Northwestern Islands (4593).
Louisiana	- Seafood production/shrimp (4865).
Maryland	- Chesapeake Bay sport and commercial striped bass fisheries (4378).
Massachusetts	- New England small-scale commercial fisheries (4668). - Oil spill clean-up and liability (4536).
Michigan	- Fishery economics and marketing (4572). - Great Lakes recreational boating (4560).
Mississippi	- Assessment of an oyster depuration facility (4238). - Linkages between the economy and the coastal zone (4235).
New York	- Multiple species input-output model (4276). - Finfish and shellfish market structure (4257). - Industry impact from a shellfish depuration facility (4256). - Great Lakes tourism development (4263). - Small boat marina development in New York City (4262). - Offshore sand and gravel mining impact on costs of construction aggregate in metropolitan New York (4255). - Development of the port of Buffalo (4273).
Oregon	- Pacific Hake fishery (4707) - International marketing of Pacific Coast seafoods (4685). - Interrelationships between wild and hatchery salmon (4705). - The effects of institutional arrangements on aquaculture development (4690).
Rhode Island	- Capacity in the New England fishery (4625). - Marine recreational fishing in Rhode Island (4643). - Analysis of the propulsion nozzle (4646). - Salmonid aquaculture for New England (4627).
South Carolina	- Pond culture of prawns (4951).

Texas	- Characteristics of Texas Gulf Coast fishermen (4739). - Production and marketing in the commercial fish industry (4737). - Shrimp mariculture (4733).
Washington	- Joint venture operations in Northeastern Pacific fisheries (4306). - Economics of marine recreation (4307).
Wisconsin	- Rehabilitating the Lake Michigan fishery (4759). - Lake Michigan recreational and commercial fishing (4756). - Economic incentives and barriers to coastal wetlands protection (4791). - Non-point source pollution in Green Bay (4772). - Transferable pollution discharge permits (4790).

Recommendations

- We should continue to encourage SG Directors to seek out quality economists and other social scientists to work on important social and economic issues, preferably as part of a programmatic team.

- SG spends many resources in support of the Fisheries Conservation and Management Act (FCMA). This effort has been appropriate as the FCMA got off the ground, but we need to ensure that it does not become a pat justification for undertaking work in this area. The point is that universities are in a unique position to maintain distance from the regulatory process per se. Our concern should be less with expanding the supply of regulations and more with the evaluation of the regulatory system itself. We have a unique opportunity in SG to examine alternative mechanisms and institutional designs, to speculate on the use of economic incentives, and to view the cumulative impact of rules. In short, we should be looking more toward the future and asking what fisheries management should be, and not be merely a job shop concerned with implementing what we have. To do this does not mean we should lapse back to viewing the regulatory process solely in terms of economic behavior. Here, economics, law, and politics are inseparable.

- We should give support to the entry of economists into new areas of inquiry. NOAA's current initiatives in fisheries development, minerals, pollution, and climate provide an indication of ripe areas for SG economists. Issues related to small ports and harbors, marine and estuarine sanctuaries, and ocean energy could be added to the list.

Statistical Report on Marine Economics in the Sea Grant Program, FY 1979

Summary

In FY 1979, the Sea Grant Program supported 55 projects in marine economics. A total of $1.67 million was awarded by Sea Grant ($235K of which came from other agencies) for these projects, while Sea Grant institutions provided $845 thousand in matching funds. This represents about four percent of Sea Grant's total awards in FY 1979 and eight percent of the amount awarded for research projects.

Twenty institutions, or about 75 percent of those receiving Sea Grant support, have a marine economics component in their program. Table I presents a breakout of funding by institution.

By far, the single largest subject area Sea Grant economists are addressing relates to issues in fisheries management and development. Add to this aquaculture, and fully 65 percent of the marine economics effort in Sea Grant is seen in support of fish resources. Table 2 gives a full breakdown by subject area.

The above indicates Sea Grant support of marine economics research (53 projects) and education (2 projects). It does not include the work of economists who are part of the Marine Advisory Service. There is no direct way to guage the amount of resources committed to extension economics work, but it is quite significant with at least 15 programs using economists in an advisory capacity.

A detailed listing of individual projects in each subject area is given in Appendix I. Some of the larger projects were cross listed in more than one subject area where appropriate. Also included in Appendix I is a listing, by subject area, of related Sea Grant projects which might be of interest to economists.

Additional information on any of these projects can be obtained from the Sea Grant Director at the investigator's institution. A listing of addresses by institution is contained in Appendix II. The Program Director for Economics in the National Sea Grant Office is also available to assist in obtaining further information.

Table 1

MARINE ECONOMICS PROJECTS
BY INSTITUTION, FY 1979

INSTITUTION	No. of Projects	Sea Grant (Thou $)	Match (Thou $)
University of Alaska	2	32.2	41.5
University of California	2	67.7	25.1
University of Southern California	1	19.9	16.2
University of Delaware	1	71.0	24.4
State University System of Florida	3	70.1	61.9
University of Georgia	1	16.2	10.3
University of Hawaii	1	18.2	21.8
Louisiana State University	1	18.1	10.2
University of Maryland	1	21.2	29.0
Massachusetts Institute of Technology	3	145.0	40.0
Woods Hole Oceanographic Institution	1	20.0	20.3
University of Michigan	2	34.0	21.4
Mississippi-Alabama SG Consortium	3	58.8	29.4
State University of New York/Cornell	9	245.5	95.9
Oregon State University	4	242.9	92.4
University of Rhode Island	6	171.5	118.1
South Carolina SG Consortium	1	6.8	2.5
Texas A&M University	5	281.5	136.4
University of Washington	3	42.4	12.4
University of Wisconsin	5	87.7	36.2
TOTAL	55	1,670.6	845.3

Table 2

MARINE ECONOMICS PROJECTS
BY SUBJECT AREA, FY 1979

SUBJECT AREA	No. of Projects	Sea Grant (Thou $)	Match (Thou $)
Fisheries Management and Development	28	970.5	501.9
Aquaculture	6	309.3	141.3
Marine Recreation	3	101.4	70.3
Coastal Zone Resources	4	161.7	31.2
Marine Minerals and Energy	4	148.8	16.9
Marine Transportation	2	44.1	29.2
Marine Pollution	3	83.3	59.0
Marine Economics Education	2	52.3	82.8

APPENDIX I

MARINE ECONOMICS: PROJECT LISTINGS BY SUBJECT AREA

A. Fisheries Management and Development

B. Aquaculture

C. Marine Recreation

D. Coastal Zone Resources

E. Marine Minerals and Energy

F. Marine Transportation

G. Marine Pollution

H. Marine Economics Education

I. Related Projects

Project Identifier and Page Number

SID #	Page	SID #	Page	SID #	Page
4156	E-1	4470	I-4	4759	A-6
4171	E-1	4536	G-1	4772	G-1
4176	C-1	4560	C-1	4786	I-7
4202	I-4	4569	I-1	4790	G-1
4203	I-2	4572	A-3	4791	D-2
4216	I-2	4579	I-6	4811	I-3
4234	D-1	4580	I-6	4827	A-1
4235	D-1	4593	A-2	4841	I-5
4238	A-3	4621	H-1	4843	I-5
4255	E-1	4625	A-5	4844	A-2
4256	A-4	4627	B-1	4845	I-1
4257	A-3	4643	C-1	4865	A-2
4258	D-1	4646	A-5	4866	I-1
4260	I-2	4648	A-5	4884	I-1
4262	C-1	4660	I-7	4896	A-1
4263	C-1	4668	A-3	4902	A-1
4264	I-2	4669	I-6	4909	I-5
4273	F-1	4670	I-8	4920	I-7
4276	A-4	4672	I-6	4941	F-1
4306	A-6	4684	I-8	4947	I-7
4307	C-2	4685	A-4	4951	B-1
4309	I-3	4687	I-3	4967	A-2
4317	I-8	4690	B-1	4982	I-4
4321	I-3	4705	A-4	5001	A-1
4326	H-1	4707	A-4	5002	A-1
4378	A-3	4733	B-2	5029	E-1
4379	I-5	4737	A-5	5032	I-8
4445	D-1	4738	I-4		
4446	A-2	4739	A-5		
4466	D-1	4756	A-6		

SEA GRANT PROJECTS IN ECONOMICS: FISHERIES MANAGEMENT AND DEVELOPMENT

TITLE: FORECASTING EX-VESSEL AND WHOLESALE PRICES FOR SELECTED ALASKAN FISHERIES USING LINEAR TIME SERIES MODEL
INVESTIGATOR(S): A. GORHAM
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF ALASKA
FISCAL YEAR: 1979 PROJECT NUMBER: R/14-05
SEA GRANT FUNDS: $1,300 MATCHING FUNDS: $35,767
SID NUMBER: 5002

TITLE: ALASKA UNDERUTILIZED SPECIES - WORLD USE INTERNADIONAL TRADE AND PROCESSING TECHNIQUES
INVESTIGATOR(S): A.H. GORHAM
SG CLASSIFICATION 6: COMMERCIAL FISHERIES--BIOLOGY
INSTITUTION: UNIVERSITY OF ALASKA
FISCAL YEAR: 1979 PROJECT NUMBER: R/14-06
SEA GRANT FUNDS: $30,886 MATCHING FUNDS: $5,697
SID NUMBER: 5001

TITLE: AN ECONOMIC ANALYSIS OF THE CALIFORNIA ABALONE FISHERY AND THE EXPERIMENTAL ENHANCEMENT PROGRAM
INVESTIGATOR(S): R.T. DEACON
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-53
SEA GRANT FUNDS: $4,420 MATCHING FUNDS: $8,307
SID NUMBER: 4902

TITLE: ECONOMICS OF FISHERIES AND AQUACULTURE DEVELOPMENT
INVESTIGATOR(S): W. JOHNSTON/C. HAND
SG CLASSIFICATION 6: COMMERCIAL FISHERIES--BIOLOGY
INSTITUTION: UNIVERSITY OF CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-52
SEA GRANT FUNDS: $63,269 MATCHING FUNDS: $16,806
SID NUMBER: 4896

TITLE: SIMULATION OF UNIFIED AND MULTI-PURPOSE FLEETS IN MULTI-STOCK FISHERIES
INVESTIGATOR(S): L. ANDERSON
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF DELAWARE
FISCAL YEAR: 1979 PROJECT NUMBER: R/E-3
SEA GRANT FUNDS: $70,981 MATCHING FUNDS: $24,376
SID NUMBER: 4827

SEA GRANT PROJECTS IN ECONOMICS: FISHERIES MANAGEMENT AND DEVELOPMENT

TITLE: ECONOMIC ANALYSIS OF COMMERCIAL FISHING & SEAFOOD MARKETING
INVESTIGATOR(S): FRED PROCHASKA
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA
FISCAL YEAR: 1979 PROJECT NUMBER: R/FR-4
SEA GRANT FUNDS: $46,500 MATCHING FUNDS: $57,700
SID NUMBER: 4446

TITLE: ECONOMIC BENEFITS AND COSTS OF THE FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976
INVESTIGATOR(S): FREDERICK W. BELL
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA
FISCAL YEAR: 1979 PROJECT NUMBER: R/FR-14
SEA GRANT FUNDS: $12,500 MATCHING FUNDS:
SID NUMBER: 4967

TITLE: RISK ANALYSIS OF THE FISHING VESSEL AS AN INVESTMENT
INVESTIGATOR(S): FRED LYDA
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF GEORGIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/ME-4
SEA GRANT FUNDS: $16,200 MATCHING FUNDS: $10,300
SID NUMBER: 4844

TITLE: ECONOMICS OF FISHERIES DEVELOPMENT FOR THE HAWAIIAN ARCHIPELAGO
INVESTIGATOR(S): JACK R. DAVIDSON/SALVATORE COMITINI
SG CLASSIFICATION 6: COMMERCIAL FISHERIES--BIOLOGY
INSTITUTION: UNIVERSITY OF HAWAII
FISCAL YEAR: 1979 PROJECT NUMBER: NI/R-10
SEA GRANT FUNDS: $18,209 MATCHING FUNDS: $21,801
SID NUMBER: 4593

TITLE: ECONOMIC ANALYSES OF SEAFOOD PRODUCTION IN LOUISIANA FOR USE IN FIRM AND PUBLIC RESOURCE MANAGEMENT
INVESTIGATOR(S): KENNETH J. ROBERTS
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: LOUISIANA STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/RRE-2
SEA GRANT FUNDS: $18,076 MATCHING FUNDS: $10,179
SID NUMBER: 4865

SEA GRANT PROJECTS IN ECONOMICS: FISHERIES MANAGEMENT AND DEVELOPMENT

TITLE: AN ECONOMIC EVALUATION OF THE CHESAPEAKE BAY SPORT AND COMMERCIAL STRIPED BASS FISHERIES
INVESTIGATOR(S): V.J. NORTON/I.E. STRAND
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF MARYLAND
FISCAL YEAR: 1979 PROJECT NUMBER: S/L-6
SEA GRANT FUNDS: $21,200 MATCHING FUNDS: $29,000
SID NUMBER: 4378

TITLE: SMALL-SCALE COMMERCIAL FISHERIES IN NEW ENGLAND
INVESTIGATOR(S): LEAH J. SMITH/SUSAN B. PETERSON
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION
FISCAL YEAR: 1979 PROJECT NUMBER: R/S-3
SEA GRANT FUNDS: $20,000 MATCHING FUNDS: $20,255
SID NUMBER: 4668

TITLE: FISHERY ECONOMICS AND MARKETING
INVESTIGATOR(S): D.R. TALHELM
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF MICHIGAN
FISCAL YEAR: 1979 PROJECT NUMBER: R/ME-1
SEA GRANT FUNDS: $34,000 MATCHING FUNDS:
SID NUMBER: 4572

TITLE: OYSTER DEPURATION FACILITY: ECONOMIC ASSESSMENTS
INVESTIGATOR(S): D. WILLIAMS
SG CLASSIFICATION 30: COMMERCIAL FISHERIES--TECHNOLOGY
INSTITUTION: MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM
FISCAL YEAR: 1979 PROJECT NUMBER: R/SP-2
SEA GRANT FUNDS: $12,159 MATCHING FUNDS: $6,080
SID NUMBER: 4238

TITLE: STRUCTURE OF THE MARKET FOR FINFISH AND SHELLFISH IN NEW YORK STATE, AND MARKET POTENTIAL FOR NEW PROCESSED FINFISH AND SHELLFISH
INVESTIGATOR(S): DANA C. GOODRICH
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/T-11
SEA GRANT FUNDS: $32,717 MATCHING FUNDS: $19,218
SID NUMBER: 4257

SEA GRANT PROJECTS IN ECONOMICS: FISHERIES MANAGEMENT AND DEVELOPMENT

TITLE: A MULTIPLE SPECIES FISHERY MODEL: AN OUTPUT-INPUT APPROACH (PILOT STUDY)
INVESTIGATOR(S): F.C. HOPPENSTEADT
SG CLASSIFICATION 47: ENVIRONMENTAL MODELS--BIOLOGICAL
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-11
SEA GRANT FUNDS: $28,436 MATCHING FUNDS: $24,585
SID NUMBER: 4276

TITLE: THE SOCIOECONOMIC IMPACT OF DEPURATION ON THE GREAT SOUTH BAY WATERMEN
INVESTIGATOR(S): J.H. GOODMAN
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-9
SEA GRANT FUNDS: $6,867 MATCHING FUNDS: $6,491
SID NUMBER: 4256

TITLE: SYSTEM DYNAMIC MODEL OF THE FISHERY FOR PACIFIC HAKE
INVESTIGATOR(S): D.R. BERNARD/J.M. STANDER
SG CLASSIFICATION 47: ENVIRONMENTAL MODELS--BIOLOGICAL
INSTITUTION: OREGON STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/OPF-10
SEA GRANT FUNDS: $94,000 MATCHING FUNDS:
SID NUMBER: 4707

TITLE: ECONOMIC ANALYSIS OF THE INTERRELATIONSHIPS BETWEEN WILD AND HATCHERY SALMON
INVESTIGATOR(S): R.B. RETTIG
SG CLASSIFICATION 38: COASTAL ZONE MANAGEMENT--SOCIAL SCIENCES
INSTITUTION: OREGON STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/PPA-12
SEA GRANT FUNDS: $29,800 MATCHING FUNDS: $38,000
SID NUMBER: 4705

TITLE: ECONOMIC IMPLICATIONS OF THE INTERNATIONAL MARKETING OF PACIFIC COAST SEAFOODS
INVESTIGATOR(S): R.S. JOHNSTON
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: OREGON STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/PD-34
SEA GRANT FUNDS: $56,000 MATCHING FUNDS: $18,900
SID NUMBER: 4685

SEA GRANT PROJECTS IN ECONOMICS: FISHERIES MANAGEMENT AND DEVELOPMENT

TITLE: AN ECONOMIC ANALYSIS OF PROPULSION NOZZLE EXPERIMENT
INVESTIGATOR(S): ANDREAS HOLMSEN
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF RHODE ISLAND
FISCAL YEAR: 1979 PROJECT NUMBER: M/PD-1.1
SEA GRANT FUNDS: $5,937 MATCHING FUNDS:
SID NUMBER: 4646

TITLE: ANALYSIS OF CHANGES IN CAPACITY IN NEW ENGLAND FISHERIES
INVESTIGATOR(S): N.E. BOCKSTAEL/K.E. MCCONNELL
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF RHODE ISLAND
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-26
SEA GRANT FUNDS: $34,910 MATCHING FUNDS: $6,111
SID NUMBER: 4625

TITLE: SOCIAL AND ECONOMIC CHARACTERISTICS OF TEXAS GULF COAST FISHERRMEN
INVESTIGATOR(S): MERVIN J. YETLEY
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: TEXAS A&M UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-12
SEA GRANT FUNDS: $35,000 MATCHING FUNDS: $18,205
SID NUMBER: 4739

TITLE: DEVELOPMENT OF A GENERAL BUDGET SIMULATOR FOR AQUACULTURE SYSTEMS AND FISHING VESSELS
INVESTIGATOR(S): WADE L. GRIFFIN
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: TEXAS A&M UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER:
SEA GRANT FUNDS: $137,500 MATCHING FUNDS: $70,591
SID NUMBER: 4648

TITLE: ECONOMICS OF PRODUCTION AND MARKETING IN THE COMMERCIAL FISH INDUSTRY
INVESTIGATOR(S): WADE L. GRIFFIN
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: TEXAS A&M UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-3
SEA GRANT FUNDS: $80,000 MATCHING FUNDS: $40,000
SID NUMBER: 4737

A-6

SEA GRANT PROJECTS IN ECONOMICS: FISHERIES MANAGEMENT AND DEVELOPMENT

TITLE: ECONOMIC IMPACT OF JOINT VENTURE OPERATIONS ON THE U.S. NORTHEASTERN PACIFIC FISHERIES
INVESTIGATOR(S): WLODZMIERZ KACZYNSKI
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979
SEA GRANT FUNDS: $17,500
SID NUMBER: 4306
PROJECT NUMBER: R/MS-6
MATCHING FUNDS:

TITLE: RECREATIONAL AND COMMERCIAL FISHING IN WISCONSINS LAKE MICHIGAN WATERS
INVESTIGATOR(S): RICHARD BISHOP
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF WISCONSIN
FISCAL YEAR: 1979
SEA GRANT FUNDS: $17,671
SID NUMBER: 4756
PROJECT NUMBER: R/LR-11
MATCHING FUNDS: $5,674

TITLE: ECONOMICS OF REHABILITATING THE LAKE MICHIGAN FISHERY: A CASE STUDY
INVESTIGATOR(S): RICHARD BISHOP
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF WISCONSIN
FISCAL YEAR: 1979
SEA GRANT FUNDS: $24,424
SID NUMBER: 4759
PROJECT NUMBER: R/LR-16
MATCHING FUNDS: $7,903

SEA GRANT PROJECTS IN ECONOMICS: AQUACULTURE

TITLE: ECONOMICS OF FISHERIES AND AQUACULTURE DEVELOPMENT
INVESTIGATOR(S): W. JOHNSTON/C. HAND
SG CLASSIFICATION 6: COMMERCIAL FISHERIES--BIOLOGY
INSTITUTION: UNIVERSITY OF CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-52
SEA GRANT FUNDS: $63,269 MATCHING FUNDS: $16,806
SID NUMBER: 4896

TITLE: RELATIONSHIPS BETWEEN INSTITUTIONAL ARRANGEMENTS AND AQUACULTURAL DEVELOPMENTS
INVESTIGATOR(S): R.S. JOHNSTON
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: OREGON STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/AQ-36
SEA GRANT FUNDS: $63,100 MATCHING FUNDS: $35,500
SID NUMBER: 4690

TITLE: SALMONID AQUACULTURE IN NEW ENGLAND: AN ECONOMIC ANALYSIS
INVESTIGATOR(S): J.M. GATES
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF RHODE ISLAND
FISCAL YEAR: 1979 PROJECT NUMBER: R/A-13
SEA GRANT FUNDS: $34,591 MATCHING FUNDS: $8,337
SID NUMBER: 4627

TITLE: ECONOMICS OF POND CULTURE OF PRAWNS IN SOUTH CAROLINA
INVESTIGATOR(S): LARRY L. BAUER
SG CLASSIFICATION 1: AQUACULTURE--CRUSTACEANS
INSTITUTION: SOUTH CAROLINA SEA GRANT CONSORTIUM
FISCAL YEAR: 1979 PROJECT NUMBER: R/A-1
SEA GRANT FUNDS: $6,800 MATCHING FUNDS: $2,500
SID NUMBER: 4951

TITLE: DEVELOPMENT OF A GENERAL BUDGET SIMULATOR FOR AQUACULTURE SYSTEMS AND FISHING VESSELS
INVESTIGATOR(S): WADE L. GRIFFIN
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: TEXAS A&M UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER:
SEA GRANT FUNDS: $137,500 MATCHING FUNDS: $70,591
SID NUMBER: 4648

SEA GRANT PROJECTS IN ECONOMICS: AQUACULTURE

TITLE: SHRIMP MARICULTURE DATA DOCUMENTATION AND ECONOMICS
INVESTIGATOR(S): WADE L. GRIFFIN
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: TEXAS A&M UNIVERSITY
FISCAL YEAR: 1979
SEA GRANT FUNDS: $4,000
PROJECT NUMBER: R/M-13
MATCHING FUNDS: $7,600
SID NUMBER: 4733

SEA GRANT PROJECTS IN ECONOMICS: MARINE RECREATION

TITLE: MICHIGAN GREAT LAKES RECREATIONAL BOATING-DEMAND, SUPPLY, MARKETING, ECONOMIC IMPACT
INVESTIGATOR(S): D.J. STYNES
SG CLASSIFICATION 19: RECREATION--OTHER
INSTITUTION: UNIVERSITY OF MICHIGAN
FISCAL YEAR: 1979 PROJECT NUMBER: R/R-2
SEA GRANT FUNDS: MATCHING FUNDS: $21,395
SID NUMBER: 4560

TITLE: THE POTENTIAL FOR SMALL-BOAT MARINA DEVELOPMENT IN NEW YORK CITY
INVESTIGATOR(S): C.A. HEATWOLE
SG CLASSIFICATION 19: RECREATION--OTHER
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/P-24
SEA GRANT FUNDS: $23,540 MATCHING FUNDS: $15,371
SID NUMBER: 4262

TITLE: TOURISM DEVELOPMENT STUDIES ON THE GREAT LAKES
INVESTIGATOR(S): T.L. BROWN
SG CLASSIFICATION 19: RECREATION--OTHER
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/R-12
SEA GRANT FUNDS: $9,216 MATCHING FUNDS: $277
SID NUMBER: 4263

TITLE: A STUDY OF MARINE RECREATIONAL FISHING IN RHODE ISLAND-REQUEST FOR AUGMENTATION OF SUPPORT
INVESTIGATOR(S): K.E. MCCONNELL
SG CLASSIFICATION 18: RECREATION--SPORTS FISHERIES
INSTITUTION: UNIVERSITY OF RHODE ISLAND
FISCAL YEAR: 1979 PROJECT NUMBER: R/MR-3
SEA GRANT FUNDS: $28,900 MATCHING FUNDS:
SID NUMBER: 4176

TITLE: A STUDY OF MARINE RECREATIONAL FISHING IN RHODE ISLAND
INVESTIGATOR(S): KENNETH MCCONNELL
SG CLASSIFICATION 18: RECREATION--SPORTS FISHERIES
INSTITUTION: UNIVERSITY OF RHODE ISLAND
FISCAL YEAR: 1979 PROJECT NUMBER: R/MR-3
SEA GRANT FUNDS: $31,750 MATCHING FUNDS: $29,958
SID NUMBER: 4643

SEA GRANT PROJECTS IN ECONOMICS: MARINE RECREATION

TITLE: ECONOMICS OF MARINE RECREATION
INVESTIGATOR(S): ROBERT L. STOKES
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979 PROJECT NUMBER: R/CZ-8
SEA GRANT FUNDS: $8,000 MATCHING FUNDS: $3,300
SID NUMBER: 4307

SEA GRANT PROJECTS IN ECONOMICS: COASTAL ZONE RESOURCES

TITLE: STRUCTURAL ANALYSIS OF THE APALACHICOLA BAY COASTAL AREA ECONOMY
INVESTIGATOR(S): DAVID MULKEY
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY SYSTEM OF FLORIDA
FISCAL YEAR: 1979 PROJECT NUMBER: R/CP-5
SEA GRANT FUNDS: $11,100 MATCHING FUNDS: $4,200
SID NUMBER: 4445

TITLE: LINKAGES BETWEEN THE ECONOMY AND THE ENVIRONMENT OF THE COASTAL ZONE OF MISSISSIPPI
INVESTIGATOR(S): E. NISSAN
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM
FISCAL YEAR: 1979 PROJECT NUMBER: R/CP-2
SEA GRANT FUNDS: $23,950 MATCHING FUNDS: $11,975
SID NUMBER: 4235

TITLE: THE STATUS AND RELATION OF THE COSTAL ZONE TO ALABAMA ECONOMY
INVESTIGATOR(S): W. HARDY
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM
FISCAL YEAR: 1979 PROJECT NUMBER: R/CP-3
SEA GRANT FUNDS: $22,653 MATCHING FUNDS: $11,327
SID NUMBER: 4234

TITLE: MANAGEMENT ECONOMICS OF NEW YORK MARINE INDUSTRIES
INVESTIGATOR(S): CORNELL
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-8
SEA GRANT FUNDS: $20,000 MATCHING FUNDS:
SID NUMBER: 4258

TITLE: THE AGGREGATE INCOME AND PRODUCT OF THE OCEANS,PHASE II
INVESTIGATOR(S): G. PONTECORVO
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: N/P-1
SEA GRANT FUNDS: $76,700 MATCHING FUNDS:
SID NUMBER: 4466

SEA GRANT PROJECTS IN ECONOMICS: COASTAL ZONE RESOURCES

TITLE: ECONOMIC INCENTIVES AND BARRIERS TO COASTAL WETLANDS PROTECTION
INVESTIGATOR(S): RICHARD BARROWS
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: UNIVERSITY OF WISCONSIN
FISCAL YEAR: 1979 PROJECT NUMBER: R/PS-29
SEA GRANT FUNDS: $7,265 MATCHING FUNDS: $3,683
SID NUMBER: 4791

SEA GRANT PROJECTS IN ECONOMICS: MARINE MINERALS AND ENERGY

TITLE: STUDY OF A COST MODEL OF DEEP SEABED MINING (SUPPLEMENT)
INVESTIGATOR(S): J.D. NyHART
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY
FISCAL YEAR: 1979 PROJECT NUMBER: R/MO-2
SEA GRANT FUNDS: $80,000 MATCHING FUNDS:
SID NUMBER: 4156

TITLE: STUDY OF A COST MODEL OF DEEP SEABED MINING-FOREIGN NATION TAX ASPECTS OF DEEP OCEAN MINING
INVESTIGATOR(S): J.D. NyHART/DANIEL M. HOLLAND
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY
FISCAL YEAR: 1979 PROJECT NUMBER: R/MO-2
SEA GRANT FUNDS: $20,000 MATCHING FUNDS:
SID NUMBER: 5029

TITLE: THE IMPACT OF OFFSHORE SAND AND GRAVEL MINING ON THE AVAILABILITY AND COSTS OF CONSTRUCTION MINERALS IN THE GREATER N.Y. METROPOLITAN AREA
INVESTIGATOR(S): WILLIAM A. WALLACE
SG CLASSIFICATION 14: MARINE ECONOMICS
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/S-9
SEA GRANT FUNDS: $23,845 MATCHING FUNDS: $16,922
SID NUMBER: 4255

TITLE: THE COST OF DEEP OCEAN MINING ENVIRONMENTAL REGULATION
INVESTIGATOR(S): JOHN E. FLIPSE
SG CLASSIFICATION 28: OCEAN ENGINEERING--OTHER
INSTITUTION: TEXAS A&M UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/COE-3
SEA GRANT FUNDS: $25,000 MATCHING FUNDS:
SID NUMBER: 4171

SEA GRANT PROJECTS IN ECONOMICS: MARINE TRANSPORTATION

TITLE: PORT AUTHORITY AS PUBLIC ENTERPRISE: ORGANIZATIONAL ADJUSTMENT TO CONFLICTING DEMANDS FOR ECONOMIC VERSUS ENVIRONMENTAL QUALITY GOALS
INVESTIGATOR(S): HERMAN L. BOSCHKEN/LOUIS F. WESCHLER
SG CLASSIFICATION 36: PORTS, HARBORS AND OFFSHORE TERMINALS
INSTITUTION: UNIVERSITY OF SOUTHERN CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/CM-12
SEA GRANT FUNDS: $19,886 MATCHING FUNDS: $16,154
SID NUMBER: 4941

TITLE: STRATEGIES TO MAXIMIZE BENEFITS TO DEVELOPMENT AT PORT OF BUFFALO
INVESTIGATOR(S): R.E. PAASWELL
SG CLASSIFICATION 39: COASTAL ZONE MANAGEMENT--NATURAL SCIENCES AND ENGINEERING
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/P-23
SEA GRANT FUNDS: $24,218 MATCHING FUNDS: $13,009
SID NUMBER: 4273

SEA GRANT PROJECTS IN ECONOMICS: MARINE POLLUTION

TITLE: OIL SPILL CLEAN-UP AND LIABILITY MODELS
INVESTIGATOR(S): J.D.NYHART/HARILAOS N. PSARAFTIS
SG CLASSIFICATION 41: POLLUTION--OIL SPILLS
INSTITUTION: MASSACHUSETTTS INSTITUTE OF TECHNOLOGY
FISCAL YEAR: 1979 PROJECT NUMBER: R/T-20
SEA GRANT FUNDS: $45,000 MATCHING FUNDS: $39,997
SID NUMBER: 4536

TITLE: NONPOINT SOURCE POLLUTION IN GREEN BAY AND ITS IMPLICATIONS FOR WATER QUALITY MANAGEMENT
INVESTIGATOR(S): DANIEL BROMLEY
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: UNIVERSITY OF WISCONSIN
FISCAL YEAR: 1979 PROJECT NUMBER: R/GB-8
SEA GRANT FUNDS: $8,559 MATCHING FUNDS: $5,160
SID NUMBER: 4772

TITLE: TRANSFERABLE DISCHARGE PERMITS:IMPLEMENTATION STUDIES
INVESTIGATOR(S): MARTIN DAVID
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: UNIVERSITY OF WISCONSIN
FISCAL YEAR: 1979 PROJECT NUMBER: R/PS-28
SEA GRANT FUNDS: $29,750 MATCHING FUNDS: $13,804
SID NUMBER: 4790

H-1

SEA GRANT PROJECTS IN ECONOMICS: MARINE ECONOMICS EDUCATION

TITLE: RESOURCE ECONOMICS PH.D. PROGRAM
INVESTIGATOR(S): THOMAS A. GRIGALUNAS
SG CLASSIFICATION 54: COURSE DEVELOPMENT--ECONOMICS
INSTITUTION: UNIVERSITY OF RHODE ISLAND
FISCAL YEAR: 1979 PROJECT NUMBER: E/ME-2
SEA GRANT FUNDS: $35,434 MATCHING FUNDS: $73,735
SID NUMBER: 4621

TITLE: RESEARCH SEMINAR IN MARINE RESOURCE MANAGEMENT
INVESTIGATOR(S): JAMES CRUTCHFIELD
SG CLASSIFICATION 62: COURSE DEVELOPMENT--OTHER
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979 PROJECT NUMBER: E/MS-3
SEA GRANT FUNDS: $16,900 MATCHING FUNDS: $9,100
SID NUMBER: 4326

RELATED SEA GRANT PROJECTS

FISHERIES MANAGEMENT AND DEVELOPMENT:

TITLE: ANALYSIS OF COORDINATION AMONG FEDERAL, REGIONAL, AND STATE POLICIES FOR MANAGING MARINE FISHERIES
INVESTIGATOR(S): J.E. MOORE/A.J. WYNER/B. CICIN-SAIN
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: UNIVERSITY OF CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-51
SEA GRANT FUNDS: $30,564 MATCHING FUNDS: $20,397
SID NUMBER: 4884

TITLE: DEVELOPMENT OF FISH PRODUCTS FOR EXPORT
INVESTIGATOR(S): C.M. ARNOLD
SG CLASSIFICATION 35: SEAFOOD SCIENCE AND TECHNOLOGY
INSTITUTION: UNIVERSITY OF GEORGIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/SS-7
SEA GRANT FUNDS: $48,200 MATCHING FUNDS: $7,000
SID NUMBER: 4845

TITLE: INTERNATIONAL TRADE AND INVESTMENT LAW ASPECTS OF THE DEVELOPMENT OF A FISHERIES PRODUCT EXPORT INDUSTRY IN LOUISIANA
INVESTIGATOR(S): MICHAEL W. WASCOM
SG CLASSIFICATION 17: OCEAN LAW--OTHER
INSTITUTION: LOUISIANA STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/L-7
SEA GRANT FUNDS: $18,743 MATCHING FUNDS: $1,642
SID NUMBER: 4866

TITLE: INCREASING THE ECONOMIC VALUE OF MICHIGAN COMMERCIAL FISHERY THROUGH THE UTILIZATION OF CARP
INVESTIGATOR(S): L.E. DAWSON
SG CLASSIFICATION 35: SEAFOOD SCIENCE AND TECHNOLOGY
INSTITUTION: UNIVERSITY OF MICHIGAN
FISCAL YEAR: 1979 PROJECT NUMBER: R/CF-8
SEA GRANT FUNDS: $25,317 MATCHING FUNDS: $9,463
SID NUMBER: 4569

RELATED SEA GRANT PROJECTS

FISHERIES MANAGEMENT AND DEVELOPMENT:

TITLE: APPLICATION OF MANAGEMENT STRATEGIES TO THE MID-ATLANTIC EXTENDED JURISDICTION RECREATIONAL FISHERIES
INVESTIGATOR(S): B.T. WILKINS
SG CLASSIFICATION 18: RECREATION--SPORTS FISHERIES
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-13
SEA GRANT FUNDS: $12,936 MATCHING FUNDS: $13,710
SID NUMBER: 4260

TITLE: IS EXTENDED JURISDICTION WORKING?
INVESTIGATOR(S): J.L. MCHUGN
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: STATE UNIVERSITY OF NEW YORK, CORNELL
FISCAL YEAR: 1979 PROJECT NUMBER: R/P-14
SEA GRANT FUNDS: $24,356 MATCHING FUNDS: $14,455
SID NUMBER: 4264

TITLE: DEVELOPMENT OF POLICY ALTERNATIVES FOR SHRIMP FISHERY MANAGEMENT
INVESTIGATOR(S): GEORGE S. FISHMAN
SG CLASSIFICATION 48: ENVIRONMENTAL MODESL--OTHER
INSTITUTION: UNIVERSITY OF NORTH CAROLINA
FISCAL YEAR: 1979 PROJECT NUMBER: R/MP-1
SEA GRANT FUNDS: $13,519 MATCHING FUNDS: $6,528
SID NUMBER: 4216

TITLE: THE SOCIOCULTURAL ORGANIZATION OF FISHING IN A NORTH CAROLINA COASTAL COMMUNITY - PERSPECTIVES FOR ECONOMIC DEVELOPMENT
INVESTIGATOR(S): J.C. SABELLA
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: UNIVERSITY OF NORTH CAROLINA
FISCAL YEAR: 1979 PROJECT NUMBER: R/LS-11
SEA GRANT FUNDS: $18,259 MATCHING FUNDS: $9,532
SID NUMBER: 4203

RELATED SEA GRANT PROJECTS

FISHERIES MANAGEMENT AND DEVELOPMENT:

TITLE: MARKET DEVELOPMENT FOR UNDERUTILIZED LAKE ERIE FISH SPECIES INCLUDING NEW PACKAGING TECHNIQUES
INVESTIGATOR(S): JEFFREY M. REUTTER
SG CLASSIFICATION 35: SEAFOOD SCIENCE AND TECHNOLOGY
INSTITUTION: OHIO STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/MD-1
SEA GRANT FUNDS: $28,400 MATCHING FUNDS: $2,200
SID NUMBER: 4811

