

CSA

Continental Shelf Associates, Inc.

A PROPOSAL
FOR THE BISCAYNE BAY
BENTHIC SAMPLING PROGRAM

14

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Submitted To:
Dade County
Department of Environmental Regulation
By: Continental Shelf Associates, Inc.

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"Applied Marine Science and Technology"



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1.0 INTRODUCTION

Continental Shelf Associates, Inc. (CSA) is pleased to submit this proposal to the Dade County Department of Environmental Resources Management (DERM) for a benthic sampling program in Biscayne Bay. Our proposal, for conducting a Benthic Sampling Program in Biscayne Bay, is one of several projects which will be conducted concurrently as part of the Biscayne Bay Restoration and Enhancement Program. The goal of our project is to establish a comprehensive data base for the benthic communities and their seasonal changes in Biscayne Bay and to correlate the distribution of various taxa with abiotic factors. Continental Shelf Associates, Inc. is prepared to assist DERM in reaching this goal in a manner which is both time and cost effective. In addition, CSA is prepared to work closely with the Biscayne Bay Restoration Working Team in the effort toward successful completion of the overall goals of the Biscayne Bay Program.

To provide (DERM) with a data base of the benthic communities in Biscayne Bay, CSA proposes to sample a total of 50 stations throughout all major areas and habitat types within the Bay. Large diameter core samples and diver observations at all study sites will be used to provide information on the seasonal abundance and distribution of benthic communities. Qualitative and quantitative descriptions of macroflora at each station will be provided by diver observation, specimen collection, and 35mm photography. Quantitative descriptions of sediment characteristics, including composition and grain size distribution, will be provided from cores for each station. Qualitative and quantitative descriptions of abiotic conditions at each station will be

obtained from diver observations, concurrent Biscayne Bay projects, and previously existing data bases. Continental Shelf Associates, Inc. will prepare and submit the necessary reports on the sampling techniques and methodologies, equipment and instrumentation, and analyses, interpretation, and synthesis of data to fulfill all contractual requirements of the study.

Benthic communities in Biscayne Bay are of vital importance to nearly all aspects of this ecosystem. For example benthic communities provide both food and shelter (seagrass beds) for organisms important to various existing commercial and sport fisheries in the Bay. Due to their sessile nature, benthic communities are important ecological indicators of water circulation and various types and sources of pollution in the Bay. In addition, nearshore seagrass bed communities may act as natural turbidity inhibitors, helping to maintain better water quality. As a widely utilized ecosystem, Biscayne Bay requires guidelines to preserve, protect, restore, and enhance this natural resource. We feel that Continental Shelf Associates can furnish the benthic community information needed to establish comprehensive guidelines for the wise use and management of the resources of Biscayne Bay.

PART 2.0 CSA ORGANIZATIONAL INFORMATION

2.1 CORPORATE BACKGROUND AND EXPERIENCE

Continental Shelf Associates, Inc. was incorporated in the State of Florida in 1970. The corporate home office is located in Tequesta, Florida.

CSA specializes in applied marine science and oceanography, providing professional services to government and industry in offshore and coastal environmental studies and permitting projects. The professional staff consists of oceanographers, environmental specialists, and marine resource scientists having extensive experience in Federal, State, and local environmental permitting and regulatory processes and projects in the marine and coastal environments.

Relevant staff experience includes environmental and regulatory permitting and marine impact studies for:

- dredge and fill construction and maintenance projects
- port development and expansions
- commercial and residential coastal land development
- OCS oil & gas exploration and development
- nuclear and coal fired power plants
- ocean disposal
- pipeline and transmission corridors
- industrial siting
- governmental civil works, projects, and actions

CSA staff members have participated in and managed comprehensive, multi-disciplinary, environmental permitting projects and planning studies. In this capacity, coordination between governmental regulatory authorities was required to establish environmental permit requirements, plans of study, and public participation in the permitting or planning process. CSA professional scientists are thoroughly experienced in coordination of program activities between regulatory authorities, industry, and the public interests.

2.2 PROJECT EXPERIENCE

Continental Shelf Associates, Inc. has been intensively involved in ocean and coastal environmental programs for over ten years. Our projects have been related primarily to environmental study programs and permitting projects for both governmental agencies and private industry. The staff at CSA has been involved in projects involving estuarine water quality investigations, environmental monitoring programs, biological, chemical, geological, and physical oceanographic studies, environmental impact studies, and preparation of environmental reports. In addition to having worked in Biscayne Bay and Card Sound, we have successfully completed projects in several areas of the Atlantic, Gulf of Mexico, Puerto Rico, Arctic, and Alaska. The following pages present some of our recent oceanographic experience and projects related to the proposed study in Biscayne Bay.

Biscayne Bay Water Quality Survey - Intensive collection of multiple water quality parameters for one year at sixty stations in Biscayne Bay and Card Sound. The project was conducted for the Florida Power and Light Company in connection with the Turkey Point Nuclear Power Plant.

St. Johns River Study - This aquatic environmental baseline study for the Jacksonville Electric Authority was an intensive collection of data to calibrate a computer design of discharge structures. The project included biological collections, water quality investigations, bathymetry, plume mapping, current measurements, tide measurements, and dye studies.

Aquatic Baseline Study - Performed an aquatic environmental survey of the river basin area associated with Port St. Lucie, Florida. This program involved intensive investigation of laboratory and instrumented water quality, benthic assessment, bathymetry, hydrology, dye tracer studies, and other physical assessments to provide baseline data for future development.

Chlorine Minimization Study - This study was performed in connection with the intake tanks at Florida Power and Light's Power Plant in Fort Lauderdale. The study included extensive underwater quantitative sampling and photography of epifaunal communities to assess the impacts due to chlorination.

Thermal Plume Mapping - This project involved the collection of oceanographic data and the mapping of the thermal discharge plume from a nuclear power plant in the Atlantic Ocean off the east coast of Florida for Ebasco Services, Inc.

Seagrass Revegetation Study - CSA conducted an experimental submerged seagrass revegetation study in the Florida Keys. Three species of seagrasses were planted using various techniques and their growth monitored for two years to aid in the interpretation of the biological results. The project was conducted for the State of Florida Department of Transportation.

Environmental Monitoring of Dredging Operations - CSA conducted a one year environmental monitoring study for Port Everglades of coral reef communities before, during, and after dredging operations at the Port Everglades Entrance Channel. The biological communities were visually inspected and the contents of sediment traps analyzed at fifteen stations on a monthly basis. The study also included the collection of continuous water current and temperature data.

Southwest Florida Shelf Ecosystems Study - CSA conducted the oceanographic surveys for the Bureau of Land Management for a pre-lease environmental characterization of the area offshore from Charlotte Harbor to Key West, Florida in the Gulf of Mexico. CSA surveyed more than 450 nautical miles of sea floor using photography and underwater television. Side scan sonar and subbottom profiling of the area were also conducted. The data produced maps of sensitive live bottom areas within the lease area.

Underwater Cable Inspection - Performed offshore telephone cable inspections for the American Telephone and Telegraph Company from Jacksonville Beach, Florida to Florida City, Florida. Provided personnel and equipment for underwater cable inspection, underwater photography, bathymetry, and report preparation.

Dye Tracer Study - Performed a dye tracer study to determine circulation patterns in the Florida Keys. The study was done for Marine Coloids, Inc. in connection with the assessment of seagrass mariculture.

Warm Reef Assessment - This study was an evaluation of potential impacts on warm reefs as a result of dredging at the Sabastian Inlet. Aerial photography and ground truth was utilized to pinpoint the location of reefs.

Marsh Environmental Study - Performed an environmental impact analysis of marsh grass areas in connection with a bridge right-of-way across the Metanzas River, Florida. The study was conducted for Houdaille-Duval-Wright Engineers, Inc.

Phosphate Spill Environmental Assessment - Provided a rapid response team of personnel, boats, equipment and instrumentation in a comprehensive physical, chemical and biological aquatic survey of a river and bay following a phosphate slurry spill. The spill occurred in the Peace River, Florida.

Hydrochloric Acid Spill Assessment - Collected and analyzed environmental data to assess the damage to botanical populations resulting from an uncontrolled spill of hydrochloric acid in Jacksonville, Florida.

NPDES Monitoring - Designed and supplied instrumentation for EPA National Pollutants Discharge Elimination Systems Permit Monitoring. Discharges were monitored and analyzed for Simplex Industries, Inc. and reports submitted to meet EPA requirements. Also, designed and provided instrumentation to Anchor Hocking Corporation for NPDES monitoring in Jacksonville, Florida.

Current and Tidal Study - This study involved the collection and analysis of current meter and tide gauge data in a Florida bay. The data was collected for use in calibrating a hydraulic model of the bay for the U.S. Army Corps of Engineers.

Mississippi River Environmental Study - This long term study, required by the Environmental Protection Agency, was aimed at characterizing three potential power plant sites along the Mississippi River, and involved biweekly collection of ichthyoplankton samples, gill net samples, hoop net samples, bottom grab samples, current measurements, water column profiles, and zooplankton samples for Middle South Services, Inc.

Mississippi Sound Environmental Studies - This project involves a comprehensive and coordinated multidisciplinary oceanographic field sampling program in the Mississippi Sound. The program consists of current meter recordings, plankton tows, sediment coring, geological grab sampling, water quality measurements and trawling for the Mississippi-Alabama Sea Grant Consortium Gulf Coast Research.

Sewage Ocean Outfall Assessment - The study involved biological assessments of several proposed sewage outfall sites in Puerto Rico. It included land surveying and underwater navigation and evaluation of potential pipeline corridors for Environmental Research & Technology, Inc.

Coastal Current Study - Studies were conducted off the coast of Puerto Rico. CSA installed and retrieved current meters and performed the necessary data analysis and computer processing for Ecosystem's and Associates.

USGS Ecological Survey Offshore Drilling Compliance Monitoring -

A marine environmental monitoring program was designed and carried out to satisfy U.S. Geological Survey environmental stipulations in connection with drilling two wells. The pre-drilling, concurrent, and post-drilling surveys involved physical and chemical oceanographic data collection and analysis as well as in-situ biological observations and analysis. East Texas Flower Garden Coral Reef, Gulf of Mexico. Mobil Oil Corporation.

Platform Monitoring Program - CSA performed a long term marine environmental monitoring program required by the USGS Ecological Survey for a development platform. The study included underwater television videotape recording and analysis, in-situ ocean current monitoring, and sediment trap accumulation investigations, as well as water column and bottom sediment sample and data collection and analysis. Near Baker Bank, Gulf of Mexico. Continental Oil Company.

