

MIAU-Q-75-001

Sea grant annual report

NO. 3



A REPORT ON THE
UNIVERSITY OF MIAMI
SEA GRANT PROGRAM
FOR JULY '74 - JUNE '75

Henry King Stanford
President

Sidney L. Besvinick
Vice President for Academic Affairs

Howard R. Cottrell
Treasurer

Eugene H. Man
Dean, Research Coordination
Director, Sea Grant Program

University of Miami
Sea Grant Program
1217 Dickinson Drive
P.O. Box 248106
Coral Gables, Florida 33124
Telephone: 305-284-3334

JULY 74 - JUNE 75
UNIVERSITY OF MIAMI

Sea
grant
annual report

No. 3

contents

INTRODUCTION
PAGE 1

OCEAN LAW AND ECONOMICS
PAGE 3

LIVING RESOURCES
PAGE 5

APPLIED ECOLOGY
PAGE 7

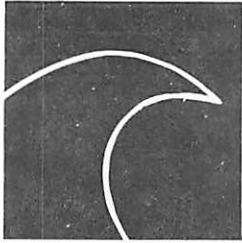
MARINE PATHOLOGY
PAGE 9

ADVISORY SERVICES
PAGE 11

1974-75 RESOURCES AND FUNDS
PAGE 14

PROGRAM SUMMARY
PAGE 16

ADVISORY COMMITTEE
Page 17



introduction

Why can't visiting tourists see the bottom of Biscayne Bay when they go snorkeling?

Are swimmers and waterskiers endangered by the same organism that killed thousands of fish yesterday?

Where can we get answers to legal questions about bulkheading?

What would it cost to reforest barren bottoms and shorelines?

Where should we place the new marina?

How much bait-shrimp trawling can the bay support?

Do circulation patterns bring sewage from ocean outfalls back into the bay?

These are a few of the questions that typically arise in a coastal community. They are certainly common in Biscayne Bay where many interests compete, sometimes inflicting injury upon each other.

Southeast Florida's leaders have come to accept two major responsibilities: to provide services to a rapidly growing population and to protect a unique tropical lagoon around which that populace is assembled so densely and so stressfully. The UM Sea Grant Program has been designed to provide direct and hopefully quick response to the interrelated problems with which decisionmakers grapple daily.

The University, because of its geography, climatology, and demography, is well situated for field investigation. Its experience in

marine research, going back three decades, enables it to exploit its environmental advantages.

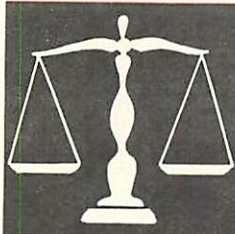
Like the national program, the UM program is committed to closing the chasm between the data-gatherers and the data-users--between science on one hand and commercial and sport fishing, sea-related industry, conservation, marine recreation, and other interests in the seaside community.

Not only must research be consumer oriented but its product must be made available in understandable, usable form to those who can put it to work. The UM program, therefore, is tripartite: research, education, and service.

This tripodal approach requires the crossing of many disciplinary frontiers. The strategy attempts, laser-like, to excite and make coherent the many beams of light emanating from investigations in economic, engineering, biology, law, management, sociology, chemistry, physics, and medicine. For instance, a Sea Grant economist worked with biologists last summer to assess the impact of sport fishing on the lobster census at a time when the Bahamas government was barring American lobstermen from territorial waters. To take another example, a Sea Grant scientist showed that Thalassia can be re-established on bay floors by a transplant technique many times faster than nature could do, and then undertook to help economists and engineers determine what the cost to a community would be.

Facilities available to Sea Grant are extensive and include those on the Main Campus in Coral Gables, the downtown Medical Campus and the Rosenstiel School of Marine and Atmospheric Science on Virginia Key, as well as field stations on Fisher Island and Pigeon Key and aquaculture ponds at Turkey Point.