TITLE: IMPLEMENTATION OF THE FISHERIES CONSERVATION AND MANAGEMENT ACT IN THE PACIFIC NORTHWEST: LEGAL INFORMATION AND EDUCATION SERVICES
INVESTIGATOR(S): J.L. JACOBSON
SG CLASSIFICATION 17: OCEAN LAW--OTHER
INSTITUTION: OREGON STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/PPA-13
SEA GRANT FUNDS: $71,100 MATCHING FUNDS: $36,400
SID NUMBER: 4687

TITLE: AN EVALUATION OF THE EFFECTS OF THE 1976 FCMA ON FISHERIES MANAGEMENT IN THE NORTHEASTERN PACIFIC OCEAN
INVESTIGATOR(S): DONALD L. MCKERNAN
SG CLASSIFICATION 16: OCEAN LAW--INTERNATIONAL
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979 PROJECT NUMBER: R/MS-5
SEA GRANT FUNDS: $26,700 MATCHING FUNDS: $21,400
SID NUMBER: 4309

TITLE: NORFISH 11-A JOINT SEA GRANT-NATIONAL MARINE FISHERIES SERVICE PROJECT IN AID OF REGIONAL FISHERIES MANAGEMENT
INVESTIGATOR(S): L.J. BLEDSOE
SG CLASSIFICATION 47: ENVIRONMENTAL MODELS--BIOLOGICAL
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-9
SEA GRANT FUNDS: $115,000 MATCHING FUNDS: $64,400
SID NUMBER: 4321

I-4

RELATED SEA GRANT PROJECTS

FISHERIES MANAGEMENT AND DEVELOPMENT:

TITLE: NORFISH II - A JOINT SEA GRANT-NATIONAL MARINE FISHERIES SERVICE PROJECT IN AID OF REGIONAL FISHERIES MANAGEMENT
INVESTIGATOR(S): LEWIS J. BLEDSOE
SG CLASSIFICATION 47: ENVIRONMENTAL MODELS--BIOLOGICAL
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-9(A)
SEA GRANT FUNDS: $62,250 MATCHING FUNDS: $5,000
SID NUMBER: 4470

MARINE RECREATION:

TITLE: THE RECREATIONAL DEMAND FOR DEVELOPMENT OF HARBORS OF REFUGE IN WESTERN LAKE SUPERIOR
INVESTIGATOR(S): LEO MCCAVOY
SG CLASSIFICATION 36: PORTS, HARBORS AND OFFSHORE TERMINALS
INSTITUTION: UNIVERSITY OF MINNESOTA
FISCAL YEAR: 1979 PROJECT NUMBER: R/C-3
SEA GRANT FUNDS: $3,163 MATCHING FUNDS: $3,231
SID NUMBER: 4982

TITLE: BOATS, MEN AND FISH: A STUDY OF THE RECREATIONAL FISHERY OFF NORTH CAROLINA
INVESTIGATOR(S): PETER FRICKE
SG CLASSIFICATION 18: RECREATION--SPORTS FISHERIES
INSTITUTION: UNIVERSITY OF NORTH CAROLINA
FISCAL YEAR: 1979 PROJECT NUMBER: R/MP-3
SEA GRANT FUNDS: $24,348 MATCHING FUNDS: $12,056
SID NUMBER: 4202

TITLE: SALTWATER BOAT FISHERMEN: A STATEWIDE SURVEY OF ACTIVITY PATTERNS, CHARACTERISTICS AND MOTIVATION
INVESTIGATOR(S): ROBERT B. DITTON
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: TEXAS A&M UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/F-11
SEA GRANT FUNDS: $28,700 MATCHING FUNDS: $14,233
SID NUMBER: 4738

RELATED SEA GRANT PROJECTS

COASTAL ZONE RESOURCES:

TITLE: WETLANDS MANAGEMENT IN COASTAL ZONE PLANNING: A PROTOTYPE FRAMEWORK FOR RELATING NATURAL SCIENCE AND LAND-USE PLANNING
INVESTIGATOR(S): T. DICKERT
SG CLASSIFICATION 38: COASTAL ZONE MANAGEMENT--SOCIAL SCIENCES
INSTITUTION: UNIVERSITY OF CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/CZ-45
SEA GRANT FUNDS: $83,042 MATCHING FUNDS: $38,038
SID NUMBER: 4909

TITLE: INDUSTRIAL, ECONOMIC, AND ENVIRONMENTAL BENEFITS OF APICULTURE IN THE COASTAL ZONE OF GEORGIA
INVESTIGATOR(S): ALFRED DIETZ
SG CLASSIFICATION 4: AQUACULTURE--OTHER ANIMALS
INSTITUTION: UNIVERSITY OF GEORGIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/G-1
SEA GRANT FUNDS: $38,300 MATCHING FUNDS: $52,300
SID NUMBER: 4841

TITLE: SOCIAL DEMOGRAPHY OF THE GEORGIA COAST
INVESTIGATOR(S): DAVOR JEDLICKA
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: UNIVERSITY OF GEORGIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/SP-2
SEA GRANT FUNDS: $16,900 MATCHING FUNDS: $6,800
SID NUMBER: 4843

TITLE: THE RELATIONSHIPS BETWEEN RESOURCE USERS AND INTEREST GROUP REPRESENTATION ON THE CHESAPEAKE
INVESTIGATOR(S): P. S. FLORESTAND
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: UNIVERSITY OF MARYLAND
FISCAL YEAR: 1979 PROJECT NUMBER: S/L-4
SEA GRANT FUNDS: $17,650 MATCHING FUNDS: $10,500
SID NUMBER: 4379

RELATED SEA GRANT PROJECTS

COASTAL ZONE RESOURCES:

TITLE: MARINE POLICY AND OCEAN MANAGEMENT
INVESTIGATOR(S): ROBERT W. MORSE
SG CLASSIFICATION 20: SOCIO-POLITICAL STUDIES
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION
FISCAL YEAR: 1979 PROJECT NUMBER: E/L-1
SEA GRANT FUNDS: $19,400 MATCHING FUNDS: $284,592
SID NUMBER: 4672

TITLE: ASSESSING THE IMPACTS OF COASTAL ZONE MANGEMENT: WETLANDS REGULATIONS AND CAPE COD PRIVATE PROPERTY DEVELOPMENT
INVESTIGATOR(S): THOMAS LESCHINE
SG CLASSIFICATION 38: COASTAL ZONE MANAGEMENT--SOCIAL SCIENCES
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION
FISCAL YEAR: 1979 PROJECT NUMBER: R/B-29
SEA GRANT FUNDS: $12,400 MATCHING FUNDS: $5,081
SID NUMBER: 4669

TITLE: COASTAL WETLANDS IN CONFLICT: A JOINT-SPACE APPROACH FOR EVALUATING MANAGEMENT ALTERNATIVES
INVESTIGATOR(S): PATRICIA L. BRADEN
SG CLASSIFICATION 38: COASTAL ZONE MANAGEMENT--SOCIAL SCIENCES
INSTITUTION: UNIVERSITY OF MICHIGAN
FISCAL YEAR: 1979 PROJECT NUMBER: R/CW-1
SEA GRANT FUNDS: $21,880 MATCHING FUNDS:
SID NUMBER: 4579

TITLE: PUBLIC POLICIES AFFECTING THE MANAGEMENT AND PROTECTION OF MICHIGANS COASTAL WETLANDS
INVESTIGATOR(S): RALEIGH BARLOW
SG CLASSIFICATION 38: COASTAL ZONE MANAGEMENT--SOCIAL SCIENCES
INSTITUTION: UNIVERSITY OF MICHIGAN
FISCAL YEAR: 1979 PROJECT NUMBER: R/CW-4
SEA GRANT FUNDS: $9,250 MATCHING FUNDS:
SID NUMBER: 4580

RELATED SEA GRANT PROJECTS

COASTAL ZONE RESOURCES:

TITLE: OCEAN POLICY AND NATURAL RESOURCE STRATEGY
INVESTIGATOR(S): RICHARD B. BILDER
SG CLASSIFICATION 16: OCEAN LAW--INTERNATIONAL
INSTITUTION: UNIVERSITY OF WISCONSIN
FISCAL YEAR: 1979 PROJECT NUMBER: R/PS-24
SEA GRANT FUNDS: $27,183 MATCHING FUNDS: $7,424
SID NUMBER: 4786

MARINE MINERALS AND ENERGY:

TITLE: PHOSPHORITES ALONG THE CENTRAL CALIFORNIA CONTINENTAL MARGIN
INVESTIGATOR(S): H.T. MULLINS
SG CLASSIFICATION 9: GEOLOGICAL OCEANOGRAPHY
INSTITUTION: UNIVERSITY OF CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/CZ-54
SEA GRANT FUNDS: $18,403 MATCHING FUNDS: $34,600
SID NUMBER: 4920

TITLE: OFFSHORE SAND AND GRAVEL RESOURCES, ORANGE COUNTY, CALIFORNIA
INVESTIGATOR(S): ROBERT H. OSBORNE
SG CLASSIFICATION 10: MINERAL RESOURCES--OTHER
INSTITUTION: UNIVERSITY OF SOUTHERN CALIFORNIA
FISCAL YEAR: 1979 PROJECT NUMBER: R/RD-9
SEA GRANT FUNDS: $15,749 MATCHING FUNDS: $44,982
SID NUMBER: 4947

TITLE: THE ECONOMIC POTENTIAL OF THE EAST COAST CONTINENTAL MARGIN: BLAKE PLATEAU TO GEORGES BANK: CONTINENTAL RISE OFF SOUTHERN NEW ENGLAND
INVESTIGATOR(S): ELAZAR UCHUPI
SG CLASSIFICATION 9: GEOLOGICAL OCEANOGRAPHY
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION
FISCAL YEAR: 1979 PROJECT NUMBER: R/G-3
SEA GRANT FUNDS: $17,800 MATCHING FUNDS:
SID NUMBER: 4660

RELATED SEA GRANT PROJECTS

MARINE MINERALS AND ENERGY:

TITLE: SOCIAL IMPACT OF OFFSHORE OIL AND GAS DEVELOPMENTS IN TWO SOUTHEASTERN NEW ENGLAND COMMUNITIES
INVESTIGATOR(S): JANE HURWITZ
SG CLASSIFICATION 38: COASTAL ZONE MANAGEMENT--SOCIAL SCIENCES
INSTITUTION: WOODS HOLE OCEANOGRAPHIC INSTITUTION
FISCAL YEAR: 1979 PROJECT NUMBER: R/B-30
SEA GRANT FUNDS: $13,300 MATCHING FUNDS: $14,500
SID NUMBER: 4670

TITLE: AN EVALUATION OF COASTAL SAND AND GRAVEL AND MARGINAL ROCK AS CONSTRUCTION MATERIALS
INVESTIGATOR(S): R.G. HICKS
SG CLASSIFICATION 10: MINERAL RESOURCES--OTHER
INSTITUTION: OREGON STATE UNIVERSITY
FISCAL YEAR: 1979 PROJECT NUMBER: R/CE-6
SEA GRANT FUNDS: $53,900 MATCHING FUNDS: $5,000
SID NUMBER: 4684

MARINE TRANSPORTATION:

TITLE: MARINE TRANSPORTATION MANAGEMENT AND RISK REDUCTION - APPLICATIONS TO PUGET SOUND
INVESTIGATOR(S): EDWARD WENK
SG CLASSIFICATION 37: TRANSPORTATION SYSTEMS--OTHER
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979 PROJECT NUMBER: R/E-8
SEA GRANT FUNDS: $39,500 MATCHING FUNDS: $22,600
SID NUMBER: 4317

TITLE: MARINE TRANSPORTATION MANAGEMENT AND RISK REDUCTION-APPLICATION TO PUGET SOUND
INVESTIGATOR(S): EDWARD WENK
SG CLASSIFICATION 37: TRANSPORTATION SYSTEMS--OTHER
INSTITUTION: UNIVERSITY OF WASHINGTON
FISCAL YEAR: 1979 PROJECT NUMBER: R/E-8(A)
SEA GRANT FUNDS: $5,000 MATCHING FUNDS:
SID NUMBER: 5032

APPENDIX II

Inquiries can be directed to: Office of the Director
Sea Grant Program

at:

Alaska, University of
Fairbanks, Alaska 99701

California, University of
La Jolla, California 92093

Delaware, University of
Newark, Delaware 19711

Georgia, University of
Athens, Georgia 30602

Hawaii, University of
Honolulu, Hawaii 96822

Louisiana State University
Baton Rouge, Louisiana 70803

Maryland, University of
College Park, Maryland 20742

Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Michigan, University of
Ann Arbor, Michigan 48109

Minnesota, University of
Duluth, Minnesota 55812

Mississippi-Alabama Sea Grant Consortium
P. O. Drawer AG
Ocean Springs, Mississippi 39564

North Carolina State University
Raleigh, North Carolina 27650

Ohio State University
Colombus, Ohio 43210

Oregon State University
Corvallis, Oregon 97331

Rhode Island, University of
Kingston, Rhode Island 02881

South Carolina Sea Grant Consortium
P. O. Box 12559
Charleston, South Carolina 29412

Southern California, University of
Los Angeles, California 90007

State University of New York/Cornell
Albany, New York 12210

State University System of Florida
University of Florida
Gainesville, Florida 32611

Texas A&M University
College Station, Texas 77843

Washington, University of
Seattle, Washington 98105

Wisconsin, University of
Madison, Wisconsin 53706

Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543

SEA GRANT PROJECTS RELATED TO OCEAN AND COASTAL LAW - FY79

John L. Pedrick, Jr.
NOAA Office of General Counsel

I. Introduction

In discussing law projects funded by Sea Grant, it is best to broadly define what constitutes a "law project" because legal analysis often cuts across the lines of, for example, social, economic, political and management issues. Conversely, these other disciplines may analyze the ramifications of a legal result upon a subject within their particular area of study. Thus, in setting out and analyzing the legal projects funded by Sea Grant for this report, all projects related to ocean and coastal law have been included. The breadth of subject matter considered law - related is evident from the categories listed in the statistics section below. Because of this relationship among the various disciplines, certain of the projects listed in the statistics and set out in Appendix A may appear in other reports.

A. Statistics

The data presented below are for law projects actually receiving grants in FY79. They do not include ongoing projects, such as the study of the Law of the Sea Conference being done at the University of Virginia Law School (John Norton Moore) whose grant, awarded in late FY 78, was extended to last through FY 79. The total funding level was $1,811,016 made up of $961,152 in Sea Grant funding and $849,864 in state matching funds. The dollar figures in parentheses are from FY77 and are provided to illustrate what may be trends in project emphasis and funding over the past two years. The two year period was selected to provide more contrast than possible with a one year interval. The FY79 law-related projects break down by category as follows:

	No. Projects	SG	Match	Total
1. Ocean Law	5	150,540	101,144	251,684
Coastal (Cat. 15)	(8)	(163,071)	(102,141)	(265,212)
2. Ocean Law	5	96,319	92,429	188,748
International (16)	(1)	(30,000)	(66,391)	(96,391)
3. Ocean Law -	4	110,343	70,242	180,585
Other (17)	(2)	(98,200)	(51,200)	(149,400)
4. Socio-Political	6	175,729	373,908	549,637
Studies (20)	(1)	(28,264)	(9,343)	(37,607)

	No. Projects	SG	Match	Total
5. Ports, Harbors and Offshore Terminals (36)	1	19,886	16,154	36,040
6. Marine Transportation Systems - Others (37)	2	71,171	33,753	104,924
7. Coastal MGMT - Social Sciences (38)	5 (6)	145,072 (121,254)	61,319 (70,284)	206,391 (191,538)
8. Pollution - Oil Spills (41)	1	45,000	39,997	84,997
9. Pollution - Other (45)	1	-	10,000	10,000
10. Environmental Models - Other (48)	1	13,519	6,528	20,047
11. Course Development - Law (55)	2 (3)	21,800 (44,777)	37,500 (41,451)	59,300 (86,228)
12. Education - Other (70)	2 (3)	32,614 (51,650)	- (23,695)	32,614 (75,345)
13. Advisory Services - Other (77)	1 (1)	79,159 (39,589)	6,890 (7,669)	86,049 (47,258)
Total	36 (28)	961,152 (638,459)	849,864 (397,216)	1,811,016 (1,035,675)

As can be seen from these figures there are a total of 36 projects in 13 categories. In FY77, the figures were 28 projects in 10 categories funded by Sea Grant at a level of approximately two-thirds of that in FY79. The FY79 distribution of projects by institution is as follows:

	No. Projects	SG	Match
1. SUNY/Cornell	3 (6)	102,906 (119,448)	59,448 (75,427)
2. LSU	2 (3)	97,907 (76,696)	8,532 (21,701)
3. Oregon State	3 (1)	154,700 (69,600)	84,100 (34,700)
4. California	2 (3)	113,606 (66,205)	58,435 (41,931)

	No. Projects	SG	Match
5. Hawaii	3 (2)	52,436 (58,264)	63,605 (75,734)
6. Washington	5 (2)	108,600 (36,300)	78,500 (33,000)
7. Wisconsin	4 (1)	92,163 (33,151)	37,541 (9,577)
8. Miss./Ala.	2 (1)	58,600 (26,500)	41,804 (14,803)
9. North Carolina	2 (2)	23,209 (17,755)	12,675 (10,493)
10. Michigan	4 (1)	31,130 (9,000)	30,000 (-)
11. Florida	1	29,100	8,200
12. Woods Hole	2	31,800	289,673
13. USC	1	19,886	16,154
14. MIT	1	45,000	39,997
15. Georgia	1	8,300	21,200

II. Analysis of Sea Grant Law Project Funding

A. General Analysis

With some slight variation, Sea Grant funded legal projects have historically been concerned with both international and coastal related issues. Some issues, such as fisheries management, have both international and coastal implications. Sea Grant is the major, if not the only, source of federal funding supporting research into these critical legal issues.

From a comparison with the FY77 figures set out above, several tentative conclusions may be drawn. There appears to be a slight decrease in the number of coastal-related projects, both in the law and social sciences categories. On the other hand, great increases are shown in the categories of international ocean law and and socio-political studies. Course development, education and advisory service projects continue at approximately FY77 levels. There seems to be a rising interest in marine transportation and pollution issues. The health of our merchant marine and the many legal issues surrounding

pollution offer many of the new initiatives worthy of funding consideration. At the same time, the strong interface between law and economics is not represented at all. The use of law to create economic incentives and disincentives toward certain behavior toward the marine environment and related industries provides a wealth of potential project topics.

It should be noted that the listing of only one advisory services project at LSU is misleading. Several other institutions provide legal advisory services, but the funds are channeled from other categories. These include the University of Washington, University of Oregon, SUNY/Cornell and Mississippi/Alabama.

One conclusion may be drawn from these figures with certainty. Funding for Sea Grant law-related projects has increased by 80 percent in the last two years. However, Sea Grant has borne only 30 percent of this increase. Fifty percent of the increase is represented by matching funds.

From the above figures, it may be seen that there has been some major shifting of Sea Grant funding for legal projects since FY77. The effect of this shift appears to be a leveling of the number of projects at the major institutions. For example, SUNY/Cornell registers a drop in number of funded projects from six to three and Washington, Oregon State, Wisconsin and Michigan registered large gains. In addition, five other institutions now have legal projects funded by Sea Grant which had none in FY77.

B. Discussion of Specific Issues

Sea Grant should continue to encourage both national and state-oriented legal research dealing with marine issues. The ideal state program would provide financial support for nationally oriented legal research as well as in-state oriented legal advisory services. An example of a program with an outstanding nationally oriented legal research program is SUNY/Cornell. Outstanding legal advisory services are provided by LSU, Oregon State/Oregon Law School and the University of Washington. None of these programs, however, can be said to be perfectly balanced between national and state issues. They all do, however, provide valuable financial support and practical training for student interns.

Advisory services performed should be reviewed to ensure that no advocacy role is played by the Sea Grant funded lawyer. The proper role of the Sea Grant adviser is to inform the people of what the law means and how it affects them. The law may be interpreted, but only in a neutral and objective manner. If approached with a request to advocate a certain position as part of his or her Sea Grant advisory function, the lawyer must refuse. He or she may offer recommendations as to where such legal services may be found, but should avoid any conflict of interest implications by recommending a particular lawyer or firm.

The share of the funding pie each Sea Grant researcher receives is controlled by the State Sea Grant Director. The importance of legal research and advisory services to the state cannot be minimized and it is hoped that Sea Grant legal researchers will take an active role to demonstrate their capability to their respective SG Director in coming years.

New and continuing curriculum development projects in ocean and coastal law are found primarily in the south and west. The many institutions in the northeast and middle Atlantic states have not shown much interest in Sea Grant funding for this purpose. Curriculum development in this field should be encouraged in these heavily industrialized areas.

Affirmative action continues to be an issue which needs more work. During the past year, involvement by women in Sea Grant legal projects has improved somewhat, but minority participation continues to be almost nonexistent. A long term effort should be commenced somehow encouraging Sea Grant Directives and researchers to involve minority students as interns and to stimulate minority faculty and minority institutions to apply for Sea Grant funding.

Delaware has instituted a program creating a chair for visiting minority faculty on a one-year appointment basis. Such a program in a Sea Grant College should provide a wealth of experience

for interested minority faculty. It has also been suggested that the reverse of this process may also prove valuable - established Sea Grant Grant programs providing faculty to minority college science, social science and law programs. A second suggestion would be to remove the boilerplate affirmative action language now appearing in proposals and encourage its replacement with more action-forcing language, such as a commitment to seek out minority interns or to create a minority visiting chair.

As more people become interested and trained in matters relating to ocean and coastal law, the stronger will be the competition for research projects and research dollars. At any one point in time, there are only so many projects worthy of funding. In addition to the increasing number of interested researchers in the legal field, the Office of Sea Grant is interested in preventing stagnation in the more established researchers.

NOAA's Office of General Counsel (OGC) has expanded the role of the General Counsel's liaison to Sea Grant. In the past, the liaison function has been primarily one of passively reviewing incoming proposals for ocean and coastal legal projects and curriculum development in those fields. It is now felt that a sufficient number of such programs has developed to a point where there is a pool of people trained in such programs available to perform more sophisticated legal research projects, potentially funded by Sea Grant.

In order to assist in stimulating and monitoring these potential researchers and their projects, the liaison role has been expanded to include active involvement in the entire process of Sea Grant proposal review, approval and interim and post-project evaluation. This function includes the solicitation of worthwhile issues for legal research, identification of those of particular interest to NOAA, and the dissemination of this information to potentially interested researchers. It would also include an effort to identify means of involving more minority programs and women in marine-oriented research.

In an effort to solicit worthwhile research problems, the OGC liaison has sought input from all Assistant Administrators and legal offices within NOAA, and Sea Grant legal researchers, one of whom has submitted the results of a similar issue search which received input from several state and federal agencies. Of the issues submitted, nearly 100 appear to have some merit. The recommended issues will be collated in the near future and prioritized with the assistance of NOAA policy makers and legal staff. All work on this task will be completed prior to meeting with any individual or group of potential Sea Grant legal researchers to disseminate this information.

APPENDIX A

PROJECTS CLASSIFIED UNDER:
II.MARINE SOCIO-ECONOMICS AND LEGAL RESEARCH
B.OCEAN LAW
15.OCEAN LAW - COASTAL

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
LEGAL ASPECTS OF MARINA SITING IN FLORIDA F.E. MALONEY STATE UNIVERSITY SYSTEM OF FLORIDA	$29,100	$8,200
MARINE RESOURCES LAW D. CRIDDLE MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM	$28,888	$26,935
ALABAMA MARINE LAW PROGRAM R. MCCURLEY MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM	$29,712	$14,869
PROBLEMS IN COASTAL LAW ROBERT I. REIS STATE UNIVERSITY OF NEW YORK, CORNELL	$53,150	$44,993
OCEAN AND COASTAL LAW PROGRAM THOMAS J. SCHOENBAUM UNIVERSITY OF NORTH CAROLINA	$9,690	$6,147

PROJECTS CLASSIFIED UNDER:
II.MARINE SOCIO-ECONOMICS AND LEGAL RESEARCH
B.OCEAN LAW
16.OCEAN LAW - INTERNATIONAL

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
LAW OF THE SEA INSTITUTE JOHN P. CRAVEN UNIVERSITY OF HAWAII	$10,000	
AN INVESTIGATION OF THE LEGAL ISSUES AND JURISDICTIONAL DISPUTES IN THE PACIFIC JON VAN DYKE UNIVERSITY OF HAWAII	$6,500	$34,696
LAW OF THE SEA INSTITUTE JOHN P. CRAVEN UNIVERSITY OF HAWAII	$35,936	$28,909
AN EVALUATION OF THE EFFECTS OF THE 1976 FCMA ON FISHERIES MANAGEMENT IN THE NORTHEASTERN PACIFIC OCEAN DONALD L. MCKERNAN UNIVERSITY OF WASHINGTON	$26,700	$21,400
OCEAN POLICY AND NATURAL RESOURCE STRATEGY RICHARD B. BILDER UNIVERSITY OF WISCONSIN	$27,183	$7,424

PROJECTS CLASSIFIED UNDER:
II.MARINE SOCIO-ECONOMICS AND LEGAL RESEARCH
B.OCEAN LAW
17.OCEAN LAW - OTHER

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
INTERNATIONAL TRADE AND INVESTMENT LAW ASPECTS OF THE DEVELOPMENT OF A FISHERIES PRODUCT EXPORT INDUSTRY IN LOUISIANA MICHAEL W. WASCOM LOUISIANA STATE UNIVERSITY	$18,743	$1,642
DEVELOPING A MODEL COMMERCIAL FISHERIES STATUTE FOR THE GREAT LAKES STATES D.A. BRONSTEIN UNIVERSITY OF MICHIGAN		$20,000
LEGAL AND INSTITUTIONAL APPROACH TO THE COLUMBIA RIVER BASINS ANADROMOUS FISHERY CRISIS: A GUIDE FOR ACTION M.C. BLUMM OREGON STATE UNIVERSITY	$20,500	$12,200
IMPLEMENTATION OF THE FISHERIES CONSERVATION AND MANAGEMENT ACT IN THE PACIFIC NORTHWEST: LEGAL INFORMATION AND EDUCATION SERVICES J.L. JACOBSON OREGON STATE UNIVERSITY	$71,100	$36,400

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
ANALYSIS OF COORDINATION AMONG FEDERAL, REGIONAL, AND STATE POLICIES FOR MANAGING MARINE FISHERIES J.E. MOORE/A.J. WYNER/B. CICIN-SAIN UNIVERSITY OF CALIFORNIA	$30,564	$20,397
MARINE POLICY AND OCEAN MANAGEMENT ROBERT W. MORSE WOODS HOLE OCEANOGRAPHIC INSTITUTION	$19,400	$284,592
IS EXTENDED JURISDICTION WORKING? J.L. MCHUGN STATE UNIVERSITY OF NEW YORK, CORNELL	$24,356	$14,455
RELATIONSHIPS BETWEEN INSTITUTIONAL ARRANGEMENTS AND AQUACULTURAL DEVELOPMENTS R.S. JOHNSTON OREGON STATE UNIVERSITY	$63,100	$35,500
NONPOINT SOURCE POLLUTION IN GREEN BAY AND ITS IMPLICATIONS FOR WATER QUALITY MANAGEMENT DANIEL BROMLEY UNIVERSITY OF WISCONSIN	$8,559	$5,160
TRANSFERABLE DISCHARGE PERMITS:IMPLEMENTATION STUDIES MARTIN DAVID UNIVERSITY OF WISCONSIN	$29,750	$13,804

PROJECTS CLASSIFIED UNDER:
III.MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT
C.TRANSPORTATION SYSTEMS
36.PORTS HARBORS AND OFFSHORE TERMINALS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
PORT AUTHORITY AS PUBLIC ENTERPRISE: ORGANIZATIONAL ADJUSTMENT TO CONFLICTING DEMANDS FOR ECONOMIC VERSUS ENVIRONMENTAL QUALITY GOALS HERMAN L. BOSCHKEN/LOUIS F. WESCHLER UNIVERSITY OF SOUTHERN CALIFORNIA	$19,886	$16,154

PROJECTS CLASSIFIED UNDER:
III.MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT
C.TRANSPORTATION SYSTEMS
37.TRANSPORTATION SYSTEMS - OTHERS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
MARINE TRANSPORTATION MANAGEMENT AND RISK REDUCTION - APPLICATIONS TO PUGET SOUND EDWARD WENK UNIVERSITY OF WASHINGTON	$39,500	$22,600
MARINE TRANSPORTATION MANAGEMENT AND RISK REDUCTION-APPLICATION TO PUGET SOUND EDWARD WENK UNIVERSITY OF WASHINGTON	$5,000	
GREAT LAKES INTERNATIONAL TRADE:HINTERLAND SERVED AND SHIPPERS ROUTE OPTIONS ERIC SCHENKER UNIVERSITY OF WISCONSIN	$26,671	$11,153

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
WETLANDS MANAGEMENT IN COASTAL ZONE PLANNING: A PROTOTYPE FRAMEWORK FOR RELATING NATURAL SCIENCE AND LAND-USE PLANNING T. DICKERT UNIVERSITY OF CALIFORNIA	$83,042	$38,038
ASSESSING THE IMPACTS OF COASTAL ZONE MANGEMENT: WETLANDS REGULATIONS AND CAPE COD PRIVATE PROPERTY DEVELOPMENT THOMAS LESCHINE WOODS HOLE OCEANOGRAPHIC INSTITUTION	$12,400	$5,081
PUBLIC POLICIES AFFECTING THE MANAGEMENT AND PROTECTION OF MICHIGANS COASTAL WETLANDS RALEIGH BARLOW UNIVERSITY OF MICHIGAN	$9,250	
COASTAL WETLANDS IN CONFLICT: A JOINT-SPACE APPROACH FOR EVALUATING MANAGEMENT ALTERNATIVES PATRICIA L. BRADEN UNIVERSITY OF MICHIGAN	$21,880	
COASTAL RESOURCES PROGRAM: GOVERNMENT AND LEGAL STUDIES RALPH W. JOHNSON UNIVERSITY OF WASHINGTON	$18,500	$18,200

PROJECTS CLASSIFIED UNDER:
IV.MARINE ENVIRONMENTAL RESEARCH
C.POLLUTION STUDIES
41.POLLUTION - OIL SPILLS

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
OIL SPILL CLEAN-UP AND LIABILITY MODELS J.D.NYHART/HARILAOS N. PSARAFTIS MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$45,000	$39,997

PROJECTS CLASSIFIED UNDER:
IV.MARINE ENVIRONMENTAL RESEARCH
C.POLLUTION STUDIES
45.POLLUTION - OTHER

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
IMPLEMENTATION OF THE TOXIC SUBSTANCES CONTROL ACT D.A. BRONSTEIN UNIVERSITY OF MICHIGAN		$10,000

PROJECTS CLASSIFIED UNDER:
IV.MARINE ENVIRONMENTAL RESEARCH
D.ENVIRONMENTAL MODELS
48.ENVIRONMENTAL MODELS - OTHER

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
DEVELOPMENT OF POLICY ALTERNATIVES FOR SHRIMP FISHERY MANAGEMENT GEORGE S. FISHMAN UNIVERSITY OF NORTH CAROLINA	$13,519	$6,528

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

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
DEVELOPMENT OF A LAW SCHOOL COURSE ON MARINE RESOURCES LAW,POLICY AND MANAGEMENT MILNER S. BALL UNIVERSITY OF GEORGIA	$8,300	$21,200
EDUCATION IN OCEAN LAW ENFORCEMENT WILLIAM T. BURKE UNIVERSITY OF WASHINGTON	$13,500	$16,300

PROJECTS CLASSIFIED UNDER:
V.MARINE EDUCATION AND TRAINING
D.OTHER EDUCATION
70.EDUCATION - OTHER

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
COASTAL LAW TRAINEESHIPS EDWARD BOLLINGER STATE UNIVERSITY OF NEW YORK, CORNELL	$25,400	
INTERNSHIPS IN LAW AND MARINE AFFAIRS WILLIAM T. BURKE UNIVERSITY OF WASHINGTON	$5,400	
INTERNSHIPS IN LAW AND MARINE AFFAIRS WILLIAM T. BURKE UNIVERSITY OF WASHINGTON	$1,814	

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

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
LEGAL ADVISORY SERVICES JOSEPH T. BOCKRATH LOUISIANA STATE UNIVERSITY	$ 79,159	$ 6,890

INTERNATIONAL COOPERATION ASSISTANCE PROGRAM

THE SECOND YEAR

by

Thomas E. Murray

Office of Sea Grant

(Prepared for an Office of Sea Grant Retreat,
December 5-7, 1979, Belmont Conference Center)

INTRODUCTION

Section 3 of P.L. 94-461, signed by the President on October 8, 1976, established the International Cooperation Assistance Program (ICAP) within the Sea Grant College Program. Its goals are (1) to enhance the research and development capabilities of developing foreign nations with respect to ocean and coastal resources, and (2) to promote the international exchange of information and data with respect to the assessment, development, use, and conservation of such resources. The Congress envisioned that grants made under this new legislation would promote cooperation between U.S. academic institutions and their counterparts in developing countries. Grants were to be made only to U.S. institutions, and consultation with the Secretary of State was required before grants were made.

The legislation which established the International Cooperation Assistance Program is given in Appendix A to this report.

Guidelines for ICAP were published in the Federal Register on April 11, 1978. They were quite brief, largely repeating the authorizing legislation. The guidelines did specify that ICAP proposals would be expected to address:

(1) The nature and scope of the proposed project;

(2) The utilization of institutional and other appropriate resources in the implementation of the project;

(3) A clear indication of the foreign participant's commitment to the project;

(4) Identification of accomplishments expected from a single granting interval;

(5) Implicit or explicit out-year commitment of resources; and

(6) The impact of the proposed project on the institution receiving funding.

The guidelines made it clear that ICAP projects should involve genuine cooperation between the grantee institution and the institution(s) in the developing country, and that any project submitted by a Sea Grant institution should take advantage of the marine capability already in existence at that institution.

The guidelines for ICAP are given in Appendix B to this report.

Subsequently, in P.L. 95-428, the second stated goal of ICAP was altered to read:

> "(2) promote the exchange among the United States and foreign nations (including, but not limited to, developing foreign nations) of information and data with respect to the assessment, development, utilization, and conservation of such resources."

The reason behind this change is perhaps best expressed in House Report No. 95-1011 from the Committee on Merchant Marine and Fisheries:

> "Specific inclusion of "developed" nations in sea grant's information and data exchange programs will allow marine scientists working under the auspices of the international cooperative assistance program to make use of structures already existing for purposes of multinational marine research efforts . . .. That such structures happen to include developed nations as well (such as South Pacific Fisheries Commission, which includes Australia and New Zealand) should not preclude participation within these structures by marine scientists receiving sea grant funding. The Director stated during hearings that the principal thrust and focus of the program would still be toward the lesser developed nations."

GOALS OF ICAP

The goals of ICAP were more fully described in last year's report entitled "International Cooperation Assistance Program: The First Year." Consequently, they will only be summarized here.

The primary goals of ICAP are those stated in the authorizing legislation:

> "To (1) enhance the research and development capability of developing foreign nations with respect to ocean and coastal resources, as such term is defined in section 203 of the National Sea Grant Program Act; and (2) promote the exchange among the United States and foreign nations (including, but not limited to, developing foreign nations) of information and data with respect to the assessment, development, utilization, and conservation of such resources." (Section 3, P.L. 94-461, amended by P.L. 95-428)

A significant but implicit goal of ICAP is to help create an atmosphere which is conducive to cooperation between U.S. scientists and those in developing countries.

In establishing ICAP as part of the Sea Grant College Program, the Congress evidently wished that it produce results qualitatively similar to those produced by Sea Grant in this country, i.e. the building of scientific and technological capacity to identify marine resource problems and to solve them.

Another goal of ICAP is to make a contribution to the economic and social development of the developing world. ICAP should foster the development process by strengthening indigenous scientific and technological institutions and by supporting education and training programs.

Finally, it is desirable that technology transfer be a mutual sharing rather than simply a one-way transfer.

GRANTS MANAGEMENT GOALS

In addition to the above goals which one might wish to find exemplified in the various international projects, there are other program-wide goals which managers in the Office of Sea Grant should strive to accomplish.

Continuity of Effort. Cooperative international projects, especially in developing countries, generally have to run for several years in order to produce any significant results. So it is advisable that each project be supported for a sufficient duration to have a real impact, even if this means fewer projects are supported than might otherwise be possible.

New Projects. Since both scientific and political elements in oceanic affairs are changing rapidly, it is desirable that ICAP be in a position

to begin some new projects each year in response to these changes. This means that--the above continuity of effort notwithstanding--program managers should not allow a situation to arise in which all resources are pre-committed and no new projects can be started.