Environmental Impact Study of Drilling Muds - This oceanographic survey included sediment sampling for barium analysis and in-situ ocean current monitoring. Gulf of Mexico. Exxon Corporation.

Pre-Exploration Oceanographic Studies - CSA performed physical, chemical, and biological oceanographic surveys and analysis to meet USGS Ecological Survey stipulations for drilling permits. Gulf of Alaska. Exxon Corporation.

South Atlantic Hard Bottom Study - The project required bottom mapping and biological community evaluations on selected oil and gas lease blocks off the coasts of South Carolina and Georgia for the Bureau of Land Management. Mapping of hard-bottom areas was accomplished with side-scan sonar, sub-bottom profiling, and precision bathymetry. The hard bottom (reef) areas were observed and documented with underwater television and remote photography. Dredge samples were also collected. The types and distributions of bottom communities were mapped and described.

Mariculture Assessment - Provided personnel, boats, equipment and instrumentation for field evaluations and assessment of sites for mariculture purposes. Studies were conducted in northwest Florida for Marifarms, Inc.

Thermal Effluent Monitoring - Provided personnel, boats and equipment for a ten year thermal effluent temperature monitoring project at Florida Power & Light's St. Lucie Nuclear Power Plant.

OCS Platform Environmental Monitoring Program - CSA performed a long-term marine environmental monitoring program required by the U.S. Geological Survey for a development platform. The study included underwater television surveys of nearby Baker Bank, in-situ ocean current monitoring, sediment accumulation investigations, water column and bottom sediment sampling, and pertinent data analysis. CSA designed the study program in concurrence with the USGS for Conoco Inc.

USGS OFFSHORE DRILLING COMPLIANCE MONITORING PROGRAM - CSA designed and performed a marine environmental monitoring program to satisfy U.S. Geological Survey environmental stipulations in

connection with drilling five wells near the East Flower Garden Bank. CSA performed pre-drilling, concurrent, and post-drilling surveys involving physical and chemical oceanographic data collection and analysis, as well as in-situ biological observations and analysis for Mobil Oil and American Natural Gas Production Companies.

Offshore Drilling Environmental Study - CSA designed and performed pre-drilling, concurrent, and post-drilling environmental assessment surveys to satisfy USGS Ecological Survey environmental stipulations for drilling. The program involved definition and tracking of the drilling fluid discharge plume, as well as chemical, physical, and biological sample and data collection and analysis. East Texas Flower Gardens, Gulf of Mexico. American Natural Gas Production Company.

2.3 FACILITIES AND EQUIPMENT

Continental Shelf Associates' facility in Tequesta, Florida consists of 2,200 square feet of office space, 950 square feet of biological laboratory space, 2,500 square feet of chemical laboratory space, and 2,900 square feet of shop space.

Continental Shelf Associates uses state-of-the-art equipment for increased efficiency, accuracy, and time utilization. A partial list of our in-house specialized field equipment is as follows:

- Offshore Survey Boat w/Trailer
- 42-Foot Research Trawler
- Specialized Boats w/Trailers Ranging from 10 to 24 Feet
- Modular Equipment Packages for Installation on Survey Boats
- Trucks and 4-Wheel Drive Vehicles
- Radio Communications Between all Units
- Hydro Products TC-125 Underwater Television Camera and Light System w/Pan and Tilt, Cable, Monitor and Recorder
- Benthos Model 372, 382 and 380-34 Underwater 35mm Deep Sea Camera System with Strobe and Data Chamber
- Deep Sea Towing System for Television Photo System
- Hydrolab Water Quality Surveyor Systems
- Precision Recording Fathometers (Raytheon and Benmar)
- Terrestrial Surveying Equipment
- Niskin and Van Dorn Water Samplers
- Wildco Ballcheck Gravity Corers
- Bottom Grabs and Box Corers (Smith-MacIntyre, Petersen, Ponar)
- Biological, Triangular, and Rock Dredges and Sediment Traps
- Various Otter Trawls and Sampling Nets
- General Oceanics Digital Flowmeters
- Recording Thermographs (Ryan and General Oceanics)
- Recording Current Meters (General Oceanics and ENDICO)
- Recording Tide Gauges (General Oceanics and Stevens)
- Strip Chart Recorders
- Pingers and Pinger Receiver (Burnett)
- Hydro Products 915S Transmissometer System
- Oil Sprill Detection System
- Diving Equipment, Radios and Underwater Tools (Burning, Welding, Jetting, Etc.)
- Underwater Cameras
- Diver Held Magnetometer
- Diver Propulsion Vehicles
- Piper Air Craft

Diesel-Powered Diving Compressor Systems (3)
Portable Generator
Portable Pump
Hydrographic Winch
Instrumentation Winch

LABORATORY EQUIPMENT INCLUDES:

Enviro Clean Benches
Mettler Balances (Models H-30 and H-34)
Rotary Vacuum Evaporator
Tekmar Tissuemizer
Corning 1 liter and 2 liter/hour Stills
Perkin Elmer Atomic Absorption Spectrophotometers
(Models 107 and 372)
Perkin Elmer Gas Chromatograph (Model 3920)
Houston Instruments Strip-Chart Recorders
Corning pH Meters
Orion Specific Ion Meter
Refrigeration and Freezing Equipment
Autoclaves
BOD Incubators
Microscopes
Bausch and Lomb spectronic 21 UV-M spectrophotometer

Continental Shelf Associates, Inc. will utilize its Lanier
Word Processing System for report documents when applicable.
The word processor can also be linked to the Texas A&M
University Amdahl 470V-6 Computer.

2.4 RESOURCES AND FINANCIAL STABILITY

CSA's primary resource is its personnel. This is true of any firm. However, we feel we are ahead of most firms with our philosophy of careful selection of personnel and controlled growth. Personnel are selected and retained not only for their professional expertise, which is paramount, but also for their demonstrated integrity, motivation, personal pride, and their ability to function smoothly within the existing team. We attempt to maintain this team as a unit, where combined experience increases efficiency and effectiveness far greater than that obtainable by turnover of personnel. Over a ten year period, Continental Shelf Associates, Inc. has earned the reputation of reliable technical performance and scientific integrity.

Materially, CSA has over 300 K dollars (replaceable cost) in field operating and sampling equipment. We prefer to purchase, whenever practical, to assure ourselves and our clients of quality equipment in first-class condition. CSA designed its own building so that it would be most functional for all of our needs. It is equipped with an extensive library, a biology laboratory, an instrumentation laboratory, an equipment storage and maintenance section, a report preparation center, and a word processing center.

Financially, CSA has demonstrated steady continuous growth and enjoys good business relationships with the four local banks. These are the Flagler National Bank, the First American Bank of North Palm Beach, the First Marine Bank of Tequesta, and

the First National Bank of Riviera Beach. The Flagler National Bank and the First National Bank of Riviera Beach have been our primary banking institutions for the last five years and extend a standing line-of-credit to CSA. CSA has open accounts with most major oceanographic instrumentation manufacturers and with many marine supply and service organizations all over the United States.

3.0 PROJECT ORGANIZATION AND KEY PERSONNEL

Continental Shelf Associates' approach to program organization is to provide the best available staff within a structure having specific lines of authority and accountability. Our objective is to be responsive to the client's needs, to provide high quality services, and to meet project schedules and budget commitments.

CSA specializes in applied marine science and oceanography, providing services to industry and government in coastal and offshore environmental studies. The professional staff consists of oceanographers, environmental scientists, and natural resource specialists having extensive experience in marine processes and projects. Over a ten-year period, CSA has earned the reputation of reliable technical performance and scientific integrity.

The program organization has been divided into logical divisions as shown in Figure 1. There will be extensive communication between units. The Scientific Director and Principal Investigator will have overall responsibility for coordinating and maintaining close and constant contact with the Biscayne Bay Restoration Working Team (B.B.R.W.T.) and insuring good communication between tasks. Continental Shelf Associates, Inc. has a quality assurance program that provides for continuous review of data collection and analyses to confirm the adequacy of techniques for meeting project objectives. Thorough documentation of techniques and internal peer review of all reports complete the quality assurance program.

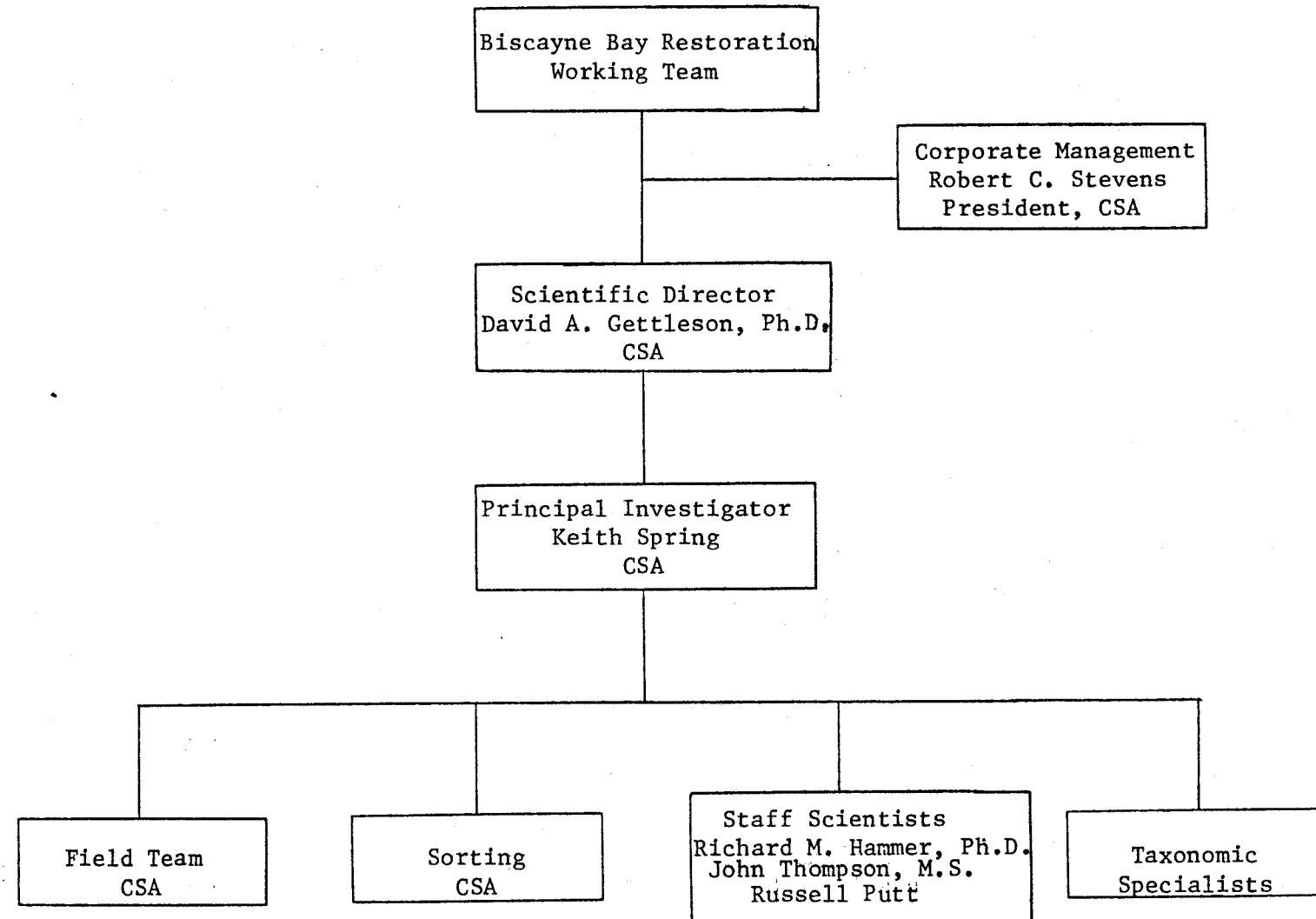


FIGURE 1 BISCAYNE BAY SAMPLING PROGRAM ORGANIZATIONAL CHART

The President of Continental Shelf Associates will handle the necessary corporate responsibilities, including accounting, legal, and insurance matters.

