

SCSGC-Q-82-001

REPORT OF  
THE SOUTH CAROLINA  
SEA GRANT CONSORTIUM

July 1, 1981 - June 30, 1982



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## Report Of

# THE SOUTH CAROLINA SEA GRANT CONSORTIUM

## BOARD OF DIRECTORS

Major General James A. Grimsley, *Chairman*  
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Clemson University

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Acting President  
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South Carolina

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South Carolina State College

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President  
University of South Carolina

Dr. James A. Timmerman  
Executive Director  
S. C. Wildlife and Marine  
Resources Department

Dr. John M. Armstrong  
*Director*

**Fiscal Year**  
**July 1, 1981 - June 30, 1982**

## SOUTH CAROLINA SEA GRANT CONSORTIUM

### STAFF

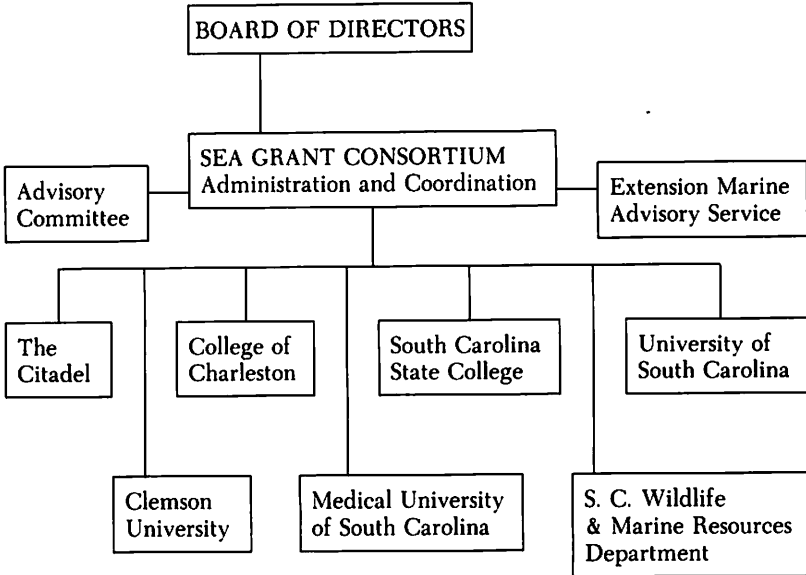
Dr. John M. Armstrong, <i>Director</i> .....	Charleston
Margaret A. Davidson, <i>Assistant to the Director</i> .....	Charleston
Malcolm R. DeVoe, <i>Assistant to the Director</i> .....	Charleston
Ernesto M. Torres, <i>Comptroller</i> .....	Charleston
James C. Burnett, <i>Communication Coordinator</i> .....	Charleston
Elaine L. Knight, <i>Accounting Technician</i> .....	Charleston
Audrey B. Brownlee, <i>Executive Secretary</i> .....	Charleston
Anita L. Nabers/Patsy Campbell, <i>Clerk/Typist</i> .....	Charleston

### MARINE ADVISORY SERVICES

C. Peter Granger, <i>Project Leader</i> .....	Charleston
John L. Keener, <i>Extension Marine Advisory Agent</i> .....	Charleston
Jack Whetstone, <i>Extension Marine Advisory Agent</i> .....	Georgetown
Thomas Potts, <i>Extension Marine Advisory Agent</i> .....	Beaufort
E. A. Gaffney, <i>Extension Marine Advisory Agent</i> .....	Charleston
Henrietta S. Wilson, <i>Editorial Assistant</i> .....	Charleston
Dianne C. Roumillat, <i>Secretary</i> .....	Charleston

# SOUTH CAROLINA SEA GRANT CONSORTIUM

## ORGANIZATION CHART



## MEMBER INSTITUTION ON-SITE COORDINATORS

Dr. Robert Baldwin  
Department of Biology  
The Citadel

Dr. Thomas C. Cheng  
Marine Biomedicine  
Medical University of  
South Carolina

Dr. Paul B. Zielinski  
Environmental Systems Engineering  
Clemson University

Dr. James Arrington  
Department of Natural Sciences  
South Carolina State College

Dr. Paul Hamill  
Office of Research  
College of Charleston

Dr. Paul A. Sandifer  
Marine Resources Research Institute  
S. C. Wildlife and Marine Resources  
Department

Dr. John M. Dean  
Department of Marine Science  
University of South Carolina

The Honorable Richard W. Riley, Governor  
The Honorable Members of the South  
Carolina General Assembly

Your Excellency, Ladies and Gentlemen:

On behalf of the South Carolina Sea Grant Consortium Board of Directors, it is my pleasure to present to you the annual report of The South Carolina Sea Grant Consortium for the fiscal year 1981-1982.

We appreciate your continued assistance and cooperation and look forward to working with you during the next year.

Please do not hesitate to call on us if we can be of service.

Respectfully submitted,

**BOARD OF DIRECTORS  
S. C. SEA GRANT CONSORTIUM**

**MAJOR GENERAL JAMES A. GRIMSLEY, JR.**  
*Chairman*

August 20, 1982

Major General James A. Grimsley, Jr.  
Chairman, Board of Directors  
S. C. Sea Grant Consortium  
Charleston, South Carolina 29412

Sir:

Attached hereto is the annual report of The South Carolina Sea Grant Consortium.

This report contains a description of the activities and accomplishments of Sea Grant Consortium programs in marine and coastal research, education, and advisory services. More detailed information is available and can be supplied upon request.

We look forward to working with you and the Board of Directors during this next year.

Respectfully submitted,

**MARGARET A. DAVIDSON**  
*Acting Director*

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## THE SOUTH CAROLINA SEA GRANT CONSORTIUM

Created by South Carolina Act No. 643 in 1978, the principal purpose of the South Carolina Sea Grant Consortium is to provide a mechanism for the development and management of the Sea Grant Program for the State of South Carolina and adjacent regions that share a common environment and resource heritage. The Consortium serves to support, improve and share research, education, training and advisory services in fields related to ocean and coastal resources. The Consortium also encourages and follows a regional approach to solving problems or meeting needs relating to ocean and coastal resources in cooperation with appropriate sea grant colleges, sea grant programs and persons in the region.

### *Charter Members*

The membership of the Consortium consists of The Citadel, the College of Charleston, Clemson University, The Medical University of South Carolina, South Carolina State College, the University of South Carolina and the South Carolina Wildlife Marine Resources Department. These members are designated as charter members.

The terms of the members are perpetual, and a majority of the charter members may vote the admission of a new member into the Consortium.

### *Board of Directors*

The board of directors for the Consortium is comprised of the chief executive officer of each of the participating educational institutions and state agencies or his designee.

### *Executive Director*

The board has the express power to employ the Sea Grant Director, who has the following powers and duties:

1. To direct supervision over all sea grant proposals;
2. To prepare annual sea grant proposals to be submitted to the National Sea Grant Office;
3. To set exact funding levels for proposals submitted by member institutions and subsequently approved by the National Sea Grant Office;
4. To maintain and control the Sea Grant Director's discretionary fund;
5. To request and receive funds from local, state, federal and private sources for use by the director, Consortium, individual member institutions, or other persons;
6. To exercise all incidental powers necessary to carry out the provisions of this act.

### *Advisory Committee*

The Sea Grant Director is assisted by an advisory committee which consists of seven members who serve for four-year terms. Four members are appointed by the Governor with the advice and consent of the Senate. The Chairmen of the



Senate Fish, Game and Forestry Committee, House Agriculture and Natural Resources Committee and South Carolina Wildlife and Marine Resources Commission also appoint one member upon the recommendation of a majority of the members of their respective committees and commission. The four members appointed by the Governor are residents of coastal counties, no more than one from each county, and two are associated with the commercial fishing industry. The initial non-gubernatorial appointees serve for terms of two years only.