The UM Sea Grant proposal stated the 1974-75 objective to be The Utilization of Estuarine Resources in South Florida. Programs directed toward this goal have been Ocean Law and Economics, Marine Pathology, Applied Ecology, Living Resources and Advisory Services. This report will show how each program contributed individually and in concert.



ocean law and economics

The Sea Grant Ocean Law Program, pioneered at the University of Miami, continued to be productive in its fifth year of operation.

Five projects with research and education orientations were carried out during the year.

Juris Doctor degree candidates were offered a strong specialization in ocean and coastal law. Courses and students enrolled in each:

First Semester: Coastal Law 10, Individual Research 5, International Law 40, Ocean Law 25, Admiralty 40

Second Semester: Admiralty 40, Individual Research 5, Marine Transportation 30, Ocean Law Seminar 8, and Coastal Law Seminar 14

Student-credit hours totaled more than 500.

University law graduates with concentrations in ocean and coastal law sponsored by Sea Grant have found positions in state and local government, academic institutions, industry, foundations, and private practice, where their influence will no doubt continue to grow.

The Master of Law Program in Ocean and Coastal Law has awarded in the five years of its existence a total of 33 LL.M. degrees and the recipients have begun active careers--six in teaching and research in the academic world, five in Florida state government, five in ocean and environmental work for the U.S. Navy, three others in the General Counsel's Office of the National Oceanic and Atmospheric Administration, ten in similar government work in Washington, and the rest in private practice.

This program is listed as terminated for Sea Grant purposes, but

courses and guided research training continue in the School of Law. Five lawyers received the Master of Laws degree with Ocean and Coastal Zone Law specialization at the end of the past year.

Community Legal Problem Services (State and Federal) produced four completed studies during the year--wetlands-related legislation in the United States, state regulation of water-area, extension of federal marine jurisdiction landward of the mean high water line, and offshore drilling and onshore impact. In addition to distribution to requesting agencies, copies were supplied to all coastal state Coastal Zone Management offices and to the Office of Coastal Zone Management and other federal agencies.

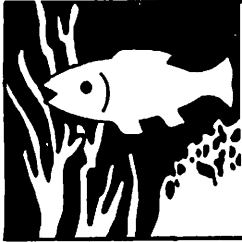
The absence of a faculty member on leave to work in the United States Department of State on ocean law matters made it necessary to terminate one project and bring another to early completion so that faculty resources could be concentrated on remaining projects.

A project to offer quick response to queries about legal problems, Community Legal Problem Services (National) was closed after completion of four studies during the year--the 1935 Anti-Smuggling Act and the contiguous zone, the legislative history of the Coastal Zone Management Act of 1972, impairments of navigation, and legal problems of undersea storage of grain and fish. In addition to distribution of study results to requesting and other interested agencies, copies were distributed to interested federal departments.

Two Ocean Law studies were published by Advisory Services at the University of Miami. Both provided background for participants in Law of the Sea Conferences:

A Multi-Disciplinary Analysis of the Various Proposals Presented for the 1974 Conference on Exclusive Fisheries Zones, by Lawrence G. Mallon, 81 pp.

An Anonymous Draft Treaty on the Law of the Sea. Edited by Dennis O'Connor, 126 pp.



living resources

Two projects were completed in the 1974-75 budget year, three others were terminated and a sixth continued into 1975-76.

A three-year study to find ways to improve techniques for mass-culture of crustacean larvae, was successfully concluded. The principal investigator succeeded in establishing a mass-culture method for stone crab, M. mercenaria, seeding production; successfully reared stone crabs from egg to third generation adult; developed large-scale production methods for unialgal phytoplankton culture media; developed a mass-culture method for two strains of Brachionus rotifer, a larval food organism; and taught a graduate level course in culture of marine organisms.

The results all contributed basic data for use in mariculture, or farming of marine resources. The investigator published a number of reports, including a Sea Grant issued publication listed at the end of this section.

A second three-year project gathered preliminary data on improvement in plant-debris feeds for shrimp, a commercially worthwhile candidate for mariculture. The principal investigators reported that the concept of artificial detrital feeds deserves a higher level of support. Termination of the project at the University of Miami was directly related to the loss of the UM mariculture research facilities and personnel. Nevertheless, pertinent results, conclusions, and recommendations were incorporated into a Sea Grant published report listed at the end of this section.