Table 1 shows a list of the key personnel and their areas of expertise proposed for this program. Resumes of these individuals are contained in Appendix A. These personnel have been selected from our permanent staff of 25. This staff includes five Ph.D. degrees, five Master of Science degrees, eight Bachelor of Science Degrees, and a Certified Professional Geologist.

Table 1. Key Personnel

Robert C. Stevens, President, CSA

Twenty years of experience in marine operations and logistics, ocean engineering, financing, and management.

David A. Gettleson, Ph.D., Scientific Director and Oceanographer, CSA

Dr. Gettleson has been involved with numerous biological, geological, physical, and chemical oceanographic studies over the past ten years. He has six years of scientific management experience, directing major research programs for federal, state, and industrial clients. He is especially knowledgeable and experienced in benthic ecology.

Keith D. Spring, M.S., Biological Oceanographer, Principal Investigator, CSA.

Mr. Spring has been responsible for the analysis and identification of hundreds of benthic biological samples from several large, multi-year programs in the Gulf of Mexico and Atlantic Ocean. He has also served as onboard chief scientist on several biological and chemical oceanographic cruises and was responsible for data control from collection through analysis and reporting.

Richard M. Hammer, Ph.D., Oceanographer, CSA

Dr. Hammer has coordinated over 50 scientific reports dealing with environmental and socioeconomic impacts of oil and gas activities in the entire Gulf of Mexico. He has ten years of experience in marine ecosystem analysis, including study design, field sampling, report writing, and editing.

M. John Thompson, M.S., Marine Ecologist, CSA

Mr. Thompson has organized and conducted several aerial mapping, and/or ground truthing investigations of coastal features for both governmental agencies and industrial groups. He has ten years of experience in remote sensing and wetland habitat mapping.

Russell E. Putt, Oceanographer, CSA

Mr. Putt is particularly knowledgeable in the areas of coral reef ecology. He has served as chief scientist on several major oceanographic data collection programs and as project manager on several environmental studies in the State of Florida. He has over 10 years experience in underwater photography and data collection techniques.

4.0 TECHNICAL PROGRAM

4.1 PHASE 1 - BENTHIC SPECIES ABUNDANCE AND DISTRIBUTION

4.1.0 DESCRIPTION OF THE SURVEY AREA

Biscayne Bay is a semi-tropical estuary adjacent to Miami, Florida which is separated from the Atlantic Ocean on the east by a series of barrier islands, including Miami Beach on the north and Key Largo in the south. The Bay is very shallow, averaging 6 feet, with a maximum depth of 13 feet, excluding dredged channels (Roessler & Beardsley, 1974a). Warm oceanic waters of the Gulf Stream enter the Bay through many tidal channels on its eastern side. Freshwater enters the Bay via rainfall, small mainland rivers and creeks, and ground water percolation along the western edge. Tides in the Bay are semi-diurnal and may be greatly affected by winds greater than 20 knots (Morril & Olson, 1955). Tidal currents within the Bay average less than a half knot (Wilson, 1975). The highest current speeds (up to 3 knots) occur on the eastern side through various tidal cuts..

Sediments in the Bay range from fine silt to coarse carbonate gravel composed of broken shell and rock fragments. In the northern portion of the Bay, sand is composed of approximately 35% silica and 65% carbonate, grading to 20% silica and 80% carbonate in the southern portion (Roessler & Beardsley, 1974a). Sediment studies of the Bay are limited, most of them having been conducted in conjunction with biological research. Vaughn (1910) presents a general distribution pattern of surface sediment types in the northern portion of the Bay. The most comprehensive sediment study has been done by Wanless (1969) in which he describes the patterns and processes of sedimentation in Biscayne Bay. The

interaction of sedimentation and biological activity in Biscayne Bay has been discussed by several investigators (McNulty, 1961; McNulty et al., 1962a, 1962b; Wanless, 1976), making it clear that a better knowledge of sedimentation in the Bay is necessary for our complete ecological understanding of the area.

The ecological literature of Biscayne Bay contains detailed information on the diversity of animal and plant communities. Seagrasses and their associated epiphytes, along with benthic micro-and macro-algae, are the major primary producers in the southern portion of the Bay (Thorhaug, 1971). In areas greatly affected by man, such as northern sections of the Bay causeways, and filled areas, the dominant producer Thalassia has disappeared and is usually replaced only sparsely by secondary seagrasses (Thorhaug, 1976). Seasonal distribution and lists of plant species found in the Bay are reported by Humm (1964), Zieman (1970) and Thorhaug (1971). Figure 2 presents a vegetation map of Biscayne Bay (Roessler and Beardsley, 1974b).

Invertebrate and vertebrate species found in many areas of the Bay have been extensively studied. Voss and Voss (1955) studied the macroscopic intertidal and shallow water invertebrate and algal life of Soldier Key. Moore et al. (1968) examined the dominant invertebrate macrofauna of a tidal flat in Biscayne Bay and O'Gower and Wacasey (1969) collected data on the animal communities associated with seagrasses and sand beds in shallow sublittoral zones near Key Biscayne and Virginia Key. Infaunal communities of the Bay and their relation to sediment size have

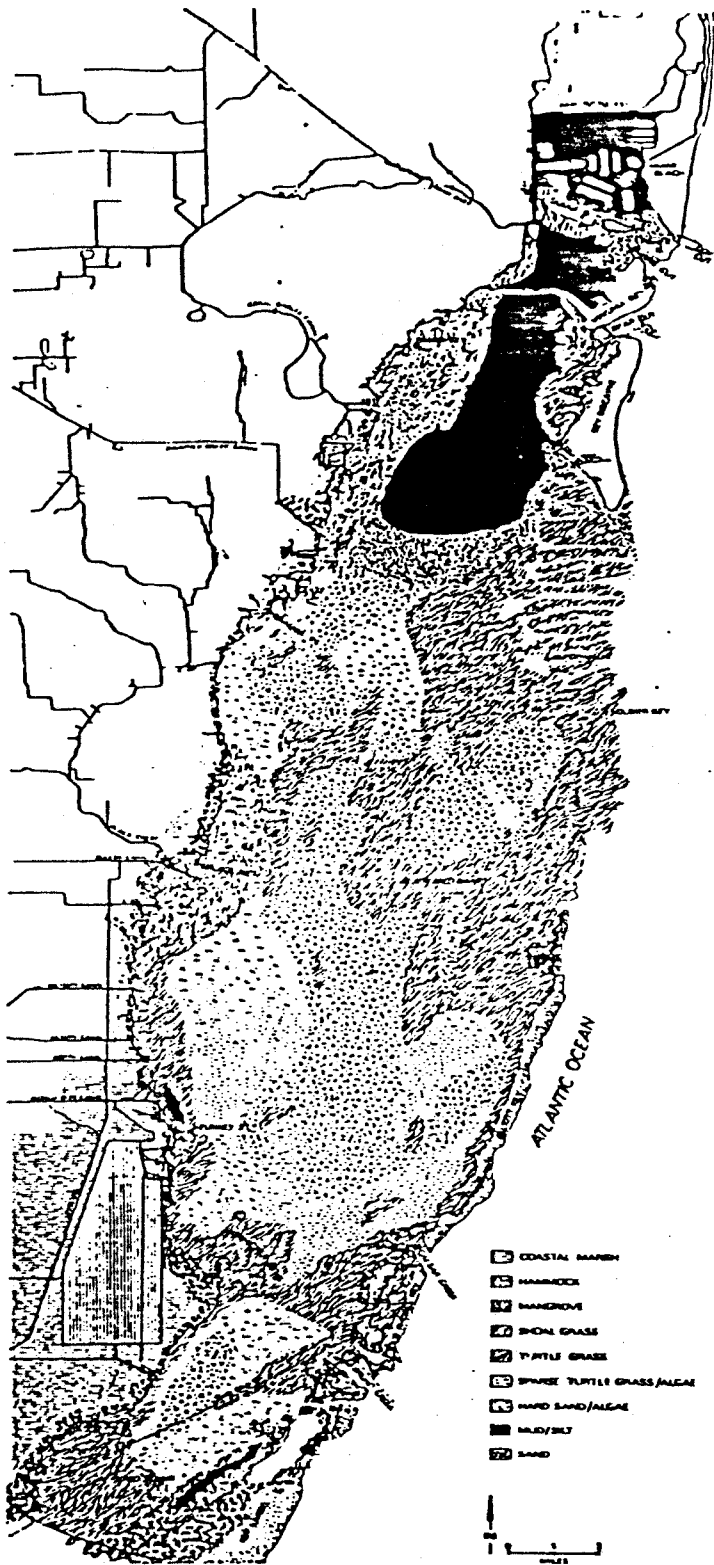


Figure 2. Vegetation map of Biscayne Bay (from Roessler and Beardsely, 1974b)

been described by McNulty et al. (1962a,b). Studies dealing with the effects of pollution on benthic communities in the Bay have been done by McNulty (1955, 1956, 1957, 1961) and Rosenberg (1975). Large quantities of information on the biota of the Bay were gathered as a result of studies dealing with the possible effects of thermal pollution in southern Biscayne Bay by the Turkey Point Power Plant (Bader and Roessler, 1971, 1972). This study provides valuable information on the seagrasses and macroalgae, as well as the benthic animal communities. Low species diversity, low evenness values, and the presence of opportunistic species indicate that Biscayne Bay is a physically stressed area due primarily to the influence of man (Rosenberg, 1975). Environmental problems in the Bay, such as high turbidity and various pollution sources, and possible solutions have been discussed by (Roessler and Beardsley 1974a).