# FISCAL REPORT

## BALANCE SHEET

Fiscal Year 1981-1982

*Assets*

Current Funds:

Unrestricted

Cash ..... \$ 5,544

State Treasurer ..... 33,091

38,635

Restricted Funds

Cash ..... 3,609

Due from Grantor ..... 7,506

State Treasurer ..... 13,576

24,691

Total Current Funds ..... \$63,326

Fixed Assets

Equipment Inventory ..... 51,732

51,732

Total Fixed Assets Funds ..... \$51,732

*Liability and Fund Balances*

Current Funds:

Unrestricted

Accounts Payable ..... \$ 185

Accrued Payroll & FB ..... 2,069

Due to State General Fund

(Exhibit B) ..... 36,381

38,635

Restricted Funds

Accounts Payable ..... 519

Payable to sub-grantee ..... 7,192

Deferred Revenue (Exhibit C) ..... 16,980

24,691

Total Current Funds ..... \$63,326

Fixed Assets Funds

Funds Balance (Exhibit D) ..... 51,732

\$51,732

STATEMENT OF CHANGES IN  
CURRENT OPERATING FUNDS  
YEAR ENDED JUNE 30, 1982

	<i>Administration and Research</i>
Balance — July 1, 1981 .....	\$ 6,604
Additions:	
Revenues (Exhibit E) .....	322,782
Deductions:	
Expenditures (Schedule I) .....	<u>293,005</u>
Balance Due To General Fund .....	<u>\$ 36,381</u>

STATEMENT OF CHANGES IN  
RESTRICTED AND OTHER FUNDS  
YEAR ENDED JUNE 30, 1982

	<i>Balance</i> <i>June 30, 1981</i>	<i>Total</i> <i>Additions</i>	<i>Total</i> <i>Deductions</i>	<i>Balance</i> <i>June 30, 1982</i>
Sea Grant Contracts 79-80 (Schedule II) .....		\$ 25,590	\$ 25,590	
Sea Grant Contracts 80-81 (Schedule III) .....		238,719	238,719	
Sea Grant Contracts 81-82 (Schedule IV) .....		244,816	244,816	
Other Restricted Contracts (Schedule V) .....	6,018	30,760	19,798	16,980
TOTAL .....	<u>\$6,018</u>	<u>\$539,885</u>	<u>\$528,923</u>	<u>\$16,980</u>

STATEMENT OF CHANGES FIXED ASSET FUND  
YEAR ENDED JUNE 30, 1982

	<i>Balance</i> <i>June 30, 1981</i>	<i>Total</i> <i>Addition</i>	<i>Total</i> <i>Deduction</i>	<i>Balance</i> <i>June 30, 1982</i>
Capital Equipment .....	\$23,987	\$14,210		\$38,197
Motor Vehicle Equipment ..	<u>13,535</u>			<u>13,535</u>
Totals .....	<u>\$37,522</u>	<u>\$14,210</u>		<u>\$51,732</u>

**STATEMENT OF CHANGES IN  
CURRENT OPERATING FUNDS  
YEAR ENDED JUNE 30, 1982**

<i>Revenues:</i>	<i>Administrative and Research</i>
State Appropriation .....	\$322,782
Total Revenue .....	322,782
<i>Expenditures:</i>	
Administration and Research (Schedule I) .....	\$286,401
Total Expenditures .....	<u>286,401</u>
Excess of Revenues Over Expenditures .....	<u>\$ 36,381</u>

**SCHEDULE OF CURRENT  
UNRESTRICTED EXPENDITURES  
YEAR ENDED JUNE 10, 1982**

Personal Service .....	\$170,596
Fringe Benefits .....	25,595
Payments to Sub-Grantees .....	37,182*
Contractual Service .....	22,489
Supplies .....	12,778
Fixed Charges .....	8,507
Equipment .....	526
Travel .....	8,728
Prior Year Fund Remitted To General Fund .....	<u>6,604</u>
Total Expenditures .....	<u>\$293,005</u>

\* PAYMENT TO SUB-GRANTEES

<i>Grant Title</i>	<i>Expenditures</i>
Natural Hazards Research Workshop .....	\$ 468
Sharks & Rays .....	1,585
Shore Beach Preservation Conference .....	550
Urban Waterfront .....	750
Tidal Inlet Atlas .....	500
National Marine Education Workshop .....	487
Cattails Energy .....	3,000
Mosquito Ponds .....	2,000
Coastal Heritage .....	13,711
International Studies .....	391
Public Fishing Pier .....	2,008
Bait Fish Economics .....	58
Groundwater Resource .....	3,345
Hard Clam Culture .....	329
Rice Field Studies .....	4,000
Education Workshop .....	<u>4,000</u>
	<u>\$37,182</u>

**STATEMENT OF CHANGES OF SEA GRANT CONTRACTS 1979-80  
YEAR ENDED JUNE 30,1982**

<i>Grant Title</i>	<i>Balance July 1, 1981</i>	<i>Total Additions</i>	<i>Total Deductions</i>	<i>Balance June 30, 1982</i>
"Sea Watch" Public Service .....		\$ 572	\$ 572	
Marine Research for Gifted Youth .....		2,441	2,441	
Comprehensive Search for Marine Ed. Mat. Telemetry Maps .....		1,693	1,693	
Marine Bait Workshop .....		3,190	3,190	
Extension Marine Advisory Program .....		2,704	2,704	
Minority Coop. Program Marine Studies, S. C. State College .....		10,001	10,001	
Minority Coop. Program Marine Studies, University of S. C. ....		4,159	4,159	
		<u>830</u>	<u>830</u>	
<b>Totals .....</b>		<u><u>\$25,590</u></u>	<u><u>\$25,590</u></u>	

STATEMENT OF RESTRICTED EXPENDITURES  
SEA GRANT CONTRACTS 1979-80  
YEAR ENDED JUNE 30, 1982

	<i>Personal Service</i>	<i>Fringe Benefits</i>	<i>Contractual Services</i>	<i>Sub- Contract</i>	<i>Fixed Charges</i>	<i>Equipment</i>	<i>Travel</i>	<i>Indirect Cost</i>	<i>Stipends</i>	<i>Total</i>
"Sea Watch" Public Service .....	\$536	\$36	\$	\$						\$ 572
Marine Research for Gifted Youth .....				2,441						2,441
Comprehensive Search for Marine Educational Material				1,693						1,693
Telemetry Maps .....				3,190						3,190
Marine Bait Workshop .			2,704							2,704
Extension Marine Advisory Program ...				10,001						10,001
Minority Coop. Prog. in Marine Studies, S. C. State College ..				4,159						4,159
Minority Coop. Prog. in Marine Studies, U.S.C. ....				830						830
TOTAL .....	<u>\$536</u>	<u>\$36</u>	<u>\$2,704</u>	<u>\$22,314</u>						<u>\$25,590</u>

STATEMENT OF CHANGES IN SEA GRANT CONTRACTS 1980-81  
YEAR ENDED JUNE 30, 1982

	<i>Balance July 1, 1981</i>	<i>Total Additions</i>	<i>Total Deductions</i>	<i>Balance June 30, 1982</i>
Sea Grant Administration .....		\$ 17,170	\$ 17,170	
Effects of Insecticide on Estuarine Fish .....		10,574	10,574	
Medicinal Agents of Salt Marsh .....		7,580	7,580	
Governmental Study .....		5,686	5,686	
S. C. Swordfish .....		20,002	20,002	
Law-of-the-Sea Negotiation .....		6,045	6,045	
Tabby Structure on the S. C. Coast .....		2,246	2,246	
Bio. Imp. Carbohydrate Binding Lectins .....		8,312	8,312	
Model of Population Survival .....		4,097	4,097	
Invertebrates Which Modify Resistance .....		3,914	3,914	
Survivorship & Bioenergetics of Clam .....		14,399	14,399	
Parasites of Cultured American Eel .....		10,267	10,267	
Devlp. & Eval. Auto. Shrimp Deheading Sys.		7,351	7,351	
Devlp. of Model Hurricane Resistant .....		(183)	(183)	
Extension Marine Advisory Program .....		65,710	65,710	
Repro. & Devlp. of Sharks & Rays .....		5,567	5,567	
Habitat Identification of Juv. Snap. ....		7,367	7,367	
Hard Clam Culture .....		10,917	10,917	
Stability Eval. of S. C. Reefs .....		7,417	7,417	
Study of Dist. of Fishes & Decapod Crust. ...		3,285	3,285	
Artificial Insemination of Prawn .....		5,709	5,709	
Demo. of Commercial Prawn Farming .....		12,528	12,528	
Multi-Jurisdictional Urban Waterfront Plan. .		2,759	2,759	
Total Sea Grant Contracts .....		<u>\$238,719</u>	<u>\$238,719</u>	