Geographic Distribution. If the Law of the Sea Conference has done nothing else, it has awakened developing coastal nations to the economic potential of their oceanic resources and to the need to possess indigenous marine research and development capabilities. Since ICAP manifestly lacks the resources to support cooperative projects with each and every one of these nations, a reasonable goal is to distribute projects broadly among the developing nations and to have at least one project in each of the principal developing regions of the globe.

ADMINISTERING THE PROGRAM

As in the previous fiscal year, the Office of Sea Grant continued during FY79 to encourage universities to submit brief preliminary proposals before development of formal proposals. This procedure was designed to prevent the full-blown development of projects which stood little chance of being supported. It was also done to avoid causing unrealistic expectations in the cooperating foreign countries. Informal advice from a Sea Grant program manager that a proposal is inappropriate for further development does not prevent a proposer from filing a formal proposal if he chooses to do so, and an informal proposal is not a strict requirement.

Generally speaking, there was no change in direction for the program; i.e.

--Emphasis was to be on projects in education and training;

--Projects should, to the extent possible, build upon existing relationships with institutions in developing countries;

--Projects should not raise unfounded expectations in developing countries; and

--Projects should be genuinely cooperative, with some real evidence that the foreign partner is committed to the work.

Fourteen formal proposals were received by the Office of Sea Grant in the course of FY79. These proposals asked for an aggregate of approximately $2.0 million. As in FY78, the majority of the projects were in Latin America and the Caribbean. Three of the proposals asked for continued support for work which was started under ICAP auspices in FY78.

These fourteen formal proposals were reviewed by people who are knowledgeable in marine education, training, research, advisory service, and international relations. They were also discussed in an interagency meeting held in the Office of Sea Grant. Some of the issues taken into consideration included technical excellence, evidence of genuine cooperation with developing countries in the formulation of projects, evidence of commitment on the part of the developing countries, geographic balance, and subject matter balance.

Final funding decisions were made by the middle of August 1979. Four projects were given support for two-year periods; three projects were given support for one year; six projects were either declined by the Office of Sea Grant or withdrawn by the proposing institutions; and one project was left for final disposition in FY80.

Interaction with the Department of State is discussed later in this report.

FUNDED PROJECTS

Table I below gives the grantee institution, participating developing country, duration, and size of grant for each project which was supported out of FY79 funds.

TABLE I

ICAP Projects Supported with FY79 Funds

Grantee Institution	Developing Country	Duration	Grant
University of Hawaii	South Pacific Nations	1 year	$ 92,800
Oregon State University	Chile and Mexico	2 years	190,000
University of California	Mexico	2 years	240,000
Florida Sea Grant Program	India	1 year	18,000
Louisiana State University	Mexico	1 year	46,800
Maryland Sea Grant Program	Egypt	2 years	134,400
University of Rhode Island	Malaysia	2 years	185,000
		TOTAL	$907,000

Details on these projects supported out of FY79 funds are given in Appendix C to this report.

It should be noted that three of these projects (Louisiana State, University of Rhode Island, and Oregon State) are continuations of projects begun last year with support from FY78 funds.

The international project at the University of Hawaii is being carried out in cooperation with the University of South Pacific. This university serves the educational needs of eleven Pacific nations: Solomons, Fiji, Tuvalu, Kiribati, New Hebrides, Cook, Nauru, Tokelau, Tonga, and Western Samoa.

For ease of reference, Table II shows the projects which were supported out of FY78 funds.

TABLE II

ICAP Projects Supported with FY78 Funds

Grantee Institution	Developing Country	Duration	Grant
New York Sea Grant Inst.	Chile	2 years	$ 72,000
University of Delaware	Costa Rica	2 years	303,500
University of Rhode Island	Malaysia	1 year	95,000
Louisiana State University	Mexico	1 year	21,600
Oregon State University	Chile et al.	1 year	90,000
Virginia Institute of Marine Science	Israel	2 years	131,400
University of Miami	Colombia	2 years	199,900
		TOTAL	$913,400

Adding the two preceding tables together, we see that ICAP is now supporting a total of eleven education and training projects in most parts of the developing world. There are as yet no projects in tropical Africa.

Since every project supported out of FY78 funds was either supported for a two-year period or received a continuation grant in FY79, no project has yet come to a conclusion.

Table III shows all the projects supported by ICAP to date, with cumulative durations and cumulative funding totals.

TABLE III

ICAP Projects Supported to Date

Grantee Institution	Developing Country	Cumulative Duration	Cumulative Funding
University of Hawaii	South Pacific Nations	1 year	$ 92,800
Oregon State University	Chile and Mexico	3 years	280,000
University of California	Mexico	2 years	240,000
Florida Sea Grant Program	India	1 year	18,000
Louisiana State University	Mexico	2 years	68,400
Maryland Sea Grant Program	Egypt	2 years	134,400
University of Rhode Island	Malaysia	3 years	280,000
New York Sea Grant Inst.	Chile	2 years	72,000
University of Delaware	Costa Rica	2 years	303,500
Virginia Institute of Marine Science	Israel	2 years	131,400
University of Miami	Colombia	2 years	199,900
	TOTAL		$1,820,400

THE DEPARTMENT OF STATE

With respect to the International Cooperation Assistance Program, Section 3 of the Sea Grant act states:

> "Each grant or contract under this section shall be made pursuant to such requirements as the Secretary (of Commerce) shall, after consultation with the Secretary of State, by regulation prescribe."

And later in the same section:

> "Before approving any application for a grant or contract under this section, the Secretary (of Commerce) shall consult with the Secretary of State."

These words clearly give the Department of State a consultative role both in the formulation of regulations for ICAP and in the approval of individual grants.

Within the Department of State, the consultations required by the act were delegated to the Bureau of Oceans and International Environmental and Scientific Affairs (OES) and in particular to the Office of Marine Science and Technology. Within the Department of Commerce, authority was delegated to the National Oceanic and Atmospheric Administration (NOAA) and in particular to the Office of Sea Grant.

Even before the passage of the 1976 Sea Grant legislation, there was close agreement between personnel in the Department of State and in the Office of Sea Grant on the role that an international Sea Grant program could play and how it might operate.

Once ICAP was established and responsible operating agencies were designated, there was collaboration in the development of the regulations which appeared in the Federal Register. This same spirit of cooperation has continued.

Evidence of State Department support for ICAP is found in testimony given by the last two Deputy Assistant Secretaries of State for Oceans and Fisheries Affairs. To quote briefly from the testimony of Ambassador John D. Negroponte before the Senate Committee on Commerce, Science, and Transportation on April 7, 1978,

> "At the present time, some $40 million of U.S. government-funded academic oceanographic research is conducted within 200 miles of foreign countries. I feel we need the good will which could be generated by the International Sea Grant Program. If the Program did not already exist, we would now have to establish one, as the U.S. must increasingly turn its attention to the problems of technical cooperation with the developing world."

On an operational level, copies of all formal proposals are sent from the Office of Sea Grant to the State Department's Office of Marine Science and Technology. There is frequent informal contact between personnel in the two offices as the proposals are subjected to review from technical as well as international affairs perspectives. Then representatives of the State Department participate in interagency meetings at which all proposals are discussed. As a final step in this interactive process, the Department of State is formally notified of the final funding decisions made in the Office of Sea Grant. The consultative steps described here are, of course, subject to change as ICAP continues to develop.

HUMAN RIGHTS

Some ICAP proposals must be reviewed by the Interagency Group on Human Rights and Foreign Assistance before grants can be concurred in by the Department of State. The Interagency Group was created in answer to a National Security Council directive dated April 1, 1977. It was directed to provide guidance on bilateral and multilateral foreign assistance and to coordinate the Administration's position in this area. The Interagency Group, which is chaired by the Deputy Secretary of State, includes representatives of Treasury, Defense, the National Security Council, and the Agency for International Development. Representatives of Agriculture, Commerce, and the Export-Import Bank also participate in the group's deliberations. In reaching its decisions, the Interagency Group considers not only human rights conditions but also other fundamental U.S. interests and objectives concerning the countries proposed as recipients.

In both FY78 and FY79, proposals for cooperative projects in Chile were examined by the Interagency Group. Since the projects involved university-to-university cooperation and would have negligible impacts on the government of Chile, all of the projects were approved.

PROGRESS REPORT

While no project supported under ICAP has yet come to a conclusion, each of the projects which received funds in FY78 has been able to report progress toward achievement of its objectives. Brief summaries of these reports follow.

New York Sea Grant Institute - University of Concepcion, Chile

This project, entitled "Strengthening Marine Sciences Capabilities and Programs at the University of Concepcion, Chile," involves personnel

from the Marine Sciences Research Center at Stony Brook and the Department of Marine Biology and Oceanography at the University of Concepcion. Co-principal investigators are Lisandro A. Chuecas, Chairman of the Department of Marine Biology and Oceanography at the University of Concepcion, and Iver W. Duedall, Associate Professor of Chemical Oceanography at the Marine Sciences Research Center.

The overall objectives is to train Chilean university personnel so they can carry out research which contributes to coastal management in Chile. Specific objectives are (1) to train faculty members in research methods which are used in coastal research, and (2) to supplement the teaching and research program at the University of Concepcion.

The project has received funding from three principal sources: ICAP, the University of Concepcion, and the Organization of American States.

Several faculty members from the University of Concepcion spent short periods of time at the Marine Sciences Research Center taking courses, attending seminars, and planning cooperative research endeavors. Faculty members from the Marine Sciences Research Center are now in Chile teaching short courses, improving the use of laboratory instrumentation, gathering data for a marine resources inventory, and planning a study of pollution processes in the Bay of Concepcion. Chilean research capabilities have been strengthened, not only in technical matters but also in the planning and management of research.

University of Delaware - University of Costa Rica

This project, entitled "Joint University of Costa Rica/University of Delaware Marine Studies Program: Manpower Training and Pollution Assessment," involves personnel from the Delaware Sea Grant College Program and several departments at the University of Costa Rica. It aims to build the necessary research and institutional base so Costa Ricans can preserve and develop their marine resources in an orderly manner. Specific objectives are (1) to work with Costa Rican trainees in carrying out a preliminary ecological assessment of marine resources in the Gulf of Nicoya, (2) to study the effects of current circulation on pollutant dispersion in the Gulf of Nicoya, (3) to provide a well-equipped modern and economical research vessel for training and research, and (4) to continue an on-going exchange of personnel between the two universities for training of graduate students and technicians.

As steps toward accomplishment of these objectives, the research vessel Skimmer was transported to Costa Rica where a ship's crew and oceanographic technicians were trained, students and faculty carried out water quality and biological surveys in the Gulf of Nicoya during both wet and dry seasons, and there was an initial remote sensing study of currents in the gulf.

Two Costa Rican students completed master's degree studies at the University of Delaware's College of Marine Studies. Training of the Costa Rican crew for R/V Skimmer progressed to the point where the vessel can be turned over to them for water quality work and light gear sampling as soon as an exchange agreement is ratified by the University of Costa Rica. Lectures and a workshop were conducted at the University of Costa Rica on the topics of remote sensing, coastal vegetation, and fisheries resources.

University of Rhode Island - Malaysian Universities

This project, entitled "Cooperative Development of University Marine Resource Capability in Malaysia," involves personnel from the University of Rhode Island, Universiti Malaya, and Universiti Pertanian Malaysia. The principal investigators are Nelson Marshall and Harlan Lampe from the University of Rhode Island.

The overall objective was to enhance the ability of the Malaysian institutions to contribute to the development and management of their country's marine resources. Specific objectives were (1) to develop academic programs in fisheries management, coastal zone management and related fields, (2) to begin appropriate courses and curricula, (3) to work out research projects for local funding, and (4) to outline the structure of a local marine extension service. In the course of the past year it was found that extension work was being adequately handled by the responsible government ministry, so this objective was eliminated. The other objectives boiled down more simply to fisheries economics, fish population dynamics, and ecological studies of factors which affect the food chain.

With respect to fisheries economics, Professor Lampe worked with the Faculty of Economics and Agribusiness at Universiti Pertanian Malaysia. Some of his work was not supported by Sea Grant, since the university asked him to stay additional time at their expense.

Professors Marshall and Saila spent several months at both Malaysian universities helping with curriculum development and research planning in the field of fish population dynamics. Three fishery research projects were starting under local funding.

With regard to coastal ecology, stream mixing diagrams were made for two estuaries, sampling and analysis was carried out jointly by Rhode Island and Malaysian investigators, and one Malaysian faculty member began to study the mangrove-dependent food chain.

Oregon State University - Chilean Universities

This project, entitled "An International Cooperative Assistance Program for Latin America, with Emphasis on Chile," involves participants from Oregon State, the Catholic University of Valparaiso, and other Chilean universities.

Objectives were (1) to assist Latin American nations in building their competence in marine resource conservation and development, (2) to continue cooperative training programs, (3) to increase the exchange of marine information and data, and (4) to help Latin Americans purchase, maintain, and use oceanographic equipment.

Some specific tasks were a seminar on the results of recent research in Latin American waters, a workshop to train technicians in marine instrumentation and data collection, supervised on-the-job experience for selected technicians, continuation of an oyster culture program in Chile, distribution of the Newsletter Exposure which describes advances in instrumentation, and initial distribution of a basic oceanography text written in Spanish. Some of these tasks were modified in the course of the past year to reflect changed perceptions of need.

A major effort was the "Inter-American Conference on Marine Science and Technology" at the Catholic University of Valparaiso. Over a hundred scientists participated. While most of the attendees were from Chile, some also came from Costa Rica, Ecuador, Norway, and the U.S. Topics included marine biology, marine chemistry, geology and geophysics, marine fisheries, instrumentation, and research vessel operation. The presentation related primarily to research done off the west coast of South America, but extending as far south as Anatarctica.

Virginia Institute of Marine Sciences (VIMS) - Israel National Oceanographic Institute (INOI)

This project, entitled "Improvement and Application of Ocean and Wave Data Acquisition and Modeling Techniques for the Facilitation of Coastal Management Decisions in Israel and in the U.S.," is led by Victor Goldsmith from VIMS and Abraham Golik from INOI.

The project aimed to strengthen the capabilities of both Israeli and U.S. scientists in the field of wave information and coastal zone planning. Specific objectives were (1) to train Israeli personnel in wave measurement and modeling techniques used at VIMS, (2) to exchange and compare wave data obtained in the same way, and (3) to improve Israeli advisory service activity in the field of wave information and coastal zone planning.

During the past year, Israeli and U.S. scientists worked at each others institutions, new information was gathered, and old data was analyzed. Since several of the Israeli investigators had previously worked in other fields this was a training experience for them. A wave guage was installed at Dado Beach south of Haifa as part of a cooperative project among INOI, the Shore Processes Laboratory at Scripps, and VIMS. The results of this work are applicable to the planning and development of a proposed coal unloading facility at Hadera, a proposed Haifa marine and recreation complex, and an extension to Haifa harbor.

Louisiana State University - Universidad Nacional Autonoma de Mexico (UNAM)

This project, entitled "An Ecological Program for the Languna de Terminos (Campeche, Mexico) with Special Reference to Fishery Resources and the Potential Impacts of Man," involved personnel from LSU's Center for Wetland Resources and UNAM's Center for Marine Sciences and Limnology. The principal investigator was Dr. John Day of LSU.

The overall objective was to improve Mexican capabilities for ecosystem analysis and coastal management. Specific objectives were (1) to identify and quantify the ecological connections between Terminos Lagoon and commercial fisheries, (2) to develop a hydrodynamic-ecological model of the lagoon, (3) to analyze ecological and economic interrelationships in the region, and (4) to prepare a coastal planning manual. Dr. Day was appointed a visiting professor at UNAM's Center for Marine Sciences and Limnology so he could act as a thesis advisor for students.

The investigators studied phytoplankton and mangrove productivity, paying special attention to the effects of river discharge. Coupled with this effort was a study of fishery dynamics. In order to better understand the drainage basin of the lagoon, a hydrodynamic model was created.

The model will be used to gain a better understanding of the lagoon circulation and to plan further research, as well as allowing for the study of pollutant dispersion, fate of spilled oil, and the movement of larvae. Finally all the information was packaged in a booklet on coastal planning.

During the past year Dr. Day advised a number of students on thesis topics such as the distribution of oyster larvae in Laguna de Terminos, microbial damage on decaying mangroves, ecological and physical parameters in Estero Pargo, the ecology of blue crabs, and community dynamics of benthos associated with Thalassia beds. Students from the Universidad Autonoma Metropolitana in Mexico City came to the marine station for classes and extended field trips.

Campeche is the site of the Ixtoc I oil spill.

University of Miami - Colombian Universities and Organizations

This project, entitled "Marine Resources and Environmental Sciences Training and Information Exchange Program for Colombia," involved personnel from the University of Miami and the Colombian Oceanographic Commission which acts as lead agency for the participating Colombian universities and other organizations. The principal investigator was Dr. Francis Williams, Professor in the Division of Biology and Living Resources at the Rosenstiel School of the University of Miami.

The overall objective was to enhance the capability of Colombian scientists and technicians to deal with the resources and environmental problems of their coastal zone. Specific objectives were (1) to provide a short series of lectures and seminars on the principles of multidisciplinary research and the application of these principles to tropical coastal areas such as Cartegena Bay and (2) to provide on-the-job experience in the design, planning, execution, and coordination of field and laboratory programs to provide the data needed for development of plans to manage coastal resources, through an integrated study of Cartegena Bay.

The initial training course was held April 17-27, 1979 at the Colombian Navy's Center for Oceanographic and Hydrographic Research in Cartegena. Thirty-five students and 10 professors from seven universities and one research group attended the seminars. Lectures were given in the language of the instructor, with translation from English to Spanish when required. COLCIENCIAS (equivalent to the U.S. National Science Foundation) supported travel and per diem for students who were not within commuting distance of Cartegena. Formal presentations and less formal discussion groups were held each day; and they covered topics as diverse as estuarine hydrodynamics, marine geology, and public health.

The broad scale integrated study of Cartegena Bay began in June 1979. Students from Colombian universities, especially the two located in Cartegena, are associated with all aspects of the work.

RECOMMENDATIONS

After two years of operation, it is reasonably clear that some steps could be taken to make ICAP a more effective instrument for accomplishing its goals. These recommendations have to do with its name, budget, geographic distribution of effort, grants management strategy, program evaluation, ISTC, and public affairs.

ICAP's Name: The name "International Cooperation Assistance Program" does not readily identify this effort with the Sea Grant College Program, and the word "Assistance" can seem patronizing to people in participating developing countries. A more appropriate name might be "International Sea Grant Program." It is recommended that the Congress be asked to make this change of name.

Budget: ICAP had a budget of approximately $900,000 in FY78 and in FY79. These budget levels were adequate to being a limited number of projects, even with the necessary international travel and subject to the effects of recent inflation. To date, no project has had to be terminated prematurely.

It must be recognized, however, that the building of indigenous marine research capacity in developing countries is a long range matter, requiring continuity of funding. Even if only a few new projects are added each year and if program managers are zealous about terminating projects, funds will have to grow rather rapidly to sustain projects to a useful conclusion.

Geographic Distribution of Effort: Ideally, one might wish to see international projects well distributed among the developing areas of the globe to serve as a symbol of our interest in strengthening marine research and development capabilities on a worldwide basis. To date, ICAP is supporting projects in Latin America and the Caribbean, the Middle East, Southern Asia, and Oceania. Tropical Africa is the only principal area of the developing world in which ICAP is not supporting any projects whatever. It is recommended that managers of the Sea Grant College Program make a sincere effort to support one or more projects in tropical Africa.

Grants Management Strategy: Cooperative international projects, especially in developing countries, generally have to run for several years in order to produce significant results. The present strategy of making one and two-year grants is based on this idea; emphasis is on continuity of effort instead of quantitative growth in the number of projects. It is recommended that program managers continue to follow this approach, and even that they award three-year grants when this becomes feasible.

Program Evaluation: ICAP has introduced an international element into what was formerly a domestic program. This is not to deny that Sea Grant researchers, educators and extension agents participated in international activities before, but this is the first time separately identified funds were made available and explicit legislation stated how the funds were to be used.

During the next few years, principal investigators on ICAP projects, local Sea Grant director, and program managers in the Office of Sea Grant should be learning together how best to carry out the program.

It is recommended that there be a thorough evaluation of ICAP at the end of its third or fourth year of operation. This evaluation should include an examination of such things as adherence to the intent of the authorizing legislation, administration of grant funds, review procedures, interagency coordination, accomplishment of the program's goals, and initial effects on participating developing countries. This formal evaluation should then be useful for further modification and development of ICAP.

ISTC: The Institute for Scientific and Technological Cooperation (ISTC) is now part of the International Development Cooperation Agency. Superficially, at least, it appears that there is some commonality between the goals of ICAP and those of ISTC. It is recommended, therefore, that program managers of ICAP maintain close contacts with the new institute and that there be an attempt to coordinate the work of the two agencies.

Public Affairs: Though there have been articles about ICAP in the MTS Journal and Sea Grant 70's as well as news releases from NOAA and from the Sea Grant institutions, it is still true that the program has had a rather low profile. This was the result of a deliberate decision in the Office of Sea Grant, a decision based on the fact that the program is so new and there was so little to tell. In addition, there was no wish to arouse unrealistic expectations in developing countries.

As shown in the preceding section of this report, Sea Grant's international program is beginning to grow up and there is now evidence of progress which deserves to be told to the taxpayers, the U.S. oceanographic community, and the scientific communities of the world.

Consequently, it is recommended that there be a modest effort in public affairs about ICAP during FY80 and FY81.

APPENDIX A

P.L. 94-461, October 8, 1976
Establishing the
International Cooperation Assistance Program

SEC. 3. INTERNATIONAL COOPERATION ASSISTANCE. 33 USC 1124a.

(a) IN GENERAL.—The Secretary of Commerce (hereafter in this section referred to as the "Secretary") may enter into contracts and make grants under this section to—

(1) enhance the research and development capability of developing foreign nations with respect to ocean and coastal resources, as such term is defined in section 203 of the National Sea Grant Program Act; and

(2) promote the international exchange of information and data with respect to the assessment, development, utilization, and conservation of such resources.

(b) ELIGIBILITY AND PROCEDURE.—Any sea grant college and sea grant regional consortium (as defined in section 203 of the National Sea Grant Program Act) and any institution of higher education, laboratory, or institute (if such institution, laboratory, or institute is located within any State (as defined in such section 203)) may apply for and receive financial assistance under this section. Each grant or contract under this section shall be made pursuant to such requirements as the Secretary shall, after consultation with the Secretary of State, by regulation prescribe. Application shall be made in such form, and with such content and other submissions, as may be so required. Before approving any application for a grant or contract under this section, the Secretary shall consult with the Secretary of State. Any grant made, or contract entered into, under this section shall be subject to the limitations and provisions set forth in section 205(d) (2) and (4) of the National Sea Grant Program Act and to such other terms, conditions, and requirements as the Secretary deems necessary or appropriate.

Regulation.

Consultation.

(c) AUTHORIZATION FOR APPROPRIATIONS.—There is authorized to be appropriated for purposes of carrying out this section not to exceed $3,000,000 for the fiscal year ending September 30, 1977. Such sums as may be appropriated under this section shall remain available until expended.

APPENDIX B

Guidelines for the International Cooperation Assistance Program
Federal Register for April 11, 1978, page 15309

Subpart D—International Cooperation Assistance

§ 917.30 General.

(a) 33 U.S.C. 1124a sets up a program of International Cooperation Assistance in marine reseach, marine education and training, and marine advisory services designed to enhance the research and technical capability of developing foreign nations with respect to ocean and coastal resources and to promote the international exchange of information and data with respect to the assessment, development, utilization, and conservation of such resources. Any Sea Grant College or Sea Grant Regional Consortium or any institution of higher education, laboratory, or institute (if such institution, laboratory or institute is located within any state) may apply for and receive International Cooperation Assistance funding.

(b) International Cooperation Assistance funding proposals will be expected to address: (1) the nature and focus of the proposed porject, (2) the utilization of institutional and other appropriate resources in the implementation of the project, (3) a clear indication of the foreign participant's (individual or institution) commitment to the project, (4) identification of accomplishments expected from a single granting interval, (5) implicit or explicit out-year commitment of resources, and (6) the impact of the proposed project on the institution receiving funding.

(c) The projects supported by International Cooperation Assistance funding are intended to be genuinely cooperative. Innovation and uniqueness will be significant factors in the determination of proposals to be funded. In the case of a proposed international project that is submitted from an institution where a Sea Grant program is in existence, the extent to which the proposed project takes advantage of the Sea Grant institutional capability existing at that institution and thereby strengthening it, as opposed to being a mere appendage to the ongoing Sea Grant program, will also be an important evaluation factor. The U.S. Department of State will be given the opportunity to review all International Cooperation Assistance projects and none will be funded without this consultation. Because the United Nations Educational, Scientific, and Cultural Organization (UNESCO) also funds international projects of the kind that can be funded under the Sea Grant International Cooperation Assistance program, and, to effect coordination in this area between Sea Grant and UNESCO, the Division of Marine Sciences (UNESCO) will be informed of all International Cooperation Assistance projects funded.

APPENDIX C

Summaries of projects supported with FY79 funds under the International Cooperation Assistance Program.

(The author of this report wrote the project summaries that follow. He alone is responsible for any difference between these summaries and the proposals submitted by the investigators.)

TITLE OF PROJECT:	University of the South Pacific/University of Hawaii Sea Grant International Cooperative Program
GRANTEE INSTITUTION:	University of Hawaii
DEVELOPING COUNTRY:	Pacific Islands (Solomons, Fiji, Tuvalu, Kiribati, New Hebrides, Cook, Nauru, Niue, Tokelau, Tonga, and Western Samoa)
DEVELOPING COUNTRY INSTITUTION:	University of the South Pacific
SIZE AND DURATION OF GRANT:	$92,800 for one year
PRINCIPAL INVESTIGATORS:	Philip Helfrich and Jack Davidson, University of Hawaii
DEVELOPING COUNTRY LIAISON:	Dr. U. Raj, Director, Institute of Marine Resources, Hawaii
OVERALL OBJECTIVES:	To assist the University of South Pacific's Institute of Marine Resources (USP-IMR) develop an advisory network. Exchange talent, information, and ideas between the University of Hawaii and USP using faculty exchanges, the PEACESAT, and other means.
SPECIFIC OBJECTIVES:	(1) To conduct a joint faculty exchange program between USP and UH designed to achieve improved tropical marine science course offerings and overall professional improvement; (2) To establish a functional marine extension service with offices at USP-IMR and one other USP center-- (a) to train two local people to serve as marine advisory agents, (b) to conduct a pilot technology transfer project using a multidisciplinary team of UH and USP personnel after the extension agents have identified a high priority solvable problem, (c) to develop specialized expertise within the USP-IMR marine extension agents through the technology transfer project and through exposure to the UH Marine Advisory Program which will retrieve and disseminate information to the agents. (3) To evaluate the program and develop a follow-up plan to complete the advisory network and professional improvement programs.

TITLE OF PROJECT:	An International Cooperative Assistance Program for Latin American Countries (with emphasis in Chile and Mexico)
GRANTEE INSTITUTION:	Oregon State University
DEVELOPING COUNTRIES:	Chile and Mexico
DEVELOPING COUNTRY INSTITUTIONS:	Universidad Catolica de Valparaiso, Chile and Centro de Investigaciones Biologicas La Paz, Mexico
SIZE AND DURATION OF GRANT:	$190,000 for two years
PRINCIPAL INVESTIGATORS:	Victor Neal and William Q. Wick
DEVELOPING COUNTRY LIAISON:	Faculty members at the Chilean and Mexican Institutions
OVERALL OBJECTIVES:	To assist Latin American nations develop competence in marine resources conservation and development; to continue the development of cooperative marine programs between Oregon State University and Latin American institutions; and to advise Latin Americans on how to purchase, maintain, and use oceanographic equipment.
SPECIFIC OBJECTIVES:	(1) To determine suitable opportunities for marine advisory service activities in Latin America; (2) To transfer knowledge of coastal processes and the techniques of study to Chilean scientists by means of an academic course, a sampling program, and technician training; (3) To apply remote sensing capabilities of NIMBUS-7 satellite to study the physical, chemical, and biological nature of the waters off Chile; (4) To conduct two workshops on modeling approaches and fisheries technology with Latin American personnel; (5) To train Mexican students and scientists in marine mammal research and management; (6) To continue support for distribution of the newsletter "Exposure".
ADDITIONAL:	This is a continuation of a project begun under ICAP auspices in FY78.

TITLE OF PROJECT:	Informational and Educational Assistance to Marine Science Institutions in Mexico
GRANTEE INSTITUTION:	University of California
DEVELOPING COUNTRY:	Mexico
DEVELOPING COUNTRY INSTITUTIONS:	Instituto Nacional de Pesca; Escuela Superior de Ciencias Marinas, Ensenada; Universidad Autonoma de Baja California; Centro de Investigaciones y de Educacion Superior de Ensenada; Centro de Investigaciones Biologicas, La Paz; and Universidad Autonoma de Baja California Sur, La Paz.
SIZE AND DURATION:	$240,000 for two years
PRINCIPAL INVESTIGATOR:	Richard A. Schwartzlose
DEVELOPING COUNTRY LIAISON:	Faculty in the Mexican institutions
OVERALL OBJECTIVE:	Cooperation between Mexican and University of California institutions to improve Mexican research and education in the marine sciences.
SPECIFIC OBJECTIVES:	(1) To train a self-supporting, self-perpetuating cadre of marine research technicians for the Mexican marine science community; (2) To acquire reprints, volumes, and hard copies of documents and journals for the Mexican institutions; (3) To provide requested short-term courses to faculty and staff members of the Mexican institutions to upgrade and expand their teaching capacity; (4) To provide upon request access to short-term, intensive training through attendance at summer courses by faculty members of the Mexican institutions.

TITLE OF PROJECT:	A Short Course on Small Harbor Engineering in India
GRANTEE INSTITUTION:	University of Florida
DEVELOPING COUNTRY:	India
DEVELOPING COUNTRY INSTITUTION:	Indian Institute of Technology
SIZE AND DURATION OF GRANT:	$18,000 for one year
PRINCIPAL INVESTIGATOR:	A. J. Mehta, University of Florida
DEVELOPING COUNTRY LIAISON:	S. Narashimhan, Indian Institute of Technology
OVERALL OBJECTIVE:	To enhance the capability of Indian engineers to develop small and intermediate-sized fishing harbors.
SPECIFIC OBJECTIVES:	(1) To provide a summary of the latest technology available in coastal/harbor engineering design practice; (2) To provide a forum for exchange of scientific know-how among Indian and non-Indian experts in the field; (3) To initiate such a forum for the first time, thus giving impetus to future forums of a similar nature.

TITLE OF PROJECT:	An Ecological Program for the Laguna de Terminos (Campeche, Mexico) with Special Reference to Fishery Resources and the Potential Impacts of Man
GRANTEE INSTITUTION:	Louisiana State University
DEVELOPING COUNTRY:	Mexico
DEVELOPING COUNTRY INSTITUTION:	Universidad National Autonoma de Mexico (UNAM)
SIZE AND DURATION OF GRANT:	$46,800 for one year
PRINCIPAL INVESTIGATOR:	John W. Day, Jr., Center for Wetland Resources, Louisiana State University
DEVELOPING COUNTRY LIAISON:	Dr. Alfredo Laguarda, Director of the Center for Marine Sciences and Limnology, UNAM
OVERALL OBJECTIVE:	Improve Mexican capabilities for ecosystem analysis and coastal management.
SPECIFIC OBJECTIVES:	(1) To continue a cooperative study with Mexican scientists of management topics associated with the shrimp fishery of Laguana de Terminos; (2) To transfer the programs and data of the hydrodynamic model developed during this past year's work to Mexican counterparts, implement it on their computer, and train individuals in its use; (3) To continue to train students in field studies necessary to complete an ecosystem analysis.
ADDITIONAL:	This is a continuation of a project begun under ICAP auspices in FY78.

TITLE OF PROJECT:	Strengthening Environmental Microbiology and Pollution Monitoring Capabilities at the High Institute of Public Health, Alexandria, Egypt
GRANTEE INSTITUTION:	Maryland Sea Grant Program
DEVELOPING COUNTRY:	Egypt
DEVELOPING COUNTRY INSTITUTION:	High Institute of Public Health Alexandria, Egypt
SIZE AND DURATION OF GRANT:	$134,000 for two years
PRINCIPAL INVESTIGATORS:	Kazuyoshi Kawata, Acting Director, Division of Environmental Health Engineering, and Vincent P. Olivieri, Assistant Professor of Environmental Health Engineering, The Johns Hopkins University
DEVELOPING COUNTRY LIAISON:	Abdel Hadi El Molla, Professor and Head, Department of Microbiology, High Institute of Public Health, Alexandria, Egypt
OVERALL OBJECTIVES:	To enhance the capabilities of the Egyptian microbiologist in environmental microbiology in marine environments.
SPECIFIC OBJECTIVES:	(1) To hold workshops on recent environmental microbiological techniques; (2) To train microbiology students in the tracer virus techniques in field research and monitoring; (3) To hold a seminar each year on environmental microbiological studies in tropical waters.
ADDITIONAL:	Links between High Institute of Public Health and The Johns Hopkins University have been frequent in past years. Many members of the High Institute faculty have been students at The Johns Hopkins University, and exchange visits have been constant.

TITLE OF PROJECT:	Cooperative Development of Marine Resources Capability in Malaysia
GRANTEE INSTITUTION:	University of Rhode Island
DEVELOPING COUNTRY:	Malaysia
DEVELOPING COUNTRY INSTITUTIONS:	Universiti Malaya, Universiti Pertanian Malaysia, and Universiti Sains Malaysia
SIZE AND DURATION OF GRANT:	$185,000 for two years
PRINCIPAL INVESTIGATORS:	Harlan C. Lampe and Nelson Marshall
DEVELOPING COUNTRY LIAISON:	Faculty at the Malaysian Universities
OVERALL OBJECTIVE:	To cooperate with peers at the three Malaysian universities in strengthening their capabilities in marine resources activities and augmenting URI capabilities in addressing the marine resource problems of the area.
SPECIFIC OBJECTIVES:	(1) To retrain at least two professionally qualified Malaysian economists in fisheries economics methods; (2) To improve the teaching of fisheries economics in the Malaysian universities; (3) To assess current economic conditions in the fisheries sector of the east coast of Penisular Malaysia; (4) To strengthen university staff capability to handle responsibilities for instruction and research in fish population dynamics and introduce the kind of research basic to population management; (5) To work with Malaysian faculty members to develop research projects that will permit the role of mangroves to be determined and factored into the making of coastal management decisions.
ADDITIONAL:	This is a continuation of work begun in fishery management, coastal zone management and related fields last year under an ICAP grant.

SEA GRANT

ENERGY-RELATED RESEARCH

SUMMARY

BY

A. G. Alexiou

INTRODUCTION

The total Sea Grant funding for energy-related research amounts to $410.5K with $168.5K match. The cut-off point separating what is (and what is not) included in this category is somewhat arbitrary. It could be argued that engineering projects related to offshore structures should be included here, but they are not. Environmentally-oriented projects directly linked to energy exploration, production, transportation, or storage, are; while aquaculture projects, for example, are not. A description of the included categories is provided herein.

ENERGY-RELATED RESEARCH IN SEA GRANT

Within Sea Grant there are a number of activities that fall under the energy-related research category. For convenience in interrelating projects included here with other disciplines (reported on elsewhere) each is classified within one of the following categories.

I. Power Conversion (includes research or methods and devices for converting energy as well as research related to better understanding of factors affecting performance of converters.)

II. Environment Related (includes impacts from pollutants that result from transporting, storing, or handling fuels or fuel wastes).

III. Power Plant Related (includes research addressing impacts of power plant operation on the environment, and the environment on power plant operation).

IV. Exploration and Production Related (includes techniques for and impacts of energy source exploration and production other than social, political, economic, or legal).