It is apparent from Figure 3, which summarizes the ecological studies in the area that there is a lack of similar, comprehensive studies encompassing all areas of Biscayne Bay. There is also a lack of uniformity in the methods and objectives of the many studies conducted in different sections of the Bay. The purpose of this study is to provide information on benthic species abundance and distribution with respect to seasonality and biotic and abiotic parameters throughout all major regions of the Bay.

1. McNulty, 1969
2. Voss & Voss, 1969
3. Iverson & Roessler, 1969
4. McNulty, Work & Moore, 1969
5. O'Gower & Wocosey, 1969
6. Weiss, 1949
7. Rosenberg, 1975
8. Boder & Roessler, 1969
9. Moore et al., 1969

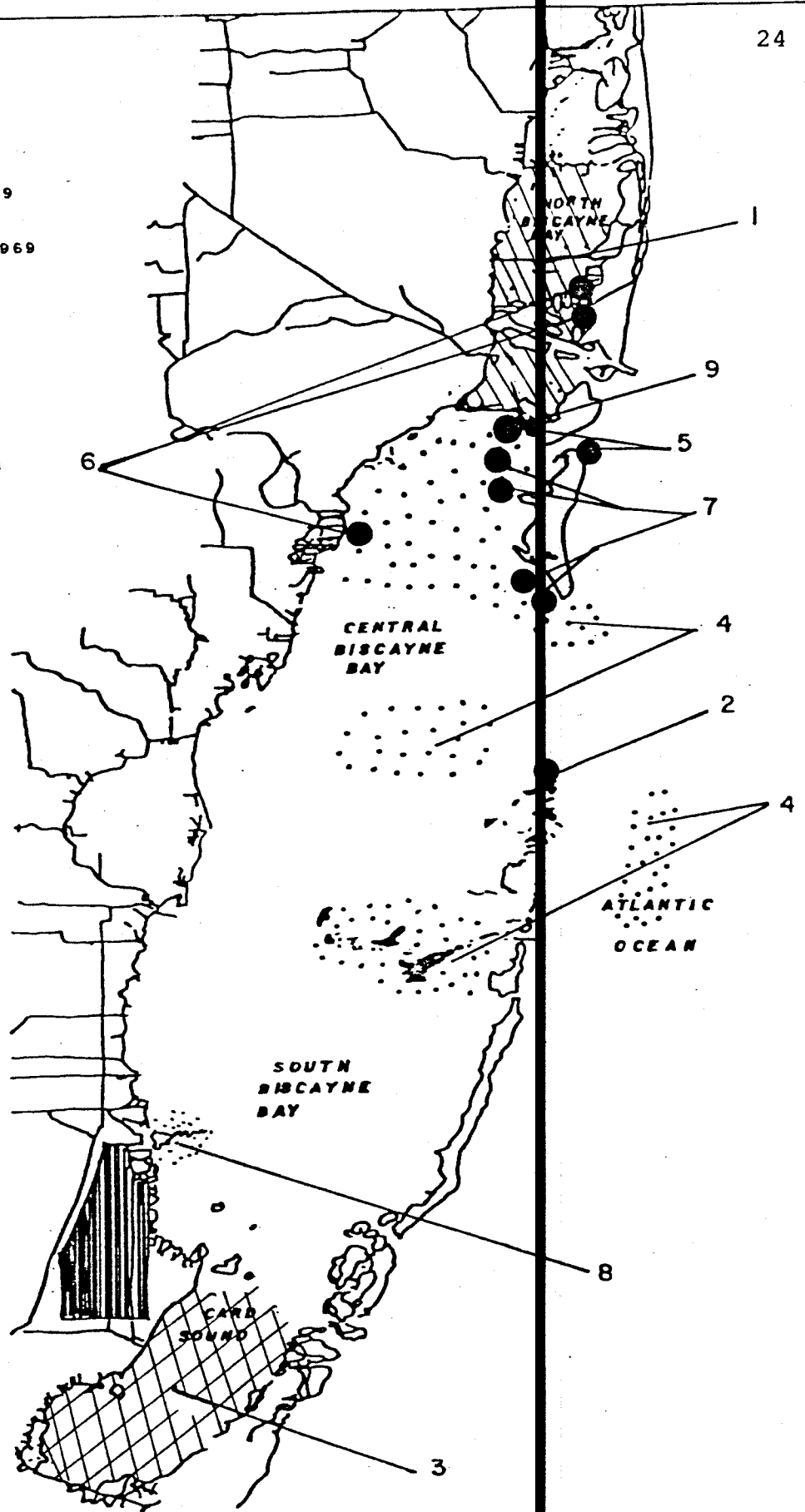


Figure 3. Previous Studies in Biscayne Bay.

4.1.1 SELECTION OF SAMPLE SITES

Fifty sampling stations will be selected throughout Biscayne Bay, covering all major benthic habits. These stations will correspond to established water quality monitoring stations where possible, but the emphasis will be upon locating stations so that a comprehensive view of the benthic communities associated with the various habitats can be attained. The number of stations in each habitat type area will be proportional to the approximate percent occurrence of that habitat in Biscayne Bay.

Two field days will be required to determine locations of the fifty sampling stations. Sampling for Phase I will be done once during both the wet and dry seasons. It is anticipated that each sampling period will be spread over a four day interval working from northern Biscayne Bay south to Card Sound. The Bay will thus be roughly divided into four sections: the area north of 79th Street Causeway, 79th Street Causeway south to the Rickenbacker Causeway, Rickenbacker Causeway to Featherbed Banks and Featherbed Banks south through Card Sound.

Sampling will be done using SCUBA with two divers collecting samples and abiotic data, a technician processing samples aboard the boat, and an operator in charge of navigation and positioning. All diver observations will be recorded in data logs and on a tape recorder.

4.1.2 QUANTITATIVE AND QUALITATIVE MACROFLORA DESCRIPTION

Macroflora will be quantitatively and qualitatively described at each station following the procedure outlined below. A general visual assessment of the station will first be performed by the divers. An estimate of percent cover of each major habitat type (e.g. 70% Thalassia testudinum, 10% algal cover, 20% fine sand) will be provided. A 0.5 m² grid will then be randomly dropped at each station, a photo taken of all macroflora lying within the grid to determine densities, and the macroflora within the grid collected for identification. This procedure will be repeated three times at each station. Any species of algae or seagrasses occurring in the vicinity of the station but not sampled by the grid will also be collected for later identification. Specimens will then be fixed and preserved in a solution of 10% buffered formalin in seawater and the specimen containers labeled.

4.1.3 QUALITATIVE DESCRIPTION OF ABIOTIC CONDITIONS OF THE STATION

Depth at each station will be measured with a recording fathometer, or with a weighted line in shallow areas. Time of day and tidal stage will also be noted.

Freshwater inflow occurs from a number of rivers and canals along the western shore of Biscayne Bay. The Miami River is the largest single source, with an estimated average flow of 626 cubic feet per second entering the Bay (Roessler and Beardsley, 1974a; Wilson, 1975). This freshwater inflow, plus groundwater discharge into the Bay, influences salinities throughout the western areas of Biscayne Bay (Kohout and Kolipinski, 1967; Roessler and Beardsley, 1974a). Established water quality monitoring stations are located near the mouths of at least eight of these canals and rivers, and these stations will be strongly considered in the selection of sampling sites.

Salinity is an abiotic factor which can greatly influence the composition of benthic assemblages in a estuary. Areas of low salinity generally show lower species diversity than high salinity areas (Boesch, 1972; Boesch et al., 1976). If sampling station locations do not correspond with water quality monitoring stations or if salinity data is not available from these monitoring stations, salinity will be measured at each site with a Goldberg Refractometer.

Pollution in Biscayne Bay is varied and multisource. Sewage is contributed to the Bay from small treatment plants throughout Dade County via canals (Thorhaug et al., 1976). Pesticides have been found in Biscayne Bay in qualitative studies, but quantitative results are unavailable. Turbidity is a major form of pollution in Biscayne Bay, due to dredge and fill operations. This suspension of

sediment in the water decreases light penetration, causing the death of seagrasses and algae in these areas, which in turn causes a change in the faunal communities. Other pollution sources in the Bay area are nutrient runoff causing phytoplankton blooms, storm sewer discharge, and industrial pollution. Once station locations are determined, all available literature will be searched for point sources of pollution near the sampling sites. Data from water quality monitoring stations will also be used to determine possible pollutant sources. Any observable pollutants, such as high turbidity, sewage, or freshwater outfalls, will be recorded for each station.

Bottom characteristics such as exposed rock, sand waves, areas of exposed peat, sand holes (Ginsburg, 1956), mangrove roots, and exposed sabellid worm rock will be noted and described at each station by divers to aid in the general site description.

Water currents will be noted by divers at each station with estimates of speed and direction recorded.

4.1.4 QUANTITATIVE DESCRIPTION OF SEDIMENT CHARACTERISTICS

General composition of the sediment will be noted at each station to determine whether it is primarily sand (siliceous or carbonate), silt or mud. A sediment sample will be taken twice a year during the wet and dry season at each station using a hand held 5 cm inside diameter coring tube. A 15 cm deep core will be taken perpendicular to the substrate at each station. A sediment grain size analysis will be performed on the sample using a nest of one phi interval sieves running from 0 to 4 phi. A pipette analysis will be performed on the silts and clays (Folk, 1974). Grain size results will be plotted as cumulative curves and median grain size, graphic mean, graphic standard deviation, and graphic skewness will be calculated using the methods of Folk (1974).