STATEMENT OF RESTRICTED EXPENDITURES  
SEA GRANT CONTRACTS 1980-81  
YEAR ENDED JUNE 30, 1982

<i>Grant Title</i>	<i>Personal Service</i>	<i>Fringe Benefits</i>	<i>Contractual Services</i>	<i>Sub-Grant</i>	<i>Fixed Charges</i>	<i>Equipment</i>	<i>Travel</i>	<i>Total</i>
Sea Grant Administration .....			\$2,783	\$		\$12,685	\$1,702	\$ 17,170
Effects of Insecticide on Estuarine Fish .....				10,574				10,574
Medicinal Agents of Salt Marsh ...				7,580				7,580
Governmental Study .....				5,686				5,686
S. C. Swordfish .....				20,002				20,002
Law-of-the-Sea Negotiations .....				6,045				6,045
Tabby Structures on the S. C. Coast .....				2,246				2,246
Bio. Imp. Carbohydrate Binding Lectins .....				8,312				8,312
Model of Population Survival .....				4,097				4,097
Invertebrates Which Modify Resistance .....				3,914				3,914
Survivorship & Bioenergetics of Clams .....				14,399				14,399
Parasites of Cultured Amer. Eel ...				10,267				10,267
Develop. & Eval. of Auto Shrimp Deheading System .....				7,351				7,351
Develop. of Model Hurricane Res. (183) .....				(183)				(183)
Ext. Marine Advisory Program ...				65,710				65,710
Repro. & Develop. Sharks & Rays ...				5,567				5,567
Habitat Identif. Juv. Snapp. ....				7,367				7,367
Hard Clam Culture .....				10,917				10,917
Stability Eval. S. C. Reefs .....				7,417				7,417
Study of Distr. of Fishes & Decapod Crustacea .....				3,285				3,285
Artificial Insemin. of Prawn .....				5,709				5,709
Demo. of Commer. Prawn Farming .....				12,528				12,528
Multi-Jurisdictional Urban Waterfront Planning .....				2,759				2,759
Total Sea Grant Contracts .....			<u>\$2,783</u>	<u>\$221,549</u>		<u>\$12,685</u>	<u>\$1,702</u>	<u>\$238,719</u>



STATEMENT OF CHANGES IN SEA GRANT CONTRACTS 81-82  
YEAR ENDED JUNE 30, 1982

	<i>Balance July 1, 1981</i>	<i>Total Additions</i>	<i>Total Deductions</i>	<i>Balance June 30, 1982</i>
Sea Grant Administration .....		\$ 15,076	\$ 15,076	
Communication .....		7,128	7,128	
Aquaculture Workshop .....		3,697	3,697	
Medicinal Agents of the Salt Marsh .....		8,119	8,119	
Coastal Heritage "History of S. C. Coast" .....		7,976	7,976	
Age Determination & Ecology of S. C. Swordfish ..		10,929	10,929	
International Biomineralization Symposium .....		1,350	1,350	
The Evolution of Fisheries .....		3,056	3,056	
Atmospheric Deposition of Toxaphene .....		19,531	19,531	
Inv. of Toxic Substances of Spartina .....		7,735	7,735	
Dev. of Marine ETV in S. C. ....		2,453	2,453	
Invertebrates Which Modify Resistance .....		9,775	9,775	
Survivorship & Bioenergetics of Clam .....		11,975	11,975	
Parasites of Cultured American Eel .....		13,812	13,812	
Devlp. & Eval. of Auto Shrimp Deheader .....		57	57	
Marine Advisory Services .....		15,757	15,757	
Repro. & Devlp. of Sharks & Rays .....		9,434	9,434	
Lab Investigations of Bulkheads .....		6,070	6,070	
Hard Clam Culture in S. C. ....		17,540	17,540	
World Mariculture Society Meeting .....		2,053	2,053	
Artificial Insemination of Shrimp .....		20,820	20,820	
Demo. of Commercial Prawn .....		23,999	23,999	
Devlp. & Demo. of Finfish Mariculture .....		8,491	8,491	
Devlp. of App. Sci. Curr. in Charleston Multi- Jurisdictional Waterfront .....		6,173	6,173	
Use of Copper Compounds in Oysters & Clams ..		8,210	8,210	
CHEC Graduate Research MPA .....		3,600	3,600	
Total Sea Grant Contracts .....		<u>\$244,816</u>	<u>\$244,816</u>	

STATEMENT OF RESTRICTED EXPENDITURES  
SEA GRANT CONTRACTS 1981-82  
YEAR ENDED JUNE 30, 1982

	<i>Personal Services</i>	<i>Fringe Benefits</i>	<i>Contractual Services</i>	<i>Sub- Grant</i>	<i>Supplies</i>	<i>Fixed Charges</i>	<i>Equipment</i>	<i>Travel</i>	<i>Total</i>
Sea Grant Administration .....	\$2,871	\$204	\$ 3,063	\$	\$ 466	\$	\$1,000	\$6,932	\$ 15,076
Communication .....			5,404		1,332			392	7,128
Aquaculture Workshop .....			3,325		211	161			3,697
Medicinal Agents of the Salt Marsh .....				8,119					8,119
Coastal Heritage "History of S. C. Coast" .....				7,976					7,976
Age Det. & Eco. of S. C. Swordfish .....				10,929					10,929
Int. Biomineralization Symposium .....				1,350					1,350
The Evolution of Fisheries .....				3,056					3,056
Atmospheric Deposition of Toxaphene .....				19,531					19,531
Inv. of Toxic Substances of Spartina .....				7,735					7,735
Dev. of Marine ETV in S. C. ....				2,453					2,453
Invertebrates Which Modify Resistance .....				9,775					9,775
Survivorship & Bio. Energetics of Clam .....				11,975					11,975
Parasites of Cultured American Eel .....				13,812					13,812
Devlp. & Eval. of Auto Shrimp Deheader .....				57					57
Marine Advisory Services .....				15,757					15,757
Repro. & Devlp. of Sharks & Rays .....				9,434					9,434

**STATEMENT OF RESTRICTED EXPENDITURES  
SEA GRANT CONTRACTS 1981-82  
YEAR ENDED JUNE 30, 1982 (Continued)**

	<i>Personal Services</i>	<i>Fringe Benefits</i>	<i>Contractual Services</i>	<i>Sub- Grant</i>	<i>Supplies</i>	<i>Fixed Charges</i>	<i>Equipment</i>	<i>Travel</i>	<i>Total</i>
Lab. Invest. of Bulkheads .....				6,070					6,070
Hard Clam Culture in S. C. ....				17,540					17,540
World Mariculture Society Meeting .....				2,053					2,053
Artificial Insemination of Shrimp .....				20,820					20,820
Demo. of Commercial Prawn ....				23,999					23,999
Devlp. & Demo. of Finfish Mariculture .....				8,491					8,491
Devlp. of App. Sci. Curr. in Chas. Multi-Juris- dictional Waterfront .....				6,173					6,173
Use of Copper Compounds in Oysters & Clams .....				8,210					8,210
CHEC Graduate Research MPA ...				3,600					3,600
<b>TOTAL .....</b>	<u><u>\$2,871</u></u>	<u><u>\$204</u></u>	<u><u>\$12,332</u></u>	<u><u>\$218,915</u></u>	<u><u>\$2,009</u></u>	<u><u>\$161</u></u>	<u><u>\$1,000</u></u>	<u><u>\$7,324</u></u>	<u><u>\$244,816</u></u>

**STATEMENT OF CHANGES OF OTHER RESTRICTED CONTRACTS  
YEAR ENDED JUNE 30, 1982**

	<i>Balance July 1, 1981</i>	<i>Total Additions</i>	<i>Total Deductions</i>	<i>Balance June 30, 1982</i>
Coastal Plains Bank Seminar .....	\$2,419	\$ (2,419)	\$	\$ —
Dreyfus Foundation .....	3,599			3,599
Intergovernmental Personnel Act .....		23,888	18,849	5,039
Coastal Heritage Phase I .....		6,060	949	5,111
Coastal Heritage Phase II .....		3,231		3,231
<b>TOTAL .....</b>	<b><u>\$6,018</u></b>	<b><u>\$30,760</u></b>	<b><u>\$19,798</u></b>	<b><u>\$16,980</u></b>

**STATEMENT OF OTHER RESTRICTED EXPENDITURES  
YEAR ENDED JUNE 30, 1982**

	<i>Personal Service</i>	<i>Fringe Benefits</i>	<i>Contractual Service</i>	<i>Supplies</i>	<i>Total</i>
Coastal Plains Bank Seminar .....	\$	\$	\$	\$	\$
Dreyfus Foundation .....					
Intergovernmental Personnel Act .....	16,071	2,778			18,849
Coastal Heritage Phase I .....			634	315	949
Coastal Heritage Phase II .....					
<b>TOTAL .....</b>	<b><u>\$16,071</u></b>	<b><u>\$2,778</u></b>	<b><u>\$634</u></b>	<b><u>\$315</u></b>	<b><u>\$19,798</u></b>

## Notes to Financial Statements June 30, 1982

### *Note 1 — Summary of Significant Accounting Policies*

#### **Basis of Accounting:**

The financial statements have been prepared on an accrual basis.