V. Social Science (includes all social science research related to all the above).

Some 15 projects are currently active. This compares with 17 reported on last year. The current projects are:

I. Power Conversion

1. CONSTRUCTION AND DEPLOYMENT OF PROTOTYPE 1500 GALLON PER DAY SEA WAVE POWERED DESALINATION BUOY
P.I.: C. M. Pleas University of Delaware
$60,194/$25,160

2. A CONDENSING CENTRIFUGAL COMPRESSOR FOR THE DISTILLATION OF SEAWATER
P.I.: M. Manalis/P.Lee University of California
$19,416/$9,301

II. Environment Related

3. EFFECTS OF OIL ON THE GROWTH AND ENERGY UTILIZATION OF JUVENILE PINK SALMON
P.I.: D. G. Shaw University of Alaska
$23,384/$11,254

4. EFFECT OF SEDIMENT PH AND OXIDATION-REDUCTION POTENTIAL ON MICROBIAL DEGRADATION OF CRUDE OIL
P.I.: W. H. Patrick/R. D. Delaune Louisiana State University
$41,848/$9,046

5. THE ROLE OF MARINE BACTERIA IN DISSOLVED PETROLEUM PERSISTENCE IN NORTHERN PORTS
P.I.: D. K. Button University of Alaska
$27,822/$12,799

6. CO-OXIDATION OF PETROLEUM HYDROCARBONS BY ESTUARINE MICROORGANISMS
P.I.: Joseph J. Cooney University of Maryland
$11,000/$15,900

7. PETROLEUM HYDROCARBONS IN THE SEDIMENTS AND BENTHOS OF LAKES MICHIGAN (INDIANA HARBOR) AND SUPERIOR (DULUTH HARBOR)
P.I.: Anders W. Andren University of Wisconsin
$33,264/$9,325

8. AN EVALUATION OF THE POSSIBLE DETRIMENTAL EFFECTS OF COAL STORAGE AREAS ON COMMERCIAL AND SPORT FISHING IN LAKE SUPERIOR
P.I.: Robert M. Carlson University of Minnesota
$25,982/$14,008

III. Power Plant Related

9. TEMPERATURE TOLERANCES OF BENTHIC MARINE INVERTEBRATES AND THEIR RELATIONSHIP TO REGULATORY REQUIREMENTS FOR THERMAL EFFLUENT
P.I.: R. F. Ford/J. C. Van Olst University of California
$39,855/$49,056

10. EFFECTS OF SURFACE CONDITIONS AND HEAT TREATMENT ON THE CORROSION CHARACTERISTICS OF TITANIUM ALLOYS AND COATINGS IN SEA WATER
P.I.: A. Raman Louisiana State University
$32,867/$12,691

IV. 11. GEOTHERMAL STUDIES OF PASSIVE CONTINENTAL MARGINS
P.I.: R. Von Hersen Woods Hole Oceanographic Institution
$15,000/$4,948

12. ANALYSIS OF ACOUSTICAL INFORMATION IN OFFSHORE GEOTECHNICAL EXPLORATION
P.I.: Gregory B. Baecher Massachusetts Institute of Technology
$*

13. SIDE-SCAN SONAR MAPPING AND COMPUTER-AIDED INTERPRETATION OF THE GEOLOGY OF THE SANTA BARBARA CHANNEL
P.I.: B. Luyendyk/D. Simonett University of California
$21,521/$31,161

V. Social Science

14. OIL SPILL CLEAN-UP AND LIABILITY MODELS
P.I.: J. D. Nyhart/Harilaos N. Psaraftis Massachusetts Institute of Technology
$45,000/$39,997

15. SOCIAL IMPACT OF OFFSHORE OIL AND GAS DEVELOPMENTS IN TWO SOUTH-EASTERN NEW ENGLAND COMMUNITIES
P.I.: Jane Hurwitz Woods Hole Oceanographic Institution
$13,300/$14,500

FEDERAL SUPPORT FOR OCEAN ENERGY

The main player in ocean energy is the Ocean Systems Branch, Division of Central Solar Technology, in the Department of Energy. It has budgeted $44.0 million in FY80, $36.0 million in FY81, and $107.8 million in 1982. The latter figure includes a $62.0 million increment for an Ocean Thermal Energy Conversion (OTEC) pilot plant. It does not include some $3.5 million in FY80 (about 4.5 in FY81) going into production of biomass in the marine part of DOE's Fuels from Biomass Program.

*P.I. currently on sabbatical.

Currently, about 95% of the Ocean Systems budget goes into OTEC, while 5% goes toward alternative energy sources such as salinity gradients, waves, and currents. Sea Grant invests less than 2% of its grant funds on energy.

TRENDS

As a result of preliminary reports from the British wave-energy program and the findings of an MIT study completed last year, wave energy devices, particularly surface followers, are now considered to have low economic potential for large-scale energy extraction. The only Sea Grant ocean-energy device currently active exploits wave power in a pressure-activated, osmotic-membrane system to produce fresh water from sea water. A 1500 gal/day prototype system has been undergoing a series of field tests in Delaware Bay and off the coast of North Carolina. Tests of a modified system are scheduled to begin in the spring of 1980 off Puerto Rico.

Another SG project for producing fresh water from the sea is aimed at significantly decreasing fuel consumption (per gallon of water produced) using an improved distillation process.

Other Sea Grant investigations on ocean energy devices, involving salinity gradients, wave pressure, and tethered-buoy motions ended last year.

DOE will continue to fund some wave-energy and salinity-gradient-energy research into the foreseeable future. The former will eschew surface followers and emphasize devices which focus waves, while the latter will assess the potential of osomotic and dialytic power.

Sea Grant will naturally continue to be a player, albeit a minor one, in the ocean energy game. We should remain alert to opportunities for contributions that are appropriate for and provide balance to programs at SG institutions especially when there is teaching-capacity enhancement in novel ocean-energy options. Other opportunities would include investigations such as in fouling, corrosion, environmental impacts, etc., that have direct relationship to energy and other marine resource applications as well. Industry partners should be insisted on for any research where industry is the most likely benefitter.

Though the DOE is evolving its own information advisory service, an important Sea Grant role should continue here, and , in areas where events and circumstances dictate, enlarged programs may be justified. For example, a major oil discovery on Georges Bank could be expected to trigger a host of energy-related proposals in the New England programs and put heavy demands on accurate, unbiased, information-dissemination services. Energy conservation methods should continue to be promoted (such as the fuel consumption vs. ship-speed charts distributed in the past).

SEA GRANT UNDERSEAS RESEARCH FY 79

Naida M. Yolen

Introduction

Undersea research funded by the Office of Sea Grant (OSG) in FY 79 totaled $1,052,451 ($686,637 SG/$341,364 match). Twenty-one projects, 2 of which utilized pass-through funds, in 8 Sea Grant institutions dealt with submersibles, remote sensors and vehicles, human diver physiology and technology, resource research, and education (Appendix I). Approximately 38 projects at 13 SG institutions used SCUBA and/or submersibles as a tool to carry out their research. A total of $1,405,236 was invested in these investigations (Appendix II).

The formal SG classifications covered in this paper -- Ocean Engineering, Resource Recovery and Utilization, Marine Recreation, Living Resources, Education and Training -- may overlap with the program descriptions and budgets that other members of OSG are discussing.

Highlights of the OSG undersea program are presented below in light of the major areas of study: Diver Physiology/Safety, Resource Research, Undersea Technology, and Education.

Discussion

Diver Physiology/Safety

An estimated 100,000 women are reported to be currently involved in SCUBA activities, including scientific, sport, and instructional diving. The physiological risks faced by both pregnant and non-pregnant female divers are a major topic of interest in NOAA, the Navy, the commercial diving industry, academia, and others.

Fife (Texas A&M) has demonstrated that there is an increased susceptibility of the fetus to decompression sickness and is now in the process of determining the effects of oral contraceptives on the nitrogen-saturated female diver. Willson and Nemiroff (U. Mich.) are extending this work by attempting to determine the physiologic processes involved in nitrogen retention under hyperbaric conditions.

Yount and Lin (U. Hawaii) are providing critical information on the physics of exogenous gas bubble formation and elimination and Rankin and Lanphier (U. Wisc.) are investigating the physiological and medical aspects of deep-sea diving and underwater work.

These researchers, who have provided a strong core group for Sea Grant, have now been joined by Pozos (U.Minn) who is working on the physiological aspects of immersion hypothermia, and is coordinating his project with Nemiroff's (U.Mich) research on coldwater and near-drowning.

Resource Research

Grimes and Able (Rutgers) engaged in a cooperative effort with National Marine Fisheries Service (NMFS) and the Office of Manned Undersea Science and Technology (MUS&T) to investigate the ecological role of tilefish and the longline gear used to catch them. A submersible was utilized in this project and proved to be a unique and effective method of investigating the fishery problem. The four hydroacoustic resource assessment projects (U.Wash) will hopefully prove to be as meritorious for assessing fish stocks, as hydroacoustic techniques have been shown to be superior to traditional assessment techniques and thus offer a potential for considerable improvement in accuracy, timeliness, and efficiency.

Undersea Technology

A combined effort between OSG (U.Minn) and MUS&T will result in the development, testing, and evaluation of a high-resolution electronic/acoustic triangulation system that could greatly increase the efficiency of archaeological mapping and small scale surveys in other fields. Other technology projects include several at MIT that are studying communication systems for untethered vehicles and sensors and the application of teleoperators to underseas tasks. Katzer and Lord (U.Wash) are developing miniaturized underseas radiation detectors for manned submersibles operations and a diver engineering study by Seirig (U. Wisc) is concerned with improving life support equipment for underwater breathing in shallow and deep water.

Education

The education component consists of the development of a new course in underwater technology (U.Hawaii), an underwater education workshop (U.Mich), and the support of a recompression chamber for the teaching and practice of saturation diving methods (U.Wash/Highline College).

In keeping with education, several SG institutions have published pamphlets on diving. For example, Michigan has prepared three: 1) "Diving and Fitness," 2) "The Diver's Ear," and 3) "Drugs and the Diver," and the University of Florida's Marine Advisory Service has produced a publication called "Diving and Smoking."

In the different categories of study, the number of projects as well as the ratio of projects to SG institutions has remained relatively constant and may indicate a trend in the type of research the individual SG programs are most responsive to (possibly because of the available talent and/or operations equipment on campus).

The strength of OSG undersea research lies in the Physiology/ Safety investigations. The P.I.s are top ranking in their fields and are doing timely, relevant, and highly visible work. However, some of the Undersea Technology projects appear to be vehicles for graduate student research, though not a bad end in itself; future underseas engineering endeavors should be more heavily evaluated as to whether any useful research and development will result from such minimal funding. In addition, the Education projects will need to be evaluated on their effectiveness, outreach, and information transfer to other users.

As noted in Tables I, II, and III, there has been a decrease in the number of projects since FY 78 and the level of funding has increased approximately 4.5%. With the recent emphasis on implementing an organized NOAA Underseas Research and Development Program, there will be a need to increase OSG effort; however, financial support may be forthcoming from sources other than Sea Grant, and the OSG effort may partially consist of interesting the quality talent at the SG institutions to participate.

Cooperating with the MUS&T office has resulted in three projects in FY 79. One was a joint effort between Rutgers-SG/MUS&T and NMFS (see Appendix III); another was an engineering project designed to facilitate underwater surveys; and the third was a physics study dealing with miniaturized radiation detectors for submersible operations.

The Marine Advisory Service can be of valuable assistance to the academic as well as public community in terms of relaying the latest information on diving. For instance, Nitrox-1, a new breathing gas developed by Dr. Morgan Wells of the NOAA Diving Office, can extend bottom time and cut down on decompression. This gas mixture, now available commercially, will enable the academic diver to increase his underwater research time as well as cut costs. Wells has also developed polluted water diving procedures, partially as a result of Rita Colwell's work, which are pertinent to safe diving. In addition

OSHA is trying to enforce regulations on educational and scientific diving that would impact on SG programs that utilize SCUBA as a research tool. Failure to comply with OSHA rules can result in legal difficulties and fines, but it is estimated that almost one-third of the universities that have diving operations are not aware of these regulations.

UNDERSEAS RESEARCH PROJECTS

TABLE I

	FY 78	FY 79	Percent of Increase
Total Funding	$1,007,447	$1,052,451	4.5%
Federal Funding	666,083	686,637	3.1%
Match Funding	341,364	365,814	7.0%

TABLE II

	Undersea Research Projects		Projects Using Diving Submersibles		TOTAL
Federal Funding	$686,637	+	$1,405,236	=	$2,091,873
Number of Projects	21	+	38	=	59
Number of Institutions	8		13	=	16 (different institutions)

Number of New Projects	8	38% of Total
Federal Funding of New Projects	$158,208	23% of Total

TABLE III
a. FY 79

Categories	Number of Projects	Number of Institutions	Total Funding SG/Match	Percent of Budget	Average Project Funding
Physiology/Safety	7	5	313,316/204,948	45.6%	$44,759
Resource Research	5	2	124,700/56,700	18.2%	$24,940
Undersea Technology	6*	4	210,665/64,916	30.7%	$36,523
Education	3	3	37,956/39,250	5.5%	$12,652

TABLE III
b. FY 78

Categories	Number of Projects	Number of Institutions	Total Funding SG/Match	Percent of Budget	Average Project Funding
Physiology/Safety	9	8	272,400/151,537	40.8%	$30,281
Resource Research	9	7	148,067/68,482	22.2%	$16,451
Undersea Technology	6	3	193,875/85,028	29.1%	$32,313
Education	3	3	51,741/36,317	7.9%	$17,247

* 2 pass-through projects: OSG $7,600/MUS&T $7,600
OSG $7,536/MUS&T $10,000

SG UNDERSEAS RESEARCH FY 79

PHYSIOLOGY/SAFETY

The Effect of Hyperbaric Exposure on Menstruation, Fertilization, and Pregnancy (19) Michigan State University/University of Michigan
Willson, Nemiroff (24,508/58,327)

Coldwater Drowning and Near-Drowning in the Great Lakes and Inland Waters of Michigan (19) University of Michigan
Nemiroff (29,036/15,424)

The Effects of Diving on the Pregnant and Non-Pregnant Female/Saturation Air Diving (32) Texas A&M University
Fife (50,000/17,378)

Inert Gas Elimination and Threshold for Decompression-Induced Venous Gas Emboli (32) University of Hawaii
Lin (69,495/28,127)

Exogenous Gas Bubble Disease: Physical Factors in the Etiology, Detection, and Prevention (32) University of Hawaii
Yount (45,439/31,539)

Physiology of Diving
(32) University of Wisconsin
Rankin (65,805/24,497)

Immersion Hypothermia
(34) University of Minnesota
Pozos (29,033/29,656)

RESOURCE RESEARCH

Evaluation of Acoustic Techniques of Resource Assessment
(06) University of Washington
Thorne (26,200/16,400)

Hydroacoustic Resource Assessment Techniques
(06) University of Washington
Thorne (30,100/22,000)

Acoustic Estimation of Salmon in Terminal Areas
(30) University of Washington
Mathisen (22,500/12,500)

RESOURCE RESEARCH (cont)

In Situ Measurement of the Acoustic Target Strength of Fish
(30) University of Washington
Ehrenberg (20,900/5,800)

Submersible Utilization for Tilefish Study (pass-through funding MUS&T)
Grimes, Able (25,000/0) Rutgers

UNDERSEA TECHNOLOGY

Development, Testing, and Evaluation of High Resolution Electronic/Acoustic Triangulation System for Underwater Survey Application
(22) University of Minnesota
Gifford (7,600/7,600/3,800) (SG/MUS&T/Match)

Underwater Communications Systems for Untethered Vehicles and Sensors
(28) Massachusetts Institute of Technology
Baggeroer (82,200/12,521)

Application of Teleoperators to Undersea Tasks
(28) Massachusetts Institute of Technology
Sheridan (42,000/18,645)

Development of Joining and Cutting Techniques for Deep Sea Applications
(28) Massachusetts Institute of Technology
Masubuchi (21,400/10,519)

Development of Underwater Devices
(31) University of Wisconsin
Seireg (32,029/19,431)

Development of Miniaturized Underseas Operations Detector Instruments for Manned Submersible Operations at 460 Meters Underseas
(34) University of Washington
Kotzer (17,536/0)

EDUCATION

Development of a New Course in Underwater Technology
(61) University of Hawaii
Noda (17,956/13,133)

Saturation Diving Program
(67) University of Washington
Talbot (20,000/18,300)

Underwater Education Workshop Program
(70) University of Michigan
Somers (0/7,817)

SG RESEARCH PROJECTS USING
DIVING/SUBMERSIBLES FY 79

CALIFORNIA

UNIVERSITY OF CALIFORNIA

An Experimental Program to Development Methods for Kelp Bed Expansion and Enhancement
Neushul, Coon (26,024/9,491)

A Study of the Entrance Problems at Humboldt Bay
Isaacs, Kerstetter (45,044/46,396)

Aquaculture of Red Algae
Hansen (36,505/4,500)

Development of Multispecies Management for Kelp Bed Resources with an Emphasis on Sea Urchins
Tegner (41,493/11,172)

Experimental Abalone Enhancement Program
Tegner, Connell (71,709/146,554)

Sensory and Behavioral Effects of Pollutants on the Crab and Lobster Fishery
Case (21,054/5,566)

Marine Natural Products for Pharmacological Evaluation
Faulkner (30,575/13,535)

New Agricultural Chemicals from Marine Organisms
Fenical (29,873/17,170)

Marine Plants as a Source of Insect Growth Inhibitors
Crews (18,757/5,217)

Thermophilic Marine Micro-organisms from Undersea Hot Springs and Seawater Cooled Heat Exchangers
Isaacs, Nealson (13,018/12,081)

Temperature Tolerances of Benthic Marine Invertebrates and Their Relationship to Regulatory Requirements for Thermal Effluent
Ford, Van Olst (33,271/32,565)

Cardiopulmonary Resuscitation in the Water
West (8,600/0) (rapid response)

CALIFORNIA (cont)

UNIVERSITY OF SOUTHERN CALIFORNIA

Ecology of a Small Tidal Lagoon Under the Influence of Urban Recreational Use
Kremer, Kremer (14,150/11,443)

Southern California's Nearshore Marine Environment: A Significant Fish Nursery
Brewer, Lavenberg (28,305/84,187)

UNIVERSITY OF DELAWARE

Construction and Deployment of a Prototype 1500-Gallon-Per-Day Sea-Wave-Powered Desalination Buoy
Pleass (60,194/25,160)

UNIVERSITY OF FLORIDA

Spiny Lobster Larval Recruitment in the Florida Keys
Menzies, Kerrigan (69,300/33,900)

Culture and Transplant Studies of the Seagrass Ruppie maritima
Winter (34,500/18,800)

Fatigue of Welded Structural Steel in Sea Water
Hartt, Wolf (33,600/17,100)

Glossaries of Tidal Inlets in Florida
Mehta (14,300/7,100)

UNIVERSITY OF HAWAII

Reef and Shelf Benthic Ecology of the Hawaiian Archipelago
Grigg (29,895/100,222)

Trophic Analysis of Shallow-Water Fish Communities in the Northwestern Hawaiian Islands: Effects of Natural and Human Predation
Parrish, Taylor (44,598/16,445)

Survey and Assessment of the Green Sea Turtle Resource of the Northwestern Hawaiian Islands
Balazs (26,785/8,317)

HAWAII (cont)

Population Biology of Spiny Lobsters Throughout the Hawaiian Archipelago
MacDonald, Stimson (36,466/16,802)

Development of A Biological Basis for Managing the Handline Fishery for Snapper and Grouper Populations in the Hawaiian Archipelago
Helfrich (30,590/8,527)

A Slanted Look at Ocean Wave Forces on Pipes
Grace (12,577/2,178)

UNIVERSITY OF MAINE, ORONO/UNIVERSITY OF NEW HAMPSHIRE

Dietary Intake and Nutritional Parameters in the Lobster, Homarus americanus
Bayer (34,674/16,118)

The Application of Genetic Studies to Seaweed Cultivation: Seed Stock Selection and Improvement in Chondrus crispus
Cheney, Mathieson (45,831/14,714)

The Effect of Carrageenan on the Growth and Metabolism of Normal and Transformed Fibroblasts, In Vitro
Mathieson, Wight (41,091/9,872)

Modeling of Fe, Mn, Cu, and Mo Sedimentary Flux in the Great Bay Estuary, NH
Gaudette (29,383/13,447)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)

Ecodynamic Analysis of Algal Blooms Fouling Nahant Bay Beaches
Quinlan (80,000/186,411)

UNIVERSITY OF OKLAHOMA

Cardiovascular, Ant-Cancer, and Central Nervous System Drugs from Marine Organisms
Ciereszko (136,000/68,000)

OREGON STATE UNIVERSITY

Submerged Offshore Artificial Reef Study
Sollitt (27,900/49,900)

UNIVERSITY OF RHODE ISLAND

Submerged Macrophytes in R.I. Coastal Lagoons and Salt Ponds
Harlin/Thorne-Miller (37,493/9,702)

UNIVERSITY OF WASHINGTON

Aquaculture of Seaweeds on Artificial Substrates
Mumford (25,000/64,200)

UNIVERSITY OF WISCONSIN

Factors Influencing the Reestablishment of Self-Sustaining Stocks of Lake Trout in Lake Michigan with Special Reference to Green Bay
Magnuson, Horrall (27,681/16,537)

WOODS HOLE OCEANOGRAPHIC INSTITUTION

The Hydrography and Circulation Over and Around Nantucker Shoals
Beardsley (42,000/0)

Movable Bed Roughness in the Coastal Zone: A Field Study and Model Design
Grant, Williams (42,000/17,848)

Sediment Transport in a Tidal Inlet
Aubrey (25,000/9,531)

SEA GRANT ENVIRONMENTAL STUDIES

DR. WILLIAM F. GRAHAM

I. INTRODUCTION

One of the major goals of the Sea Grant Program is to bring the skills and talents of the nation's universities to bear on the problems involved in utilizing and conserving our marine resources in a wise manner. In the marine environmental portion of the Sea Grant Program, the research objectives are to:

1) Understand marine ecosystems and how they control the abundance of marine life available for man's exploitation.

2) Understand the impact that man and his waste products are having on marine ecosystems so that the resource managers may take appropriate steps to protect and revitalize the marine resources situated within these ecosystems.

3) To provide predictive tools such as models to scientists and managers as an aid to their understanding and management of ecosystems.

II. SCOPE OF THE PROGRAM

The Sea Grant research program in Marine Environmental Research for Fiscal Year 1979 consists of 164 projects supported by $7,249,100 in research funds. Of this amount, $4,653,600 (65%) came as federal funds from the National Office of the Sea Grant Program while the remaining $2,595,500 (35%) were supplied from state, university, and local sources. The environmental research program can broadly be broken down into four parts. These are:

1) Ecological Research (70 projects)
2) Pollution Related Research (73 projects)
3) Modeling Research (14 projects)
4) Applied Oceanography (7 projects)

Excluded from this program summary are projects which focus on the biology of commercial fisheries species, projects in aquaculture, and almost all ocean engineering projects. These areas are covered by separate reports in this series.

All twenty-six of the Sea Grant College, Institutional, and coherent area programs were involved in environmental research in FY-79. As would be expected within a program whose primary goal is

to be responsive to needs as seen at the local level, there is a high diversity in the projects funded in the marine environmental research category. Projects range from studies of the ecology of coastal wetlands and man's impact on these valuable lands to the effects of PCB's on the food chains in the Great Lakes. Mathematical modeling of pollutant transport, the uptake and fate of potentially carcinogenic hydrocarbons in fish, and the impact of the feeding habits of harbor seals on salmon aquaculture are some of the projects initiated by local Sea Grant programs because of their particular importance in that state. The need for the research may have been suggested by university scientists, by state and local officials, or by the marine advisory program, Sea Grant's outreach arm to our coastal citizens. The projects eventually supported by the National Sea Grant Office are those that have survived rigorous screening for need and scientific merit at both the local and the federal level.

III. COMPARISON WITH PREVIOUS YEAR

Total support for Marine Environmental Research by Sea Grant programs increased by 7% between FY 78 and FY 79. (Table I) Both Federal and non-Federal contributions increased at the same rate, thus the distribution of support did not change from 65% federal, 35% non-federal. The number of projects supported grew by 20 or by almost 15%. The difference in growth rates between the number of projects and the dollar support is reflected in a decrease in the average size of a project from $46,900 to $43,400.

Within the program area, the major change between FY 78 and FY 79 has occurred in the category of ecological research with an increase of 16 projects and about one million dollars of support. The number of pollution-related projects, on the other hand, only increased slightly, from 69 to 73. Actual dollars devoted to pollution-related projects declined between FY 78 and FY 79.

Within the last eight years, Office of Sea Grant support for environmental research has not kept pace with the growth of the Sea Grant budget. The proportion of Sea Grant dollars devoted to environmental research peaked at 21% in FY 73 and has steadily declined since. (Table II) Currently environmental research supported by Sea Grant takes 14% of the program dollars. Within this eight year time frame, the number of environmental research projects supported has ranged from a low of 124 in FY 72 to a high of 180 in FY 76. Thus the change in the total number of projects supported between FY 78 and FY 79 appears to be within the "noise level" of the program and is not significant. The decline since FY 73 in the proportion of Sea Grant resources devoted to marine environmental research appears to be real, however.

Rarely today can a single modest research project provide the breadth of information needed by decision makers. Thus a growing trend in Sea Grant sponsored research is to organize a research subprogram consisting of coordinated projects involving investigators from a variety of disciplines which addresses a major resource development or management problems within the state. Such major marine environmental research programs currently exist, in varying size, in Massachusetts, Rhode Island, New Jersey, Florida, Louisiana, Michigan, Wisconsin, California, and Hawaii.

IV. IN THE FEDERAL PERSPECTIVE

A. Within NOAA

The National Oceanic and Atmospheric Administration is research programs in marine ecology are carried out mainly by the Office of Sea Grant and the National Marine Fisheries Service. The programs appear to be of comparable magnitude. Sea Grant is supporting $3.7 million in ecological research, while the Marine Habitat Investigation Program of NMFS was supported to the amount of $3.5 million in FY 79. The programs are to a great extent complementary. Most of the NMFS program is being carrried out in NMFS laboratories while the Sea Grant program is entirely university based. Sea Grant research is heavily focused on bays, estuaries, and their adjoining wetlands. The NMFS program extends further offshore, being heavily involved in coastal and shelf waters. Sea Grant and NMFS have had a close and mutually profitable relationship over the years. In the field of marine ecology, as in the areas of fisheries biology and economics, Sea Grant and NMFS cooperate closely, both at the program manager and the research scientist level. NMFS reviews all proposals in marine ecology for the Sea Grant Office and often contributes experts in marine ecology to Sea Grant Review Panels.

NOAA's marine pollution activities are conducted by Sea Grant, NMFS, the Marine Ecosystems Analysis Office (MESA), the Ocean Dumping Office, and the Great Lakes Environmental Research Laboratory. Much of the thrust of both university-based Sea Grant research and laboratory based NMFS research is to understand the impacts of pollution on fisheries resources. As with research in marine ecology, the NMFS and Sea Grant programs are highly complementary.

The Ocean Dumping program has the responsibility of assessing the environmental impacts (at specified deep water dump sites) of the dumping of various industrial and municipal wastes. The program is comparable in size to the Sea Grant Pollution research program. It is managed by the Office of Ocean Dumping in Washington but uses a mixture of NOAA and university based scientists to do the work. Though Sea Grant has no effort in this area, the programs do interact

both informally and formally by the use of Ocean Dumping Program personnel as reviewers by Sea Grant and by the inclusion of a representative of the Office of Sea Grant on the Office of Ocean Dumping Proposal Review Panel.

At seven million dollars plus, the MESA program is the largest NOAA marine pollution program. The program has focused on assessing the environmental health of two major areas, Puget Sound and the New York Bight. The MESA program has interacted most strongly with Sea Grant at the state program level, with close cooperation occurring between the New York Sea Grant Program and the New York Bight MESA Program Office.

Because of the smallness of the Great Lakes research communities, government and university scientists have traditionally had a high level of awareness of each other's research programs. The devastating effects that toxic substances such as PCB's have had on the commercial and sports fisheries of the Great Lakes have led the area Sea Grant programs to devote a significant fraction of their resources to this serious pollution problem. To date the Great Lakes Environmental Research Laboratory has devoted much of its effort to the problem of eutrophication in the lakes. This problem appears to be on its way to solution. Thus GLERL is also turning its attention to the problem of toxic substances. This presents opportunities not only for close cooperation but for the formulation of joint programs to attack the problem and find solutions.

The Office of Marine Pollution Assessment was recently established in NOAA to coordinate NOAA's marine pollution research from a national perspective. While it is expected that Sea Grant research will continue to be responsive to problems as they are identified at the local level, there are many areas of possible Sea Grant - OMPA collaboration. Hopefully the relationship will develop into one as strong as that between Sea Grant and NMFS.

B. Within the Federal Program

Research in marine ecology may both address specific resource exploitation and management questions and generate new scientific knowledge of marine ecosystems. The difference in purposes often shows up less in the research problem proposed than in the use to which the results are put. Thus, there is often overlap in scientific content between Sea Grant and NSF sponsored projects in marine ecology. Overall the NSF program is about six to seven million dollars in size, about double the Sea Grant effort. However, much of the NSF research goes to support studies in the open ocean where Sea Grant has essentially no effort. In estuaries, lagoons, and wetlands, where major resource exploitation and management decisions must be made at state and local levels, the Sea Grant program is about twice the size of the NSF effort.

In FY 79, the federal government spent $164 million on ocean pollution research, development, and monitoring activities. Sea Grant's expenditure in this area was $2.6 million or less than two percent of this amount. However, almost one half of this total expenditure is used for environmental studies related to major national energy development projects such as off-shore oil. Sea Grant's expenditures are perhaps more properly compared with EPA expenditures in the area of marine pollution ecology. EPA spent $20.7 million for research in pollution ecology in FY 79, or about eight times the Sea Grant effort. EPA, of course, is allocating its research effort based on its perception of needs at the federal level. These often do not match the perceived needs at lower levels of government, especially if the problem is highly localized. It is appropriate for Sea Grant programs to address these local concerns.

Sea Grant and EPA personnel interact frequently at the local and federal levels. EPA scientists review proposals and serve on Sea Grant Review Panels. Research programs are compared to avoid unnecessary duplication of effort.

In summary, Sea Grant support of marine environmental reserach is a relatively small amount of the total federal effort in this area. However, Sea Grant appears to be the only program designed to address environmental problems as they are perceived at the state and local levels. As such, by providing timely information to local decision makers, the program is capable of affecting the life of every coastal citizen.

V. HIGHLIGHTS OF STATE PROGRAMS

ALASKA

The Alaska Sea Grant Program is supporting three environmental research projects in areas of concern to that state. One project involves attempting to understand the formation, movement, and decay of sea ice in the Bering Sea and how the behavior of the ice relates to meteorological parameters and sea surface temperatures.

The other two projects both address problems which may arise as the results of oil production in Alaska. One of these is assessing the role that marine bacteria play in degrading oil spilled in Northern ports where the water temperature is low. The other project addresses the problem of possible oil contamination in aquaculture facilities. It will look at the effect of oil on the the growth and energy utilization of juvenile pink salmon.

TABLE I
COMPARISON OF SEA GRANT FUNDING FOR MARINE ENVIRONMENTAL RESEARCH
FISCAL YEARS 1978 AND 1979

	PROJECTS			TOTAL FUNDING ($000)		
CATEGORY	FY-78	FY-79	CHANGE	FY-78	FY-79	CHANGE
Ecological Research	54	70	+17	2,646	3,646	+1000
Pollution Research	69	73	5	3,092	2,633	-459
Modeling	15	14	-1	775	644	-131
Applied Oceanography	6	7	+1	243	290	+47
	144	164	+22	6,756	7,213	457

TABLE II
MARINE ENVIRONMENTAL SUPPORT IN SEA GRANT
FY 72 - FY 79

FISCAL YEAR	# OF PROJECTS	FEDERAL FUNDING ($000)	% OF SEA GRANT BUDGET	TOTAL SUPPORT ($000)
FY 72	124	3,095	18.8	4,776
FY 73	163	3,910	21.2	6,209
FY 74	165	3,384	18.0	5,728
FY 75	155	3,388	16.2	5,782
FY 76	180	3,807	16.3	6,251
FY 77	149	4,490	16.1	6,666
FY 78	144	4,539	15.0	6,756
FY 79	167	4,711	13.4	7,249

CALIFORNIA

The University of California Sea Grant Program is currently supporting eight projects in marine environmental research including three major ecological studies of California's fragile wetlands. The studies are being conducted at sites of the Tijua estuary, Mugu Lagoon, and the Elkhorn Slough System. In the Tijua study, investigators at San Diego State are determining how to best go about restoring degraded wetlands using the appropriate natural vegetation. The feasibility of transplanting the naturally occurring species to dredge spoil sites will also be studied. Ultimately, guidelines for restoration procedures for west coast wetlands will be published. At Mugu Lagoon, scientists from UC Santa Barbara are determining the long term response of a wetland to heavy siltation and if mitigation of the siltation effects by augmented tidal flushing will be beneficial. In the last estuarine project, researchers from Berkeley and the Moss Landing Laboratory are attempting to relate the intensity and type of land use around Elkhorn Slough to observed impacts in the estuary. The multidisciplinary project includes studies on land use, hydrology of the watershed, primary productivity of the wetlands, and studies of the infauna, fish, and avian communities. Elkhorn Slough has been named as an estuarine sanctuary. This research should make a major contribution to the ability of sanctuary managers to predict what effect land use changes outside the sanctuary boundaries will have on the sanctuary environment.

Kelp bed enhancement and resource development are the focus of two projects. Investigators from UC - Santa Barbara are studying ways to economically enhance and expand California's valuable kelp beds, while scientists at UC - San Diego are determining the basic ecological relationships between kelp beds, sea urchins, and abolones. The work will contribute badly needed information to state officials charged with drawing up a mangement plan for the urchin fishery.

Understanding possible pollution effects is the focus of two projects. At San Diego State, scientists are determining the temperature tolerance of key invertebrate species and how these species will be impacted by the regulations controlling power plant thermal effluent. Leading scientists at California Institute of Technology are using sophisticated new underwater particle detection and sampling devices to evaluate the accuracy of models which predict the flow and dispersion of sewage from deep-water outfalls. Such evaluation is critical before mathematical models can be safely used for such predictive purposes.

The University of Southern California Sea Grant Program also has an active program in marine environmental research. Ecological

projects include a study of the impact of recreational use on the ecology of a small tidal lagoon and two projects focused on understanding the role of microorganisms in the food chain of coastal waters. A pollution-oriented project is determining the rate of sedimentation and pollution accumulation in San Francisco Bay in past years with the aim of identifying problem areas. An important mathematical modeling effort is attempting to duplicate the behavior of irregularly shaped harbors to resonance events. To date the mathematical model has been more successful than existing hydrodynamic models in predicting this response. Ability to predict the resonance response is critical in the design of harbor facilities.

DELAWARE

The Delaware Sea Grant Program has for many years studied the salt marshes of the state in an attempt to understand the importance of their preservation. Scientists at the University of Delaware are currently attempting to measure the rate of release of marsh detritus to the estuary, are studying the nitrogen cycle in the marsh and the role of marsh fishes in this cycle, and are investigating the effects of tides and habitat restrictions on marsh fish reproduction.

A mathematician at the University is applying new developments in ray theory to the modeling of ocean waves. Accurate wave models are critical to the prediction of beach erosion during storms.

FLORIDA

A project of several years duration in Florida Sea Grant has been a study of the ecology and water quality of Apalachicola Bay and surrounding coastal areas. Current studies of this project, which is approaching its conclusion, include ecological and microbiological studies of the effects of water runoff from clear-cut areas upon the water quality and the biota of the bay and an effort to combine sophisticated estuarine circulation and runoff water quality models so the effects of alternate lumbering practices can be better evaluated. Apalachicola Bay, the main oyster producing area in Florida, has recently been designated as an estuarine sanctuary to protect the valuable fishery resource. Sea Grant research was instrumental in providing much of the data which demonstrated the value of the bay as a fishery area. Scientists from both Florida State and the University of Florida are participating in this estuarine study.

In addition to the studies of Apalachicola Bay, scientists from the University of Florida are assessing the impact of new sewage treatment facilities on the water quality of Hillsborough Bay. The project basically involves before and after comparison to determine the degree of benefit obtained from the new treatment facility.

Two additional projects in the Florida program are the development of effective transplantation techniques for sea grasses by a scientist at the University of West Florida and a study of the effects of salt water on turf grasses and ornamental plants which is being conducted by scientists at Gainesville. Salt water intrusion into fresh water sources is a significant problem in several areas of the State.

GEORGIA

The University of Georgia Sea Grant Program has several projects focused on the major pollution problems in the estuaries and coastal waters of the State. Skidaway Institute of Oceanography scientists are identifying the long term chemical changes that occur in dredged material deposits in Savannah Harbor, and are studying the possible use of clams and oysters as indicator organisms for hydrocarbon pollution. Investigators at the University of Georgia are evaluating the effects of pulp-mill effluents on critical microbial processes in coastal waters, are applying new techniques for the measurement of the effects of pollutants to coastal fishes and invertebrates, are evaluating the effects of mercury pollution on fungi, and are determining if the reduced exposure to pesticides in the coastal area will be of benefit to the bee-keeping industry.

HAWAII

A major subprogram in the Hawaii Sea Grant Program is an investigation into the fisheries resources of the northwest islands of the archipelago. Most of the projects in the subprogram are discussed in the commercial fisheries report, however, three projects are appropriate for inclusion here. Two are ecological studies of the producers that underlie the food chain, a study of the primary and secondary plankton productivity of the area, and a study of the reef and shelf ecology of the region. A third study is attempting to understand the role the green turtle plays in the ecology of the study area.

Ocean outfalls are the major method of sewage disposal in Hawaii. Consequently, a continuing effort by Hawaii Sea Grant has been to understand the behavior of bacteria and viruses in marine waters. One project is aimed at developing a new, more rapid method for ascertaining fecal contamination in marine waters, while another is determining the bactericidal effect of sunlight on pathogenic bacteria in marine waters. Two additional projects focus on viruses. and the possible existence in marine waters of natural antiviral agents which appear to be capable of inactivating pathogenic viruses A final project is evaluating the utility of marine mollusks as indicators of environmental stress in benthic communities.