4.1.5 COLLECTION OF BENTHIC SAMPLES

One quantitative benthic sample will be collected at each station twice a year during the wet and dry seasons. Sampling will be accomplished using a 15 cm inside diameter PVC pipe corer (Figure 4) which is easy to handle, gives a uniform penetration in various sediments, and can be used in any water depth found in Biscayne Bay. The core will be positioned randomly on the bottom by a diver and pushed 15 cm into the substrate. The sand will then be removed from one side of the corer and a flat cover plate will be slipped underneath to hold the sediment sample in place (this method has been used extensively by the principal investigator in both ocean beach subtidal and estuarine studies on the central Florida east coast). The core sample will then be returned to the boat where it will be washed through a 0.5 mm mesh size sieve. A 0.5 mm size mesh is recommended rather than the 0.6 mm size mesh called for in the RFP due to recent studies using 0.5 mm as the lower size limit for macroinfauna (Sanders, 1958; McIntyre, 1964; McIntyre and Eleftheriou, 1968; McIntyre and Munison, 1973; Parr et al., 1978). Samples will be washed using an elutriation system (Figure 5) in which fragile floatable organisms will be separated into a 0.5 mm mesh bag. Heavier organisms and the sediment will then be washed on a 0.5 mm mesh sieve. Both the 0.5 mm mesh bag and the sample not passing through the 0.5 mm mesh sieve would then be labelled and placed in a container of 15 percent $MgSO_4$ solution for approximately 30 minutes for narcotization. The samples will then be transferred to a solution of 10 percent buffered formalin in seawater for preservation and stained with Rose Bengal solution. Any sponges or corals located in the station vicinity will be photographed for later identification.

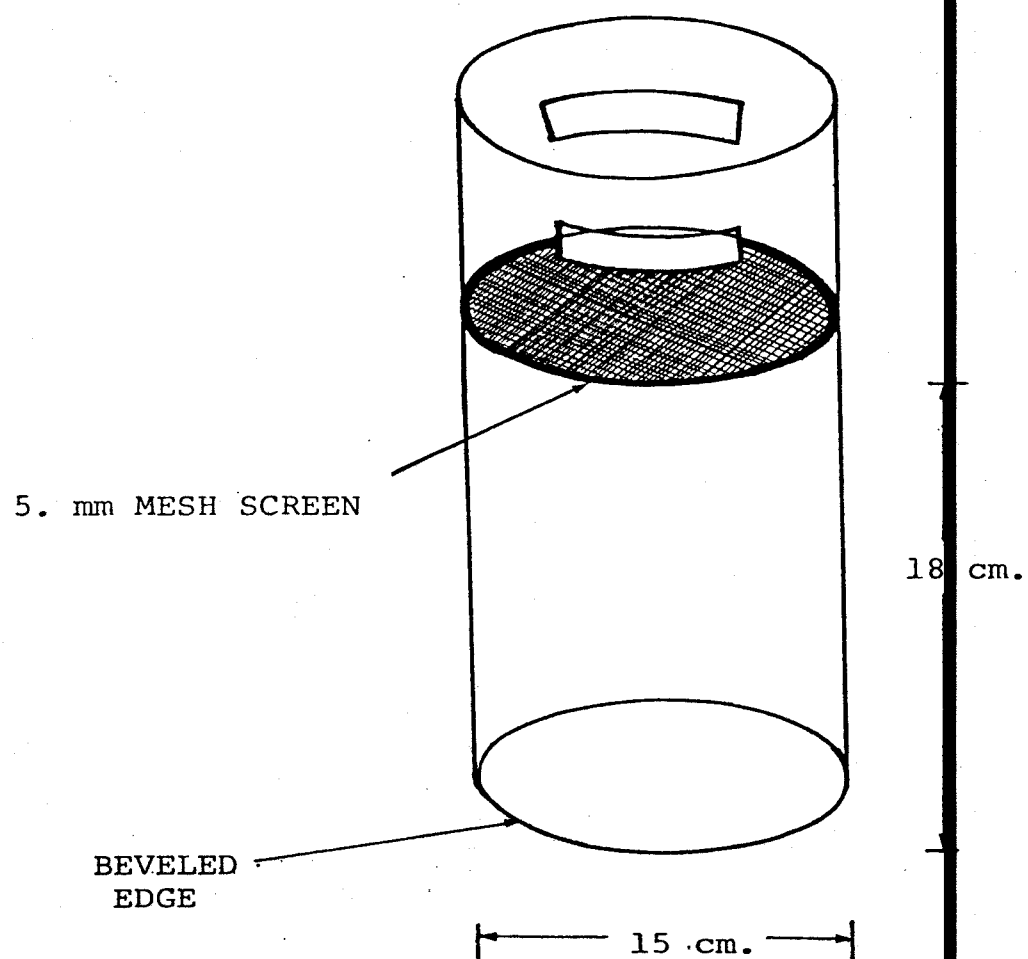


Figure 4. PVC Pipe Corer.

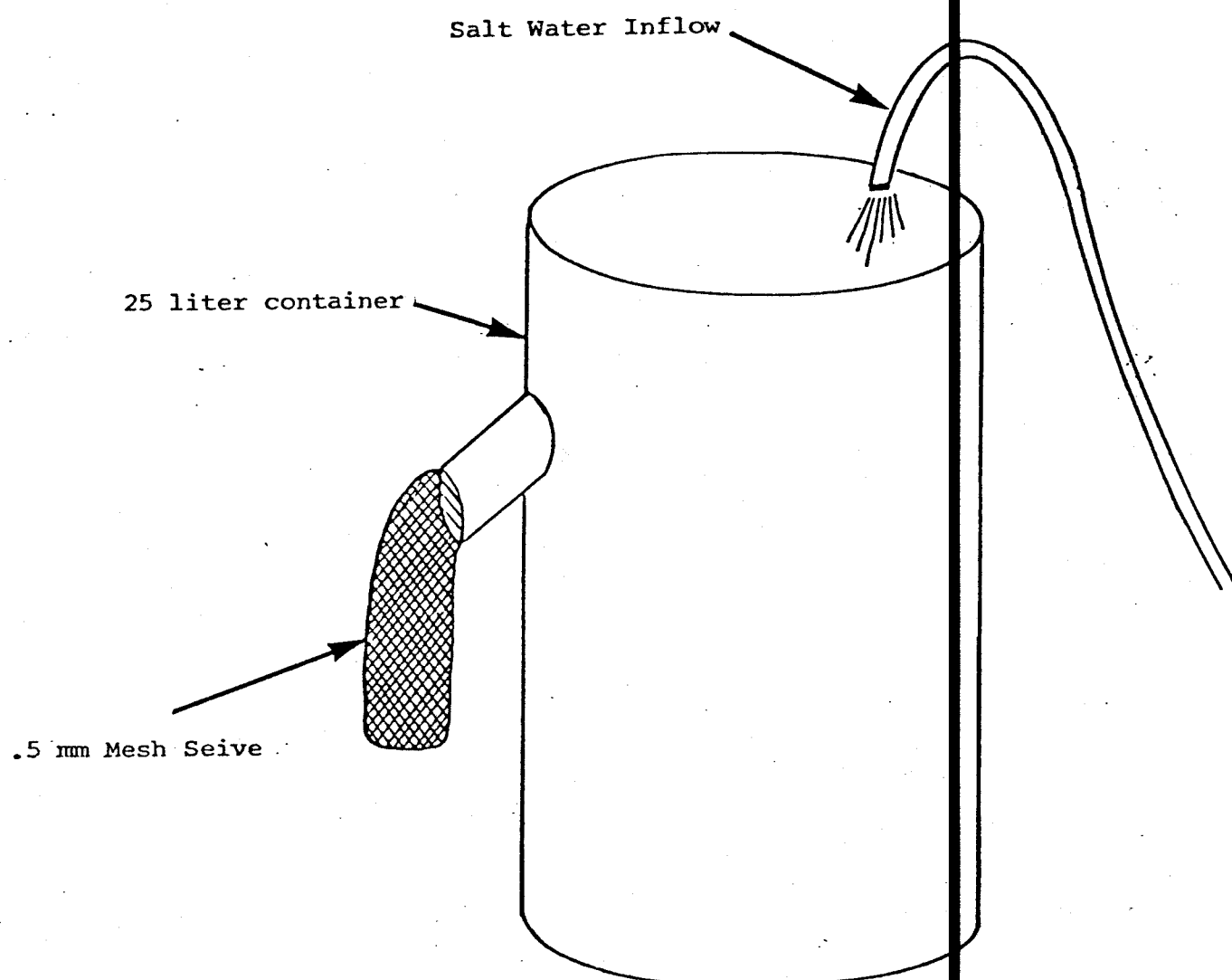


Figure 5. Core Sample Elutriation Device

4.1.6 MACROBIOTA IDENTIFICATIONS

After arrival at our laboratory in Tequesta, the faunal and macrofloral samples will be sorted to major taxa (polychaetes, molluscs, decapod crustaceans, amphipods, isopods, holothuroids, ophiuroids, echinoids, etc.) using 10x - 40x dissection microscopes and under the supervision of Dr. David Gettleson and Mr. Keith Spring. These groups will then be identified to the lowest possible taxonomic level and identifications will be confirmed by the following taxonomic consultants;

Dr. Patsy McLaughlin	Decapod Crustaceans
Mr. Raphael Lemaitre	Decapod Crustaceans
Dr. Shirley Pomponi	Sponges
Dr. Richard Turner	Ophiuroids and Asterooids
Ms. Paula Mikkelsen	Molluscs
Mr. Kalani Cairns	Peracarid Crustaceans
Mr. John Miller	Holothuroids and Echinoids
Mr. Grant Gilmore	Fishes
Mr. Stephen Blair	Algae and Seagrasses
Ms. Margaret Hall	Algae and Seagrasses
Ms. Mary Ann Capone	Polychaetes
Dr. Walter Goldberg	Corals

Continental Shelf Associates, Inc. will use reference collections maintained at our Tequesta office, at the Harbor Branch Foundation, and at the Florida Institute of Technology to assist in species identifications.

4.1.7 SPECIES ABUNDANCE, BIOMASS, AND REFERENCE COLLECTION

Abundances of all individuals will be recorded for each station sampled. Dry weight biomass will be determined for all major taxa previously listed by drying the organisms to constant weight at 105°C for 24 hours. At least one individual of each species collected will be permanently preserved and catalogued into a permanent reference collection.

4.1.8 PHASE I DATA INTERPRETATION/DATA SYNTHESSES

The final report for Phase I of this study will include descriptions of the sampling sites derived from both diver observations and collected samples. A map will also be submitted showing station locations and habitats. Results of qualitative and quantitative studies of the abiotic factors and sediment characteristics will be presented, and the various biological assemblages of the samples will be analyzed once the taxonomy is completed.

Species lists of macroflora, epifauna, and infauna will be compiled with relative abundance, density, distribution, and seasonality of the biota determined and reported. Species richness, diversity, and evenness values will be determined for the quantitative samples at each Phase I station, using the Shannon-Weaver Diversity Index and Pielou's (1969) Evenness Measure.