#### **Fund Accounting:**

To ensure observance of limitations and restrictions placed on the use of resources available to the Consortium, the accounts are maintained in accordance with the principles of fund accounting. This is the procedure by which resources for various purposes are classified for accounting and reporting purposes into funds that are in accordance with specified activities or objectives. Separate accounts are maintained for each fund.

#### **General Fixed Assets:**

Fixed assets are recorded as expenditures of the general operating fund upon acquisition and subsequently capitalized at actual cost in the general fixed asset account group. In accordance with generally accepted accounting principles prescribed for governmental funds, a provision for depreciation of general fixed assets is not recorded.

#### **Grant Accounting:**

The Consortium is a State agency involved in ocean and coastal research, education, and advisory extension work. It serves to encourage, coordinate and facilitate projects pertaining to coastal and ocean areas of South Carolina and utilize the talents of its members to address marine issues.

The Consortium identifies possible problems of concern to the State of South Carolina which meet Grant criteria. The Consortium then arranges for the design of a project, usually by member agencies, to investigate the problem. On an annual basis, the projects are submitted to grantors for funding. A majority of the projects funded are then sub-contracted to various member agencies.

Expenditures by sub-grantees under the sub-contracts which have not been reimbursed to the sub-grantee by the Consortium at June 30, are included in accounts payable. Likewise, expenditures paid or payable by the Consortium at June 30, and not yet reimbursed by the primary grantor are recorded as accounts receivable. Revenues received on specific grants which are in excess of expenditures are recorded as deferred revenues.

### *Note 2 — Retirement Plan*

Substantially all employees of the Consortium are covered by a retirement plan through the South Carolina Retirement System. It was not feasible to separately identify current year retirement plan cost included as a portion of employer contributions in the accompanying financial statements.

Information regarding the excess, if any, applicable to the Consortium, of the actuarially computed value of vested benefits over the total of the pension fund and any balance sheet accruals, less any pension prepayments of deferred charges is not available. By State Law, the Consortium's liability under the retirement plan is limited to the amounts appropriated therefor in the South Carolina Appropriation Act for the fiscal year 1981, plus the amount paid from other revenue sources for the current year. Accordingly, the Consortium recognizes no contingent liability for unfunded costs associated with participation in the plan.

*Note 3 — Contingent Liabilities*

The Consortium has numerous contracts with the Federal Government and other State agencies for the reimbursement of specific costs related to the various programs described in each contract. Reimbursement costs subsequently deemed to be unallowable by the sponsoring entity, if any, would have to be repaid. A material amount of the contracts are in-turn sub-contracted by the Consortium and reimbursed costs deemed to be unallowable would result in a claim by the Consortium against the sub-contractor.

No audits have been made by grantors of Federal contracts or grants administered by the Consortium. Management does not believe that audits of such funds would result in any material claims against the Consortium.

*Note 4 — Changes in General Fixed Assets*

Changes in general fixed assets for the year ended June 30, 1982 are as follows:

	<i>Balance</i> <i>July 1, 1981</i>	<i>Additions</i>	<i>Deletions</i>	<i>Balance</i> <i>June 30, 1982</i>
Equipment	\$37,522	\$14,210		\$51,732

## OVERVIEW

The South Carolina Sea Grant Consortium is a unique partnership of universities, colleges, and state agencies working to promote and implement research, education, and advisory services in the sphere of marine and coastal resources. The Consortium accomplishes these concurrent tasks by drawing on the diverse and extensive talents and expertise available at its seven constituent institutions:

- The Citadel
- Clemson University
- College of Charleston
- Medical University of South Carolina
- South Carolina State College
- South Carolina Wildlife and Marine Resources Department
- University of South Carolina

The Consortium is charged with bringing together and coordinating the diverse and extensive talents and expertise of its constituent institutions to assist the state in resolving coastal and marine issues. Three distinct advantages are realized by this "partnership" mechanism:

- Duplication, often a problem in scientific research, is avoided by encouraging cooperation among the different institutions and among different disciplines within the institutions.
- The promotion of manpower sharing results in greater productivity and lower costs.
- The ability to put together teams of faculty and staff from the various member institutions to help solve problems of concern to the state maximizes the effectiveness of existing personnel at the lowest possible cost. Because of this, the South Carolina Sea Grant Consortium office can operate efficiently with a very small staff.

In its first three years of operation as an independent state agency, the Consortium has expanded its efforts in marine research programs, educational activities, and technical and advisory services: it serves as a "broker" between its member institutions and those individuals, industries, and agencies that can benefit from the results of such a range of programs. The emphasis is placed on applied research based upon the needs identified by potential users; the information gained from Consortium activities is then transferred to those users. In other words, the Consortium acts as an information synthesis and dissemination clearinghouse.

The Sea Grant Consortium is primarily responsible for the administration and management of the Sea Grant Program for the State of South Carolina. The National Sea Grant College Program, signed into law in 1966, awards competitive grants to some 30 coastal and Great Lakes states for the express purpose of accelerating the national development of marine resources, including their con-

servation, proper management, and economic utilization. It is through research, education, and advisory work that the objectives of the National Sea Grant Program are implemented and realized.

The Consortium thus derives its major funding from two sources — The State of South Carolina and the federal government through the National Sea Grant College Program. Through an annual appropriation from the State, the Consortium receives funding to support the staff, program overhead, and the program discretionary fund. The National Sea Grant Office provides funding primarily for full-scale research, education, and advisory service projects. This commitment by both the state and the federal government in supporting the Sea Grant Consortium is representative of the cooperative nature of the Sea Grant Program in addressing coastal and marine resource issues.

The Consortium is guided in its policy decisions at the state level by its Board of Trustees. The Board, which consists of the chief executive of each of the Consortium's member institutions, meets quarterly to review the Consortium's program and to propose new directions for broadening the scope of its activities.

To facilitate the interaction between the Consortium and its member institutions, a Sea Grant Coordinator has been designated by the Director at each of the seven institutions. There, the coordinators serve to further the objectives of the Sea Grant program in the state and ensure the best utilization of talent and expertise found within the Consortium member institutions.

Actual research, education, and advisory work on Consortium projects is, of course, carried out by the faculty and staff at the institutions. Their expertise and talent are the strengths of the South Carolina Sea Grant Consortium; enabling it to meet the challenge of developing and managing coastal resources in an efficient and comprehensive fashion. Both faculty and staff approach this challenge from the variety of perspectives inherent in their multi-disciplinary fields.

In addition to providing professional expertise in many marine and coastal disciplines, member institutions are able to provide a wide range of facilities for use by Consortium project investigators. These investigators have access to more than 30 research laboratories, including those of the South Carolina Wildlife and Marine Resources Department and a large biomedical research facility of the Medical University of South Carolina. Six research vessels are available for field studies. Clemson University possesses the best agricultural engineering facilities for technological development and refinement in the state. Further, among the several field laboratories found throughout South Carolina, the University of South Carolina's 5000 square foot Belle Baruch Laboratory in Georgetown County provides a staff of twelve research associates and technicians with a fully equipped facility, including living quarters, and a large conference center.

## **PROGRAM DEVELOPMENT**

The South Carolina Sea Grant Consortium has instituted a structured mechanism for its program identification and development process. Program areas are identified by the Consortium staff and Institutional Coordinators in consultation with state and federal natural resource agencies, private industry, and Marine



Advisory Service personnel. Figure 1 illustrates the program identification and development process followed by the Consortium leading to final review by the National Office of Sea Grant.