LOUISIANA

Because of the riches of Louisiana's coastal areas, both in living and non-living resources, the Louisiana State University Sea Grant Program has always focused a significant part of its research effort in attempting to understand the ecology of the region and the impact of developmental activities upon it. A major subprogram which is being completed this year is a five year study of the Barataria Basin. The projects to be completed this year include a study of effect of man's alterations on the chemistry of the wetlands and estuaries of the basin and a similar study on the primary productivity of the basin. A third project will assess the rate at which the basin's wetlands are being formed and lost to open water, while a final project will review the sum of the research to date and search for general principles that can be applied to the management of other basins and ecosystems.

A new subprogram, initiated this year, will follow the formation of a new delta at the mouth of the Atchafalaya River. The formation of a new delta can be likened to the growth of a new volcano, a rare opportunity to understand some of the basic mechanisms of nature. The three projects in this subprogram are concerned with understanding the dynamic forces controlling sediment transport and delta growth, the interaction between sediment and vegetation and how that interaction promotes delta growth, and how the actual development of an ecosystem on the delta compares with what would be predicted from current ecosystem theory.

In addition to the two major subprograms, scientists at LSU are also studying the rates of degradation of crude oil by the microbes present in wetland sediments and are applying to marsh plants new methods of evaluating the effects of low level chronic pollution.

MARYLAND

The decline of the oyster fishery in Chesapeake Bay is of great concern to the State of Maryland and to Maryland Sea Grant. An important oceanographic effort to understand the difference between productive and unproductive oyster areas is being conducted by scientists at Johns Hopkins. These investigators are looking at the roles that mixing, exchange, and the plankton productivity of Bay waters play in determining the location of productive oyster beds. Understanding why the beds are where they are is an important first step in understanding how to protect them.

Other oyster related projects in Maryland Sea Grant are an investigation into the role chitin plays in the uptake of heavy metals by oysters and the measurement of rates of cadmium uptake by

oysters. Scientist at the University of Maryland CBL and Eastern Shore are conducting these investigations.

Additional pollution studies by University of Maryland investigators include an investigation of the mechanisms by which microorganisms oxidize hydrocarbons and a study of the behavior of the herbicide atrizine in the waters and sediments of the estuary.

MASSACHUSETTS

The fouling by noxious algae of Nahant Beach north of Boston is of major concern to the residents of the area. MIT scientist have developed a multidisciplinary program to understand what triggers the growth of these noxious algae, how the circulation patterns of the area affect the distribution on the beaches, and what solutions to the problem might be feasible. The project is currently in its second year of research.

Additional ecological and pollution research being undertaken by the MIT Sea Grant program includes a study on techniques for decontaminating dredge spoils, an investigation into rates of uptake of heavy metals by marine organisms, the development of models to guide the allocation of oil spill cleanup resources, and the development of a model capable of predicting sea water intrusions into fresh water beneath coastal peninsulas and offshore islands. Martha's Vineyard is the specific island to be studied in the project.

Understanding the surface and subsurface tidal flows of water in salt marshes is an important key to understanding their productivity. An MIT Sea Grant scientist is attempting to measure and model these flows in conjunction with a project being conducted by the WHOI Sea Grant program.

Red tide outbreaks have been severe in the northeast in recent years. In a project supported for several years by MIT Sea Grant and now supported by WHOI Sea Grant, scientists have made major strides in understanding the causes of red-tide outbreaks and how the outbreaks are spread along the coast. To a limited extent, outbreaks can now be predicted. Whether they will ever be controllable is still an unanswered question.

At WHOI, Sea Grant scientists are also determining if coastal marsh production of commercially important species can be increased by fertilization, are determining the distribution of PCB's in New Bedford Harbor and Buzzard's Bay, are investigating the mechanisms for the metabolism of petroleum hydrocarbons in fishes, are studying the source and fate of both natural and sewage derived sediments in Boston Harbor, and are developing new techniques for the analysis of

organic material in marine systems and for the design of ecological experiments.

MICHIGAN

As with its sister Sea Grant program in Wisconsin, the major environmental thrust of the Michigan Sea Grant program is to understand the impact that toxic substances, specifically PCB's, are having on the Great Lakes, on their natural resources, and on their human populations. The eight research projects in this important program include studies of how PCB's accumulate and are released from lake sediments, how they pass through the air-water interface of the lake, and how they are accumulated and removed by lake phytoplankton and zooplankton. Other projects are measuring PCB levels in carp and determining the effects of PCB's on the mink industry of the state. Investigators in the latter project have shown that there was essentially complete reproductive failure in minks when fed PCB-containing Great Lake fish. Both University of Michigan and Michigan State University scientists are carrying out these projects. Two additional projects focus on the problems of toxic substances in general. One is attempting to develop methods for predicting which chemicals could cause problems in the lakes, while the other is looking at the social impacts that the toxic substances control act is expected to have.

In coordination with the Wisconsin Sea Grant Program's Green Bay project, Michigan scientists are studying the effects the Lake Michigan and Fox River waters have on the growth of zooplankton in Green Bay.

MINNESOTA

The environmental concerns of the relatively young Minnesota Sea Grant program have been with the impact of pollutants on Lake Superior. Three projects include a study of the distribution of PCB's and aromatic hydrocarbons in Lake Superior, an investigation of the interaction of coal particles, lake waters, and toxic chemicals, and a study of the distribution of sediments in Duluth Harbor.

MISSISSIPPI-ALABAMA CONSORTIUM

The main environmental effort of the Mississippi-Alabama Sea Grant Program is a study of Mississippi Sound. Scientists from the University of Alabama, Mississippi State, and the Gulf Coast Research Lab are modeling the hydrodynamics of Mobile Bay and the Sound, are assessing the importance of the aquatic based food web, are describing the transport of pollutants, and are preparing a hydrographic atlas of the Sound. A separate project at the University of Southern Mississippi is assisting state management of

shell fish grounds by assessing the degree of viral contamination present at various sites.

MAINE-NEW HAMPSHIRE CONSORTIUM

Maine's tidal flats are important fishery resources in the state. Two projects are studying the ecology and community structure of the intertidal, soft bottom community with emphasis on clams and bloodworms.

The behavior and health of the estuaries of these states is of concern to the citizen of both states. Consequently, marine scientists at the Universities of Maine and New Hampshire are focusing their attention on understanding these estuaries. Projects include a study of the flow in Maine estuaries and an investigation into the ability of existing hydrodynamic models to predict the flux of radionuclides into the estuarial sediments. New Hampshire scientists are focusing on the Great Bay Estuary and are studying the sources and sinks of nutrients, the distribution of heavy metals in the sediments of the estuary, and the rate at which the Bay can disperse short-duration discharges of pollutants.

NEW JERSEY

The New Jersey Sea Grant Program has chosen to concentrate much of its marine environmental research in a program aimed at understanding the distribution of heavy metal pollutants in Newark Bay and the effect these pollutants have had on the biota of the Bay. Current projects are a study of the descriptive physical oceanography of the Bay through the atmosphere, a study of the distribution of these metals in bay water and sediments, and an attempt to detect the effect of chronic stress due to heavy metals on target marine species that reside in the bay. Scientists participating in the program are from Kean College and from Montclair State.

Other environmental projects are also being supported by New Jersey Sea Grant. Investigators from Farleigh Dickinson are studying the controls on enrichment and mobilization of heavy metals in Raritan Bay, while a Rutgers scientist is developing new techniques for recovering viable microorganisms from marine sediments. Finally, an investigator at the New Jersey Marine Science Consortium is studying the causes of the various dinoflagellate blooms which have occurred off the New Jersey Coast in recent years.

NEW YORK

Two projects in the New York Sea Grant Program are concerned with the Mirex problem in Lake Ontario. Scientists at Oswego are studying

the distribution of Mirex in Lake Ontario bottom sediments and are evaluating the reproductive and tisue response to test animals fed Mirex-containing fish.

NORTH CAROLINA

The North Carolina Sea Grant Program contains six projects in marine environmental research. Oceanographers at UNC are conducting studies of Pamlico Sound to understand the circulation and to develop the capability to predict flooding along the shoreline. The impact offroad vehicles have on the ecosystems of barrier islands is a project at UNC - Wilmington, while the physical and biological requirements necessary to permit the successful establishment of new vegetation for shore line erosion control are being investigated by scientists at North Carolina State. The continuing pressure of coastal development have led to projects at NC State which are developing new septic waste disposal systems for coastal dwellings and are evaluating North Carolina shellfish for the presence of pathogenic organisms.

OHIO

The new Ohio Sea Grant program has a project aimed at the development of an operational Lake Erie storm-surge, flood forecasting program.

OREGON

With the passage of the marine Mammal Protection Act, there has been a large growth in the harbor-seal and sea-lion populations in Oregon waters, with possible impact on commercial and sports fishing and ocean-ranching activities. Oregon State scientists are studying the ecological behavior and feeding habits of both these animals so that their impact or lack of impact on these industries can be quantified.

In addition to these projects, Oregon Sea Grant scientists are developing improved fog detection devices at the inlets of small harbors, are developing a new tracer for following the paths of pollutants in estuaries, and are determining the factors that control sediment dispersal in two typical Oregon estuaries.

RHODE ISLAND

Continued population growth around Rhode Island salt ponds (lagoons) and their alteration in past years has led to serious problems in circulation, siltation, and eutrophication along with the complete demise of some fisheries and their replacement by others. In a major effort to assist state management personnel by providing

them with critical information for decision making, Rhode Island Sea Grant has undertaken a seven project research program on these coastal ponds. Scientists from URI are modeling the circulation of these ponds, determining the current sedimentation patterns, and what they might be with altered circulation. Additional projects are studying the role of macrophytic algae in the pond's ecology, are determining if leach fields are contributing to the eutrophication of the ponds, are evaluating the pond's fishery potentials, and are studying the interaction between game birds and protected species. The work is being carried out in close cooperation with the Rhode Island Coastal Resources Center and with the State fishery and environmental protection agencies.

Two additional Rhode Island projects are aimed at the red tide problem in the northeast and complement red tide studies being conducted by Woods Hole Sea Grant. One project will measure the physiological ecology of the red tide dinoflagellate. The other, under the supervision of one of the country's leading toxin chemists, will continue to map and type the distribution of toxic dinoflagellates nationwide.

Environmental research in Narragansett Bay is the subject of two projects. One is modeling the circulation dynamics of the Bay while the other is determining the carbon flux in a bottom community in the Bay.

SOUTH CAROLINA

Scientists in the South Carolina Sea Grant Program are engaged in four environmental research projects. The effects of toxaphene on estuarine fish and the possible negative effects that insect growth regulators might have on marine crustaceans are the subject of studies by USC scientists. USC scientists are also investigating the role that fungi plays in the export of sediment microflora from salt marshes. Scientists at MRRI are synthesizing from a large quantity of NMFS data a study of the seasonal distribution and abundance of fishes and crustaceans in South Carolina waters.

TEXAS

The Texas A&M Sea Grant Program contains six environmental research projects covering a variety of subjects. A project concluding this year has determined the cost effectiveness and time required to accelerate the revegetation of dredge spoil islands. A new project will study ways to improve the current techniques for imprinting endangered sea turtles. Pollution studies include one by scientists at UT that will measure the flux of aromatic hydrocarbons in the Corpus Christi Bay System, and another by Texas A&M scientists which is measuring the uptake and transfer of selenium in an esturine

food chain. A project in viral pollution is attempting to undertand the role environmental factors play in controlling the occurrences of pathogenic viruses in shellfish and their source waters.

In applied oceanography, engineers have developed a wave data bank which will permit more accurate prediction of wave forces likely to effect coastal structures, thus reducing the overdesign required.

VIRGINIA

The Sea Grant Program of VIMS has two environmental research projects in FY 79. Investigators from VIMS and University of Virginia are jointly studying the nutrient balances and fluxes of the marshes of lower Chesapeake Bay, while scientist at University of Virginia are determining how the input of natural organic matters during storms affects the oxygen content of the receiving waters, and how this effect compares with that of possible pollution inputs.

WASHINGTON

The development of models which can predict the motions of waves in small harbors and marinas is being conducted by oceanographers in the Washington Sea Grant Program.

WISCONSIN

Environmental research has traditionally been a cornerstone of the Wisconsin Sea Grant Program. Research into the limnology and ecology of the Great Lakes, and research into the effects of man's activities on this ecology continue to play a major role in Wisconsin Sea Grant in FY 79.

As with the Michigan program a major area of research concerns the PCB problem. Univesity of Wisconsin scientists from several campuses are measuring the rates of input of PCB's to the Great Lakes, are studying PCB's in yellow perch, are investigating the effect of spawning on the distribution and elimination of PCB's in fish, and are determining the transformations of PCB's that occur in fish. Two projects are looking at PCB's effect on the top of the food chain. One concerns itself with determining the responses of primates to continued ingestion of low levels of PCB's. The other, in cooperation with state health officials, is comparing PCB levels in the milk and blood of mothers who are high consumers of fish with the level of those who eat little fish.

Heavy metal pollution is the focus of three projects. One project is developing a mass balance of heavy metal inputs and fates in southern Lake Michigan. Another is studying the responses of a key lake zooplankton species to long term exposure to cadmium. The

third project is developing an improved method for analyzing heavy metals onboard ships.

A separate project is determining the level of hydrocarbons present in harbor sediments and organisms in Indiana and Duluth harbors.

Evaluation of the ecological health of Green Bay is a major Wisconsin Sea Grant subprogram. The program, which includes investigators from the Green Bay and other University of Wisconsin campuses, is managed at Green Bay. The subprogram includes projects in lake ecology, pollution effects, and fisheries. Only the first two subjects will be discussed here.

An understanding of the physical and chemical limnology of the Bay and how it is affected by the Fox River at one end and Lake Michigan at the other is an important project in the program. Other projects include the measurement of the primary productivity of the surrounding wetlands and an investigation into the fate of arsenic deposited in Green Bay from a pollution source along the Menominee River. The impact of nonpoint source pollution is the focus of another project, while a fifth is attempting to use remote sensing to estimate the impact of changes in land use on Bay water quality. A food chain study of the dynamics of herbivore populations and first-year perch complete the environmental research portion of this subprogram.

The Wisconsin program has four projects in general lake ecology. Scientists are studying the rate of nutrient recycling in the water column of the lake, are compliling a monograph and key for the zooplankton of the lakes, are determining the food requirements of young alewives, and are studying the competition for food resources among the planktivorous fishes in the lakes.

VI. PROGRAM EVALUATION

While the share of total Sea Grant dollars going to marine environmental research has declined from approximately 20% in 1972 to 13% in 1979, the program has maintained its proportion of the dollars going to research. This fraction has stayed relatively constant at 27-28%. Thus the growth of educational, advisory, and management expenses in Sea Grant programs, rather than research opportunities in other fields, are what have slowed the growth of the environmental research program.

The strong points of the research are the following:

1) The science is generally good and has improved over the last two years. The Sea Grant directors have attracted more of the better

established investigators and some bright young people to their programs.

2) There has been a growth of organized subprograms which attempt to bring enough resources to bear on problem to achieve some answers in a reasonable length of time. About one-third of the marine environmental research projects can be considered part of some more or less organized larger effort.

3) Throughout the program there is a sprinkling of investigators who have an interest in working directly with management personnel. These people should be encouraged, and we should try to develop this sort of interest in more university scientists through meetings and workshop.

The major problem with the program is that, in too many projects, it's not clear how that particular piece of work will contribute to the development or conservation of resources. For example, ecological projects ought to show how the proposed work fits into an understanding of the appropriate ecosystem, and why it is important to understand that particular ecosystem. Often they do not. Pollution projects in general tend to have a better problem focus but, again, for many it is difficult to relate the results of the research to mangement.

Sea Grant's goal should be to be the leading program in supporting research on coastal marine ecosystems and the ecosystems of the Great Lakes. The research should be aimed at understanding specific ecosystems which contain exploitable living or non-living resources. These ecosystems should be well defined for study. Besides addressing local problems, the research should strive to understand general ecological principles which will be utilizable by other scientists studying other ecosystems. The individual projects or focused group of projects may be either long or short term, and should demonstrate to the National Office how they will contribute to the understanding of the ecosystem as a whole.

Sea Grant should deemphasize pollution research unless it is having a strong impact in the local program area (i.e., PCB's in the Great Lakes or pathogens in Hawaiian coastal waters). With the resources that EPA is giving to research on toxic substances, and with the hoped for growth of NOAA's program, Sea Grant can never be more than a "tag-along" in most areas. Sea Grant should not use its scarce resources on problems where it can have little impact and where it will receive little recognition.

However, Sea Grant should be alert to the opportunity to handle significant amounts (million dollar) of pass-through funds for pollution research projects if the Office can do so within its operating guidelines.

Modeling and applied ocanography projects should be supported only as integral parts of ecological or pollution studies or if they offer something unique and creative in approach or methodology.

TABLE III

CROSS COMPARISON OF PROJECT SUBJECT AREAS AND STATE PROGRAM

	GREAT LAKES	WETLANDS	PONDS/LAGOONS	ESTUARIES/BAY	SOUNDS/COAST WTRS	SEDIMENTS	HYDROLOGY	MICOORGANISMS	NUTRIENTS	CARBON FLOWS	PRIMARY PROD.	PLANKTON/RED TIDES	BENTHIC INVERT.	FISH	BIRDS	MAMMALS	HEAVY METALS	TOXIC ORGANIC	HYDROCARBONS	PATHOGENS	POLLUTION-GENERAL	DUNES/BARRIER/ISLANDS	WAVES MODELS	CIRCULATION MODELS	DISPERSION MODELS	ECOLOGICAL MODELS	DREDGE SPOILS	PHYS/CHEM OCEANOG.	SEA GRASSES	REMOTE SENSING
ALASKA								X											X									X		
CALIFORNIA		X	X	X	X				X	X	X	X	X	X	X		X	X					X	X		X		X	X	
DELAWARE		X							X	X				X									X							X
FLORIDA				X				X			X		X	X							X			X				X		
GEORGIA				X	X			X					X	X			X	X	X		X						X			
HAWAII					X	X		X	X			X	X							X										
LOUISIANA		X		X		X			X	X	X								X							X				
MAINE/NEW HAMP.				X					X				X											X	X	X				
MARYLAND				X				X					X				X	X	X									X		
MASSACHUSETTS		X	X	X	X	X	X				X	X		X			X		X		X						X		X	
MICHIGAN	X					X						X		X		X		X										X		
MINNESOTA	X					X												X	X											
MISS./ALA.					X		X				X		X				X	X	X	X				X					X		
NEW JERSEY				X	X			X				X		X			X											X		
NEW YORK	X					X										X		X												
NORTH CAROLINA					X	X							X		X					X	X	X	X		X			X	X	
OHIO	X																						X							
OREGON				X		X								X		X				X								X		
RHODE ISLAND			X	X		X	X		X	X	X	X	X	X	X									X	X					
SOUTH CAROLINA		X				X		X					X	X				X												
TEXAS				X	X							X	X				X		X	X		X	X				X	X		
VIRGINIA		X		X					X	X																				
WASHINGTON				X																		X								
WISCONSIN	X	X				X			X		X	X		X	X	X	X	X	X		X			X	X	X		X		X

APPENDIX A

ALASKA

UNIVERSITY OF ALASKA

TITLE: EFFECTS OF OIL ON THE GROWTH AND ENERGY UTILIZATION OF JUVENILE PINK SALMON
INVESTIGATOR(S): D.G. SHAW
PROJECT NUMBER: R/02-07
SEA GRANT FUNDS: $23,384 MATCHING FUNDS: $11,254

TITLE: THE ROLE OF MARINE BACTERIA IN DISSOLVED PETROLEUM PERSISTENCE IN NORTHER PORTS
INVESTIGATOR(S): D.K. BUTTON
PROJECT NUMBER: R/41-01
SEA GRANT FUNDS: $27,822 MATCHING FUNDS: $12,799

TITLE: ICE DISTRIBUTION AND SEA SURFACE TEMPERATURE IN THE BERING SEA
INVESTIGATOR(S): G. WENDLER
PROJECT NUMBER: R/46-02
SEA GRANT FUNDS: MATCHING FUNDS: $14,212

SUBTOTAL = $51,206 $38,265

CALIFORNIA

UNIVERSITY OF CALIFORNIA

TITLE: WETLANDS MANAGEMENT IN COASTAL ZONE PLANNING: A PROTOTYPE FRAMEWORK FOR RELATING NATURAL SCIENCE AND LAND-USE PLANNING
INVESTIGATOR(S): T. DICKERT
PROJECT NUMBER: R/CZ-45
SEA GRANT FUNDS: $83,042 MATCHING FUNDS: $38,038

TITLE: AN EXPERIMENTAL PROGRAM TO DEVELOP METHODS FOR KELP BED EXPANSION AND ENHANCEMENT
INVESTIGATOR(S): M. NEUSHUL
PROJECT NUMBER: R/CZ-46
SEA GRANT FUNDS: $27,988 MATCHING FUNDS: $15,541

TITLE: COASTAL WETLANDS MANAGEMENT: APPLICATION OF BIOLOGICAL CRITERIA
INVESTIGATOR(S): C.P. ONUF/R.W. HOLMES/C.H. PETERSON
PROJECT NUMBER: R/CZ-52
SEA GRANT FUNDS: $30,599 MATCHING FUNDS: $46,056

TITLE: DEVELOPMENT OF MULTISPECIES MANAGEMENT FOR KELP BED RESOURCES WITH AN EMPHASIS ON SEA URCHINS
INVESTIGATOR(S): M.J. TEGNER
PROJECT NUMBER: R/F-36
SEA GRANT FUNDS: $48,915 MATCHING FUNDS: $10,296

TITLE: COASTAL WETLANDS MANAGMENT: RESTORATION AND ESTABLISHMENT
INVESTIGATOR(S): J.B. ZEDLER
PROJECT NUMBER: R/CZ-51
SEA GRANT FUNDS: $21,359 MATCHING FUNDS: $13,920

TITLE: TEMPERATURE TOLERANCES OF BENTHIC MARINE INVERTEBRATES AND THEIR RELATIONSHIP TO REGULATORY REQUIREMENTS FOR THERMAL EFFLUENT
INVESTIGATOR(S): R.F. FORD/J.C. VAN OLST
PROJECT NUMBER: R/E-23
SEA GRANT FUNDS: $39,855 MATCHING FUNDS: $49,056

TITLE: ANALYSIS OF COASTAL OCEAN MIXING MODELS
INVESTIGATOR(S): E.J. LIST/J.J. MORGAN
PROJECT NUMBER: R/CZ-48
SEA GRANT FUNDS: $26,052 MATCHING FUNDS: $9,342

UNIVERSITY OF SOUTHERN CALIFORNIA

TITLE: PROBLEMS OF HARBOR MODELING
INVESTIGATOR(S): JIIN J. LEE/LANDON C. WELLFORD
PROJECT NUMBER: R/CE-4
SEA GRANT FUNDS: $33,162 MATCHING FUNDS: $22,481

TITLE: HETEROTROPHIC METABOLISM OF MARINE DINOFLAGELLATES
INVESTIGATOR(S): BERNARD C. ABBOTT/MARIA R. ROSS
PROJECT NUMBER: R/EQ-18
SEA GRANT FUNDS: $32,460 MATCHING FUNDS: $18,300

TITLE: THE ROLE OF NATURAL POPULATIONS OF MICROHETEROTROPHS IN CARBON CYCLING IN SOUTHERN CALIFORNIA COASTAL WATERS
INVESTIGATOR(S): CORNELIUS W. SULLIVAN
PROJECT NUMBER: R/EQ-19
SEA GRANT FUNDS: $27,745 MATCHING FUNDS: $21,000

TITLE: ECOLOGY OF A SMALL TIDAL LAGOON UNDER THE INFLUENCE OF URBAN RECREATIONAL USE
INVESTIGATOR(S): JAMES N. KREMER/PATRICIA KREMER
PROJECT NUMBER: R/EQ-20
SEA GRANT FUNDS: $17,005 MATCHING FUNDS: $11,965

TITLE: SEDIMENT ACCUMULATION AND THE HISTORY OF POLLUTANT ACCUMULATION IN SAN FRANCISCO BAY
INVESTIGATOR(S): DOUGLAS E. HAMMOND
PROJECT NUMBER: R/EQ-22
SEA GRANT FUNDS: $23,793 MATCHING FUNDS: $11,967

SUBTOTAL = $411,975 $267,962

DELAWARE

UNIVERSITY OF DELAWARE

TITLE: THE ROLE OF FUNDULUS HERTEROCLITUS IN TIDE MARSH DYNAMICS
INVESTIGATOR(S): V. LOTRICH
PROJECT NUMBER: R/B-4
SEA GRANT FUNDS: $26,811 MATCHING FUNDS: $13,762

TITLE: INFLUENCE OF TIDES AND HABITAT RESTRICTIONS ON FUNDULUS REPRODUCTION
INVESTIGATOR(S): M. TAYLOR
PROJECT NUMBER: R/B-6
SEA GRANT FUNDS: $23,189 MATCHING FUNDS: $4,011

TITLE: DEVELOPMENTS ON THE RAY THEORY FOR OCEAN WAVES
INVESTIGATOR(S): C. LOZANO
PROJECT NUMBER: R/T-42
SEA GRANT FUNDS: $24,378 MATCHING FUNDS: $12,390

TITLE: REMOTE SENSING OF ESTUARINE DETRITAL FLOW AND SURFACE WATER PRODUCTIVITY
INVESTIGATOR(S): V. KLEMAS
PROJECT NUMBER: R/B-7
SEA GRANT FUNDS: $21,910 MATCHING FUNDS: $36,277

TITLE: MICROBIAL NITROGEN TRANSFORMATIONS IN A DELAWARE TIDE MARSH
INVESTIGATOR(S): D. SMITH
PROJECT NUMBER: R/B-5
SEA GRANT FUNDS: $21,533 MATCHING FUNDS: $16,234

SUBTOTAL = $117,821 $82,674

FLORIDA

STATE UNIVERSITY SYSTEM OF FLORIDA

TITLE: COASTAL FORESTRY PRACTICES & ESTUARINE PRODUCTIVITY: A CASE STUDY THE APALACHICOLA BAY
INVESTIGATOR(S): ROBERT J LIVINGSTON
PROJECT NUMBER: R/EM-12
SEA GRANT FUNDS: $42,900 MATCHING FUNDS: $23,800

TITLE: COASTAL FORESTRY PRACTICES & ESTUARINE PRODUCTIVITY: A CASE STUDY THE APALACHICOLA BAY
INVESTIGATOR(S): B A CHRISTENSEN
PROJECT NUMBER: R/EM-13
SEA GRANT FUNDS: $74,800 MATCHING FUNDS: $37,900

TITLE: COASTAL FORESTRY PRACTICES & ESTUARINE PRODUCTIVITY: A CASE STUDY THE APALACHICOLA BAY
INVESTIGATOR(S): DAVID C WHITE
PROJECT NUMBER: R/EM-14
SEA GRANT FUNDS: $40,800 MATCHING FUNDS: $20,100

TITLE: CULTURE & TRANSPLANT STUDIES OF THE SEAGRASS RUPPIA MARITIMA
INVESTIGATOR(S): P.A. WINTER
PROJECT NUMBER: R/EM-10
SEA GRANT FUNDS: $34,500 MATCHING FUNDS: $18,800

TITLE: EFFECTS OF SEWAGE POLLUTION ABATEMENT ON ENVIRONMENTAL QUALITY IN HILLSBOROUGH BAY FLORIDA
INVESTIGATOR(S): JOSEPH L. SIMON
PROJECT NUMBER: R/EM-7
SEA GRANT FUNDS: $62,000 MATCHING FUNDS: $39,000

TITLE: SALT TOLERANCE OF COMMON ORNAMENTAL HORTICULTURE PLANTS & TURFGRASSES
INVESTIGATOR(S): TERRIL A NELL
PROJECT NUMBER: R/CP-4
SEA GRANT FUNDS: $26,000 MATCHING FUNDS: $55,000

SUBTOTAL = $281,000 $194,600

GEORGIA

UNIVERSITY OF GEORGIA

TITLE: INDUSTRIAL, ECONOMIC, AND ENVIRONMENTAL BENEFITS OF APICULTURE IN THE COASTAL ZONE OF GEORGIA
INVESTIGATOR(S): ALFRED DIETZ
PROJECT NUMBER: R/G-1

SEA GRANT FUNDS: $38,300 MATCHING FUNDS: $52,300

TITLE: POTENTIAL USE OF CLAMS AND OYSTERS AS INDICATOR PRGANISMS OF POLLUTION BY POLYCYCLIC AROMATIC HYDROCARBONS
INVESTIGATOR(S): RICHARD F. LEE
PROJECT NUMBER: R/EE-6
SEA GRANT FUNDS: $27,000 MATCHING FUNDS: $22,200

TITLE: A BIOCHEMICAL INVESTIGATION OF FUNGAL RESPONSE TO ELEVATED LEVELS OF MERCURY
INVESTIGATOR(S): STEVEN Y. NEWELL
PROJECT NUMBER: R/EE-7
SEA GRANT FUNDS: $19,200 MATCHING FUNDS: $10,100

TITLE: EVALUATION OF DREDGED MATERIAL DEPOSITS TO PROVIDE INFORMATION APPLICABLE TO SAVANNAH HARBOR MANAGEMENT
INVESTIGATOR(S): HERBERT L. WINDOM
PROJECT NUMBER: R/EE-9
SEA GRANT FUNDS: $35,900 MATCHING FUNDS: $25,700

TITLE: REFINEMENT AND USE OF ADENYLATE ENERGY CHARGE AS A STRESS MEASUREMENT IN COASTAL FISHES AND INVERTEBRATES
INVESTIGATOR(S): ROBERT HODSON
PROJECT NUMBER: R/EE-5
SEA GRANT FUNDS: $25,900 MATCHING FUNDS: $13,100

TITLE: INTERACTION OF PULP MILL EFFLUENTS WITH MICROBIAL POPULATIONS OF GEORGIA COASTAL WATERS AND SEDIMENTS
INVESTIGATOR(S): ROBERT E. HODSON
PROJECT NUMBER: R/EE-4
SEA GRANT FUNDS: $43,300 MATCHING FUNDS: $7,400

SUBTOTAL = $189,600 $130,800

HAWAII

UNIVERSITY OF HAWAII

TITLE: SURVEY AND ASSESSMENT OF THE GREEN SEA TURTLE RESOURCE OF THE NORTHWESTERN HAWAIIAN ISLANDS
INVESTIGATOR(S): GEORGE H. BALAZS
PROJECT NUMBER: NI/R-5
SEA GRANT FUNDS: $26,785 MATCHING FUNDS: $8,317

TITLE: REEF AND SHELF ECOLOGY OF THE HAWAIIAN ARCHIPELAGO

INVESTIGATOR(S): RICHARD W. GRIGG
PROJECT NUMBER: NI/R-3
SEA GRANT FUNDS: $29,895 MATCHING FUNDS: 100,222

TITLE: PRIMARY AND SECONDARY PLANKTON PRODUCTIVITY AND POTENTIAL FISHERY YIELDS IN THE HAWAIIAN ARCHIPELAGO
INVESTIGATOR(S): JED HIROTA
PROJECT NUMBER: NI/R-1
SEA GRANT FUNDS: $99,804 MATCHING FUNDS: $46,899

TITLE: MICROBIOLOGICAL INDICATOR FOR ASCERTAINING FECAL CONTAMINATION OF MARINE RECREATIONAL WATERS
INVESTIGATOR(S): ROGER S. FUJIOKA
PROJECT NUMBER: WQ/R-2
SEA GRANT FUNDS: $9,296 MATCHING FUNDS: $2,950

TITLE: PATHOGENIC HUMAN ENTERIC VIRUSES IN HAWAIIAN OCEAN WATERS: ROLE AND EFFECTS OF ANTIVIRAL AGENT(S)
INVESTIGATOR(S): PHILIP C. LOH/L. STEPHEN LAU
PROJECT NUMBER: WQ/R-1
SEA GRANT FUNDS: $22,790 MATCHING FUNDS: $3,362

TITLE: THE SIGNIFICANCE OF THE BACTERICIDAL EFFECT OF SUNLIGHT ON INDICATOR AND PATHOGENIC BACTERIA IN MARINE WATERS ON MEASUREMENTS AND ...
INVESTIGATOR(S): ROGER S. FUJIOKA
PROJECT NUMBER: WQ/R-5
SEA GRANT FUNDS: $32,145 MATCHING FUNDS: $38,731

TITLE: MARINE MOLLUSKS AS INDICATOR ORGANISMS IN BENTHIC COMMUNITIES
INVESTIGATOR(S): E. ALLISON KAY
PROJECT NUMBER: WQ/R-3
SEA GRANT FUNDS: $4,660 MATCHING FUNDS: $1,338

TITLE: DISTRIBUTION, ISOLATION, AND CHARACTERIZATION OF THE NATURAL MARINE ANTIVIRAL AGENTS(MAVAS)FROM HAWAIIAN OCEAN WATERS AND OTHER PACIFIC...
INVESTIGATOR(S): PHILIP C. LOH
PROJECT NUMBER: WQ/R-6
SEA GRANT FUNDS: $19,951 MATCHING FUNDS: $23,256

SUBTOTAL = $245,326 $225,075

LOUISIANA

LOUISIANA STATE UNIVERSITY

TITLE: FACTORS AFFECTING STABILITY AND PRODUCTIVITY OF LOUISIANAS COASTAL MARSH
INVESTIGATOR(S): W.H. PATRICK/R.D. DELAUNE
PROJECT NUMBER: R/MPE-10
SEA GRANT FUNDS: $42,704 MATCHING FUNDS: $8,627

TITLE: ECOSYSTEM DEVELOPMENT IN THE ATCHAFALAYA BAY
INVESTIGATOR(S): JOHN W. DAY/J.G. GOSSELINK
PROJECT NUMBER: R/MPE-9
SEA GRANT FUNDS: $23,927 MATCHING FUNDS: $21,872

TITLE: DYNAMIC FORCES CONTROLLING SEDIMENT TRANSPORT AND DELTA GROWTH
INVESTIGATOR(S): JOHN W. WELLS
PROJECT NUMBER: R/MPE-8
SEA GRANT FUNDS: $99,196 MATCHING FUNDS: $5,667

TITLE: GROWTH AND IMPACT OF THE ATCHAFALYA DELTA
INVESTIGATOR(S): R.D. ADAMS
PROJECT NUMBER: R/MPE-7
SEA GRANT FUNDS: $70,660 MATCHING FUNDS: $13,040

TITLE: EFFECTS OF CURRENT MANAGEMENT PRACTICES ON THE PRIMARY PRODUCTIVITY OF THE BARATARIA BASIN
INVESTIGATOR(S): JAMES G. GOSSELINK
PROJECT NUMBER: R/E-12
SEA GRANT FUNDS: $45,432 MATCHING FUNDS: $17,356

TITLE: EFFECT OF MANS ALTERATION ON WETLAND AND ESTUARINE CHEMISTRY
INVESTIGATOR(S): W.H. PATRICK/R.D.DELAUNE
PROJECT NUMBER: R/E-13
SEA GRANT FUNDS: $41,192 MATCHING FUNDS: $8,016

TITLE: A REVIEW OF ECOSYSTEM STUDIES IN THE BARATARIA BASIN
INVESTIGATOR(S): JOHN W. DAY
PROJECT NUMBER: R/E-17
SEA GRANT FUNDS: $19,134 MATCHING FUNDS: $11,080

TITLE: EFFECT OF SEDIMENT PH AND OXIDATION-REDUCTION POTENTIAL ON MICROBIAL DEGRADATION OF CRUDE OIL
INVESTIGATOR(S): W.H. PATRICK/R.D. DELAUNE
PROJECT NUMBER: R/HSE-8
SEA GRANT FUNDS: $41,848 MATCHING FUNDS: $9,046

TITLE: A METHOD FOR MONITORING SUBLETHAL STRESS IN COASTAL PLANT COMMUNITIES
INVESTIGATOR(S): I.A. MENDELSSOHN/W.H. PATRICK
PROJECT NUMBER: R/HSE-9
SEA GRANT FUNDS: $20,994 MATCHING FUNDS: $1,651

SUBTOTAL = $405,087 $96,355

MARYLAND

UNIVERSITY OF MARYLAND

TITLE: ROLE OF ISOPYCNAL MIXING, CONVERGENCES, AND EXCHANGE PATTERNS IN THE DISTRIBUTION OF OYSTER BEDS
INVESTIGATOR(S): H.H. SELIGER
PROJECT NUMBER: R/F-13
SEA GRANT FUNDS: $20,000 MATCHING FUNDS: $4,100