Species and station associations will be ascertained with the Bray-Curtis Similarity Index (dissimilarity) using flexible sorting. Normal (Q-mode classification with species as attributes) and inverse (R-mode with stations as attributes) cluster analyses will be applied to the computed quantitative data (Stephenson et al, 1970, 1974; Boesch, 1973). The Bray-Curtis Index is not highly responsive to rare species and is quite sensitive to dominant taxa (Stephenson, 1973). A cube root transformation of the data will be employed to avoid classifications influenced totally by dominant species (Williams and Stephenson, 1973). Flexible sorting is a hierarchical fusion strategy which clusters or groups the similarity coefficient values into discrete groups. The similarity coefficient values form the Bray-Curtis Index will be sorted into a dissimilarity matrix and displayed in dendrogram form.

Pearson product-moment correlations (Pearson 1926) and stepwise multiple regressions will be performed on the faunal data and abiotic factors to determine possible correlation between these factors and faunal abundance.

The collection of only one sample per station precludes the use of an analysis of variance (ANOVA) on the data.

The results of these analyses will be interpreted and explained ecologically in regard to various factors influencing both faunal and macro-floral abundance and distribution. In some cases sites and species grouped in the cluster analysis may have to be re-assigned to other groups. Faunal assemblages or communities delineated as a result of the interpretation of the preceding clustering and correlation analyses will be mapped.

Recommendations will be made for the location of Phase II study sites using abundance data, species and site groupings from the clustering analysis and interpretation, and abiotic data analysis.

4.2 PHASE II SEASONAL ABUNDANCE AND DIVERSITY

Selection of Phase II sampling stations will be based upon information gained from the analysis of the Phase I samples. A quantitative and qualitative description of the abiotic factors will be performed at each station as in Phase I. Quantitative sediment analysis and a description of its composition will also be performed with one sediment core being taken at each of the Phase II stations.

Five quantitative core samples will be collected quarterly at randomly selected positions at each station following the sampling methods outlined in Phase I. Abundance of individuals per taxon will be determined as in Phase I.

Species richness, evenness, and diversity will be determined for the assemblages at each station as in Phase I. The Bray-Curtis Similarity Index, with normal and inverse classification, will be used to determine similarities between stations and to determine species groups. Various taxa will be correlated through linear regression and correlation techniques to various abiotic factors as in Phase I. An ANOVA will be performed on the numerical data collected to determine differences both within and between stations. Duncan's Multiple Range Test will be used to show which stations significantly differ from one another.

Pertinent data and results from other studies in this program such as the fishery resources assessment, turbidity sources, and circulation studies will be integrated into our final analyses to provide as large a data base as possible on which to base our

conclusions. The final report will include complete quantitative and qualitative descriptions of the macrofaunal communities occurring at each sampling station, their correlations with abiotic factors, and seasonal correlations. Also included will be maps of the various habitats sampled and different faunal assemblages observed.

5.0 QUALITY ASSURANCE

CSA's success in carrying out oceanographic environmental programs is partially attributable to our high standards in quality assurance. From the time a project is initiated until the completion of analysis and a final report, all steps are logically planned out in advance and are double checked along the way by means of check sheets, pre-designed data logs and peer review.

One person, in this case the Principal Investigator, is designated with the responsibility of quality assurance and data control throughout the entire project. During the sample collection phase, a field scientific log is kept with detailed information pertaining to activities performed, samples collected, any problems encountered and steps taken to remedy such, and any additional information which may be useful during future sampling or analysis. Specific data forms are tailored for each individual project. These forms are designed to be filled out with minimal effort and provide maximum protection against human error. A sample label will be filled out for each sample collected and placed inside the sample container. Each sample will have a unique identification number to identify it. Examples of typical data log forms including Sample Log, Sample Collection Label, Weather Log, and Photograph Data Recording Form which will be used during this project are shown in Figures 6 through 9 .

An inventory of all samples and data collected will be recorded in the field scientific log. Proper preserving techniques will be maintained by the Principal Investigator.

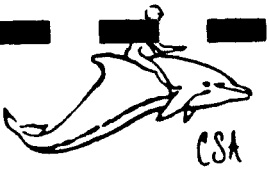


Remarks

SAMPLE LOG

Job No. _____

Vessel _____

[illegible]

CONTINENTAL SHELF ASSOCIATES, INC.
SAMPLE COLLECTIONS

Job No. _____ Location _____
Sample No. _____ Date _____ Time _____
Depth _____ meters Gear _____
No. of Specimens _____ Preservative _____
Sample Description _____
Coll. by _____ Id. by _____
Remarks _____

FIGURE 7

[illegible]

FIGURE 8

43

FIGURE 9

All samples will be checked when they arrive at the lab to ensure that they arrived in total and without damage. Data sheets will be checked by the Principal Investigator and by a staff scientist for completion. Biological samples will be sieved, sorted and identified by our in-house sorting team supervised by the Principal Investigator. Ten percent of all samples will be resorted and identifications rechecked by alternate personnel for quality assurance.

Selective samples will be sent out to taxonomic specialists for verification of identifications. A Sample Transmittal Form as shown in Figure 10 will be included with all sample transfers.

SAMPLE TRANSMITTAL FORM

JOB NO. _____

PRINCIPAL INVESTIGATOR _____

SIGNATURE	DATE
-----------	------

NUMBER OF DATA SHEETS OR SAMPLES	
----------------------------------	--

DESCRIPTION	DATE	AMOUNT	REMARKS
...	...	...	...

SAMPLE NUMBERS

This image shows a blank sheet of white paper with horizontal black ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. A vertical black line runs down the right side of the page, creating a margin. The paper appears to be from a notebook or a form.

FIGURE 10

6.0 REPORTS AND MEETINGS

6.1 BISCAYNE BAY RESTORATION WORKING TEAM MEETINGS

This proposal for conducting a Benthic Sampling Program in Biscayne Bay is one of several projects which will be conducted concurrently as part of the Biscayne Bay Restoration and Enhancement Program. In order to use the information obtained from this portion of the total program most effectively, a mechanism for bringing together and sharing data and information is necessary. This is being done through the Biscayne Bay Restoration Working Team which will be comprised of participating consultants, and appropriate Project Managers. In addition to sharing information and knowledge of data collected, it also prevents a duplication of effort by maintaining contact with all program participants.

Continental Shelf Associates is experienced in participating in this type of an information sharing mechanism. CSA will be available to attend monthly or any special meetings and will participate enthusiastically with other members in an effort to bring about a successful completion of the overall goals and objectives of the Biscayne Bay Program.

6.2 QUARTERLY REPORTS

Quarterly reports will be provided within thirty days after the close of each quarterly period. These reports will be specific and concise in nature describing the events of the previous three months. The general status of the project will be described and any problems and their solutions will be included. An inventory of data collected and analysis performed will be presented. Any unusual events or results will be reported at this time. In addition to relaying pertinent information of the report period, the quarterly reports will give a summary of upcoming events and schedules for the following three months.

6.3 FINAL REPORTS

A Final Report will be written at the end of Phase I, (one year) and Phase II (2 years). These reports will be submitted to the Dade County Department of Environmental Resources Management at the conclusion of each appropriate phase. The contents of the Final Report for Phase I are detailed in Section 4.1.8 of this proposal. A copy of all original data and an operations log will also be submitted as part of the Final Report.

A Final Report will also be prepared at the end of Phase II. Specific contents of this will be dependent upon and clearly defined after the conclusion of Phase I. Contents of the Phase II Final Report are described in Section 4.2 of this proposal. Again, a copy of all original data and an operations log will be submitted with the Final Report.

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8.0 COSTING

8.1 INTRODUCTION

The costing for this project details expenditure outlays for personnel, operations, materials, etc. for six month intervals beginning August 1, 1981.

Phase I costing is very specific and based on past experience in performing these types of studies. CSA is confident that this is a realistic budget for performing the scheduled work.

Phase II costing, while realistic, is based on a projected schedule and scope of work which can only be clearly defined after the conclusion of Phase I. We do feel, however, that this budget is appropriate for planning purposes and that by maintaining close coordination and flexibility between contractor and client that appropriate changes can be made, if necessary, after the conclusion of Phase I.

8.2 PROJECT SCHEDULE

Continental Shelf Associates takes great pride in successfully completing projects within scheduled time frames and projected budgets. The Following Figures 11 to 13 summarize the time schedule for Phases I and II of the Benthic Sampling Program.

FIGURE 11 - SCHEDULE OF EVENTS - PHASE I

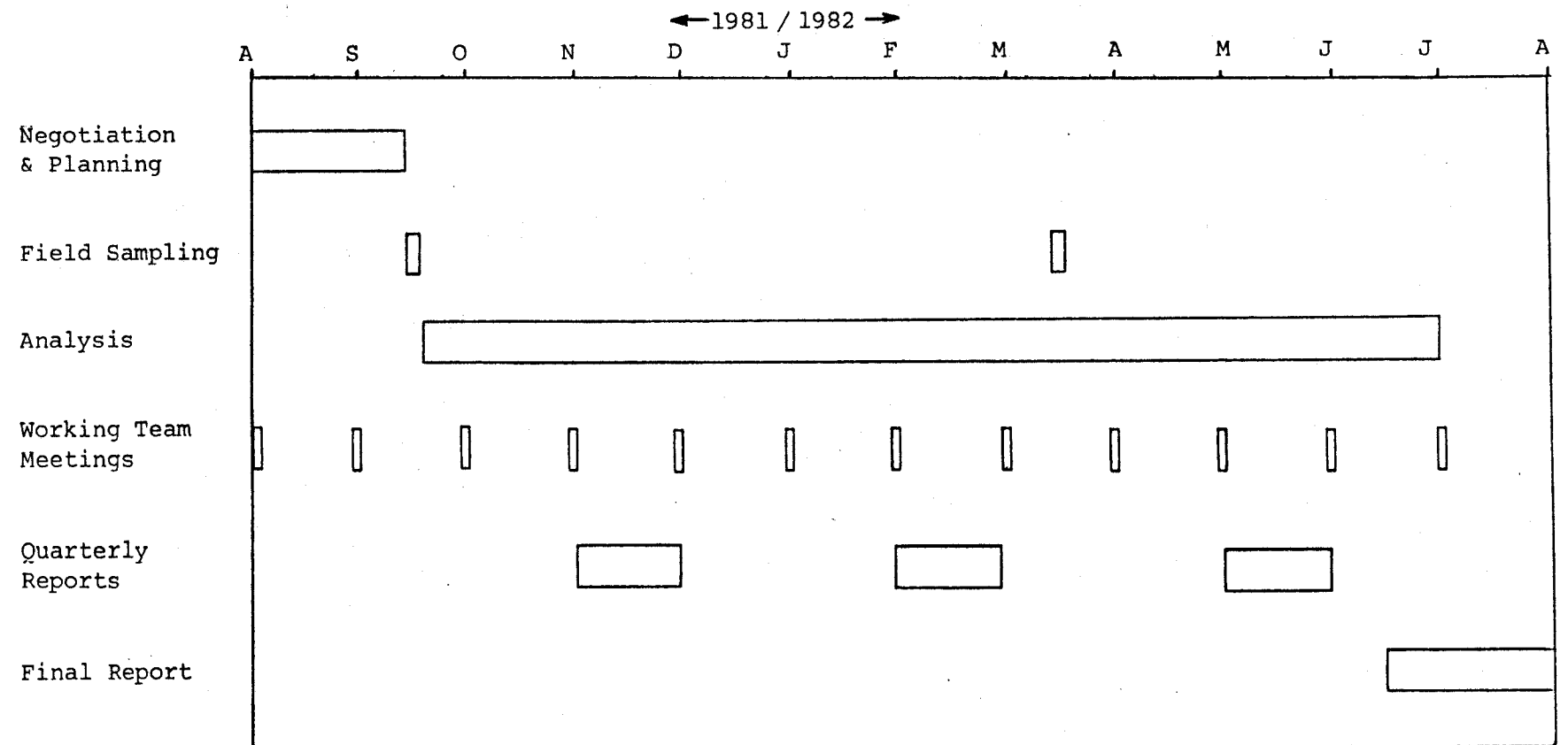


FIGURE 12 - SCHEDULE OF EVENTS - PHASE II (1st year)