A four-year study of the abundance of eggs and larvae of commercial fishes off the west coast of Florida was completed in 1974-75.

All objectives of the research were met: all related to obtain-

ing information on population, sizes, and fluctuations of little-exploited fish stocks, particularly clupeids, annually and seasonally.

The investigators indeed found large underutilized stocks of thread herring, round herring, scaled sardines, and Spanish sardines, with mean biomasses estimated at 240,000, 388,950, 184,200, and 184,200 metric tons, respectively. In addition, much was learned about the early life histories, growth, mortality, spawning seasons, and territories of these important fishes.

Several articles were published and a complete technical report carrying the Sea Grant logo is in press.

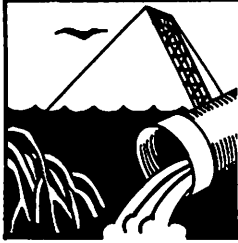
In response to the needs of the important sport fishery in south Florida, a study was undertaken, and continues through 1975-76, of the biology and fisheries of baitfishes.

Most fishing depends on use of shrimp or baitfishes. The baitfish stocks have been little studied heretofore. Knowledge of the biology and characteristics will be valuable to management agencies should the need arise to regulate these fisheries.

Two species of ballyhoo, Hemiramphus brasiliensis and H. balao, and the silver mullet, Mugil curema, were selected for investigation. Characteristics of the fisheries were learned, including annual catches, catch effort, sizes, spawning seasons, diets, and growth rates. Additionally, H. brasiliensis eggs were hatched and the longest surviving larva raised to a size of 51 mm at 40 days. UM Sea Grant published findings of the investigators. (See list at end of this section).

The University's pioneering mariculture studies, carried out in test ponds provided by Florida Power & Light Co. at Turkey Point, were terminated after the principal investigator left the University and Sea Grant funding was cut off.

Also terminated was a study of the use of acoustic methods of assessing living aquatic resources. The principal objective was to evaluate wide-angle Doppler detectors for assessing fish stocks in nearshore waters and mariculture ponds. Two prototype electric pulse generators and three Doppler detector circuits were constructed and evaluated.



applied ecology

The bays of subtropical Florida behave as systems with considerable differences from those of higher latitudes. With strongly different seasonal precipitation amounts, they are no longer true estuaries and the resultant physical, biological, and chemical systems react differently to urban and agricultural activities. All of the programs of this grant year operated under reduced budgets and most are phasing out with further reductions imposed. The results available show that in addition to the low circulation of the waters of Biscayne Bay and Card Sound, the nearshore waters of the Miami Terrace are weakly and irregularly exchanged with those of the Florida Current by cyclonic "spin-off" eddies - further complicating the efforts to protect the quality of this resource.

Nitrogenous compounds were investigated as a likely cause of declines in quality and productivity. Data gathered in the inputting canals shows high loadings by usual standards. However, measurements in the bay water column showed low values. The uptake apparently is by bottom sediments and vegetation. Extremely high variability seen in the observational part of these studies makes it not possible to state the water quality impact by man-induced compounds. It has been found, however, that the flux from sediment to water column is an important natural limitation on the productivity of the bay.

The significance of bottom vegetation to the bay and coastal beaches was addressed in two projects. Offshore, vegetation is found to play an important role in controlling the texture of the bottom substrate and its loss can have a severe detrimental effect on both local and adjacent bottom environments. A companion wave study was conducted at Fowey Light and this data is being prepared in climato-

logical form. It will be the only such summary available for coastal design in this area.