TITLE: STUDY OF THE ECOLOGY OF BDELLOVIBRIO IN THE CHESAPEAKE BY AND ITS SUB-ESTUARIES
INVESTIGATOR(S): W. S. FALKLER/H.N. WILLIAMS
PROJECT NUMBER: R/I-6
SEA GRANT FUNDS: $5,000 MATCHING FUNDS: $7,550

TITLE: ROLE OF CHITIN IN THE ACCUMULATION OF HEAVY METALS IN THE AMERICAN OYSTER (CRASSOSTREA VIRGINICA)
INVESTIGATOR(S): R.A. SMUCKER
PROJECT NUMBER: R/I-7
SEA GRANT FUNDS: $18,000 MATCHING FUNDS: $13,850

TITLE: EFFECTS OF ENVIRONMENTAL VARIABLES ON UPTAKE OF CADIUM IN THE TISSUES OF AMERICAN OYSTER, CRASSOSTREA VIRGINICA
INVESTIGATOR(S): YEN-WAN HUNG
PROJECT NUMBER: R/I-5
SEA GRANT FUNDS: $11,000 MATCHING FUNDS: $1,500

TITLE: CO-OXIDATION OF PETROLEUM HYDROCARBONS BY ESTUARINE MICROORGANISMS
INVESTIGATOR(S): JOSEPH J. COONEY
PROJECT NUMBER: R/P-2
SEA GRANT FUNDS: $11,000 MATCHING FUNDS: $15,900

TITLE: ADSORPTION, BIOCONCENTRATION, AND DEGRADATION OF 14C LABELED ATRAZINE IN AN ESTUARINE SYSTEM
INVESTIGATOR(S): D.C. WOLF/R.D. SJOBLAD
PROJECT NUMBER: R/P-1

SEA GRANT FUNDS: $15,450 MATCHING FUNDS: $8,250

SUBTOTAL = $80,450 $51,150

MASSACHUSETTS

MASSACHUSETTTS INSTITUTE OF TECHNOLOGY

TITLE: ECODYNAMIC ANALYSIS OF ALGAL BLOOMS FOULING NAHANT BAY BEACHES
INVESTIGATOR(S): ALICIAN V. QUINLAN
PROJECT NUMBER: R/E-3
SEA GRANT FUNDS: $80,000 MATCHING FUNDS: 186,411

TITLE: MOTILITY AND METABOLISM OF A MARINE MICROORGANISM IN RELATION TO ITS SUBSTRATE ZOSTERA MARINA
INVESTIGATOR(S): EUGENE BELL
PROJECT NUMBER: R/E-4
SEA GRANT FUNDS: $65,000 MATCHING FUNDS: $38,983

TITLE: DECONTAMINATION OF DREDGE SPOILS BY EXTRACTION WITH WATER UNDER NEAR CRITICAL CONDITIONS
INVESTIGATOR(S): MICHAEL MODELL
PROJECT NUMBER: R/T-21
SEA GRANT FUNDS: $45,000 MATCHING FUNDS: $6,639

TITLE: TRACE ELEMENTS UPTAKE IN THE MARINE FOOD CHAIN
INVESTIGATOR(S): MORTEZA JANGHORBANI
PROJECT NUMBER: R/E-5
SEA GRANT FUNDS: $57,100 MATCHING FUNDS: $24,738

TITLE: OIL SPILL CLEAN-UP AND LIABILITY MODELS
INVESTIGATOR(S): J.D.NYHART/HARILAOS N. PSARAFTIS
PROJECT NUMBER: R/T-20
SEA GRANT FUNDS: $45,000 MATCHING FUNDS: $39,997

TITLE: SEA WATER INTRUSION IN OFFSHORE ISLANDS
INVESTIGATOR(S): JOHN L. WILSON
PROJECT NUMBER: R/C-5
SEA GRANT FUNDS: $39,800 MATCHING FUNDS: $13,167

TITLE: TIDAL INDUCED TRANSPORT IN SALT MARSH ECOSYSTEMS
INVESTIGATOR(S): H.F. HEMMOND
PROJECT NUMBER: R/C-6
SEA GRANT FUNDS: $52,300 MATCHING FUNDS: $15,673

WOODS HOLE OCEANOGRAPHIC INSTITUTION

TITLE: DORMANT CYSTS AND TRACE METAL SENSITIVITY: KEY FACTORS IN INITIATION, DEVELOPMENT, & GEOGRAPHIC SPREADING OF THE TOXIC DINOFLAGELLATE BLOOMS
INVESTIGATOR(S): ROBERT R. L. GUILLARD
PROJECT NUMBER: R/B-20
SEA GRANT FUNDS: $30,000 MATCHING FUNDS: $5,860

TITLE: THE ROLE OF COMPARTMENTAL MODELS IN THE DESIGNS OF AQUACULTURE AND ECOSYSTEMS EXPERIMENTS
INVESTIGATOR(S): WOOLLCOTT SMITH
PROJECT NUMBER: R/M-6
SEA GRANT FUNDS: $17,000 MATCHING FUNDS: $6,217

TITLE: SOURCE AND FATE OF ESTUARINE SEDIMENTS-BOSTON HARBOR
INVESTIGATOR(S): JOHN MILLIMAN
PROJECT NUMBER: R/M-5
SEA GRANT FUNDS: $40,000 MATCHING FUNDS: $9,244

TITLE: STIMULATED MARINE BIOPRODUCTION
INVESTIGATOR(S): JOHN TEAL
PROJECT NUMBER: R/B-18
SEA GRANT FUNDS: $61,800 MATCHING FUNDS: $41,827

TITLE: A NEW METHOD FOR CHARACTERIZATION OF MARINE ORGANIC MATERIAL IN THE WATER COLUMN AND SEDIMENTS
INVESTIGATOR(S): JEAN WHELAN
PROJECT NUMBER: R/B-27
SEA GRANT FUNDS: $24,000 MATCHING FUNDS: $6,485

TITLE: BIOCHEMISTRY OF PCBS IN NEW BEDFORD HARBOR AND BUZZARDS BAY, MASSACHUSETTS
INVESTIGATOR(S): JOHN W. FARRINGTON
PROJECT NUMBER: R/B-25
SEA GRANT FUNDS: $31,300 MATCHING FUNDS:

TITLE: METABOLISM OF AROMATIC HYDROCARBONS BY THE BIVALVE MOLLUSC (MYTILUS EDULIS)
INVESTIGATOR(S): JOHN J. STEGEMAN
PROJECT NUMBER: R/B-23
SEA GRANT FUNDS: $19,400 MATCHING FUNDS: $1,325

SUBTOTAL = $607,700 $396,566

MICHIGAN

UNIVERSITY OF MICHIGAN

TITLE: PCBS, DDT COMPOUNDS AND DIELDRIN LEVELS IN CARP
INVESTIGATOR(S): MARY E. ZABIK
PROJECT NUMBER: R/GLF-2
SEA GRANT FUNDS: MATCHING FUNDS: $14,287

TITLE: RENEWED USE OF UNDERUTILIZED SPECIES OF GREAT LAKES FISH FOR ANIMAL FEED
INVESTIGATOR(S): R.J.AULERICH
PROJECT NUMBER: R/GLF-7
SEA GRANT FUNDS: MATCHING FUNDS: $10,537

TITLE: INFLUENCE OF LAKE MICHIGAN AND FOX RIVER WATERS ON THE WATER QUALITY OF GREEN BAY
INVESTIGATOR(S): R. BEETON/A.M. BEETON/J. BOWERS
PROJECT NUMBER: R/ER-8
SEA GRANT FUNDS: $19,441 MATCHING FUNDS:

TITLE: EARLY ASSESSMENT OF POTENTIAL FOR ENVIRONMENTAL TOXICITY OF POLLUTANTS IN THE GREAT LAKES
INVESTIGATOR(S): R. HARTUNG
PROJECT NUMBER: R/TS-8
SEA GRANT FUNDS: $21,912 MATCHING FUNDS:

TITLE: UPTAKE, ACCUMULATION AND REMOVAL OF POLYCHLORINATED HYDROCARBONS (PCBS) BY GREAT LAKES PHYTOPLANKTON AND ZOOPLANKTON
INVESTIGATOR(S): C.K. LIN/M. SIMMONS
PROJECT NUMBER: R/TS-6
SEA GRANT FUNDS: $29,254 MATCHING FUNDS:

TITLE: RELEASE OF PCB FROM SEDIMENT
INVESTIGATOR(S): C.P. RICE
PROJECT NUMBER: R/TS-9
SEA GRANT FUNDS: $20,701 MATCHING FUNDS:

TITLE: SORPTION OF POLYCHLORINATED BIPHENYLS ON SUSPENDED SOLIDS AND THEIR DISTRIBUTION AND DIFFERENTIAL ACCUMULATION IN RIVERS, HARBORS, AND LAKES
INVESTIGATOR(S): WALTER J. WEBER
PROJECT NUMBER: R/TS-3
SEA GRANT FUNDS: $32,794 MATCHING FUNDS:

TITLE: IMPLEMENTATION OF THE TOXIC SUBSTANCES CONTROL ACT
INVESTIGATOR(S): D.A. BRONSTEIN
PROJECT NUMBER: R/TS-10
SEA GRANT FUNDS: MATCHING FUNDS: $10,000

TITLE: CONTRIBUTION OF SURFACE MICROLAYER TO AIR/WATER EXCHANGE OF ORGANIC POLLUTANTS
INVESTIGATOR(S): C.P. RICE/P.A. MEYERS
PROJECT NUMBER: R/TS-12
SEA GRANT FUNDS: $31,451 MATCHING FUNDS:

SUBTOTAL = $155,553 $34,824

MINNESOTA

UNIVERSITY OF MINNESOTA

TITLE: SEDIMENTATION IN DULUTH-SUPERIOR HARBOR
INVESTIGATOR(S): THOMAS C. JOHNSON
PROJECT NUMBER: R/CL-2
SEA GRANT FUNDS: $7,314 MATCHING FUNDS: $8,124

TITLE: AN EVALUATION OF THE POSSIBLE DETRIMENTAL EFFECTS BY THE INTRODUCTION OF ORGANICS AND SECOND-ORDER ORGANICS
INVESTIGATOR(S): RONALD CAPLE
PROJECT NUMBER: R/F-2
SEA GRANT FUNDS: $8,726 MATCHING FUNDS: $17,489

TITLE: MICROCONTAMINANT-AIR, WATER, SEDIMENT, BIOTA INTERACTIONS IN LAKE SUPERIOR
INVESTIGATOR(S): S.J. EISENREICH
PROJECT NUMBER: R/CL-1
SEA GRANT FUNDS: $13,122 MATCHING FUNDS: $13,927

SUBTOTAL = $29,162 $39,540

MISSISSIPPI

MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM

TITLE: VIRAL EVALUATION OF PROHIBITED OYSTER GROWING WATERS
INVESTIGATOR(S): R. ELLENDER
PROJECT NUMBER: R/SP-1
SEA GRANT FUNDS: $20,562 MATCHING FUNDS: $10,281

TITLE: A PRELIMINARY ASSESSMENT OF THE AQUATIC GRASS-BASED FOOD WEB IN MISSISSIPPI SOUND
INVESTIGATOR(S): M. YOUNG
PROJECT NUMBER: R/LR-8
SEA GRANT FUNDS: $8,494 MATCHING FUNDS: $4,247

TITLE: HYDRODYNAMICS OF MOBILE BAY AND MISSISSIPPI SOUND
INVESTIGATOR(S): G. APRIL
PROJECT NUMBER: R/ES-4
SEA GRANT FUNDS: $43,304 MATCHING FUNDS: $21,652

TITLE: POLLUTANT TRANSPORT IN MISSISSIPPI SOUND
INVESTIGATOR(S): T. LYTLE
PROJECT NUMBER: R/ES-3
SEA GRANT FUNDS: $51,767 MATCHING FUNDS: $25,883

TITLE: PRODUCTION OF A HYDROGRAPHICAL-METEOROLOGICAL ATLAS OF MISSISSIPPI SOUND
INVESTIGATOR(S): C. ELEUTERIUS
PROJECT NUMBER: R/ES-1
SEA GRANT FUNDS: $20,780 MATCHING FUNDS: $13,233

SUBTOTAL = $144,907 $75,296

NEW HAMPSHIRE

UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE

TITLE: THE REGULATION OF INTERTIDAL SOFT-BOTTOM COMMUNITY STRUCTURE AND THE POPULATION DYNAMICS OF MYA ARENARIA, NEREIS
INVESTIGATOR(S): JOHN A. COMMITO
PROJECT NUMBER: R/LRF-11
SEA GRANT FUNDS: $19,847 MATCHING FUNDS: $10,176

TITLE: THE ECOLOGY OF MYA ARENARIA IN THE TIDAL FLAT ENVIRONMENT
INVESTIGATOR(S): LES WATLING
PROJECT NUMBER: R/LRF-17
SEA GRANT FUNDS: $50,000 MATCHING FUNDS: $35,590

TITLE: ESTUARINE ASSESSMENT: A LOOK AT THE FLOW REGIME IN MAINE ESTUARIES
INVESTIGATOR(S): BRYAN R. PEARCE
PROJECT NUMBER: R/OE-37
SEA GRANT FUNDS: $17,036 MATCHING FUNDS: $12,969

TITLE: USE OF ESTUARINE HYDRODYNAMIC MODELS TO DESCRIBE THE DISTRIBUTION DYNAMICS OF TRACE ELEMENTS IN THE SEDIMENTS OF MAINE ESTUARIES
INVESTIGATOR(S): C.T.HESS/C.W.SMITH
PROJECT NUMBER: R/EMP-11
SEA GRANT FUNDS: $38,534 MATCHING FUNDS: $28,197

TITLE: STUDIES ON THE ROLE OF SUBSTRATE ANGLE AND PREDATION IN FOULING COMMUNITY SUCCESSION
INVESTIGATOR(S): LARRY G. HARRIS
PROJECT NUMBER: R/EM-34
SEA GRANT FUNDS: $10,260 MATCHING FUNDS: $8,886

TITLE: MODELING OF FE, MN, CU, MO SEDIMENTARY FLUX IN THE GREAT BAY ESTUARY, NH
INVESTIGATOR(S): HENRI E. GAUDETTE
PROJECT NUMBER: R/EM-10
SEA GRANT FUNDS: $29,383 MATCHING FUNDS: $13,447

TITLE: DISPERSION MODELING FOR SHORT DURATION DISCHARGES TO THE GREAT BAY ESTUARY SYSTEM
INVESTIGATOR(S): P. BISHOP/Y. CHU
PROJECT NUMBER: R/EM-32
SEA GRANT FUNDS: $13,604 MATCHING FUNDS: $6,983

TITLE: NUTRIENT PROCESSES IN THE GREAT BAY ESTUARY SYSTEM
INVESTIGATOR(S): B. CELIKKOL/T. LODER/A. MATHIESON
PROJECT NUMBER: R/EM-20
SEA GRANT FUNDS: $33,866 MATCHING FUNDS: $22,643

SUBTOTAL = $212,530 $138,891

NEW JERSEY

NEW JERSEY MARINE SCIENCES CONSORTIUM

TITLE: FACTORS INHERENT IN THE LIFE CYCLES OF DINOFLAGELLATES ASSOCIATED WITH NOXIOUS BLOOMS OFF NEW JERSEY
INVESTIGATOR(S): STEPHEN ESSER
PROJECT NUMBER: R/E-1
SEA GRANT FUNDS: $4,500 MATCHING FUNDS: $3,900

TITLE: ATMOSPHERIC CONTRIBUTIONS TO THE PH, TRACE METAL, AND ANION CONTENT OF NEWARK BAY
INVESTIGATOR(S): C.H. MURPHY
PROJECT NUMBER: R/P-10

SEA GRANT FUNDS: $8,200 MATCHING FUNDS: $6,900

TITLE: HEAVY METAL ENRICHMENT/MOBILIZATION CONTROLS, RARITAN BAY, NEW JERSEY
INVESTIGATOR(S): H. GRAY MULTER
PROJECT NUMBER: R/P-11
SEA GRANT FUNDS: $20,000 MATCHING FUNDS: $22,900

TITLE: FIELD DETECTION OF CHRONIC STRESS IN NEWARK BAY TARGET BIOTA, INCL. CORR. W/ ON-GOING HEAVY METAL & EXPER. BIOASSAY STUDIES W/IN SAME SYSTEM
INVESTIGATOR(S): S.J. KOEPP/J.M. MCCORMICK
PROJECT NUMBER: R/P-1
SEA GRANT FUNDS: $20,000 MATCHING FUNDS: $14,500

TITLE: QUANTITATIVE RECOVERY OF VIABLE MICROORGANISMS FROM MARINE SEDIMENTS AND PARTICULATE MATTER
INVESTIGATOR(S): C.D. LITCHFIELD
PROJECT NUMBER: R/P-12
SEA GRANT FUNDS: $20,000 MATCHING FUNDS: $7,200

TITLE: DISTRIBUTION, FLUX & BIOLOGICAL EFFECTS OF HEAVY METAL POLLUTANTS IN THE NEWARK BAY ESTUARY: HEAVY METAL TRANSPORT PATTERNS IN NEWARK BAY
INVESTIGATOR(S): A.L. MEYERSON
PROJECT NUMBER: R/O-2
SEA GRANT FUNDS: $25,000 MATCHING FUNDS: $24,300

TITLE: PHYSICAL OCEANOGRAPHIC STUDIES IN NEWARK BAY
INVESTIGATOR(S): RICHARD HIRES
PROJECT NUMBER: R/O-3
SEA GRANT FUNDS: $24,000 MATCHING FUNDS: $12,000

SUBTOTAL = $121,700 $91,700

NEW YORK

STATE UNIVERSITY OF NEW YORK, CORNELL

TITLE: REPRODUCTION AND TISSUE RESPONSE IN PRAIRIE VOLE RED MIREX AND LAKE ONTARIO COHO SALMON
INVESTIGATOR(S): K. H. MARTIN
PROJECT NUMBER: R/Q-16
SEA GRANT FUNDS: $13,061 MATCHING FUNDS: $9,978

TITLE: LAKE ONTARIO BOTTOM SEDIMENT-MIREX RELATIONSHIP
INVESTIGATOR(S): R.J. SORUDATO
PROJECT NUMBER: R/Q-15
SEA GRANT FUNDS: $14,784 MATCHING FUNDS: $15,811

SUBTOTAL = $27,845 $25,789

NORTH CAROLINA

UNIVERSITY OF NORTH CAROLINA

TITLE: MICROBIOLOGICAL EVALUATION OF SHELLFISH AND NEW SEAFOOD PRODUCTS: COLLABORATIVE STUDIES
INVESTIGATOR(S): M.L. SPECK
PROJECT NUMBER: R/SST-9
SEA GRANT FUNDS: $7,639 MATCHING FUNDS: $3,828

TITLE: THE PHYSICAL AND BIOLOGICAL PARAMETERS AFFECTING ESTABLISHMENT OF MARSH VEGETATION FOR SHORELINE EROSION CONTROL
INVESTIGATOR(S): F.D. SENECA
PROJECT NUMBER: R/CZS-13
SEA GRANT FUNDS: $24,052 MATCHING FUNDS: $12,458

TITLE: DEVELOPMENT OF ALTERNATIVE ON-SITE SEPTIC WASTE DISPOSAL SYSTEMS FOR THE COASTAL ZONE OF NORTH CAROLINA
INVESTIGATOR(S): B.L. CARLILE
PROJECT NUMBER: R/ES-23
SEA GRANT FUNDS: $44,985 MATCHING FUNDS: $20,935

TITLE: THE IMPACT OF OFF-ROAD VEHICLES ON BEACH, DUNE, AND GRASSLAND ECOSYSTEMS ON THE BARRIER ISLANDS OF NORTH CAROLINA
INVESTIGATOR(S): PAUL HOSIER
PROJECT NUMBER: R/MP-4
SEA GRANT FUNDS: $18,864 MATCHING FUNDS: $9,571

TITLE: TECHNIQUES FOR COLONIAL WATERBIRD MANAGEMENT
INVESTIGATOR(S): JAMES F. PARNELL
PROJECT NUMBER: R/MP-2
SEA GRANT FUNDS: $14,512 MATCHING FUNDS: $7,496

TITLE: PHYSICAL STUDIES OF PAMLICO SOUND, N.C.
INVESTIGATOR(S): R.H. WEISBERG
PROJECT NUMBER: R/ES-27
SEA GRANT FUNDS: $45,093 MATCHING FUNDS: $17,540

SUBTOTAL = $155,145 $71,828

OHIO

OHIO STATE UNIVERSITY

TITLE: PRELIMINARY DEVELOPMENT OF AN OPERATIONAL LAKE ERIE STORM SURGE FLOOD FORECASTING PROGRAM
INVESTIGATOR(S): K.W. BEDFORD
PROJECT NUMBER: R/EM-1
SEA GRANT FUNDS: $26,600 MATCHING FUNDS: $16,300

SUBTOTAL = $26,600 $16,300

OREGON

OREGON STATE UNIVERSITY

TITLE: AN ASSESSMENT OF SEA LIONS IN THE ROGUE RIVER AREA
INVESTIGATOR(S): B. R. MATE
PROJECT NUMBER: R/CM-19
SEA GRANT FUNDS: $15,500 MATCHING FUNDS: $10,300

TITLE: POPULATION GROWTH AND FEEDING HABITS OF HARBOR SEALS IN AN AQUACULTURAL-ENHANCED ENVIRONMENT
INVESTIGATOR(S): B.R. MATE
PROJECT NUMBER: R/CP-4
SEA GRANT FUNDS: $46,000 MATCHING FUNDS: $12,400

TITLE: ESTUARINE TRACE ELEMENTS AND THEIR APPLICATION IN WATER POLLUTION TRACING
INVESTIGATOR(S): W.D. LOVELAND
PROJECT NUMBER: R/CP-14
SEA GRANT FUNDS: $26,500 MATCHING FUNDS: $10,000

TITLE: HARBOR ENTRANCE VISIBILITY
INVESTIGATOR(S): W.H. QUINN
PROJECT NUMBER: R/CP-5
SEA GRANT FUNDS: $17,400 MATCHING FUNDS: $42,600

TITLE: SEDIMENT TRANSPORT AND DEPOSITION IN OREGON ESTUARIES
INVESTIGATOR(S): P.D. KOMAR
PROJECT NUMBER: R/CP-11
SEA GRANT FUNDS: $30,400 MATCHING FUNDS: $12,400

SUBTOTAL = $135,800 $87,700

RHODE ISLAND

UNIVERSITY OF RHODE ISLAND

TITLE: PHYSIOLOGICAL-ECOLOGY OF THE RED TIDE, DINOFLAGELLATE (GONYAULAX TAMARENSIS EXCAVATA) A PRODUCER OF PARALYTIC SHELLFISH POISON
INVESTIGATOR(S): THEODORE J. SMAYDA
PROJECT NUMBER: R/D-7
SEA GRANT FUNDS: $31,116 MATCHING FUNDS: $8,918

TITLE: DISTRIBUTION MAPPING AND TYPING OF TOXIC DINOFLAGELLATES
INVESTIGATOR(S): YUZURU SHIMIZU
PROJECT NUMBER: R/D-6
SEA GRANT FUNDS: $23,598 MATCHING FUNDS: $9,546

TITLE: SUBMERGED MACROPHYTES IN RHODE ISLAND COASTAL LAGOONS AND SALT PONDS
INVESTIGATOR(S): MARILYN HARLIN
PROJECT NUMBER: R/CL-3
SEA GRANT FUNDS: $37,493 MATCHING FUNDS: $9,702

TITLE: THE ECOLOGY OF BIRDS IN RHODE ISLAND COASTAL LAGOONS AND PONDS
INVESTIGATOR(S): J. STANLEY COBB
PROJECT NUMBER: R/CL-2
SEA GRANT FUNDS: $23,731 MATCHING FUNDS: $6,581

TITLE: OPTIONS AND TECHNIQUES FOR THE MANAGEMENT OF COASTAL LAGOONS AND SALT PONDS
INVESTIGATOR(S): STEPHEN OLSEN
PROJECT NUMBER: R/CL-6
SEA GRANT FUNDS: $17,710 MATCHING FUNDS:

TITLE: DEVELOPMENT AND VERIFICATION OF HYDRODYNAMIC AND DISPERSION MODELS FOR CHARLESTON AND POINT JUDITH PONDS
INVESTIGATOR(S): MALCOLM SPAULDING
PROJECT NUMBER: R/CL-1
SEA GRANT FUNDS: $34,851 MATCHING FUNDS: $15,000

TITLE: SEDIMENT TRANSPORT AND DEPOSITIONAL PATTERNS IN SELECTED COASTAL LAGOONS AND SALT PONDS, SOUTHERN R.I.
INVESTIGATOR(S): JON C. BOOTHROYD
PROJECT NUMBER: R/CL-4
SEA GRANT FUNDS: $11,105 MATCHING FUNDS: $11,168

TITLE: FISH AND FISHERIES OF RHODE ISLAND COASTAL LAGOONS AND PONDS
INVESTIGATOR(S): STEPHEN OLSEN
PROJECT NUMBER: R/CL-5
SEA GRANT FUNDS: $56,979 MATCHING FUNDS: $10,312

TITLE: CARBON FLUX IN A COASTAL MARINE BOTTOM COMMUNITY
INVESTIGATOR(S): SCOTT NIXON
PROJECT NUMBER: M/PD-1.2
SEA GRANT FUNDS: $16,450 MATCHING FUNDS: $2,145

TITLE: CARBON, NITROGEN, AND PHOSPHORUS BUDGETS FOR COASTAL LAGOONS AND SALT PONDS
INVESTIGATOR(S): CANDACE OVIATT/SCOTT NIXON
PROJECT NUMBER: R/CL-7
SEA GRANT FUNDS: $56,941 MATCHING FUNDS: $10,724

TITLE: CIRCULATION DYNAMICS OF NARRAGANSETT BAY
INVESTIGATOR(S): FRANK M. WHITE
PROJECT NUMBER: R/ES-14
SEA GRANT FUNDS: $42,776 MATCHING FUNDS: $17,967

SUBTOTAL = $352,750 $102,063

SOUTH CAROLINA

SOUTH CAROLINA SEA GRANT CONSORTIUM

TITLE: USE OF FUNGI AS AN INDICATOR OF THE EXPORT OF SEDIMENT MICROFLORA FROM A TIDAL MARSH
INVESTIGATOR(S): L. HAROLD STEVENSON
PROJECT NUMBER: R/ER-2
SEA GRANT FUNDS: $15,000 MATCHING FUNDS: $9,600

TITLE: A COMPARATIVE STUDY OF SEASONAL DISTRIBUTION AND ABUNDANCE FOR FISHES AND DECAPOD CRUSTACEA WITHIN SOUTH CAROLINA
INVESTIGATOR(S): ELIZABETH LEWIS WENNER
PROJECT NUMBER: R/ER-3
SEA GRANT FUNDS: $21,000 MATCHING FUNDS: $10,400

TITLE: INTERACTIONS OF INSECT GROWTH REGULATORS ON COMMERCIALLY IMPORTANT MARINE CRUSTACEANS
INVESTIGATOR(S): T.K. BORG
PROJECT NUMBER: R/PS-2
SEA GRANT FUNDS: $20,500 MATCHING FUNDS: $27,000

TITLE: EFFECTS OF TOXAPHENE INSECTICIDE AND ITS REDUCTIVELY DECHLORINATED PRODUCTS ON ESTUARINE FISH
INVESTIGATOR(S): TERRY F. BIDLEMAN
PROJECT NUMBER: R/PS-3
SEA GRANT FUNDS: $13,700 MATCHING FUNDS: $7,000

SUBTOTAL = $70,200 $54,000

TEXAS

TEXAS A&M UNIVERSITY

TITLE: METHOD FOR LARGE SCALE PLANTING ON DREDGED MATERIALS
INVESTIGATOR(S): CARL H. OPPENHEIMER
PROJECT NUMBER: R/SP-22
SEA GRANT FUNDS: $20,000 MATCHING FUNDS: $15,049

TITLE: IMPRINTING IN MARINE TURTLES
INVESTIGATOR(S): DAVID OWENS
PROJECT NUMBER: R/F-15
SEA GRANT FUNDS: $26,000 MATCHING FUNDS: $9,994

TITLE: FLUX OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE CORPUS CHRISTI BAY SYSTEM
INVESTIGATOR(S): PATRICK L. PARKER
PROJECT NUMBER: R/EQ-28
SEA GRANT FUNDS: $18,400 MATCHING FUNDS: $13,567

TITLE: ACCUMULATION AND TRANSFER OF NUTRIENTS AND SELENIUM IN AN ESTUARINE FOOD CHAIN
INVESTIGATOR(S): JERRY M. NEFF
PROJECT NUMBER: R/EQ-19
SEA GRANT FUNDS: $30,000 MATCHING FUNDS: $14,895

TITLE: ASSESSMENT AND CONTROL OF VIRAL POLLUTION OF MARINE RESOURCES
INVESTIGATOR(S): JOSEPH L. MELNICK
PROJECT NUMBER: R/EQ-25
SEA GRANT FUNDS: $48,300 MATCHING FUNDS: $24,243

TITLE: WAVE DATA BANK FOR THE TEXAS COAST
INVESTIGATOR(S): JOHN B. HERBICK
PROJECT NUMBER: R/OP-2
SEA GRANT FUNDS: $20,000 MATCHING FUNDS: $25,500

SUBTOTAL = $162,700 $103,248

VIRGINIA

VIRGINIA INSTITUTE OF MARINE SCIENCE

TITLE: NUTRIENT MASS BALANCE STUDIES OF MESOHALINE MARSHES IN THE LOWER CHESAPEAKE BAY
INVESTIGATOR(S): R. WETZEL/K. WEBB/M. BENDER/J.ZIEMAN
PROJECT NUMBER: R/ER-1
SEA GRANT FUNDS: $41,600 MATCHING FUNDS: $22,914

TITLE: OXYGEN DEMAND AND ESTUARINE WATER QUALITY
INVESTIGATOR(S): WILLIAM E. ODUM
PROJECT NUMBER: R/BP-1
SEA GRANT FUNDS: $5,700 MATCHING FUNDS: $9,283

SUBTOTAL = $47,300 $32,197

WASHINGTON

UNIVERSITY OF WASHINGTON

TITLE: WAVE MOTION IN HARBORS AND MARINAS
INVESTIGATOR(S): DONALD F. WINTER
PROJECT NUMBER: R/NE-10
SEA GRANT FUNDS: $31,500 MATCHING FUNDS: $17,500

SUBTOTAL = $31,500 $17,500

WISCONSIN

UNIVERSITY OF WISCONSIN

TITLE: NONPOINT SOURCE POLLUTION IN GREEN BAY AND ITS IMPLICATIONS FOR WATER QUALITY MANAGEMENT
INVESTIGATOR(S): DANIEL BROMLEY
PROJECT NUMBER: R/GB-8
SEA GRANT FUNDS: $8,559 MATCHING FUNDS: $5,160

TITLE: REMOTE SENSING OF THE GREEN BAY WATERSHED TO ESTIMATE THE IMPACT OF LAND DEVELOPMENT ON THE BAYS WATER QUALITY
INVESTIGATOR(S): FRANK SCARPACE
PROJECT NUMBER: R/GB-9
SEA GRANT FUNDS: $36,998 MATCHING FUNDS: $18,512

TITLE: WATER MASS STRUCTURE AND EXCHANGES IN GREEN BAY, LAKE MICHIGAN
INVESTIGATOR(S): CLIFFORD MORTIMER
PROJECT NUMBER: R/GB-10
SEA GRANT FUNDS: $18,353 MATCHING FUNDS: $10,286

TITLE: PHYSICAL-CHEMICAL CHARACTERISTICS AND DYNAMICS OF GREEN BAY, LAKE MICHIGAN
INVESTIGATOR(S): JAMES WIERSMA
PROJECT NUMBER: R/GB-12
SEA GRANT FUNDS: $16,050 MATCHING FUNDS: $8,863

TITLE: IMPACT OF NUTRIENT RECYCLING ON LAKE MICHIGANS NUTRIENT BUDGET
INVESTIGATOR(S): A.S. BROOKS
PROJECT NUMBER: R/LR-10
SEA GRANT FUNDS: $20,970 MATCHING FUNDS: $7,360

TITLE: GREAT LAKES ZOOPLANKTON KEY AND MONOGRAPH
INVESTIGATOR(S): STANLEY I. DODSON
PROJECT NUMBER: R/LR-12
SEA GRANT FUNDS: $26,884 MATCHING FUNDS: $11,046

TITLE: FOOD REQUIREMENTS, GROWTH AND METABOLISM OF YOUNG ALEWIVES(ALOSA PSEUDOHARENGUS)
INVESTIGATOR(S): CARROLL R. NORDEN
PROJECT NUMBER: R/LR-9
SEA GRANT FUNDS: $18,047 MATCHING FUNDS: $7,623

TITLE: COMPETITION FOR RESOURCES AMONG PLANTIVOROUS FISHES IN LAKE MICHIGAN
INVESTIGATOR(S): JOHN MAGNUSON
PROJECT NUMBER: R/LR-15
SEA GRANT FUNDS: $34,812 MATCHING FUNDS: $18,939

TITLE: DYNAMICS OF HERBIVORE POPULATIONS AND FIRST-YEAR YELLOW PERCH IN LOWER GREEN BAY
INVESTIGATOR(S): SUMNER RICHMAN/PAUL SAGER
PROJECT NUMBER: R/LR-7
SEA GRANT FUNDS: $43,085 MATCHING FUNDS: $8,448

TITLE: BIOLOGICAL PRODUCTION IN GREEN BAY COASTAL MARSHES
INVESTIGATOR(S): H.J. HARRIS
PROJECT NUMBER: R/GB-6
SEA GRANT FUNDS: $22,249 MATCHING FUNDS: $10,134

TITLE: GREEN BAY SUBPROGRAM COORDINATION
INVESTIGATOR(S): H.J. HARRIS
PROJECT NUMBER: R/GB-5
SEA GRANT FUNDS: $17,773 MATCHING FUNDS: $9,506

TITLE: EVALUATION OF PROCESSES CONTROLLING THE TRACE METAL STATUS OF SOUTHERN LAKE MICHIGAN
INVESTIGATOR(S): DAVID ARMSTRONG
PROJECT NUMBER: R/MW-11
SEA GRANT FUNDS: $29,095 MATCHING FUNDS: $6,034

TITLE: ON-SITE HEAVY METAL ANALYSIS USING ANODIC STRIPPING VOLTAMMETRY
INVESTIGATOR(S): W.J. BLAEDEL
PROJECT NUMBER: R/MW-15
SEA GRANT FUNDS: $14,370 MATCHING FUNDS: $6,335

TITLE: RESPONSES OF DAPHINIA TO LONG-TERM CADIUM EXPOSURE
INVESTIGATOR(S): A.S. BROOKS
PROJECT NUMBER: R/MW-16
SEA GRANT FUNDS: $15,033 MATCHING FUNDS: $6,072

TITLE: FATE OF ARSENIC DEPOSITED IN GREEN BAY BY THE MENOMINEE RIVER
INVESTIGATOR(S): MARC A. ANDERSON
PROJECT NUMBER: R/GB-11
SEA GRANT FUNDS: $24,524 MATCHING FUNDS: $9,480

TITLE: INVITATIONAL WORKSHOP ON THE ANALYSIS OF TOXIC ORGANIC COMPOUNDS IN THE GREAT LAKES
INVESTIGATOR(S): JOSEPH DELFINO
PROJECT NUMBER: R/MW-19
SEA GRANT FUNDS: $5,418 MATCHING FUNDS: $5,418

TITLE: PETROLEUM HYDROCARBONS IN THE SEDIMENTS AND BENTHOS OF LAKES MICHIGAN(INDIANA HARBOR) AND SUPERIOR (DULUTH HARBOR)
INVESTIGATOR(S): ANDERS W. ANDREN
PROJECT NUMBER: R/MW-13
SEA GRANT FUNDS: $33,264 MATCHING FUNDS: $9,325

TITLE: ACCUMULATION,DISTRIBUTION AND ELIMINATION OF POLYCHLORINATED BIPHENYLS (PCBS) IN YELLOW PERCH FED A CONTAMINATED RATION
INVESTIGATOR(S): RICHARD PETERSON
PROJECT NUMBER: R/MW-14
SEA GRANT FUNDS: $29,852 MATCHING FUNDS: $7,943

TITLE: AIR POLLUTION INPUT OF ORGANIC AND INORGANIC SUBSTANCES TO LAKE MICHIGAN WATER
INVESTIGATOR(S): ANDERS W. ANDREN
PROJECT NUMBER: R/MW-6
SEA GRANT FUNDS: $21,955 MATCHING FUNDS: $6,263

TITLE: EFFECT OF SPAWNING ON DISTRIBUTION AND ELIMINATION OF POLYCHLORINATED BIPHENYLS IN LAKE MICHIGAN FISH
INVESTIGATOR(S): RICHARD PETERSON
PROJECT NUMBER: R/MW-9
SEA GRANT FUNDS: $20,865 MATCHING FUNDS: $3,383

TITLE: RESPONSE OF PRIMATES TO POLYCHLORINATED BIPHENYLS
INVESTIGATOR(S): JAMES R. ALLEN
PROJECT NUMBER: R/BR-9
SEA GRANT FUNDS: $21,831 MATCHING FUNDS: $5,074

TITLE: BIOTRANSFORMATION OF SUBSTITUTED PHENOLS BY FISH AND AQUATIC MICROORGANISMS
INVESTIGATOR(S): JOHN LECH
PROJECT NUMBER: R/MW-17
SEA GRANT FUNDS: $33,196 MATCHING FUNDS:

TITLE: PCB LEVELS IN HUMAN FLUIDS:SHEBOYGAN CASE STUDY
INVESTIGATOR(S): JOHN RANKIN
PROJECT NUMBER: R/MW-18
SEA GRANT FUNDS: $19,350 MATCHING FUNDS: $17,795

TITLE: RESPONSE OF LAKE SUOERIOR NET BASIN SUPPLIES AND GREAT LAKES WATER LEVELS TO CLIMATE VARIATIONS
INVESTIGATOR(S): W.A.R. BRINKMANN
PROJECT NUMBER: R/NA-7
SEA GRANT FUNDS: $33,796 MATCHING FUNDS: $14,056

TITLE: ALTERNATIVE MANAGEMENT STRATEGIES FOR MINIMIZING PBCS IN LAKE MICHIGAN FISHES
INVESTIGATOR(S): JAMES F. KITCHELL
PROJECT NUMBER: R/LR-14
SEA GRANT FUNDS: $21,979 MATCHING FUNDS: $9,522

SUBTOTAL = $588,308 $222,577

RESEARCH ON MARINE NATURAL PRODUCTS IN THE NATIONAL SEA GRANT COLLEGE PROGRAM*

Research under this heading is divided into two groups - studies directed toward development of uses for chitin, a waste product from processing of crustacean shellfish, and studies directed toward discovery of novel biochemicals whose biological properties make them of potential use in medicine, medical research, and agriculture. The research is classified in Sea Grant categories 11, 12, and 13. The number and nature of projects are closely similar to what was underway last year; in fact, all but two of the projects are continuations from last year. The table below shows the level of funding is up, but only by an amount roughly equivalent to inflation. The projects in each group are listed Appendices A and B.