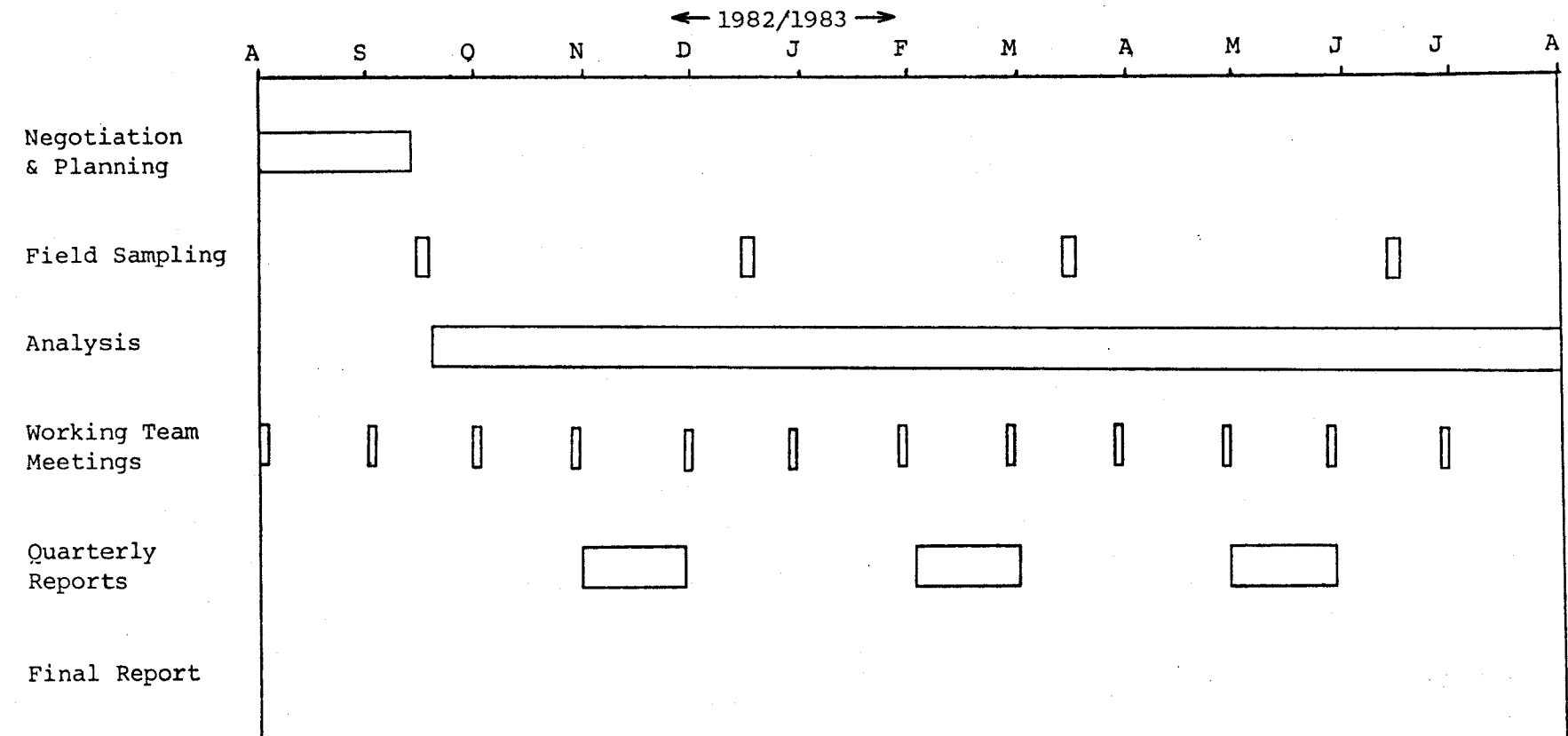
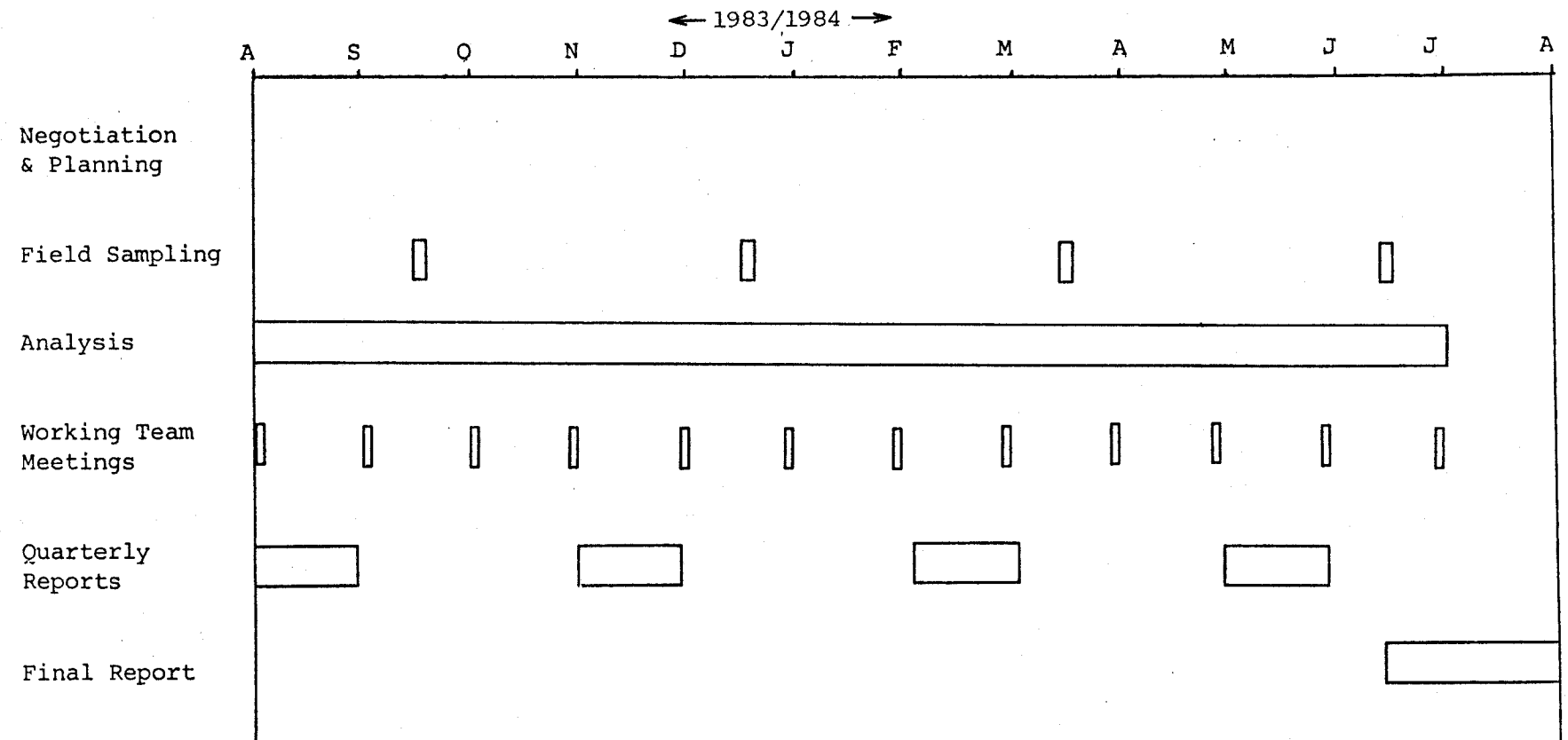


FIGURE 13 - SCHEDULE OF EVENTS - PHASE II (2nd year)



8.3 PROPOSAL PRICING

I. Personnel	Est. Hours	Billing Rate*	Sub	Total Cost
			Total Cost	
Principal (Management)	20	\$ 28.49	\$ 569.80	
Robert C. Stevens, Jr.				
Senior Scientist	75	25.78	,933.50	
David A. Gettleson, Ph.D.				
Staff Scientist	278	13.57	3,772.46	
Keith Spring, M.S.				
Senior Field Technician	64	9.17	586.88	
Dave Delater				
Technician - Various	829	8.82	7,311.78	
Total Personnel Cost				\$14,174.42
II. Operations				
1. Equipment				
Research boat @ \$180/Day/6 Days			1,080.00	
Underwater Camera Equipment @				
\$50/Day/6 Days w/standoff and			300.00	
special lens				
Refractometer, Sieves and Shakers,				
Diving Equipment and all other				
necessary support equipment			200.00	
2. Travel and Per Diem				
a. Transportation:				
Jupiter to Miami: 250 Miles				
Roundtrip (2 Trips) - Van &				
Trailer - \$.60/Mile + \$45/Day				
x 6 Days			570.00	
Sample Distribution:				
Jupiter to Miami				
150 Miles @ \$.30/Mile + 2 Days @ \$30/Day			105.00	
Jupiter to Ft. Pierce				
100 Miles @ \$.30/Mile + 2 Days @ \$30/Day			90.00	
Meetings:				
Jupiter to Miami				
150 Miles x 6 Trips @ \$.30/Mile + 6 Days				
@ \$30/Day			450.00	
b. Per Diem				
4 People @ \$55/Day x 5 Days			1,100.00	
1 Person @ \$25/Day x 4 Days (Sample Distribution)			100.00	
1 Person @ \$25/Day x 6 Days (Meetings)			150.00	
Total Operations Cost				4,145.00

*Billing Rate Includes Salary and Labor Overhead (.411).