For fiscal year 1981-1982, the Consortium received some 110 pre-proposals in response to its call for proposals, totaling more than \$2.3 million. Review of these pre-proposals by the Consortium staff and Institutional Coordinators, and by various state agencies and entities with interests and responsibilities in marine resource development and regulation, was followed by submission of invited, fully developed proposals. These proposals were then reviewed by qualified professionals nationwide. Of these, 28 proposals were included in the FY 1981-82 proposal package to the National Office of Sea Grant for final review and consideration, and 20 were subsequently funded. These are listed in the next section.

In addition to federal Sea Grant project support, the Consortium Director is provided federal and state discretionary funds to allow for program flexibility and prompt response to high priority needs, to encourage innovative ideas and approaches, and to provide special support as needs arise. A sizeable number of discretionary projects were funded during FY 1981-82 in program areas that will provide a base of information to build and strengthen the Sea Grant Consortium program in future years. These projects include:

- "Natural Hazards Research Workshop — Travel" — Dr. Keith Davis — University of South Carolina
- "Reproduction and Development of Sharks and Rays — Supplemental Award" — Dr. John Wourms — Clemson University
- "Shore and Beach Preservation Association Meeting" — Dr. Billy Edge — Clemson University
- "Hard Clam Workshop" — Ms. Margaret Davidson — Consortium
- "A Multi-Jurisdictional Urban Waterfront Planning and Management Model — Supplemental Funding" — Dr. Roger Stough — College of Charleston
- "Reproduction and Development of Sharks and Rays — Supplemental Award II" — Dr. John Wourms — Clemson University
- "Tidal Inlet Atlas — Drafting" — Dr. Gary Zarillo — University of South Carolina
- "National Marine Education Conference — Travel" — Ms. Wendy Allen — University of South Carolina
- "Cattails as an Energy Source" — Dr. Kurt Ladenburg — Clemson University
- "Assessment of Mosquito Populations in Crawfish Ponds" — Dr. Dennis Forsythe — The Citadel

- “Coastal Heritage of South Carolina” — Dr. Charles Joyner — University of South Carolina — Coastal Carolina College
- “Presentation of Paper at International Studies Association Annual Conference” — Dr. Roger Coate — University of South Carolina
- “A Patriots Point (Charleston County) Public Fishing Pier — A Feasibility Study” — Mr. Charles Moore — S. C. Wildlife and Marine Resources Department
- “Potential for Baitfish Culture in South Carolina” — Mr. Frank Taylor — Marine Resources Research Institute
- “A Precursor Evaluation for the Management of Groundwater Resources on Isle of Palms and Sullivans Island, S. C.” — Dr. Steve Shelton — University of South Carolina
- “Hard Clam Culture in S. C.: A Demonstration Scale Analysis for an Alternative Fishery — Supplemental Award” — Dr. John Manzi — S. C. Wildlife and Marine Resources Department
- “Teacher Training in the Use of Marine Education Materials” — Ms. Wendy Allen — University of South Carolina
- “Rice Field Studies in the Cooper River — Summer 1982” — Dr. B. J. Kelley — The Citadel

## **SEA GRANT PROGRAM DESCRIPTION AND REVIEW**

The South Carolina Sea Grant Consortium manages and administers the Sea Grant Institutional Program for the state. As its primary responsibility, the Consortium develops a program that focuses on institutional research, marine education, and marine advisory services. Since 1980, the Consortium has administered over \$2.5 million in federal and state-appropriated funds for over 110 research, education, and advisory service projects. For the 1981-82 fiscal year, some 37 projects were funded at a combined federal-state level of over \$600,000. More important, however, is the fact that major economic benefits accrue to the state, the region, and, in many cases, the nation from these investments.

# CONSORTIUM PROJECT IDENTIFICATION AND DEVELOPMENT PROCESS

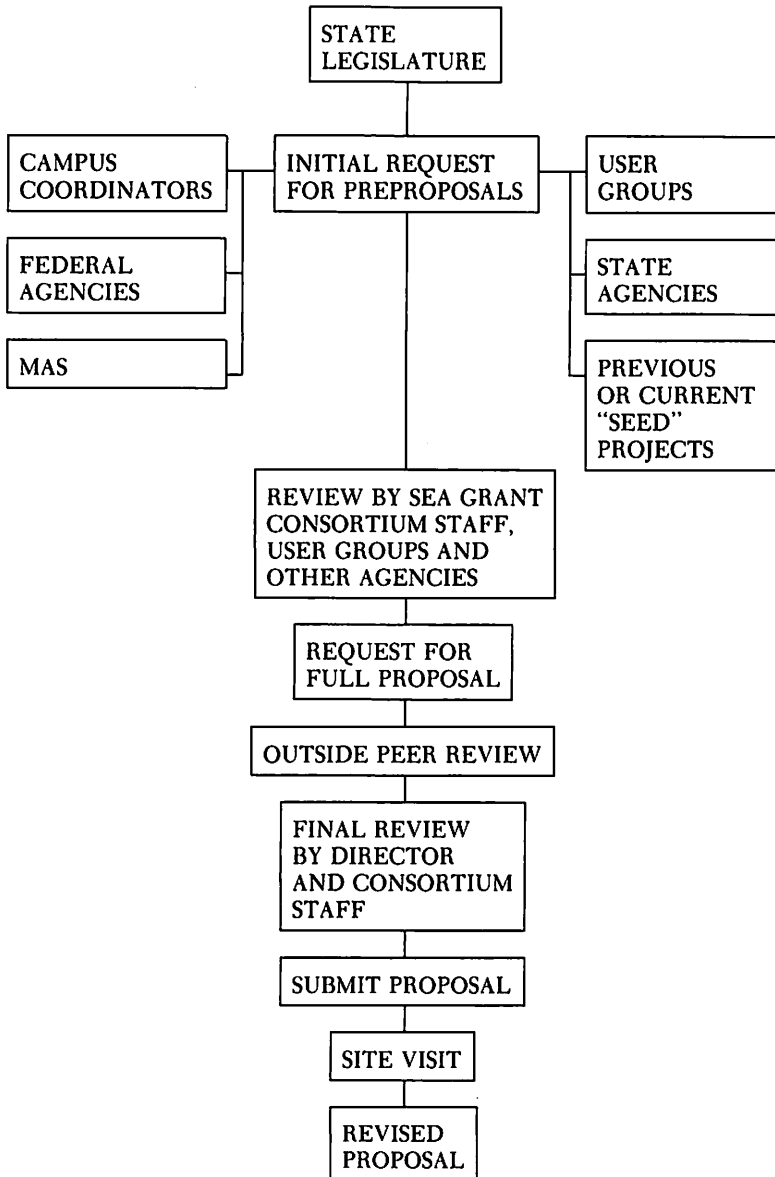


Figure 1

## INSTITUTIONAL RESEARCH

Marine and coastal research programs undertaken by Consortium institutional investigators can be divided into six functional categories:

- Aquaculture Development and Management
- Fisheries Development and Management
- New Marine Product Development
- Marine Environmental Research
- Coastal Resource Development and Management
- Coastal Processes and Engineering

### AQUACULTURE DEVELOPMENT AND MANAGEMENT

Aquaculture research and development has evolved more slowly in the United States as compared with the major aquaculture countries of the world. However, with growing consumer desire for seafood creating increasing demand, the concept of aquaculture has been gaining more and more attention. This is true for South Carolina where a variety of species, including prawns, hard clams, crawfish, and striped bass, are being examined for their desirability as aquaculture species, basically as a result of Consortium research initiatives.

Consortium aquaculture research efforts have focused on the aforementioned species, but have also included eel, channel bass, and baitfish. The research varies from species to species, ranging from basic biological studies on reproduction and development of candidate species, to applied studies on the economics, management, and marketing of viable culture species.

In one research effort, the Consortium has funded a biological study on culturing the hard clam, *Mercenaria mercenaria*, in a cooperative effort with the S. C. Wildlife and Marine Resources Department and Trident Seafarms, Inc. Currently, the Consortium is assisting the Department and Trident Seafarms in conducting economic analysis which, when completed, will project the success rate and future potential of this operation. Preliminary analysis indicates that net profits of Trident Seafarms, Inc. will reach \$1 million by 1985. This project is typical of Consortium efforts in assisting both government and private industry through cooperative research programs.