Within the bay, Thalassia testudinum (Turtle Grass) has been studied for its significance in biological productivity and water clarity. A thick and slow-growing plant, it by natural processes takes roughly a decade to regrow over an area denuded by propellers or construction. During that time the fine bottom sediments are easily stirred and cause an immediate loss of recreation values and a long-term loss of adjacent vegetation and related marine life. During this year, trial replanting was carried out in north Biscayne Bay on a moderate scale in an area where none had regrown after two decades. Results show that such replanting is now technically plausible. The step to be taken in the next year is to determine cost estimates for varying physical conditions.



marine pathology

Seventeen massive fish-kills in streams emptying into Biscayne Bay were investigated in 1974-75 by Sea Grant scientists. The etiology of many was determined and reported to local authorities.

An innovative research program in marine pathology was undertaken by the University of Miami in quick response to a community appeal. All too frequently the media had showed photographs of hundreds or thousands of fish carcasses on the shores of south Florida waterways, distressing sport and commercial fishermen. Residents and tourists were not fully aroused, however, until the problem was dramatized by the appearance of the "Dance of Death" in which dying fish twirled, nose to tail, until they died.

What evolved in the Sea Grant program was a three-project approach to the problem: to determine the causes of fish-kills, to determine if the waters in which they occurred were safe for human use, and to study acquisition, concentration, and dissemination of viruses by marine animals.

In the fish pathology project, several known causes of kills have been confirmed: eutrophic conditions and subsequent low dissolved oxygen levels generated by faulty sewage treatment, herbicide toxicity caused by improper canal maintenance, and a natural epizootic of Ichthyophirus multifiliis. Other causes of this mortality have been more elusive. In the cause of the twirling death of thousands of black mullet, mojarra, saltwater catfish and a few snook, a number of potential causes has been eliminated; several possible causes remain.

The parasite Myxosome cephalus has been found in the brains of many sick and dead fish. This organism could not be found in many

of those showing the twirling syndrome but this may be due to techniques that are currently inadequate. Proliferation of blue-green algae remains a possible cause. Results from necropsy and histopathology revealed congested splenic sinuses.

A third explanation, currently favored, involves an anerobic bacterium cultured from every moribund fish examined. It has not been classified by scientists at the University or at the U.S. Center for Disease Control. It has been concluded that the bacterium that causes the twirling death is a species in either the genus Eubacterium or Clostridium.

It has been observed by field investigators that resident fishes in north Biscayne Bay and recently-arrived migrants are increasingly found with external hemorrhage, fin erosion, fin deformity, and scale and lateral line disorientation. Careful records are being kept.

A 24-hour "Hot-Line" has been opened (and well publicized) so diseased fish can be collected and examined before putrefaction obscures important symptoms.

The marine environment has been considered hostile to known human pathogens, yet infectious diseases have been contracted after exposure to seawater pollutants. It has been proposed that virulence of these organisms is related to the chemical environment into which they are introduced.

Preliminary studies deal with survival of indicator microorganisms in seawater augmented with organic rich sediments and indicate the sediments tend to enhance survival of the organisms. Field tests indicated that some microorganisms commonly found in human intestinal tracts are more frequently recovered in areas enriched with certain chemical constituents. Microbial and chemical determinations were made on sediment samples collected from 11 stations in the bay and are producing data suitable for statistical treatment.

Virological studies of diseased animals continue. Virus concentrators were used in a search for viruses in the sea, and in collaboration with Millipore Corp., a new method was developed for recovery of viruses from water. Experiments on the antiviral substance in conch mucus was restricted because of the sudden shortage of conchs in nearby waters.



advisory services

One of the few private universities in the Sea Grant Program, the University of Miami has never had at its disposal a network of extension workers to allow easy transfer of data from marine scientists to those who apply such information. Since the UM research and education programs are directed to a populace gathered thickly and stressfully upon the shores of the unique tropical estuary known as Biscayne Bay, Advisory Services have been specific and delivered at minimum effort and expense.

A two-part system has developed: personal contact with individual and agency decisionmakers in and out of government and contact through publications and media with the citizens who elect the decisionmakers and approve their plans and budgets. Liaison with decisionmakers was maintained by the program's management; contact with the media and citizenry was the responsibility of Information Dissemination (AS/PO-1). In a sense, however, all Sea Grant program managers and investigators have considered themselves to be engaged in Advisory Services, so close is the relationship between Sea Grant and the community it serves. Management, Advisory Services, and research scientists all participated in seminars sponsored and not sponsored by Sea Grant. The UM program was represented at Advisory Services conferences and seminars.