COMPARISON OF FUNDING IN FISCAL YEARS 1978 AND 1979

Type of Project	No. of Projects (1978)	Level of Funding Fed.	Matching	No. of Projects (1979)	Level of Funding Fed.	Matching
Bioactive Natural Products	16	$456K	$270K	17	$553K	$312K
Chitin-Related	6	$133K	$ 99K	5	$158K	$ 77K
	22	$589K	$369K	22	$711K	$389K

STUDIES OF NOVEL BIOCHEMICALS

Introduction

For thousands of years, first in folk culture and later in the more formal fields of medicine and chemistry, land-based plants and animals have been used as a source of pharmacologically active agents to treat a variety of humans disorders and diseases. Such well-known substances as belladonna, digitalis, morphine, and even aspirin had their origins in land organisms. In fact, most of the drugs now in use are derived from land-based plants and animals or are synthetic substances based on structures of natural molecules of terrestrial origin.

Only relatively recently has man turned to the sea as a source of novel chemicals for industrial use and biologically active substances for treating human illnesses and studying medical disorders. The last 10 years, especially the last five years, have been a period of significant progress in the chemistry of natural marine substances. In 1973 a

*by David H. Attaway, Office of Sea Grant, National Oceanic & Atmospheric Administration, Rockville, Maryland 20852. Telephone: 301/443-8290.

slender volume entitled Chemistry of Marine Natural Products was published as a survey of the entire field. At that time fewer than 100 marine organic compounds had been identified. The author stated in the preface, "Since few natural products have been isolated so far from marine organism, it is not yet possible - except in a few isolated areas that have been well studied - to make intelligent predictions about that likely outcome of an investigation, a feature that makes this area of natural products research particularly attractive." Even though over 600 marine compounds are now known, that statement still holds and nature is still providing novel marine products, many of which exhibit biological activity. This is the feature making the chemistry of marine natural products relevant to the goals of the National Sea Grant College Program which was established a dozen years ago for the purpose of bringing academic expertise to bear on practical problems of developing marine resources.

Biological activity is a general term that encompasses the ability of chemicals to elicit physiological responses in living systems. Substances like toxins, venoms, and poisons exhibit biological activity which also includes, besides deleterious properties, the ability of substances to affect the central nervous system or the vascular and muscular systems of mammals in positive ways, as for example, by strengthening the contractions of a weak heart. Even the toxicity of natural substances can be useful in killing internal parasites or insects and weeds detrimental to agricultural crops, to name a few examples.

Because our biochemical and physiological knowledge of diseases is still inadequate for designing synthetic drugs from scratch, nature will continue to serve for some time as a source of new chemical structures useful because of their biological activity or useful as inspiration for synthetic chemists who design molecules with modified biological activity. In 1974 a review on "Quantitative Drug Design" stated, "While to our knowledge, there is no example of any molecule having found its way into the physicians armamentarium via quantitative structure-activity analysis, developing techniques are becoming increasingly more capable of directing synthetic effort..." Although progress in synthesis by medicinal chemists has been good recently, this five year old statement still points to the importance of natural products in the field of drugs.

That the sea should be a rich source of new natural products is not unexpected. After all, some phyla and many smaller subdivisions of plants and animals occur exclusively or primarily in marine waters, and few of their representatives have been subjected to thorough chemical study. The potential array of marine bioactive substances may be greater than for terrestrial substances because approximately 80% of animal life lives in the oceans and comprises 1,000,000 species in 30 phyla. This potential is being substantiated by accumulating results of research in this area much of which in the United States is undertaken through the

National Sea Grant College Program. This research is closely relevent to practical use of marine resources and is thereby appropriate for Sea Grant.

It should be pointed out that marine organisms themselves are unlikely to serve routinely as the source of commercial supplies of new pharmaceutical chemicals because in most cases laboratory synthesis will be less expensive. More importantly, marine organisms will provide novel chemical structures and associated biological and physiological activities on which new synthetic commercial substances can be based.

Progress and Description

California's Sea Grant College Program maintains a subprogram of six projects in marine product development. The primary goal of five of them is elucidation of the chemistry of new marine compounds while the sixth provides for pharmacological evaluation of new substances isolated through the other projects in the subprogram. Recently this subprogram has identified more than 25 new substances that in preliminary biological evaluation have shown promise for application in medicine, medical research or agriculture.

Twelve new compounds isolated from marine plants or animals were shown to inhibit cell division (mitosis) in fertilized sea urchin eggs which are used as test systems for speed and convenience. This antimitotic property is used as an indication that the active substances may have the ability to inhibit cell division in other types of cells such as those of mammalian tumors. Results with this test system so far correlate fairly well with results from bioassays conducted by the National Cancer Institute in its standard test systems. Even those new active substances whose toxicity or inadequate levels of activity will make them unsuitable for trials as therapeutic agents may prove useful in studying the process of growth and cell differentiation. Three of the twelve active substances are significantly interesting from a therapeutic point of view, however. One of them, elatol, was isolated from a red alga and shown to act in a fashion analogous to vinblastine, a natural product currently used in chemotherapy for cancer. Another, curcuquinone, has shown enough promise that the University of California has filed a patent disclosure.

One of fourteen compounds tested for diuretic properties showed impressive activity. Diuretic activity indicates the ability to lower blood pressure and hence this compound or derivatives of it may find use in understanding mechanisms of ion transport or, more importantly, in treating hypertension or congestive heart failure. The substance apparently works as an antagonist of aldosterone which regulates ion transport in the kidney.

Two new compounds of 71 tested show activity in a bioassay for neuromuscular transmission. One increases the force of contraction of

muscles. This is the kind of biological activity required for drugs useful in treating neuromuscular diseases such as muscular dystrophy. The other active substance is a neurotoxin which produces paralysis and could be useful in surgical procedures in a manner similar to curare.

A number of extracts and pure compounds have shown significant activity against common insects such as flies, mosquitos, spider mites, tobacco budworm, and beetles. Most of the substances contain chlorine and/or bromine and are common metabolites of several genera of red algae. The results of testing with insects so far are extremely encouraging when it is realized that very few leads of comparable promise have come from testing large numbers of extracts of terrestrial plants during the last several decades.

Because California's researchers in this field are working in collaboration with indusrial laboratories, the more nearly complete evaluation of potentially useful substances and their subsequent introduction into usage is likely.

In a similar program at the University of Oklahoma researchers over the past two years have isolated 21 new compounds and determined the chemical structures of 18 of them. Five of the isolated compounds show levels of cytotoxicity that meets the National Cancer Institute's criteria for further evaluation of anticancer activity, and one of these is undergoing in vivo testing. Another new compound, dactylyne, which was isolated from the sea hare, Aplysia dactylomela, was shown to be a potent inhibitor of pentobarbital metabolism, a property giving it the potential of lowering the dosage of pentobarbital used in medicine while increasing the duration of its effects, thereby making it significantly safer and less likely to cause addiction. This is potentially important because pentobarbital is widely used in medicine for its sedative, anticonvulsant, and anesthetic properties. Dactylyne has been shown to be more active than a commonly used inhibitor of drug metabolism and preliminary studies show no gross toxicity of dactylyne in mice.

A number of other compounds and fractions prepared by the Oklahoma group show promising pharmacologic activity in assays on mammalian cardiovascular and central nervous systems. These assays are used as guides for the isolation and purification of substances having potential for use in medicine and medical research or as models for drugs to treat disorders of the heart, high blood pressure, nervous anxiety, and convulsive reaction.

Cooperative Sea Grant projects at Ohio State University and the American Cancer Research Center in Colorado are directed toward isolation and identification of the substance or substances in the clam, Mercenaria mercenaria, which are active against certain malignant tumors in mammals. Since beginning the work on purification, the intensity of active fractions has been increased up to 1000 fold. Even though a pure active component has yet to be isolated, experiments with mice show the

level of activity which now can be attained with certain fractions is equivalent to that of some substances used clinically in treatment of cancer.

At the University of Rhode Island research in marine natural products is underway for a purpose quite different from that of the projects discussed above. This research is directed toward controlling the problem of paralytic shellfish poisoning (PSP) which is a severe form of food poisoning contracted by eating shellfish which have imbibed toxic algae. PSP is commonly associated with "red tides", dense blooms of toxic dinoflagellar algae. The researchers have shown that not just one substance is responsible for toxicity, as was formerly believed, but a whole family of complex compounds. They believe that a determination of the toxicity and toxin profiles of dinoflagellates along with studies of their geographical distribution will pinpoint the origin of toxic blooms and help to predict the occurrence of toxic shellfish in specific regions. They anticipate their results will be useful in developing a procedure for remote spectroscopic sensing of toxic blooms.

Conclusion and Discussion

Many new types of chemical structures are being identified through Sea Grant research in marine natural products. Up to 20 percent or more of them are showing biological activity of potential importance in one or more of a variety of bio-assays to which they are subjected. These results prove the richness of marine organisms as a source of novel chemical structures that display biological activity potentially of importance in medicine and agriculture as well as resource management.

The work currently underway is, in general, of high scientific quality. Although investigators in several projects cooperate to some degree with industry or the National Cancer Institute, which provides service in biological evaluation of new substances, most of the other projects have no close relationships with industry or other potential users of research results. One of the more notable exceptions is the University of Rhode Island's project dealing with toxins responsible for paralytic shellfish poisioning. The investigators in this project are aware of the need for application of their chemical results in management of resources and are working closely with biologists in several regulatory and educational institutions on both the West and East Coasts to this end.

The two projects cooperatively directed toward isolation of the antitumor factor in Mercenaria mercenaria are being handled well scientifically and are designed to prove or disprove conclusively the presence of a natural antitumor factor in this clam. The factor was reported several years ago but it has proved to be elusive in pure form.

Only two projects are weak from the point of view of both rationale and user relationship, and they may be justified because they involve new

institutions or investigators in Sea Grant.

In summary, the projects in this group are strong scientifically, and are directed toward development of marine resources in rather innovative ways. Because the investment is low for this kind of work, the program could be expanded usefully by involving additional marine natural products chemists who have not turned their attention to bioactive compounds, and especially by increasing the level of effort in pharmacological and biological evaluation so that a broader array of biological assays can be provided for new substances. In evaluating proposals for new projects in this field special scrutiny should be put on both the biological and chemical aspects of the work. A truly cross-disciplinary approach and proper plans for biological testing of new materials will make it more likely that new projects are focused on problems or opportunities of significance and that progress in research can be evaluated better.

STUDIES ON CHITIN

Introduction

Chitin is the major part of the waste from processing of crabs, shrimps, lobsters, and crayfish. It is, in fact, the substance that makes up the shells of these commercial species. It constitutes a problem in waste disposal that is thousands of tons in magnitude. Lack of solution to the problem may make some processing operations unprofitable or impossible under upcoming regulations of the Environmental Protection Agency. A promising approach to solving such problems is the development of uses for chitin and this is the goal of the five Sea Grant projects dealing with chitin or its derivative, chitosan.

Two companies in the United States have recently or are now producing small quantities of chitosan and another is considering going into major production, so the research projects are relevant to an emerging industry. They are sophisticated in approach, yet likely to produce results immediately applicable if the industry gains strength. From the commercial point of view, however, there are serious uncertainties in regard to market potential and stability of supply of raw material.

Japan's industry in chitosan has emerged to the point that it is selling there at about $3.00 per pound primarily for use as a coagulant of organic materials in waste waters, so there is reason to believe a viable industry in the U.S. can develop, particularly if research can demonstrate potential uses of chitosan and strengthen the commercial interest in it.

All five Sea Grant projects have in common the goal of exploiting the chemical nature of chitin and chitosan, but in different and creative ways.

Progress and Description

At the University of Washington recent research has shown that chitosan, when formulated in a paint-like coating, can prevent emission of formaldehyde from building materials such as some wooden particle boards which are bonded with urea-formaldehyde resins. Formaldehyde, which can be deleterious to human health and causes cancer in mice is continuously emitted in low concentrations from these products. This is a problem of potentially immense importance because particle board has been used in tens of thousands of mobile homes now occupied to large extent by young couples with small children who may be particularly vulnerable to the effects of formaldehyde.

At the University of Delaware and Massachusetts Institute of Technology researchers have developed effective solvent systems to be used in making chitosan into thin, flexible and transparent films which have a wide range of possible applications. Related studies have shown that the membranes chelate many heavy metal ions. These results will make it possible to define precise rates of uptake reactions and efficiency of regeneration of chemically active chitosan, and thereby enhance efforts to design various types of chitosan for specific purposes such as selective removal of metal ions from waste effluents.

Some of the most promising work in development of uses for chitin is underway at the University of Southern Mississippi where chemists are attempting to develop a new class of pesticides and herbicides by chemical conjugation of presently used substances to chitin or chitosan. The conjugated materials would provide controlled release of the pesticidal or herbicidal components and prevent rapid run-off into drainage waters and transport to municipal water supplies or environmentally sensitive estuaries. Success will allow smaller, safer applications of toxic substances to agricultural lands and provide uses for waste materials in large volume. Discoveries of solvents for chitin by Sea Grant researchers at the University of Delaware have made it possible for reseachers in Mississippi to manipulate chitin and chitosan synthetically and to produce materials which in preliminary trials by the U.S. Department of Agriculture appear to be effective herbicides. Cooperative research agreements with two chemical companies will provide for pilot scale production of the new materials.

Conclusion and Discussion

In the U.S. there has been little interest in research on chitin and chitosan from marine sources as an industrial substance outside the National Sea Grant College Program and the Western Regional Research Laboratory of the U.S. Department of Agriculture where the yearly level of effort is about one-half-man year. The significance of chitin as a waste in processing of seafood, the fascinating chemical and biological properties of its derivative chitosan, the weak beginnings of an industry

for production of chitosan, and the low level of research to back up a fledgling industry indicate the importance of research in this field.

All five projects dealing with chitin and chitosan are continuations of work in progress last year. They are innovative in concept, nonduplicative one of the others, and scientifically meritorious. The principal investigators as a group have a good record of publication of results and their research objectives are closely geared to producing information useful in developing an industry. All of the projects show a strong user relationship.

Even Sea Grant's low level of effort ($159K in FY 1979) in this field has made the National Sea Grant College Program the primary focus of research on marine chitin in the United States. If an industry based on chitin and chitosan develops, it will be in large part as a result of Sea Grant research. Sea Grant's role could be expanded usefully as good projects are proposed. One such project coming up in 1980 has been proposed by Washington State University (WSU) through the Washington Sea Grant College Program. It is based on the recent observation that chitosan is powerfully fungicidal, a property making it a potential agricultural chemical for preventing diseases such as root rot in seedlings. Plant physiologists at WSU, who are experienced in research on fungal diseases of agricultural crops, will be trying to establish methods of preparation and application which will render chitosan most effective in protecting plants from pathogenic fungi.

SUMMARY OF RESEARCH ON MARINE NATURAL PRODUCTS

Research in Sea Grant categories 11, 12, and 13 (Enzymes, Extracts, and Biomedicals) includes 22 projects which as a group do the following:

- o focus on development of new marine resources,
- o take innovative approaches to resource development,
- o require a research approach that includes both chemistry and biological science,
- o have some relatively good ties with industry,
- o have a strong record of publication in the scientific literature,
- o have relatively weak link to advisory programs, and
- o will have infrequent success in commerce because of the low level of research effort.

It should be kept in mind that because putting a new drug into medical use takes about ten years, completed success stories in this area will be especially slow in coming. The testing and evaluation of new substances of potential use as herbicides and pesticides in agriculture or as new industrial materials can be done much more quickly than clinical trials, however, so commercial applications along these lines are expected to result sooner.

STUDIES ON MARINE BIOCHEMICALS
OTHER THAN CHITIN AND CHITOSAN

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
PHARMACOLOGICAL EVALUATION PROGRAM R.S. JACOBS UNIVERSITY OF CALIFORNIA	$51,161	$20,511
MARINE NATURAL PRODUCTS FOR PHARMACOLOGICAL EVALUATION D.J. FAULKNER UNIVERSITY OF CALIFORNIA	$38,445	$13,621
ANTIVIRAL COMPOUNDS FROM ALGAE N.A. VEDROS UNIVERSITY OF CALIFORNIA	$22,949	$25,522
CHEMICAL CHARACTERIZATION OF THE ANTITUMOR FACTOR IN THE CLAM MERCENARIA MERCENARIA A.C. SCHMEER AMER. CANCER RES. CTR. AND HOSP.,CO.	$26,000	$44,000
THE EFFECT OF CARRAGEENAN ON THE GROWTH AND METABOLISM OF NORMAL AND TRANSFORMED FIBROBLASTS IN VITRO A. MATHIESON/T. WIGHT UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE	$41,091	$9,872
EXTRACTIONS, EVALUATION AND CHARACTERIZATION OF ANTICOAGULANT DRUGS FROM MARINE ANIMALS S.S. STIVALA NEW JERSEY MARINE SCIENCES CONSORTIUM	$20,000	$23,500
CARDIOVASCULAR, ANTICANCER, AND CENTRAL NERVOUS SYSTEM DRUGS FROM MARINE ORGANISMS FRANCIS J. SCHMITZ UNIVERSITY OF OKLAHOMA	$136,000	$68,000
ISOLATION, PURIFICATION, AND CHARACTERIZATION OF NEW MEDICINAL AGENTS OF THE SALT MARSH THOMAS A. BRYSON SOUTH CAROLINA SEA GRANT CONSORTIUM	$14,100	$10,800

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
POTENTIAL DRUGS FROM MARINE ORGANISMS ALFRED J. WEIINHEIMER TEXAS A&M UNIVERSITY	$25,000	$20,039
STUDIES ON THE STRUCTURE AND BIOLOGICAL PROPERTIES OF THE HORSESHOE CRAB AGGLUTININ RUTH KAPLAN VIRGINIA INSTITUTE OF MARINE SCIENCE	$24,300	$11,855
NEW NATURAL PRODUCTS FROM ALGAE BORIS WEINSTEIN UNIVERSITY OF WASHINGTON	$26,900	$2,200
BROMINASES FROM MARINE ORGANISMS G. GRAHAM ALLAN UNIVERSITY OF WASHINGTON	$12,200	$5,500
CHEMICAL CHARACTERIZATION OF THE ANTITUMOR FACTOR INTHE CLAM MERCENARIA MERCENARIA DEREK HORTON OHIO STATE UNIV. RESEARCH FOUNDATION	$17,500	$9,359
DISTRIBUTION MAPPING AND TYPING OF TOXIC DINOFLAGELLATES YUZURU SHIMIZU UNIVERSITY OF RHODE ISLAND	$23,598	$9,546
IDENTIFICATION OF BIOLOGICALLY IMP. CARBOHYDRATE BINDING LECTINS IN S.C MARINE INVERTEBRATES EDWIN H. LIU SOUTH CAROLINA SEA GRANT CONSORTIUM	$22,300	$14,200
NEW AGRICULTURAL CHEMICALS FROM MARINE ORGANISMS W.H. FENICAL UNIVERSITY OF CALIFORNIA	$35,660	$16,892
MARINE PLANTS AS A SOURCE OF INSECT GROWTH INHIBITORS P. CREWS UNIVERSITY OF CALIFORNIA	$16,241	$6,170
TOTAL	$553,445	$311,557

APPENDIX B

STUDIES ON CHITAN AND CHITOSAN

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
CHITOSAN IN HIGH-VALUEHEALTH-RELATED APPLICATIONS G. GRAHAM ALLAN UNIVERSITY OF WASHINGTON	$28,300	$20,900
UTILIZATION OF CHITIN TO CONTROL PESTICIDE MOBILITY C. MCCORMICK MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM	$27,309	$13,655
CHITIN AND CHITOSAMINE GLUCOSIDES FOR IMPROVING THE DIGESTION OF WHEY JOHN P. ZIKAKIS UNIVERSITY OF DELAWARE	$22,520	$8,914
CRAB WASTE CHITIN DEVELOPMENT P. AUSTIN UNIVERSITY OF DELAWARE	$39,094	$17,207
CHEMICAL AND STRUCTURAL CHARACTERISTICS OF CHITIN AND CHITIN DERIVATIVES FOR INDUSTRIAL APPLICATIONS B.L. AVERBACH MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$40,700	$16,604
TOTAL	$157,923	$77,280

SEAFOOD SCIENCE AND TECHNOLOGY IN THE NATIONAL SEA GRANT COLLEGE PROGRAM*

Introduction

Except in coastal areas where seafood can be eaten fresh, consumers in the United States traditionally have had little dietary dependence on fisheries. The U.S. Citizenry historically has eaten primarily meat and potatoes and of course, other vegetables. Consequently, the technology for processing, preservation, and transportation of vegetables and meats of cattle, hogs and poultry has grown to be quite sophisticated and efficient in large part as a result of research at Land Grant Colleges. Sophistication and efficiency at this level are largely absent from the seafood processing industry. The archaic methods often practiced, especially by low-volume processors, can result in low profits, high prices, products of limited quality, and inability to compete in international markets.

The United States trails several European and Asian nations in the science and practice of seafood processing. This technological inferiority is becoming more highly significant as the fishing industry, in response to the extention of U.S. jurisdiction in marine waters, attempts to harvest and process resources formerly taken by foreign fishing fleets. Along with the opportunities and associated problems offered by the Fisheries Conservation and Management Act of 1976 (the act which extended the zone of jurisdiction) the seafood processing industry is facing ever more stringent restrictions in regard to disposal of wastes and stricter regulations on quality of effluents. These complex issues in regard to efficient, competitive, and environmentally sound uses of rich fisheries off both the West and East Coasts and in the Gulf of Mexico are compounded by concern about the microbial quality of resources in nearshore waters, particularly in shellfishing areas of which a large proportion is closed to fishing because of anxiety over pollution and related problems in human health.

Many of the issues surrounding problems and opportunities in development and efficient use of fishery resources are appropriately treated by academic food scientists and engineers. Since passage of the Sea Grant Act of 1966 there has been a sharp increase in the number of academic scientists addressing issues in seafood science and technology. Their numbers and activities have increased over the past several years, but are still inadequate for addressing all the important problems. The National Sea Grant College Program is the major source of funding for academic research in seafood science and technology which is still a relatively undeveloped field. Sea Grant has been the primary stimulus for development of a marine emphasis in highly respected departments of food science or animal science at Cornell University, Texas A&M University, Michigan State Universitiy, North Carolina University, University of California at Davis, University of Georgia and Virginia Polytechnic Institute and State University, as well as a

*by David H. Attaway, Office of Sea Grant, National Oceanic & Atmospheric Administration, Rockville, Maryland 20852. Telephone: 301/443-8290.

stimulus for increased marine interest at other institutions, incuding the University of Washington and Oregon State University, which were involved in seafood science prior to Sea Grant affiliation. The yearly federal expenditure for research in seafood science through Sea Grant is now $900,000 and supports 36 research projects. In addition, most of the 26 major Sea Grant programs have part-time or full-time advisory specialists in seafood science. These specialists are responsible for the especially close link and exchange of information between fish handlers and processors, and academic researchers who are now providing students trained for careers in the seafood industries.

Research activities, can be divided into the following four groups all of which fall into Sea Grant category 35:

1. Engineering and Waste Treatment
2. Product Development/By-Product Recovery
3. Microbial and Nutrional Quality
4. Handling and Processing.

The Appendix lists the projects by goup and name and shows principal investigators, their institutional affiliations, and amount of funding for each project. The table below compares levels of funding for the four groups in fiscal years 1978 and 1979 and shows that the total number of projects is the same for both years, but that funding dropped by 12% in 1979.

COMPARISON OF FUNDING IN FISCAL YEARS 1978 AND 1979

Subject of Project	No. of Projects (1978)	Funding(1978) Fed.	Matching	No. of Projects (1979)	Funding (1979) Fed.	Matching
Engineering of Waste Treatment	4	$121K	$ 104K	3	$ 45K	$ 27K
Product Development & By-Product Recovery	14	356K	222K	15	398K	197K
Microbial and Nutrional Quality	9	315K	147K	9	197K	116K
Handling & Processing	9	220K	127K	9	261K	188K
	36	$1,012K	600K	$36K	$901K	$510K

Engineering and Waste Treatment

Projects in this group are directed toward development of equipment and procedures that can solve problems in waste water treatment or in processing of finfish and shellfish, especially species not traditionally harvested by U.S. fishermen. Some of these species, such as various squids and sharks, constitute large and potentially valuable resources in U.S. coastal waters. There are traditional markets for some of them in Europe and the Orient, yet, for example, there are no commercial processing facilities for squid in the United States. Recognizing this deficiency and the slow and unpleasant manual procedures by which squids are presently cleaned and skinned, researchers at the University of California are designing an automatic processing system for squids. So far they have quantitatively defined the properties and factors required to design the system -- properties such as surface friction and strong points of attachment of viscera to musculature, factors such as forces necessary for separating body parts and the level of water pressure and period of application required to separate skin from fresh. It is expected the coming year will produce a prototype for laboratory testing.

In similar work at the Massachusetts Institute of Technology, engineers have developed a machine for skinned spiney dogfish which are consumed in high volume in Europe. In cooperation with the National Marine Fisheries Service the machine is being demonstrated to the fishing industry and may aid in significantly increasing exportation of seafood.

A combined engineering-microbiological approach is being developed at the University of California for disposing of crustacean shellfish wastes, particularly the chitin fraction whose disposal is a severe environmental problem. The concept is to divert a minor fraction of the wastes into a system where it would induce microbiological growth and production of extracelluar chitinases, enzymes capable of hydrolyzing chitin. These cell-free chitinases would be used to hydrolyze the bulk of the waste chitin and the resulting products (primarily sugars) would be used as substrate for production of edible protein by yeasts. So far, the bacterium, Serratia marcescens, has been selected for production of chitinase and the conditions optimum for its growth have been defined. Further, hydrolytic conditions suitable for maintaining enzymatic stability have been determined. Work is in progress on selection of organisms to be used in conversion of hydrolysate to protein. Several species have been identified in preliminary trials.

Product Development/By-Product Recovery

Development of feed for domestic animals and aquacultural species as well as new products for human consumption is the emphasis of research in this category. The researchers' raw materials are wastes from processing, underutilized species, and species not traditionally harvested by the U.S. fishing fleet. The intent is to solve problems of waste disposal and to increase the domestic and foreign use of

domestically harvested fishes, including presently discarded by-catches of traditional fisheries.

Research at Cornell University in this field has resulted in development of a number of commercial products such as fish chowders and clam broth made from minced fish or processing by-products. This work has demonstrated the feasibility of using formerly wasted protein by expanding the diversity of seafood products available to consumer. The work has been done in close collaboration with seafood processors in New York and has included successful testing marketing.

Along similar lines, researchers at the University of Georgia have shown that Yu-sone, a seasoned and semi-dried fish flake, which is consumed in enormous quantities in the Orient, can be produced without major problems from various noncommercial species including rays, sharks, croakers, and lizard fish. They have also developed a mechanized production system which is currently under economic evaluation. This exploratory work may pay off in aiding development of a Yu-sone industry that would make a major contribution to much wider and more efficient use of domestic fisheries.

Researchers at the University of Alaska are taking a different tack in their focus, not on products for humans, but for domestic animals. Their intent is to determine the feasibility of using wastes from the processing of shrimp and tanner and king crabs as supplements or replacements for soybean meal in rations for swine. Their preliminary work has demonstrated that up to 50% replacement does not reduce either the rate or efficiency of gaining weight. Physical separation of some of the waste materials produced fractions that would replace up to 100% of the soybean meal without any obvious negative effects.

Microbial and Nutritional Quality

Projects in this category of research bear directly on problems relating to sanitary procedures in processing facilities and to microbial quality of seafood, especially shellfish, as it is harvested, transported and marketed. A smaller effort also goes into defining the biochemical quality of seafood and its role in human nutrition.

Post-harvest handling of fish on fishing vessels is a special interest of researchers at Oregon State University (OSU) who frequently work with fishermen in conducting experiments and in advising on improved procedures of sanitation. They have recently concluded successfully an investigation into the causes of high concentrations of bacteria in refrigerated seawater which is recirculated in many fishing vessels as a means of preserving the catch at low temperature without freezing. The modified procedures they have developed drastically lower the numbers of bacteria in the circulating seawater and thereby make for improved quality of catch at delivery on shore. The procedures were demonstrated

in a refrigerated sea water system provided by the National Marine Fisheries Service and presented as part of a six-part series, "Design and Operation Notes on Refrigerated Seawater Spray (RSWS) for shrimp vessels," published by OSU and reprinted in Fisherman's News.

Researchers at Texas A&M University have developed a rapid and sensitive procedure for measuring objectively the quality of shrimp. The instrumental procedure uses an electrode specific for ammonia, a product of spoilage, and is expected to be valuable to the shrimp industry in selecting batches for frozen rather than fresh retailing and in controlling quality of product.

In North Carolina the Sea Grant researchers have focused their attention to large degree on pathogenic microorganisms in seafoods by attempting to improve techniques for their detection and enumeration. Their particular interest is with molluscs and they recently developed a much more reliable and precise method for measurement of fecal coliforms in shellfish, water, and sediments. The "repair-detection" method is expected to form the basis for safer and more selective procedures for closing and opening shellfishing areas and for defining the microbial quality of seafood.

Processing of Seafood

Research in this category is directed primarily at improving packaging and transportation of seafood, and at extending the shelf-life of various products. Market surveys have shown the fluctuations in product quality are a major problem, so they are closely relevant to commercial issues that directly affect the consumer.

At the University of Rhode Island (URI), for example, a study is underway to determine the role enzymes can play in extending the stability of fresh fish under refrigerated and hypobaric storage. Hypobaric storage (storage in a partial vacuum) has shown the potential to greatly extend the storage life of numerous kinds of fresh foods yet no reports have yet been published on the effects of hypobaric conditions on processes of spoilage in fish. The URI researchers believe the technique may be especially effective when combined with enzymatic techniques for inhibiting growth of degradative organisms.

In Florida where many small processors produce excellent products from smoked fish, Sea Grant investigators have turned their attention to developing an inexpensive solar system for drying and smoking fish. The impetus is new federal safety regulations that will require fish processors to install expensive electric or fuel heating units in order to reach the temperatures required to eliminate any possible problem of contamination with the baterium, Clostridium botulinum, which produces a deadly toxin. Preliminary results indicate development of a system heated by solar energy will be feasible.

Projects at Michigan State University, Ohio State University and the University of Minnesota are defining the factors and procedures for producing products of high quality from a number of fishes of the Great Lakes. Efforts are focused primarily on use of mechanical skinners and deboners, use of artificial atmospheres in preservation, and evaluation of a variety of possible types of packaging. The results of the research efforts will be important in aiding a feeble commercial fishing industry in the Great Lakes.

Fresh fish generally command a higher price, but bringing that fresh fish to the market in a condition of high quality can be a difficult and expensive proposition, especially if the fish are harvested at long distances from the market location. This is the situation with salmon caught in Alaska and marketed in Seattle. In the past, fresh salmon were all shipped by air to Seattle. Investigators from the University of California at Davis began in 1977 working cooperatively with a company to modify and test a technique for transporting fresh fish in a carbon dioxide atmosphere. This firm has transported over 5 million pounds of fresh salmon in the past two yers from Anchorage to Seattle using this technique. This resulted in a real savings over air freight which was 15-40 cents per pound versus 4-5 cents per pound by surface ship.

Conclusion and Discussion

The largest research effort in Sea Grant continues to be in product development and by-product recovery. Six of the fifteen projects in this group are directed toward development of rations for aquacultural species or domestic animals from wastes of seafood processing. These six projects are clearly focused on issues appropriate for Sea Grant, that is - problems in disposing of wastes in seafood processing and opportunities for more fully using fishery resources. The remaining nine projects in this group are directed toward development of new seafood products for human consumption either domestically or abroad. The appropriateness of academic institutions' being involved in product development has been questioned because (1) this appears to be an industrial responsibility, and (2) universities have no widespread mechanism for introducing new products to consumers. However, academic institutions can develop and introduce to industry new concepts in products and they can test new products in local markets. Product development from vegetables, red meats, and poultry is a significant and traditional part of activities in agricultural colleges and universities. One major payoff of these activities is in training of students for productive careers in industry. This same justification applies to Sea Grant research in product development and may be a more powerful argument in this case because seafood processing in the United States is not nearly as well developed or as sophisticated as processing of vegetable, red meats, and poultry. Professor Robert Baker of Cornell University made a strong case for Sea Grant's involvement in product development in a letter to the Office of Sea Grant. He wrote in response to a memorandum on seafood technology that was sent to Sea Grant directors last year. It questioned

whether there were activities for food scientists in Sea Grant more appropriate than product development. Professor Baker made the following major points (paraphrased) in his letter:

1. Product development offers training for students planning industrial careers.

2. An estimated 70% of Cornell University's graduates in food science go into product development.

3. It is commonly, erroneously perceived that product development is equivalent to recipe making.

4. Product development requires basic work involving considerations in organic chemistry, biochemistry, microbiology, and engineering.

5. Many commercial products in widespread use are based directly on new products from poultry meat and eggs at Cornell University and other academic institutions.

The two next largest groups of projects in seafood science and technology each encompass nine projects, but the investment in "handling and Processing" is considerably greater than in "Microbial and Nutrional Quality." The theme running through the projects in Handling and Processing is improvement of shelf-life of seafood products in fresh, frozen, and dry states. In general, they are focused on current problems and provide results that are immediately transferable through advisory service.

Under "Microbial and Nutrional Quality" is in progress sophisticated research concerning viral and bacterial quality of seafood as it relates to preservation of seafood and health of consumers. A number of the projects focused in part on development of better methods for detection and enumeration of hazardous microorganisms. The results will have application in industrial quality control and in regulation of fishing and processing for reasons of health. A few of the projects in this group deal with nutritional quality and there is strong encouragement from the National Marine Fisheries Service (NMFS) for increased efforts along these lines. Specifically, NMFS is interested in cataloging of data on content of various metals and their bioavailability in humans. NMFS's interest appears to be more relevant to promotion of seafood than to significant problems in health that relate to nutrition. Special care should be taken in evaluating proposals for work in regard to mineral quality of seafoods and bioavailability of their minerals for two primary reasons:

1. A routine cataloging of mineral content of seafood may not be the best use of academic expertise.

2. Developing reliable information on bioavailability of chemical species in most cases requires the use of human subjects, and careful

controls. Experiments of this type are expensive and if undertaken through Sea Grant, should be on the basis of very significant and specific problems or important opportunities in development of resources. Sea Grant may have an important role to play, however, in developing new techniques or methods for measuring the nutrional quality of seafood if present techniques are unsuitable.

The weakest part of Sea Grant's program in seafood science and technology is in "Engineering and Waste Treatment." The weakness lies in the low level of effort rather than the quality of three current projects and several previous projects of this type. The very low level of engineering expertise being applied to problems in seafood technology and the increasingly stringent regulations on control of quality of effluents from processing plants indicates Sea Grant may be an appropriate vehicle for encouraging greater interaction between engineers and food scientists and thereby, for creating an atmosphere conducive to innovation and greater effort in long range research.