#### FY 1981-1982 Projects

- "Parasites of Cultured American Eel (*Anguilla rostrata*)" — Drs. Arnie Eversole and Steve Hayasaka — Clemson University
- "Development and Demonstration of *Macrobrachium* Aquaculture for South Carolina" — Drs. Ted Smith and Paul Sandifer — S. C. Wildlife and Marine Resources Department
- "Artificial Insemination, *In Vitro* Fertilization, and Hybridization of Shrimps and Crawfish" — Dr. Paul Sandifer — S. C. Wildlife and Marine Resources Department
- "Hard Clam Culture in South Carolina: A Demonstration Scale Analysis for an Alternative Fishery" — Dr. John Manzi — S. C. Wildlife and Marine Resources Department

- "Development and Demonstration of Finfish Mariculture in South Carolina" — Drs. Ted Smith and Paul Sandifer — S. C. Wildlife and Marine Resources Department

*Publications and Presentations — Eels*

- Crane, J. S. and A. G. Eversole. 1981. Helminth parasites of American eels from brackish water. Proc. Ann. Conf. S. E. Assoc. Fish Game Comm. 35: (In press).
- Field, D. W. and A. G. Eversole. 1982. Parasite levels of stocked glass eel and elver stages of American eel. Proc. World Maricult. Soc. 13: (In review).
- Eversole, A. G. and D. W. Field. 1982. Prophylactic treatment of elvers for *Trichodina* infestation. Prog. Fish-Cult. 44: (In press).
- Hayasaka, S. S. and J. Sullivan, 1981. Furunculosis in cultured American eel (*Anguilla rostrata*). (LeSueur). J. Fish Biol. 18:655-659.

*Publications and Presentations — Prawns*

- Hale, M. B. and M.E. Waters. 1981. Frozen storage stability of whole and headless freshwater prawns (*Macrobrachium rosenbergii*). Marine Fisheries Review, 43(12): 18-21.
- Liao, D. S. and T. I. J. Smith. 1982. Marketing of cultured prawns (*Macrobrachium rosenbergii*) in South Carolina. Presented at: 13th Annual Meeting of World Mariculture Society, Charleston, South Carolina, February 1982.
- Liao, D. S., T. I. J. Smith, and P. A. Sandifer. 1982. Economic, market and technical considerations for prawn farming in South Carolina. Presented at 7th Annual Tropical and Subtropical Technological Conference of the Americas. New Orleans, Louisiana, January 1982.
- Liao, D. S., T. I. J. Smith and F. S. Taylor. 1981. Marketability of prawns (*Macrobrachium rosenbergii*) in restaurants in South Carolina: A preliminary analysis. Tropical and Subtropical Fisheries Technological Conference 6: 38-41.
- Sandifer, P. A. 1981. Recent advances in the culture of crustaceans. Presented at: EMS/WMS World Conference on Aquaculture, Venice, Italy, 21-25 September 1981, (In press).
- Smith, T. I. J., P. A. Sandifer, W. E. Jenkins, A. D. Stokes and G. Murray. 1982. Prawn rearing trials with private growers in South Carolina, 1981. Presented at: 13th Annual Meeting of the World Mariculture Society, Charleston, South Carolina, February 1982.
- Smith, T. I. J., P. A. Sandifer, W. E. Jenkins, A. D. Stokes, and G. Murray. 1982. Summary of prawn rearing trials with private growers in South Carolina. Presented at: Annual Meeting of the South Carolina Fisheries Workers Association. Clemson, South Carolina, February 1982.
- Waters, M. E. and M. B. Hale. 1981. Quality changes during iced storage of whole freshwater prawns (*Macrobrachium rosenbergii*). Tropical and Subtropical Fisheries Technological Conference 6: 116-127.

*Publications and Presentations — Shrimps and Crawfish*

- Sandifer, P. A., W. B. Greene, and A. V. Berg. 1981. A morphological study of shrimp gametes. Abstract. Presented at: Annual Meeting, Southeastern Electron Microscopy Society, Atlanta, GA., February 1981.
- Sandifer, P. A. 1981. Recent advances in the culture of crustaceans. Presented at: EMS/WMS World Conference on Aquaculture, Venice, Italy, 21-25 September 1981 (In press).
- Berg, A. V. and P. A. Sandifer. *In vitro* fertilization and hybridization in the grass shrimp (*Palaemonetes*) (Decapoda, Caridea) (In preparation).
- Sandifer, P. A., A. V. Berg, and W. B. Greene. Organization and fine structure of the spermatophore of the prawn (*Macrobrachium rosenbergii*) (de Man) (In preparation).
- Sandifer, P. A., A. L. Lawrence, A. V. Berg, and G. Chamberlain. Improved methods for artificial insemination of shrimp (In preparation).

*Publications and Presentations — Hard Clams*

- Manzi, J. J., V. G. Burrell, Jr., and W. Z. Carson. 1980. A mariculture demonstration project for an alternative hard clam fishery in South Carolina: Preliminary results. Proc. World Mariculture Soc. 11: 79-89.
- Manzi, J. J., V. G. Burrell, Jr., and H. Q. M. Clawson. Commercialization of hard clam (*Mercenaria mercenaria*) mariculture in South Carolina: Preliminary report. Proc. World Mariculture Soc. 12: XX-XX (In press).
- Manzi, J. J. 1981. Hard Clam Culture in South Carolina. Presented at: Long Island Hard Clam Culture Workshop, SUNY-Stony Brook, New York, 7 May 1981.
- Manzi, J. J., M. B. Maddox, F. S. Stevens, and W. Z. Carson. 1981. An inexpensive commercial scale nursery system for juvenile *Mercenaria mercenaria*. National Shellfish Assoc. Ann. Meeting, Williamsburg, Virginia, August 1981.
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- Manzi, J. J. and J. M. Whetstone. 1981. Intensive hard clam mariculture: A primer for South Carolina fishermen. South Carolina Sea Grant Consortium, Marine Advisory Publication 81-01, Charleston, South Carolina.
- Hadley, N. H. Growth of juvenile clams (*Mercenaria mercenaria*) at different densities in South Carolina. Masters Thesis, College of Charleston, Charleston, S. C. (In Preparation).
- Manzi, J. J. 1981. Present status of hard clam culture in South Carolina. Presented at: A Workshop on Hard Clam Culture in South Carolina, Folly Beach, S. C., 13 August 1981.
- Manzi, J. J., V. G. Burrell, Jr., H. Q. M. Clawson, F. S. Stevens, and M. B. Maddox. 1982. Commercialization of hard clam (*Mercenaria mercenaria*) mariculture in South Carolina: One year later. 13th Annual Meeting, World Mariculture Society, Charleston, S. C., March 1982.
- Manzi, J. J., V. G. Burrell, Jr., H. Q. M. Clawson, F. S. Stevens, M. B. Maddox and N. H. Hadley. 1981. Early grow-out of *Mercenaria mercenaria* seed in a

commercial scale nursery system. World Conference on Aquaculture, Venice, Italy, September 1981.

- J. J. Manzi and Hadley, N. H. 1982. Growth of seed clams (*Mercenaria mercenaria*) at various densities in a commercial scale nursery system. 13th Annual Meeting. World Mariculture Society, Charleston, S. C., March 1982.

## FISHERIES DEVELOPMENT AND MANAGEMENT

Although commercial aquaculture in South Carolina may prove to be an excellent supplementary source of needed seafood products, it can only be expected to provide a fraction of consumer seafood demand in the near future. Thus, the growing demand for seafood must be satisfied by the natural fisheries of the state and region. For the short term, research in all aspects of the development and management of South Carolina's natural fisheries must continue. Fisheries research conducted by Consortium investigators serves to augment that of the various state and federal fisheries management and regulatory bodies in South Carolina.

Consortium biological research in commercial fisheries has focused on such traditional species as snappers and groupers, flounder, clams, oysters, and shrimp, and on several underutilized species including shark and knobbed whelk. In addition, studies on recreational fisheries have focused on swordfish and baitfish.