Information Dissemination prepared reports, summaries, an internal Sea Grant Log, and special features. A catalog of UM Sea Grant publications was issued in late summer, 1975, and it reflects great publishing activity during the years of Sea Grant at UM. In the past half of the budget year, the product was: two Field Guides; three Special Reports, including the long-awaited Biscayne Bay Re-

port; and four Technical Bulletins. Many others are in the process of editing. The office mails close to 200 publications per month on an annual basis. A list of 1974-75 publications is provided on the inside back cover.

Information Dissemination also developed a strong relationship with the Marine Advisory Program at the State University System of Florida. It has been able to supply MAP with needed information from UM files, libraries, etc. The UM now contributes annually to the cost of publishing the MAP Newsletter of SUSF. Information Dissemination has provided an article for each edition throughout the year. Sea Grant 70's twice used features prepared at UM for cover stories and several others have appeared in Museum, local monthly magazine.

In addition to routine news announcements, major articles have been inspired in all dailies covering the area. Sea Grant scientists in 1974-75 discussed their activities in a total of seven television talk shows. One local outlet frequently runs as a community service a spot it designed calling attention to the Fish Pathology Hot-Line sponsored by Sea Grant.

Information Dissemination activities have been carried out at minimum cost by a PI working at 50 percent of his time and one secretary who carries all Sea Grant clerical responsibilities. The University New Bureau mimeographs news stories and logs at no cost to Sea Grant and also addresses and mails news releases.

Information Dissemination has been terminated as a project. Funds for publication and other Information Dissemination activities must now be found in the Management Program Budget.

Another Advisory Service project (AS/PO-2) is Entitled Manuals on Marine Organisms. This project is funded to produce manuals for the field identification of economically important groups of marine plants and animals of Florida, the Gulf Coast, and the Caribbean Region. Produced in 1974-75 were No.3, Guide to the Mangrove, Buttonwood and Poisonous Shoreline Trees, and No. 4, Guide to Seagrasses. Others are being hurried to completion. Information Dis-

semination has paid the printing costs and handled distribution of the field guide series.

Technical Bulletins and Special Reports published by Advisory Services in 1974-75 or in press include:

A Manual for Large-Tank Culture of Penaeid Shrimp to Postlarval Stages. By Won Tack Yang, 95 pp.

Preliminary Experimentation in the Development of Natural Food Analogues for Culture Detritivorous Shrimp. By Steven Y. Newell and Jack Fell, 125 pp.

Date Report--Fish Egg and Larvae Studies, Eastern Gulf of Mexico, 1971-74. By Edward D. Houde, 100 pp.

Biology and Fishery for Ballyhoo on the Southeast Florida Coast. By Edward D. Houde, 15 pp.

resources - funds

GROUPING SEA GRANT RESEARCH	SEA GRANT CLASSIFI- CATION	PROJECT NUMBER	TITLE	NOAA 74-75 SEA GRANT AWARD	74-75 MATCHING FUNDS	TOTAL 74-75 PROGRAM
I. MARINE RESOURCES DEVELOPMENT						
A. Aquaculture						
	01	R/LR-3	Improvement of Techniques for Mass- Culture of Crustacean Larvae	\$ 35,050	\$ 4,380	\$ 39,430
		R/LR-4	Experimentation in the Improvement of Plant-Debris Feeds for Shrimp Mari- Culture	5,600	13,876	19,467
B. Living Resources, other than Aquaculture						
	06	R/LR-5	The Abundance of Eggs and Larvae of Commercial Fishes off Western Florida	26,820	3,864	30,684
		R/LR-7	Biology and Fisheries of Baitfishes in South Florida	15,180	12,028	27,208
	08	R/MP-1	Pathology of Marine Animals	116,169	13,237	129,406
		R/MP-2	Bacteria as Pathogens in the Marine Environment	20,000	24,673	44,673
		R/MP-3	Viruses in the Sea and in Marine In- vertebrates	20,000	12,330	32,330
				SUB	238,819	323,207
				TOTAL	84,388	32,330
II. SOCIO-ECONOMIC AND LEGAL STUDIES						
B. Ocean Law						
	15	R/L-5	Community Legal Problem Services (State and Local)	28,524	6,186	34,710
	16	R/L-9	A Study of Compulsory Dispute Settle- ments with Respect to Law of the Sea	553	-----	553
	17	R/L-1	Community Legal Problem Services (National)	22,938	6,186	29,124
				SUB	52,015	64,387
				TOTAL	12,372	29,124
III. MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT						
A. Ocean Engineering						
	25	R/AE-6	A Study of Near Shore Process in Southeast Florida	29,046	17,970	47,016