Sea Grant is the major source of funding for academic research in seafood science and technology. Because the quality of science and practice in this field is inferior to the more highly developed vegetable, red-meat, and poultry industries, Sea Grant is making a worthwhile investment in a field assuming greater importance as a result of extention of jurisdiction and closer control of environmental quality.

The work underway through Sea Grant is good and getting better as communications among researchers in this field improve. Two recent national meetings of the American Chemical Society have included symposia dealing exclusively or in large measure with seafood science. Most of the speakers in both presented results of research sponsored by Sea Grant. Further advances and expansion of efforts through innovative research activities of academic personnel are needed.

Universities are playing an appropriate and important role in advancing the state of science and practice in seafood processing and in training students for careers in a field that will be rapidly evolving for several years. It is anticipated the National Sea Grant College Program will continue to put a major emphasis in this field during the next ten years.

APPENDIX

I. ENGINEERING AND WASTE TREATMENT

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
SOLID-LIQUID SEPARATION AND WATER CONSERVATION IN THE SHELLFISH AND FISH PROCESSING INDUSTRY R.A. JOHNSON UNIVERSITY OF ALASKA	$31,286	$14,716
BIOCONVERSION OF CHITIN WASTES P. CARROAD UNIVERSITY OF CALIFORNIA	$7,398	$7,142
DESIGN AND DEVELOPMENT OF A SQUID-PROCESSING MACHINE R.P. SINGH UNIVERSITY OF CALIFORNIA	$7,302	$5,187
TOTAL	$45,986	$27,045

II. PRODUCT DEVELOPMENT AND BY-PRODUCT RECOVERY

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
SEAFOOD PATTIES FROM UNDERUTILIZED FISHERIES J C DENG STATE UNIVERSITY SYSTEM OF FLORIDA	$34,000	$10,900
UTILIZATION OF ALASKAN MARINE BY-PRODUCTS IN RATIONS FOR DOMESTIC LIVESTOCK F. HUSBY UNIVERSITY OF ALASKA	$61,492	$12,476
FISHFEED DEVELOPMENT C.L. KERNS UNIVERSITY OF ALASKA	$25,231	

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
RECOVERY AND UTILIZATION OF PROTEIN AND OTHER NUTRIENTS FROM SEAFOOD PROCESSING WASTE R.ZELL/L. HOOD STATE UNIVERSITY OF NEW YORK, CORNELL	$32,269	$21,718
DEVELOPMENT OF CONVENIENCE PRODUCTS FROM UNDERUTILIZED SPECIES OF FISH ROBERT C. BAKER STATE UNIVERSITY OF NEW YORK, CORNELL	$26,269	$28,598
INVESTIGATION OF THE FUNCTIONAL PROPERTIES OF FISH PROTEIN AND APPLICATION TO NEW PRODUCTS HAVING IMPROVED TEXTURE D.D. HAMANN UNIVERSITY OF NORTH CAROLINA	$52,196	$28,300
EVALUATION OF LIQUEFIED FISH PROTEIN AS AN ANIMAL FEED D.C. CHURCH OREGON STATE UNIVERSITY	$17,400	$7,600
DEVELOPMENT OF FISH PRODUCTS FOR EXPORT C.M. ARNOLD UNIVERSITY OF GEORGIA	$48,200	$7,000
APPLICATION OF ASTAXANTHIN-CONTAINING CRAWFISH WASTES IN AQUATIC DIETS SAMUEL P. MEYERS LOUISIANA STATE UNIVERSITY	$17,752	$5,431
DEVELOPMENT OF FOOD-GRADE PRODUCTS FROM GULF SHRIMP CANNERY WASTES SAMUEL P. MEYERS LOUISIANA STATE UNIVERSITY	$19,252	$5,431
SYNTHESIS OF CHITOSAN STRUCTURE MATRIX FOR FOODS CHOKYUN RHA MASSACHUSETTTS INSTITUTE OF TECHNOLOGY	$25,600	$13,619
RENEWED USE OF UNDERUTILIZED SPECIES OF GREAT LAKES FISH FOR ANIMAL FEED R.J.AULERICH UNIVERSITY OF MICHIGAN		$10,537
GENETIC IMPROVEMENT OF A CHITINASE-PRODUCING MICROORGANISM D. ORGRYDZIAK UNIVERSITY OF CALIFORNIA	$6,271	$6,844
TOTAL	$398,032	$178,754

III. MICROBIAL AND NUTRITIONAL QUALITY

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
ASSURANCE OF QUALITY IN PREPACKAGED FRESH FISHERY PRODUCTS TYRE C. LANIER UNIVERSITY OF NORTH CAROLINA	$20,555	$13,450
HAZARDOUS MICROORGANISMS IN SEAFOODS M.L. SPECK UNIVERSITY OF NORTH CAROLINA	$12,201	$7,043
MICROBIOLOGICAL EVALUATION OF SHELLFISH AND NEW SEAFOOD PRODUCTS: COLLABORATIVE STUDIES M.L. SPECK UNIVERSITY OF NORTH CAROLINA	$7,639	$3,828
DETECTION OF MICROBIAL GROWTH AND ACTIVITY IN SEAFOODS AND SEAFOOD PRODUCTS P.J. VABDEMARK STATE UNIVERSITY OF NEW YORK, CORNELL	$18,902	$22,092
LIPIDS: THEIR ROLE IN FISH QUALITY J.KINSELLA STATE UNIVERSITY OF NEW YORK, CORNELL	$3,300	$8,145
SEAFOODS ROLE IN HUMAN NUTRITION D.T. GORDON OREGON STATE UNIVERSITY	$16,100	
SEAFOOD TECHNOLOGY GUNNAR FINNE TEXAS A&M UNIVERSITY	$65,000	$35,748
INVESTIGATIONS OF THE MICROBIOLOGY OF RANGIA CLAM WITH EMPHASIS ON SOLUTIONS TO MARKETABILITY PROBLEMS B. E. KANE UNIVERSITY OF NORTH CAROLINA	$11,840	$5,336
ASSESSMENT AND CONTROL OF VIRUS CONTAMINATION OF SHELLFISH M. D. Sobsey UNIVERSITY OF NORTH CAROLINA	$41,171	$20,045
TOTAL	$196,708	$115,687

IV. HANDLING AND PROCESSING

TITLE/INVES./INST.	FED FUNDS	MATCHING FUNDS
IMPROVED FISH SMOKING WITHY A COMBINED SOLAR DRYER & SMOKER C.D. BAIRD/J.C. DENG STATE UNIVERSITY SYSTEM OF FLORIDA	$11,800	$3,000
INCREASING THE ECONOMIC VALUE OF MICHIGAN COMMERCIAL FISHERY THROUGH THE UTILIZATION OF CARP L.E. DAWSON UNIVERSITY OF MICHIGAN	$25,317	$9,463
APPLICATION OF CONTROLLED ATMOSHERIC STORAGE TO EXTENDING THE SHELF LIFE OF WHOLE AND PROCESSED FRESH FISH FRANCIS F. BUSTA UNIVERSITY OF MINNESOTA	$25,440	$8,876
MICROBIAL QUALITY IMPROVEMENTS OF SEAFOODS J.S. LEE OREGON STATE UNIVERSITY	$37,000	$42,600
ENZYMATIC PROCESSES TO PRESERVE FRESH FISH A.G. RAND/S.M. BARNETT UNIVERSITY OF RHODE ISLAND	$30,289	$12,160
IMPROVED MARINE FOOD PRODUCTS AND MARINE FOOD TECHNOLOGY W.D. BROWN UNIVERSITY OF CALIFORNIA	$34,382	$37,500
MARKET DEVELOPMENT FOR UNDERUTILIZED LAKE ERIE FISH SPECIES INCLUDING NEW PACKAGING TECHNIQUES JEFFREY M. REUTTER OHIO STATE UNIVERSITY	$28,400	$2,200
SEAFOOD PROCESSING AND UTILIZATION J.K. BABBITT OREGON STATE UNIVERSITY	$53,900	$62,800
STORAGE STABILITY OF THE PURPLE-HINGE ROCK SCALLOP (HINNITES MULTIRUGOSUS) R.V. JOSEPHSON UNIVERSITY OF CALIFORNIA	$14,112	$9,437
TOTAL	$260,640	$188,036
GRAND TOTAL	$901,366	$509,522

SEA GRANT PUBLIC AFFAIRS

James C. Elliott

The Sea Grant public affairs effort during the past year had three primary objectives:

(1) To promote broader public understanding of Sea Grant research, educational, and marine advisory service activities;

(2) To improve liaison between the National Sea Grant Office and the Sea Grant Communications Network; and

(3) To establish more effective internal communications as they relate to the Sea Grant staff, the Sea Grant institutions, and the National Oceanic and Atmospheric Administration (NOAA).

To meet these goals, a variety of public relations strategies were employed.

To promote broader public understanding, the office continued its program of grant and feature press releases. The activity was marked by an increase in the number of releases produced and a heavier concentration on the feature type release. In the latter category, our most successful efforts continue to be with Dr. Martin J. Nemiroff and his cold water drowning techniques and with aquaculture, a subject of growing interest both nationally and internationally. We have had some success, too, with our release dealing with the work of Dr. William Fife at Texas A&M University. Dr. Fife is conducting research on pregnant sheep and relating his experiments to pregnant scuba divers. His findings have been supplemented by an international survey of women divers conducted by Margie Bolton in Florida, and we are just now getting into publicizing her findings. Dr. Fife's work won the interest of Senator William Proxmire but did not win the Golden Fleece Award. We won our first Golden Fleece Award this year, however, for research carried out five years ago in Hawaii on the effect of marijuana smoking on scuba divers.

Other releases that generated press interest included the vaccinator peg (use of the wooden peg to inoculate lobsters against gaffkemia); desalination (wave-powered desalination system); chitin and chitosan studies; medicines from the sea; and international cooperation assistance programs.

Through suggestions to writers and editors, queries resulting from press releases, interviews with Sea Grant staff members, and initiative taken by the Sea Grant Communicators, a number of articles on specialized subjects involving Sea Grant research and NOAA appeared on a national level through outlets that included the Associated Press, United Press International, *The New York Times Sunday Magazine*, *The New York Times Week In Review*, *the Boston Globe*, *the Baltimore Sun*, *MTS Journal*, *Sea Technology*, *Dun and Bradstreet Journal*, *Nursing Research*, *The Wall Street Journal*, *Sport Diver Magazine*, *National Fisherman*, *Shellfish Digest*, *American Way* (American Airlines), *Sky* (Delta Airlines), *LSU Alumni Magazine*, and the *University of Georgia Alumni Magazine*.

Additionally, we are aware of articles in preparation for publication or already in the hands of the editors of *Science 80s*, a new publication by the American Association for the Advancement of Science (AAAS); *GEO*, a new magazine published by a German firm with a U.S. outlet; *Emergency, the Journal of Emergency Services; Oceans*, which has a circulation of 50,000; and *Family Weekly*, a Sunday supplement with a readership of 24 million.

Of course, contributions to *NOAA Magazine*, both from the office in Washington and from Communicators in the field, continued during the year, as did items for *NOAA News*.

Because of the retirement of Jack Guinan and Jeff Baker, we have not been as active in radio and television as we have in the past. We did manage to provide a couple of subjects for radio interviews, however, and assisted Jeff in making some of the filming arrangements for the coldwater drowning TV spot and for the Sea Grant movie.

We have realized success, also, with radio, TV, and the newspapers in arranging for interviews with Sea Grant personnel in travel. The most recent example was with Dr. Ned Ostenso during the Sea Grant Review Panel meetings in Athens, Ga. An interview with the Athens paper resulted in a column and a half article, and a TV interview is expected to end up as a 30-minute show on Educational TV outlets from Virginia to Texas.

New publications during the year included *The First Ten Years*, an informational, historical accounting of Sea Grant's first decade of operation, and *University Curricula in the Marine Sciences and Related Fields*, a compilation of oceanographic study courses offered in approximately 300 colleges and universities across the Nation. The magazine, *Sea Grant '70s*, continued in operation at Virginia Polytechnic Institute and State University, and new proposals for that publication are now being received. Indications are that proposals will come from VPI&SU, New York Sea Grant Institute, Georgia Sea Grant Program, and the Mississippi/Alabama Sea Grant Consortium.

During the past year, the Sea Grant Public Affairs staff played a major role in planning and conducting the annual Sea Grant Communicators' Workshop, held at the Ramada Inn in Rosslyn, Virginia, last April. Host institution for the three-day event, entitled "The Washington Connection," was the University of Maryland. Personnel from the Washington office, however, working in coordination with the University of Maryland's Communicator, Mike Fincham, largely were responsible for making hotel, meal, and transportation arrangments, as well as for the selection of key speakers. National office personnel also served as liaison with the Communicators in the field who were responsible for seminars and as coordinators between the Communicators and NOAA Congressional Affairs in the planning and implementation of a presentation and reception on the Hill for members of the Congress and their staffs. The workshop marked the first time the Sea Grant Office had been asked by the Communicators to provide major assistance for one of their national meetings, an indication of the improved working relationship between the national office and the field.

In line with the mandate "to improve the operations of Sea Grant with respect to internal and external communications," the publication of an internal calendar and bulletin, known as *Comings and Goings*, was launched in 1979. The periodical, produced every two weeks, is designed to report on Sea Grant office activities and -- because of the heavy travel schedules of our scientists -- to show who is on travel and where they are. In addition to internal distribution, the publication is distributed to members of the Sea Grant Review Panel, Sea Grant Directors, Sea Grant Communicators, Program Leaders in the Marine Advisory Service, NOAA PA, and other NOAA offices. Its contents have proved highly useful within the Sea Grant office.

Additionally, the information has been well received in the field. While a number of persons have written complimentary notes, the most recent note from Dr. Rita Colwell, Sea Grant Director at the University of Maryland and an internationally-renowned microbiologist, was received just this week and represents the attitude reflected in other letters. Dr. Colwell wrote: "I wanted to compliment you on the in-house Sea Grant newsletter that you put together. It's very useful and very interesting. Our staff appreciates the information you provide. It's a very nice communications mechanism."

This past year has seen improvements, also, in *Communicators' Update*, a semiannual compilation of Sea Grant Communicators' activities, which was started in 1978. Format of the publication has been changed and more frequent production and distribution are under consideration. Evidence of the Communicators' reaction to this effort and its improvement can be found in a letter, also received this week, from Karen Y. Tanoue, Pub-

lications Editor, of the University of Hawaii Sea Grant College Program. Ms. Tanoue wrote, "Thank you (or as they say in Hawaii, 'mahalo') for all the super information that appeared in the November 9, 1979 issue of the 'Sea Grant Communicators' Update.' I especially appreciated the item on copyright laws. Downs Matthews' personal views on aspects of publications production and editing were very precious, too."

Because communications activities are spread among a number of classifications in the Sea Grant Program, identifying all communications projects is difficult. However, a compilation of well-identified projects follows:

SEA GRANT COMMUNICATIONS ACTIVITIES - 1979

PA-Related Budgetary Information

Institution	P.I.	Activity	SG Funds	Match
1. Maryland	Fincham	Communicators' Workshop	$ 8,800	-----
2. N. Carolina	Pilkey	Citizens Guide to U.S. Barrier Islands	$ 90,000	-----
3. Rhode Island	Tippie	Coastal Oceanography and Climatological News	$ 24,000	-----
4. Washington	Fuller	Sea Search - TV Program	$ 21,400	$ 28,300
5. Wisconsin	Weimer	Earthwatch - Radio and news column	$ 19,918	$ 12,649
6. Puerto Rico	Sotomayer	Brochure - PR Vacation Guide	$ 4,000	------
			$168,118	$ 40.949

SEA GRANT COMMUNICATIONS ACTIVITIES - 1979

Budgetary Information

	Institution	P.I.	Sea Grant Funds	Matching Funds	
1.	Univ. of Alaska	Melteff	$145,916	$ 92,621	
2.	Univ. of California	Sullivan	$129,749	$ 29,991	
3.	Univ. of Delaware	Danberg	$ 97,257	------	
4.	Univ. of Georgia	Rivers	$ 39,100	$ 20,300	
5.	Univ. of Hawaii	Pfund	$101,221	$ 27,021	
6.	Louisiana State Univ.	Becker	$ 66,235	$ 95,399	
7.	Michigan Sea Grant	Lin	$122,123	$ 17,796	
8.	Univ. of N. Carolina	Copeland	$ 79,211	$ 26,910	
9.	Ohio State Univ.	Herdendorf	$ 12,000	------	
10.	Univ. of Rhode Island	Edel	$105,000	------	*
11.	Texas A&M Univ.	Colunga	$125,000	$ 89,640	
12.	Virginia Tech	Holliman	$ 72,250	------	**
13.	Univ. of Washington	Peyton	$ 35,200	------	
14.	Univ. of Washington	Peyton	$ 13,800	------	
15.	Univ. of Washington	Peyton	$ 49,900	------	
16.	Univ. of Washington	Peyton	$ 41,700	------	
17.	Univ. of Washington	Duxbury	$225,700	------	***
18.	Univ. of Wisconsin	Weimer	$ 95,515	$ 59,629	
			$1,556,877	$459,307	

* Sea Grant Depository
** Sea Grant '70s
*** Puget Sound Publications Series

As mentioned earlier, the compilation includes only well identified communications projects. As a result, somer institutions which have significant programs in communications are not identified in the tabulation. A revised classification system would be helpful.

Work also has been started on two major projects: (1) the Sea Grant Biennial Report, which replaces the annual report; and (2) a revised "Green Book," describing how proposals should be prepared for submission to Sea Grant.

Staff changes during the year included Mary C. Holliman, of the Virginia Polytechnic Institute and State University (VPI&SU), who replaced Ann Greer as the IPA (Intergovernmental Personnel Act) assistant in the office, and Barbara Rotondi, a secretary supported by Sea Grant funds who previously had worked in the NOAA Film Library. Ms. Holliman, formerly editor of *Sea Grant '70s*, and Mrs. Rotondi, out first fulltime secretarial assistant, bring great potential to the office that already has been demonstrated by a significant increase in productivity. The addition of these capable individuals should be considered one of the major accomplishments in Sea Grant Public Affairs during 1979.

THE 1980 PROGRAM

Target Audiences

In keeping with a policy supportive both of Sea Grant and NOAA, the public affairs program in 1980 will be designed to appeal to several target audiences. They are:

(1) General Public -- A more concentrated effort aimed at attracting attention of Sea Grant and NOAA in national publications, both newspapers and magazines, and on network radio and television will be undertaken.

(2) Congress -- A more emphatic program will be developed to bring about improved methods of informing the members of the Congress and their staffs about Sea Grant and NOAA activities.

(3) Academia -- In line with NOAA's announced intention of increased activity with campuses across the Nation, a more definitive drive will be made to utilize the capabilities within the Sea Grant Program to address NOAA issues so that its needs are more clearly recognized and understood in the academic community.

(4) Industry -- Greater devotion of effort will be made with this important segment of the private sector in a move designed not only to bring about a better understanding of the goals and objectives of Sea Grant and NOAA, but also to attract more active participation of industry in the research.

Strategies

Public Affairs strategies to be employed with these target audiences include, but are not limited to, the following:

Fundamentally, any objective calling for wider public understanding of an agency's activities demands a multidirectional thrust which incorporates a wide range of outlets and audiences, including not only the media, but specialized groups in education, industry, and other organizations during their annual meetings or conferences.

As a start, public affairs intends to prepare a comprehensive general press kit for distribution to editorial writers, science writers, and others involved or interested in oceanic affairs. The kit will contain background papers on Sea Grant and NOAA; fact sheets on significant Sea Grant research, educational, and marine advisory service activities; a directory of Communicators, listing their addresses and phone numbers; a summary of major Sea Grant accomplishments showing cost effectiveness

and benefits of the research; photos; and other appropriate materials. The press kit also will serve as a handout to reporters and others who visit the office seeking specialized information on specific topics or backgound on the overall Sea Grant Program.

The press kit also will be helpful as an introductory tool for visits to editorial offices with magazine editors and TV and radio producers, as well as with freelance writers in what, during this next year, will be a major concentration toward the national media. As mentioned earlier, several magazine articles in nationally-distributed publications already are underway. A great many other opportunities exist, however, and the intention is to focus not only on nationally-recognized publications, such as *National Geographic*, *Reader's Digest*, *The New York Times*, and others, but also on more specialized magazines in fields such as fishing, medicine, nursing, education, environment, engineering, science, academia, recreation, and others.

The media effort will both offer and seek the assistance of the Sea Grant Communicators in this endeavor, concentrating in obtaining coverage in the Sunday section of the newspapers in close proximity to the institution involved and in regional, State, or local magazines, which most major cities now have.

The media thrust also will necessitate greater involvement of the Sea Grant staff with the press. Initial efforts this past year indicate clearly that the press is interested in talking with our scientists and top echelon personnel, particularly on travel when they enjoy the identification of being "an expert from out of town." Here, again, assistance will be asked of the Communicators' at the institutions, who -- because of their already-established press contacts -- would be the best source for approaching the media.

As a further strengthening of this program, plans are underway to have top echelon Sea Grant officials, most likely Dr. Ned Ostenso, the Director; Bob Wildman, Deputy Director; and Bob Shephard, Director, NOAA Marine Advisory Services; attend a one-day short course to better acquaint them with how to make a more effective appearance on television and radio. The course, offered by MediaCom in New York City, is considered one of the best in the Nation and has been used quite effectively by chief executives of some of the major corporations in the Nation for years. MediaCom not only assists in showing candidates how to sit, how to gesture, and how to dress, but also on what to say. The establishment of a "story line" for Sea Grant, of course, also would serve as input for a speakers kit that can be made up for other scientists in the office for their use on trips where they will be confronted by the press.

In the area of television, plans are underway to take advantage of Dr. Nemiroff and his coldwater drowning techniques in the spring just prior to the opening of the swimming season. Through personal contacts with friends of long standing at NBC, it is hoped that interest can be developed on the Today Show, Prime Time Sunday, and on the Johnny Carson show. Efforts also will be explored with the other networks, of course, particularly with some of the more popular talk shows, such as Mike Douglas and Merv Griffin.

We already are aware of a great deal of interest among producers of children's shows to air topics involving science. This is a result of work that Shirley Hudgins of the University of Southern California, who has been working with educational TV and other outlets in both Los Angeles and New York. As a result, we intend to get in touch with the producers of Kid's World and the Children's TV Workshop in the hope of generating interest in a lively topic that depicts the work of Sea Grant and NOAA.

Another program targeted for approach is PM Magazine, the nightly CBS network show which covers a wide range of subjects and, in initial talks with the Washington producer, appears to be receptive to suggestions and ideas.

Other TV plans for the year, still in the formative stages, include:

(1) Representation at the annual meeting of American Women in Radio and Television, which will hold its session in San Antonio, Texas, next June. This meeting attracts 400 to 500 broadcasters from throughout the Nation, all of whom attend the get-together with the idea of bringing back interviews with interesting people on interesting topics. Involvement requires the expenditure of some effort, particularly in a strong advance preparation to interest the broadcaster in your topic or topics, and of some money for the expense of camera crews and cassettes.

(2) Attendance at the annual convention of the Food Editors, to be held on the West Coast next October. This convention allows, for a fee, the presentation of a one-hour program on a subject related to food. It would afford an opportunity to interest the food editors in writing about underutilized species, the best ways of selecting fresh fish, better ways of storing fish, and a number of other topics. The meeting normally attracts about 125 food editors.

(3) Development of subjects for public service spots on Sea Grant in which sports personalities or individuals in the entertainment field would be used as the narrators. Personal contacts in these fields would permit their participation either without cost or at scale.

With a little bit of luck, the Sea Grant motion picture should be completed during the coming year. This 28-minute color presentation will be distributed through NOAA channels and through the Sea Grant Communicators for use throughout the United States on television and before other audiences.

A greater effort will be expended in the coming year in radio, also. In addition to providing subjects for NOAA and Commerce radio programs, plans call for a wider use of private sector outlets for distributing the Sea Grant and NOAA messages. Two of those outlets established as immediate targets are the Associated Press Audio, which produces a weekly consumer show, and Gene King's Consumer Buyers' Guide, sponsored by the Better Business Bureau and aired nationally over the Mutual Network, the Nation's largest radio network. The latter program involves taping five one-minute programs with an introduction and signoff by King at no cost to the agency.

While there is by no means any intention of usurping the prerogatives of Congressional Affairs, there is -- of necessity -- a public affairs requirement, it seems, in assuring that members of the Congress are kept informed of significant Sea Grant activities. In the scheme of things, public affairs does, after all, prepare the press releases and fact sheets that, to a large measure, assist in informing the folks on the Hill what is taking place currently in the program, particularly as it relates to their home constituency. In addition to that channel of communication, Sea Grant public affairs has been involved in past years with underutilized species dinners for the members of Congress and for special events on two occasions this year. One of them, already mentioned, was the presentation and reception last April during the annual Sea Grant Communicators' Workshop. The other was this fall when we assisted NOAA Congressional Affairs and several Sea Grant Directors in the planning and development of a Great Lakes Symposium. The program, which included appearances by NOAA Administrator Richard A. Frank and Congressmen Jim Oberstar and Jim Blanchard, outlined NOAA activities in the Great Lakes area, with representatives from several NOAA activities and from a number of Sea Grant institutions explaining the roles of the activity or institution in making the Lakes a better and cleaner body of water. Top level Sea Grant officials believe this type of presentation is an excellent means of informing the Congressmen, Congresswomen, and

Senators. However, they are not yet satisfied that these sessions have been conducted as effectively as they might be. As a result, plans are underway to hold more seminar-type sessions on the Hill, probably concentrating on one State at a time and involving a great deal more advance promotion and planning and allowing more generously for the vicissitudes of the time demands faced by any Representative or Senator in Washington.

Additionally, plans call for paying closer attention to activities of Sea Grant in the field so that when something occurs that might be of interest to someone on the Hill, the information is dispatched promptly. This effort would include sending copies of newspaper and magazine articles, speeches, or reports that might be helpful in creating a better understanding of the program.

Another public affairs effort planned in the Congressional area is for some type of special event which will involve Senator Claiborne Pell, one of the "fathers" of Sea Grant. At the present, a ceremony is planned tentatively for the University of Rhode Island in February, the anniversary of the first Sea Grant made to URI. An invitation will be extended to Mr. Frank.

By design and by experience, Sea Grant is acknowledged as one of the most active Federal-university programs in the Nation. The original legislation in 1966 laid out the program as one which would marshal the intellectual talents on campuses of institutions throughout America to bring about wiser understanding and use of the oceans. In the 13 years since its founding, Sea Grant has become an integral part of many college programs. It has grown to be well recognized as a program of consequence and a research effort that has been highly successful in unlocking many of the secrets of the oceans. There now are 13 Sea Grant colleges. In the original legislation, Congress outlined the necessity for the promotion of marine education as well as marine advisory services. In the revised legislation of 1976, Congress reemphasized the need for education, specifically stressing the necessity for oceanic education in grades kindergarten through twelve (K-12).

While Sea Grant has been instrumental in what might be termed token introduction of the subject into the school systems of America, a great vacuum still exists. In the past year, considerable progress has been achieved in this area, primarily through the efforts of Dr. Barbara Spector, another IPA in the Sea Grant office, who not only has brought greater focus on elementary and secondary educational opportunities for Sea Grant, but also has mustered a great deal of support for wider introduction of marine education in the schools in major Federal agencies involved with education

and with State and local school authorities throughout the land. These include the Department of Education, National School Boards Association, National Association of State Boards of Education, Council of Chief State School Officers, and Council of State Science Supervisors. In addition, Dr. Spector has prepared a number of highly popular papers that have been distributed nationally, all of which indicate why marine education is important and how it can be introduced into the schools.

What is needed now is a wider teacher constituency to support her efforts. As a result, a much more serious look is being taken toward appearances of Sea Grant speakers at major educational meetings throughout the country. As initial targets, the focus is being placed on the National Education Association and the American Federation of Teachers. These organizations are teacher unions, and they represent a powerful influence over the determination of school curricula.

Another weapon to be used in influencing the academic community is *Sea Grant '70s*. In the coming year, the publication is scheduled to become less parochial in its contents, offering articles of wider appeal than Sea Grant research itself and more stimulating to both the academic leaders and to the major thought leaders of the Nation. The new format is expected to create a wider interest in the oceans and in Sea Grant and thus generate participation of more of the country's leading scientists in the program.

The magazine's new format also is expected to have a greater impact on industrial leaders of the Nation, many of whom already are significant partners of Sea Grant in trying to overcome some of the perplexing problems and challenges inherent in the seas. More emphasis will be placed this year on widening institutional efforts throughout the Sea Grant system for greater intercourse with industry. While no specific program has been determined, indications are that greater efforts to present Sea Grant speakers at national assemblages will be made and that more determined communications will be established with the industrial community to create better knowledge and understanding of the program.

While the aforementioned audiences and strategies will be the major goals and objectives of the Sea Grant Public Affairs Program in 1980, there are a number of other activities, still in the formulative stages, that are planned. Some examples are:

(1) Designation of the University of New Hampshire/University of Maine cooperative program and University of Georgia as Sea Grant Colleges. There is a possibility that the University of Alaska will win that designation in the coming year, also.

(2) The First International Hypothermia Workshop and Conference will be held at the University of Rhode Island in January. This meeting will attract leading experts from throughout the world.

(3) In conjunction with the Year of the Coast, the Georgia Sea Grant Program is planning a media briefing on the Georgia Coast sometime in January. The program is being carried out to determine the interest of inlanders in oceanic and coastal activities and to broaden the interest of all Georgians in coastal area. Other Sea Grant programs are considering similar activities.

(4) A media workshop is planned for Hawaii next April. The Workshop will be patterned after some of the similar media events that have been staged by NOAA. Concentration will be on marine research, however, and the audience will be largely from the islands.

(5) Next year's Communicators' Workshop will be held at Sapelo Island, Ga., next April. The Communicators also will get together again at the Sea Grant Association Conference at Mackinac Island, Michigan next fall.

(6) A conference on International Ocean Policy at URI for which greater public affairs support will be provided.

(7) To a certain extent, Sea Grant's involvement with the refugee problem in the United States is expected to require some public affairs support. Information is being collected to determine what the various Sea Grant programs are doing to assist with the problem. A fact sheet outlining those activities is anticipated.

(8) There is every intention, too, to assist NOAA in the celebration of its tenth anniversary. Our search for events that might be tied in with the anniversary have been far from fruitful, however. The topic has been brought before the Sea Grant Directors, both at the Sea Grant Association meeting in Orlando and at the Directors' meeting in Athens, Ga., without the appearance of any useful ideas.

(9) Sea Grant scientists from five institutions will be conducting a major field study of the California shoreline in February. The work is being carried out as a Sea Grant national project and represents the second major field study carried out under the project. The scientists will be using more than 100 instruments to measure all types of flows, currents, sand movements, shelf changes, etc., during the period, many of which have been designed by instrumentation experts in the program itself. The field study lends itself to press coverage, however, and support for that effort is being planned.

Overall and in retrospect, the Sea Grant Public Affairs effort in 1979 has had its ups and downs. The public affairs officer was hospitalized for approximately three months during the year at a time when no IPA assistant was physically on board. The combination of events resulted in near zero productivity during one full quarter of the year. With the return of the public affairs officer and the arrival of the new IPA assistant, a vigorous program of catch-up was launched. As of now, the backlog is down to zero, and we are looking forward to 1980 with a great deal of optimism and expectation.

The following is an overview of Sea Grant marine recreation related research funded during the 1979 fiscal year. Like other forms of outdoor recreation, marine recreation is a diverse and multi-disciplinary field of study. While much of Sea Grant's research is potentially relevant to the development and utilization of marine and coastal resources for recreation, this review focuses on those research efforts directly addressed to recreational topics. Due to the multi-disciplinary character of marine recreation research, many of the projects included in this review may also be incorporated in other subject area discussions. For purposes of identifying relevant projects, marine recreation has been broadly defined to include research that examines the nature and characteristics of marine recreational activity participation, marine recreational industries and potential recreational resources.

During the 1979 fiscal year, 18 marine recreation related research projects were funded involving $338,018 in Federal funds and $210,582 in non-Federal funds. As in previous years, the major emphasis is on the participation characteristics, resource and economic impacts of sport fishing, and recreational boating. Although there remains a major emphasis on the resource aspect of recreation, additional effort has been directed to the socio-psychological aspects of recreation. The attached listing presents the FY-1979 marine recreation projects relative to the recreational activity examined.

Due to the paucity of baseline information available for assessing marine recreation development potential and the relationship of recreation to other marine and coastal uses, Sea Grant research has been a major aid to public and private recreation developers and managers. In many instances, Sea Grant research has provided the information necessary for making recreation planning and development decisions.

Sea Grant Marine Recreation Research - FY 1979

Sport Fishing (cont.)

		SG/Funds	Matching Funds
TITLE :	Recreational and Commercial Fishing in Wisconsin's Lake Michigan Waters	$ 17,671	$ 5,674
INVESTIGATOR:	R. Bishop		
INSTITUTION :	University of Wisconsin		

Recreational Boating

TITLE :	Legal Aspects of Marina Siting in Florida	29,100	8,200
INVESTIGATOR:	F. E. Maloney		
INSTITUTION :	Florida Sea Grant College Program		
TITLE :	Michigan Great Lakes Recreational Boating - Demand, Supply, Marketing and Economic Impact		21,395
INVESTIGATOR:	D. J. Stynes		
INSTITUTION :	University of Michigan		
TITLE :	The Recreational Demand for Development of Harbors of Refuge in Western Lake Superior	3,163	3,231
INVESTIGATOR:	L. MaCavoy		
INSTITUTION :	University of Minnesota		
TITLE :	Economics of Marine Recreation	8,000	3,300
INVESTIGATOR:	R. L. Stokes		
INSTITUTION :	University of Washington		

Other

TITLE :	Tourism Development Studies on the Great Lakes	9,216	277
INVESTIGATOR:	T. C. Brown		
INSTITUTION :	New York Sea Grant College Program		
TITLE :	Water Related Fatalities in Coastal Texas	19,000	9,968
INVESTIGATOR:	J. A. McCloy		
INSTITUTION :	Texas A & M University		
TITLE :	Assessing an Underwater Park Preserve for Wisconsin's Great Lakes Waters	8,775	4,023
INVESTIGATOR:	W. Fisher		
INSTITUTION :	University of Wisconsin		

Sea Grant Marine Recreation Research - FY 1979

Sport Fishing

		SG/Funds	Matching Funds
TITLE :	An Economic Evaluation of the Chesapeake Bay Sport and Commercial Striped Bass Fisheries	$ 21,200	$ 29,000
INVESTIGATOR:	V. J. Norton/I. E. Strand		
INSTITUTION :	University of Maryland		
TITLE :	The Relative Impact of Netting and Sport Fishing on Economically Important Estuarine Species	19,482	9,742
INVESTIGATOR:	W. Lorid		
INSTITUTION :	Mississippi/Alabama Sea Grant Consortium		
TITLE :	Application of Management Strategies to the Mid-Atlantic Extended Jurisdiction Recreational Fisheries	12,936	13,710
INVESTIGATOR:	B. T. Wilkins		
INSTITUTION :	New York Sea Grant College Program		
TITLE :	Determined Movement Patterns of Salmonids to Aid Sport Fishing and Stock Assessment	24,465	19,487
TITLE :	Boats, Men and Fish: A Study of the Recreational Fishery Off North Carolina	24,348	12,056
INVESTIGATOR:	P. Fricke		
INSTITUTION :	University of North Carolina		
TITLE:	A Study of Marine Recreational Fishing in Rhode Island	31,750	29,958
INVESTIGATOR:	K. E. McConnell		
INSTITUTION :	University of Rhode Island		
TITLE :	Salt Water Boat Fishermen: A Statewide Survey of Activity Patterns, Characteristics and Motivations	28,700	14,233
INVESTIGATOR:	R. B. Ditton		
INSTITUTION :	Texas A & M University		
TITLE :	Sport Fishery Citation Data Coding and Storage	13,500	7,257
INVESTIGATOR:	C. E. Richards		
INSTITUTION :	Virginia Institute of Marine Science		
TITLE :	Northern Puget Sound Non-Salmon Recreational Fishery	16,500	9,500
INVESTIGATOR:	S. B. Mathews		
INSTITUTION :	University of Washington		

Sea Grant Marine Recreation Research - FY 1979

Other (cont.)

		SG/Funds	Matching Funds
TITLE	The Impact of Off-Road Vehicles on Beach, Dune and Grassland Eco-Systems on the Barrier Islands of North Carolina	$ 18,864	$ 9,571
INVESTIGATOR:	P. Hosier		
INSTITUTION :	University of North Carolina		
	TOTALS	$338,018	$210,582

National Sea Grant Library
Pell Library Building
Narragansett Bay Campus
University of Rhode Island
Narragansett, RI 02882-1197 USA

DEMCO