Fisheries technology development geared toward more efficient harvesting and processing of seafood comprises a portion of the Consortium's efforts in fisheries research. A Clemson investigator has been funded to develop equipment and procedures for orienting and deheading shrimp. This research will be used to interface the orientation and deheading mechanisms into an automatic deheading system, which is currently being tested, modified, and evaluated in both laboratory and commercial tests. The ultimate goal is to provide the shrimping industry with a dockside commercial shrimp deheading machine which will alleviate labor problems, increase efficiency, and improve overall shrimp quality. Several private firms have expressed interest in manufacturing the machine, which could result in over \$1 million dollars in sales. Efforts such as this are important for the management of the State's traditional fisheries, and the development of existing, underutilized fisheries, and result in improved efficiency and a boost to the state's economy.

### FY 1981-82 Projects

- "Reproduction and Development of Sharks and Rays" — Dr. John Wourms — Clemson University
- "Development and Evaluation of an Automatic Shrimp Deheading System" — Dr. John Collier — Clemson University
- "Survivorship and Bioenergetics of the Young Adults of a Commercially Important Clam, (*Mercenaria mercenaria*)" — Dr. F. John Vernberg — University of South Carolina
- "Age Determination and Ecology of South Carolina Swordfish" — Dr. John M. Dean — University of South Carolina

— "Use of Selected Copper Compounds in Bacterial Depuration of Oysters and Clams" — Dr. Thomas Cheng — Medical University of South Carolina

*Publications and Presentations — Sharks and Rays*

- Hamlett, W. C., J. S. Hudson, and J. P. Wourms. 1981a. Ultrastructure of histotrophe secreting cells in stingray uterine epithelium. Proc. 1981 Ann. Meeting So. East Elect. Micr. Soc. (1981):
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- Wourms, J. P. and G. S. Whitt (Editors). 1981c. Symposium on the Developmental Biology of Fishes. Amer. Zool. 21:317-598.
- Whitt, G. S. and J. P. Wourms. 1981d. Introduction to the symposium on the developmental biology of fishes. Amer. Zool. 21: 323-324.
- Wourms, J. P. 1981e. Viviparity: The maternal-fetal relationship in fishes. Amer. Zool. 21:467-509.
- Wourms, J. P. and G. S. Whitt. 1981f. Future directions of research in fish development. Amer. Zool. 21:591-598.
- Wourms, J. P., W. C. Hamlett, and M. D. Stribling. 1981g. Embryonic oophagy and adelphophagy in sharks. Presented at: Annual meet. Amer. Soc. Zool., Dallas, Tx., December 1981.

*Publications and Presentations — Swordfish*

- Wilson, C. A. and J. M. Dean. 1981. How old is that rascal: Techniques for age determination. Presented at: Joint Meeting of the Georgia and South Carolina Fishery Workers Assn. Conf. Augusta, GA., Spring, 1981.
- Wilson, C. A. and J. M. Dean. 1981. Age estimation of billfish. Presented at: Southeastern Estuarine Research Society Meeting. Wrightsville Beach, N. C. Spring, 1981.

**NEW MARINE PRODUCT DEVELOPMENT**

The pharmaceutical industry currently spends billions of dollars each year on the research and development of new and better products; however, it is only recently that attention has been focused on exploring marine sources for these products. The discovery of new and better pharmaceuticals and medicinal agents from the oceans is becoming more promising and rewarding, as evidenced by recent Consortium research initiatives. Substances are being isolated from both marine organisms and plants, and the potential for new product discovery is encouraging.

In one Consortium-funded study, a researcher at the University of South Carolina is involved with the isolation and identification of chemicals in coastal plants that possibly could be used as medicinal agents. Of the most important drugs used world-wide, more than half come from natural sources; the rest are derived directly or indirectly from petroleum. With the escalating demand for petroleum and natural food products, alternative sources for existing and new drugs must be sought. Several classes of compounds have been produced which,



with further study, will be completely purified and categorized. The research seeks to define structures of various salt marsh chemicals with the ultimate goal of discovering and identifying new medicinal, plant growth-controlling, and potential antitumor agents.

### FY 1981-1982 Projects

- "Substances from Invertebrates Which May Modify Resistance to Infection and Disease in Commercially Valuable Aquatic Species" — Dr. M. Michael Sigel — University of South Carolina
- "Isolation, Purification, and Characterization of New Medicinal Agents of the Salt Marsh" — Dr. Thomas Bryson — University of South Carolina

#### *Publications and Presentations — Invertebrate Substances*

- McCumber, L. J., R. Trauger, and M. M. Sigel. 1981. Modification of the Immune System of the American Eel (*Anguilla rostrata*), by Ete. International Symposium on Fish Biologics: Serodiagnostics and Vaccines, Lee-town, W. V. 1981. Develop. Biol. Stand. 49:289-294, 1981.
- Sigel, M. M., L. J. McCumber, J. A. Hightower, S. S. Hayasaka, E. M. Huggins, Jr., and J. F. Davis. 1981. *Ecteinascidia turbinata* extract activates components of inflammatory responses throughout the phylogenetic spectrum. Presented at: The Annual Meeting of the American Society of Zoologists, Dallas, 1981. Amer. Zool. (In press).

#### *Publications and Presentations — New Medicinal Agents*

- Reichert, C. F. and T. A. Bryson. Lipid constituents of salt marsh plants: *Scurpus americanus* and *Distichlis spicata*. Phytochemistry (1982) (In press).
- Reichert, C. F. and T. A. Bryson. New separations techniques for natural products isolation. Phytochemistry (1982) (In press).

## MARINE ENVIRONMENTAL RESEARCH

Recent interest in the marine and coastal environment is based primarily on its scientific and economic value. Exploitation of the various resources in this environment has led to increasing demand and, ultimately, to competition for the right and access to these resources. Coupled with increased exploitation, e.g., industrial development, shipping, fishing, and recreation, impacts upon the marine environment, in one form or another, are almost always inevitable. However, environmental research conducted by Consortium researchers contributes to the development of solutions to environmental issues that exist in South Carolina and the Southeast.

Researchers at the University of South Carolina, for example, are studying the effects of toxaphene insecticides on marine and aquatic organisms. Efforts are now underway to determine the aerial input of these insecticides to North Inlet estuary, a pristine estuary where little freshwater input occurs other than through rainfall. Coastal South Carolina is also directly downwind of the cotton

belt, a region of very high pesticide use. Because of the location of North Inlet, studies at this estuary offer a major opportunity to document the impact of aerial input of toxaphene on an east coast ecosystem and, specifically, on oysters and plankton.

#### **FY 1981-1982 Projects**

- "Atmospheric Deposition of Toxaphene and Other Organochlorines at North Inlet Estuary: Uptake Responses of Oysters and Plankton" — Dr. Terry Bidleman — University of South Carolina.
- "Investigation of the Toxic Substances of *Spartina*" — Dr. Thomas Bryson — University of South Carolina

#### *Publications and Presentations — Toxaphene*

Harder, H. W. and T. F. Bidleman, 1980. Acute effects of Toxaphene insecticide and its degradation products in estuarine sediments to the White Mullet (*Mugil curema*). Presented at: The Southeast Estuarine Research Society Meeting, Wrightsville Beach, N. C. April, 1980.

### **COASTAL RESOURCE DEVELOPMENT AND MANAGEMENT**

Coastal management issues in South Carolina are of the utmost importance to coastal zone planners, managers, and developers. The state has an approved Section 306 Coastal Zone Management program which is implemented by the South Carolina Coastal Council. Through cooperative arrangements, the Consortium has undertaken contracts with the Coastal Council in investigating important coastal zone issues: the Consortium also examines coastal management issues under the Sea Grant program. These efforts reflect the needs of the state in terms of coastal decision making, planning, and assessment.

One such need, being addressed by an investigator at the College of Charleston, is the development of a comprehensive and integrated waterfront planning and management model for the Charleston region. Problems involving waterfront accessibility, user conflicts, and environmental impacts do exist in this area as shown through preliminary studies. This effort will result in a multi-objective waterfront land use model and a report outlining future waterfront-related management strategies for the region. These results will help integrate and coordinate future development and use of Charleston's waterfront area, including urban revitalization and port expansion.

#### **FY 1981-1982 Project**

- "A Multi-Jurisdictional Urban Waterfront Planning and Management Model" — Dr. Roger Stough — College of Charleston.

## COASTAL PROCESSES AND ENGINEERING

Natural physical processes along the coast can have favorable or adverse impacts upon the activities of man. These dominant forces continue to be investigated for viable solutions in accommodating the needs of man to the necessities imposed by the environment. Factors such as coastal erosion and accretion, sediment transport, and storm impacts must be taken into consideration as coastal development and use continues.