26	R/LR-9	Use of Acoustic Methods for Assessing Living Aquatic Resources	SUB TOTAL	16,546 45,592	----- 17,970	16,546 63,562
IV. MARINE ENVIRONMENT RESEARCH						
	B. Ecosystems Research	Effect of Man's Activities on Benthic Macrophyte Production		18,904	6,655	25,559
	40					
	D. Environmental Models	Circulation and Exchange Processes		15,000	9,847	24,847
	46					
	R/AE-2					
	47	Effects of Nitrogenous Compounds on Florida's Estuarine Aquatic Resources	SUB TOTAL	20,000 53,904	47,700 64,202	67,700 118,106
	R/AE-1					
V. MARINE EDUCATION AND TRAINING						
	D. Other Education	Juris Doctor Specialization in Ocean and Coastal Law		4,370	17,078	21,448
	70					
	E/L-2					
	47	Master of Laws Program in Ocean and Coastal Law	SUB TOTAL	----- 4,370	21,164 38,242	21,164 42,612
	E/L-3					
VI. ADVISORY SERVICES						
	B. Other Advisory Services	Information Dissemination		82,100	-----	82,100
	76					
	AS/PO-1					
	AS/PO-2	Manuals on Marine Organisms	SUB TOTAL	10,000 92,100	18,524 18,524	28,524 110,624
VII. PROGRAM MANAGEMENT AND DEVELOPMENT						
	A. Program Administration	Program Management and Development		29,400	120,170	149,570
	79					
	A/MD					
	SUB TOTAL			29,400	120,170	149,570
	GRAND TOTAL			\$ 516,200	\$ 355,868	\$ 872,068

program summary

TITLE OF PROJECT - YEAR 74-75 PROPOSAL	PROJECT NUMBER 73-74	YEAR 73-74	PROJECT NUMBER 74-75	YEAR 74-75	PROJECT NUMBER 75-76	YEAR 75-76
OCEAN LAW		N C T R		N C T R		C R
Juris Doctor Specialization in Ocean and Coastal Law					E/L-2	
Master of Laws Program in Ocean and Coastal Law					R/L-5	
Community Legal Problem Services (National)	R/L-1					
Community Legal Problem Services (State and Local)	R/L-5					
A Study of Compulsory Dispute Settlements with Respect to Law of the Sea						
LIVING RESOURCES						
Improvement of Techniques for Mass-Culture of Crustacean Larvae	R/LR-3					
Experimentation in the Improvement of Plant-Dabris Feeds for Shrimp Mariculture	R/LR-4					
The Abundance of Eggs and Larvae of Commercial Fishes off Western Florida	R/LR-5					
Biology and Fisheries of Baitfishes in South Florida	R/LR-7					
Use of Acoustic Methods for Assessing Living Aquatic Resources	R/LR-9					
APPLIED ECOLOGY						
Effects of Nitrogenous Compounds on Florida's Estuarine Aquatic Resources	R/AE-1					
Circulation and Exchange Processes	R/AE-2					
Studies of the Effect of Man's Activities on Benthic Macrophyte Population (in the Very Near Shore Areas)	R/AE-3					
MARINE PATHOLOGY						
A Study of Near Shore Processes in Southeast Florida	R/AE-6					
Pathology of Marine Animals	AS/PO-3					
Bacteria as Pathogens in the Marine Environment	R/MP-1					
Viruses in the Sea and In Marine Invertebrates	R/MP-2					
ADVISORY SERVICES	R/MP-3					
Information Dissemination	AS/PO-1					
Manuals on Marine Organisms	AS/PO-2					
PROGRAM MANAGEMENT AND DEVELOPMENT	A/MD					