The construction of bulkheads is one method used to reduce coastal erosion of shoreline properties. However, property adjacent to bulkhead structures tends to erode at a proportionally faster rate. The development of an innovative bulkhead design to minimize adjacent shoreline erosion is being investigated by Clemson University researchers. It is anticipated that, with the development of such a bulkhead design, this adjacent shoreline erosion may be reduced by as much as 90 percent.

### FY 1981-1982 Project

- "Laboratory Investigation of Bulkheads Designed to Minimize Adjacent Shoreline Erosion" — Drs. John Fisher, Billy Edge and Ben Sill — Clemson University

## MARINE EDUCATION

The Consortium established a Marine Education Study Group as one of its first actions as a viable program. The Study Group, established in order to provide for the development of the educational component of the Consortium, was charged with the task of assessing various educational activities that would be appropriate for Sea Grant support in South Carolina and developing a series of recommendations as to which activities would best serve Sea Grant educational goals.

The recommendations of the Study Group have led to the development and implementation of several marine education projects, including:

- The development of a combined marine affairs and applied sciences curriculum in the Charleston Higher Education Consortium's (CHEC) graduate program. This effort will provide graduate students in coastal South Carolina opportunities for interdisciplinary education and research activities in a broad range of marine issues.
- A cooperative program in marine studies for minority students. This year, minority students enrolled at South Carolina State College have been selected for research apprenticeships in marine science at the University of South Carolina. This program will result in increased opportunities for the movement of ethnic minorities into careers in marine science.

These efforts provide the foundation for the continued development of a comprehensive educational program in marine and coastal studies, and reflect the Consortium's interest in providing students with a better understanding of the South Carolina coast.

### **FY 1981-1982 Projects**

- “Development of an Applied Science Curriculum in the Charleston Higher Education Consortium’s Graduate Program” — Dr. Roger Stough — College of Charleston and Dr. Paul Sandifer — S. C. Wildlife and Marine Resources Department
- “Development of an Area Specific Educational Television Series on the Marine Environment for South Carolina” — Dr. Richard Dame — University of South Carolina
- “A Cooperative Program in Marine Studies with Emphasis on Minority Educational Institutions” — Dr. James Arrington — S. C. State College

### **MARINE ADVISORY SERVICES**

The South Carolina Marine Advisory Service represents the Sea Grant Consortium’s extension of Consortium member expertise and skills to all the people of South Carolina. Basically, the Marine Advisory Service operates under a philosophy of transferring skills and knowledge to a variety of marine user groups. More specifically, the goal of the Marine Advisory Service is to enhance the knowledge of both targeted constituencies and the general public about South Carolina’s marine resources and coastal environment through information dissemination and education. The Marine Advisory Service, as is the case in several other states, functions within the structure of the Cooperative Extension Service of the state Land Grant College; in this case, Clemson University. Marine Advisory Specialists are located in Georgetown, Charleston, and Beaufort, the three main centers of marine activity on the South Carolina coast. The MAS project leader maintains an office at Consortium headquarters in Charleston.

During the past year, the Marine Advisory Service provided technical assistance in commercial fishing, aquaculture, recreation, coastal zone management, seafood utilization, and general public education. The Marine Advisory Service has been involved in coordinating workshops on Hard Clam Culture, Crawfish Culture, Marine Baitfish, Prawn Farming, and Aquaculture Legislation. Specialists have also worked closely with other Sea Grant programs, the U. S. Coast Guard, National Marine Fisheries Service, National Weather Service, the S. C. Coastal Council, the Cooperative Extension Program, and other government entities to bring timely and practical information to specific user groups.

The Marine Advisory Service designs its activities to meet the needs of marine resource users and provides the information necessary to ensure wise and effective use of South Carolina’s marine resources. Through Marine Advisory Service identification of needs, research efforts can be identified and conducted in a responsive and efficient manner. Marine Advisory Service cooperative efforts in the development of new technology and provision of advisory services to coastal and marine related businesses enhance the sound growth of the economy of South Carolina.

## FY 1981-1982 Selected Accomplishments

### — *Commercial Fisheries*

- A plumb staff beam trawl designed from an Alaska Sea Grant publication was built during 1981 to be used with the commercial outboard shrimp fishery. A demonstration of this gear will be held during the 1982-83 shrimping season.
- A special edition of *Marine Briefs* containing record-keeping and tax management information was published and mailed to over 1,000 commercial fishermen.
- Five editions of *Marine Briefs* were mailed to over 1,000 commercial fishermen per edition; information covered timely and practical items such as marine safety, turtle excluder devices, local notice to mariners, Coast Guard Regulations, and fuel conservation.

### — *Aquaculture*

- A hydraulics workshop was held in McClellanville, S. C. in December, 1981, to better inform local dredge operators of the theoretical aspects of hydraulics, maintenance and materials savings, and onboard applications of hydraulics were suggested. Operators from 6 or 10 dredges in South Carolina were in attendance.
- With assistance from a S. C. Wildlife and Marine Resources Department researcher, a publication entitled INTENSIVE HARD CLAM MARICULTURE: A Primer For South Carolina Watermen was completed in July, 1981. Four individuals were assisted in on-site analysis of whether clam gardening would be feasible on their property.
- Technical assistance on-site was provided to at least 40 area landowners interested in hard clam, prawn, shrimp and crawfish culture; also work with the South Carolina House Agriculture and Natural Resources Committee and Senate Fish, Game and Forestry Committee on the development of comprehensive aquaculture legislation and identification of issues.

### — *Recreation/Coastal Zone Management*

- A Coastal Cruising Guide to south Carolina has been completed which will provide boat tourists traveling the Intercoastal Waterway with information about the little known historic, scenic, and natural features of Carolina Lowcountry.
- The Coastal State Park Fishing Guide has been completed and reviewed: it was designed as a saltwater fishing guide to increase tourist awareness of the four state coastal parks. The State Parks, Recreation and Tourism Department will print the guide and will handle sales through the "general stores" located and operated by PRT at the state parks. They expect the guide to be in print by June of 1982.
- Gulf Stream Telemetry charts are mailed three times each week from the MAS office to marine users: including commercial fishing/sportfishermen and shipping companies. At present, the chart is mailed to 50 individuals. Besides facilitating fishing the edge of a warm water mass, fuel savings result from use of the chart.

— *Seafood Utilization*

- A series of programs on seafood storage and preparation was presented on the Beaufort ETV station by the Beaufort Agent. The seafood home economist presented three demonstrations at the Tri-County Fair in Charleston. Through every day interactions between the marketing section of S. C. Wildlife and Marine Resources Department and MAS specialists, underutilized species were introduced to the general public.

— *Public Education*

- A three day workshop on finfish utilization education for high school home economics teachers and extension home economists in South Carolina was developed and several workshops have been conducted during the summer.
- MAS interacts with the Consortium Study group for Marine Education Activities in South Carolina, assists in the educational component of the South Carolina Sea Grant Program, and helps develop programs which will enhance the educational effort without duplicating advisory programs.

## COMMUNICATIONS AND INFORMATION SERVICES

The Sea Grant Consortium's principal objective is to serve as a clearing-house for marine and coastal-related information. In this respect, the Consortium communication and information service serves as the focal point for Consortium research, education, and advisory activities.

In an ambitious effort, the Coastal Heritage Program (CHP) was initiated to provide information on the interaction of the environment, the economy, and the culture in Coastal South Carolina's history. Utilizing data from interdisciplinary research, CHP is designed to increase public awareness of and involvement in coastal issues. Information has been and will be presented through diverse materials and activities, e.g., regular as well as special topic bulletins, press releases, a special exhibit for schools and museums, production of ETV and NPR spots, a conference, and publication of an intellectually and aesthetically-sound popular history book. CHP has already produced two Coastal Heritage Bulletins and an information workshop: it has also generated support for research and other activities from the S.C. Committee for the Humanities.

Emphasis is being placed on expanding the communications program to enhance the effective development of current and future innovative programs. Communication and information activities are designed to ensure that concerned audiences receive the benefit of Consortium research, education, and advisory activities. Through maximizing the availability of Consortium-generated information, coastal and marine audiences can use and manage resources in an effective and productive manner.