N = New
 C = Continuing
 T = Terminated or Completed
 R = Restructured

PUBLICATIONS

- Technical Bulletin No. 29 - An Anonymous Draft Treaty on the Law of the Sea, 126 pp.
- Technical Bulletin No. 30 - Preliminary Experimentation in the Development of Natural Food Analogues for Culture of Detritivorous Shrimp, 116 pp.
- Technical Bulletin No. 31 - A Manual for Large-Tank Culture of Penaeid Shrimp to Postlarval Stages, 95 pp.
- Technical Bulletin No. 32 - Fish Egg and Larvae Studies, Eastern Gulf of Mexico, 1971-1974, 100 pp.
- Field Guide No. 3 - Guide to the Mangroves, Buttonwood, and Poisonous Shoreline Trees of Florida, the Gulf of Mexico, and the Caribbean Region, 29 pp.
- Field Guide No. 4 - Guide to the Seagrasses of Florida, the Gulf of Mexico, and the Caribbean Region, 30 pp.
- Special Report No. 1 - Biscayne Bay: Environmental and Social Systems, 52 pp.
- Special Report No. 2 - A Bibliography of Biscayne Bay, Florida, Monitoring and Research Programs, 82 pp.
- Special Report No. 4 - Biology and Fishery for Ballyhoo on the Southeast Florida Coast, 15 pp.
- Catalog - Sea Grant Publications, through July, 1975.

SOURCE OF MATCHING FUNDS
for 1974-75

University of Miami
Armour Pharmaceutical
Coca Cola
Deltona
Florida Power & Light Co.
Virus Research Fund

COMMUNITY ADVISORY BOARD
(As of April 3, 1975)

- MR. JAMES REDFORD
Dade County Commissioner
- MR. HARVEY RUVIN
Dade County Commissioner
- MR. RICHARD BRUSUELAS
Greater Miami Chamber of Commerce
- DR. HARRIS STEWART
NOAA - AOML
- MS. MAUREEN B. HARWITZ
Izaak Walton League
- MR. THOMAS J. BUCHANAN
U.S. Geological Survey
- MR. RAY GOODE
Dade County Manager
- MR. HARMON W. SHIELDS
Florida Dept. of Natural Resources
- MR. PETER BALJET
Florida Dept. of Pollution Control
- MR. JOHN W. GREENLEAF
Marine Council of Greater Miami
- MS. ROSE GORDON
City of Miami Commissioner
- RADM A.C. WAGNER, USCG
Seventh Coast Guard District
- MS. JUANITA GREEN
The Miami Herald
- MR. GARRETT SLOAN
Miami Dade Water & Sewer Authority
- MS. ELAINE BLOOM
State Legislature
- MR. STEPHEN WAYNER
Greater Miami Chamber of Commerce
- MS. JEANNE BELLAMY
Midtown Bank

EX OFFICIO

- MS. PRISCILLA PERRY
UM Center for Urban & Regional Studies
- MS. SUSAN WILSON
UM Sea Grant Program
- MR. THOMAS BILHORN
UM Sea Grant Program
- DR. EUGENE H. MAN
UM Sea Grant Program

NATIONAL SEA GRANT DEPOSITORY
PELL LIBRARY BUILDING
URI, NARRAGANSETT BAY CAMPUS
NARRAGANSETT, RI 02882



University
of
Miami
Sea
Grant

RECEIVED
NATIONAL SEA GRANT DEPOSITORY
DATE: APR 15 1976