		Sub Total Cost	Total Cost
III. <u>Material</u>			
1. Expendables:			
12 Rolls 35 mm Film (36 Exp.) @ \$5/Roll	\$	60.00	
10 Gal. Formalin @ \$30		30.00	
2 Boxes MgSO ₄ @ \$1/Each		2.00	
1,200 Labels @ \$.03/Each		36.00	
60 Plastic Sample Containers (egg buckets) @ \$1.89/Each		113.00	
1 Package Ziplock Bags @ \$3/Each		3.00	
75 Gal. Ethanol @ \$187 for 55 Gal.		265.00	
1 Case - 1 Dram Specimen Vials @ \$80.64/Case		81.00	
1 Case - 4 Dram Specimen Vials @ \$60.48/Case		60.00	
3 Gross Specimen Jars. (American Int. Container)		105.00	
100 Grams Rose Bengal @ \$40		40.00	
5 - 1000 ml Graduated Cylinders @ \$110		110.00	
0.5 mm Mesh Sieve Material		50.00	
Boat Fuel - 35 Gal/Day @ \$1.75/Gal x 6 Days		168.00	
SCUBA Air Fills @ \$3/Each x 8 Fills/Day x 4 Days		96.00	
2. Services			
Film Developing		72.00	
Total Material Cost			1,481.00
IV. <u>Consultants</u>			
Outside Taxonomy			1,500.00
V. <u>Total Direct Costs</u>			21,300.42
General and Administrative Costs @ .172			3,663.67
Total Price for First 6 Months of Phase I (First Sampling Period)			24,964.09
Total Price for Subsequent Sampling Period of Phase I (subsequent sampling period will have a reduction in expendables costs of \$313 and in transportation and per diem costs of \$220 (times .172 G & A) for a total cost reduction of \$624.68).			24,339.41
First Year Pricing - 1st and 2nd Sampling Period			49,303.50
Second Year Pricing Estimate			48,678.82
Third Year Pricing Estimate			48,678.82
Note: Detailed cost breakdown can be provided on Year 2 and 3 if requested, however, inflationary costs have not been considered in these future estimates.			

APPENDIX A - RESUMES

CSA Personnel

Robert C. Stevens, Jr., President
David A. Gettleson, Ph.D., Scientific Director
Keith D. Spring, Principal Investigator
Dave B. Delater, Marine Technician
Richard M. Hammer, Ph.D., Oceanographer
Maryjon Large, Marine Biologist
Russell E. Putt, Oceanographer
Richard A. Shaul, Marine Biologist
M. John Thompson, Marine Ecologist

Associate Consultants

Stephen M. Blair
Richard G. Gilmore
Walter M. Goldberg
Margaret O. Hall
Rafael Lemaitre
Patsy A. McLaughlin
Paula M. C. Mikkelsen
Shirley A. Pomponi
Richard L. Turner

CSA PERSONNEL

ROBERT C. STEVENS, JR.
President

Education: Bachelor of Science in Marine Science and Marine Transportation, U.S. Merchant Marine Academy, 1953. Completed Naval Flight Training School, Fleet Sonar School, Naval Underwater Swimmers School, Naval Deep Sea Diving School and Sea Lab Aquanaut Training. Also completed graduate courses in engineering, business management, and environmental sciences at the University of Southern California and George Washington University.

Experience: August 1970 to Present: Continental Shelf Associates, Inc. Founder and Chief Executive Officer. Responsible for corporate development, budgetary planning, marketing and sales, proposal coordination, contractual agreements and project performance. Directly participates in engineering designs and operational logistics involved in technical studies. Manages an interdisciplinary team of scientists and engineers involved in marine technical services and environmental studies in the aquatic environment. These projects have ranged from aquatic baseline studies in upland marsh areas for land development; to coastal, estuarine, and river aquatic environmental studies in conjunction with utilities and industrial production; to offshore environmental baseline studies in relation to oil exploration and production. Projects have included technical service involving hydrological, bathymetric, physical, biological and chemical parameters.

Founded and operated Underseas Maintenance as a subsidiary of Continental Shelf Associates, Inc. during 1971 to 1972. Underseas Maintenance was involved in the application development of equipment and techniques for underwater brushing of ship's hulls using pneumatic and hydraulic rotating brushes operated by divers. The technology was ahead of its time and had not reached its market potential.

1967 - 1970: Perry Oceanographics. Vice President of Submarine Equipment Company and Operations Manager for Perry Submarine Builders. Directed the development of company capabilities to meet current and future commercial submersible operational requirements, directed the design and operation of diving and life support systems, and assisted in market surveys and development. Developed equipment and techniques for diver lock-out submersible operations and directed the first commercial lock-out dive; planned and directed the Power Cell Operation in which the Perry Hydro Lab was powered by a Pratt and Whitney fuel cell, the first time a habitat was operated free from surface or land support and in a one atmosphere mode.

1963 - 1967: U. S. Naval Coastal Systems Laboratory Mechanical Engineer. Served as Task Leader in development programs for a dry hull submersible, advanced underwater propulsion systems, open sea tests for the Sea Lab habitat and development of a classified special purpose craft. Participated in study tasks for the Technical Analysis Division and served as aquanaut and task leader for the Scientific Division in the Laboratory Oceanographic Programs for the Sea Lab III.

1961 - 1963: Tri-State Engineering Services, Inc. Marine Consultant. Responsible for conducting research and surveys into various fields of marine engineering, including marine salvage, underwater demolition and offshore mineral exploration.

1960 - 1961: Independent Marine Consultant. Involved in the conception, design, construction, testing and evaluation of small boats for special purposes and in training and supervising of personnel for operation and maintenance.

1953 - 1961: Spent a year in the Virgin Islands in the yachting and sport diving industry following four years service in the U.S. Navy as a helicopter pilot specializing in anti submarine warfare. Attained rank of Lieutenant Commander. Served as a licensed officer in the U.S. Merchant Marine prior to Naval Service.

Professional Societies: Coastal Society (founding member)
National Association of Environmental Professionals (founding member)
Marine Technology Society (officer in local chapter)
International Association of Professional Divers (past member)
Society of Naval Architects and Marine Engineers (past member)

Professional Licenses: Navy certified deep sea helium oxygen Diving Officer, qualified air and mixed-gas SCUBA and hard hat diving; Commercial Pilot License with multi-engine, rotor craft, and instrument rating; Third Mate's License, Oceans, with radar endorsement; Small Boat Operator's License; and Radio Telephone Operator's License.

Publications and Reports: Authored and co-authored several technical publications, reports and papers, (some classified) and several magazine articles.

DAVID A. GETTLESON, Ph.D.
Biological Oceanographer

Education: Bachelor of Arts in Biology, Rollins College, 1971. Doctor of Philosophy in Biological Oceanography, Texas A & M University, 1976.

Experience: August 1976 to Present: Continental Shelf Associates, Inc., Scientific Director. Program Manager for biology and chemistry and Chief Scientist on three cruises involving a major environmental survey in the eastern Gulf of Mexico (Southwest Florida Shelf Ecosystems Study - BLM funded)(1980-81). Directed permitting process that included Exploratory Plans, Environmental Reports and Hard Bottom Field Surveys (Chief Scientist on two week cruise) for eleven oil and gas lease tracts in the eastern Gulf of Mexico (1978-81). Major participant in one year environmental assessment of the impact of a dredging operation on nearby coral reefs (1980-81). Co-chief scientist for Gulf Reef Fish Study (BLM funded) which determined the most appropriate sampling devices for remotely assessing reef fish and compared fish populations between oil and gas platforms and natural hard bottom areas (1980-81). Scientific director of an environmental monitoring program for an oil and gas production platform near Baker Bank in the Gulf of Mexico (1978-81). Chief scientist of a one month oceanographic cruise in the western Atlantic involving the oceanographic mapping and sampling of live bottom assemblages (BLM funded South Atlantic Hard Bottom Study). Scientific director and major participant in the interpretation of geophysical data, television observations, still camera photographs, and dredge samples. Directed and major participant in data analysis and report phase of study (1978-9). Chief scientist of two environmental monitoring programs for exploratory oil and gas wells drilled near the East Flower Garden Bank in the Gulf of Mexico (1977-8). Chief scientist on a two month oceanographic cruise in the Gulf of Alaska and principal author of an environmental assessment concerning nine lease blocks on the outer continental shelf in the Gulf of Alaska (1976).

April 1976 - July 1976: Post-doctoral research associate at Texas A & M University. Supervised two major research projects dealing with the meiofauna and macroinfauna of the south Texas continental shelf which were funded by the Bureau of Land Management (Principal Investigator, W.E. Pequegnat).

1971 - 1976: Graduate student at Texas A & M University and employed by TerEco Corporation. Participant in study of five submarine banks on the continental shelf of the northwest Gulf of Mexico (1975). Member of field team which tested a Biotol Ocean Monitor System in the Gulf of Mexico (1975). Participated in water turbidity measurements and the collection of neuston samples at St. Croix, Virgin Islands (1975). Worked

on baseline study of Stetson Bank (northwest Gulf of Mexico) to assess possible environmental effects of drilling for oil and gas (1974). Member of field team that monitored the burning of chemical wastes by Shell Oil Co. on the incineration ship Vulcanus in the Gulf of Mexico (1974). Participated in an environmental assessment of south St. Croix, Virgin Islands for a supertanker SALM (1973). Analyzed benthic samples collected over a portion of the continental shelf and slope of the Gulf of Mexico (1972).

Professional Interests: Marine benthic ecology; spatial and temporal distribution of hard and soft bottom fauna; distribution and feeding of demersal fishes.

Publications and Reports: Pequegnat, W.E. and D.A. Gettleson. 1974. The meiofauna and macrofauna of Stetson Bank, p. 39-59. In: Baseline Survey of Stetson Bank, Gulf of Mexico. A report to Signal Oil and Gas Co.

Gettleson, D.A. and W.E. Pequegnat. 1976. Meiofauna sediment correlations of samples from submarine banks in the Gulf of Mexico, p. 221-265. In: A Biological and Geological Reconnaissance of Selected Topographical Features on the Texas Continental Shelf. A final report to the U.S. Dept. of Interior, Bureau of Land Management Outer Continental Shelf Office, New Orleans, La. Contract No. 08550-CT5-4.

Gettleson, D.A. 1976. An Ecological Study of the Macrofauna and Meiofauna of a Soft Bottom Benthic Community on the Texas Continental Shelf. Ph.D. Thesis, Texas A & M University.

Continental Shelf Associates, Inc. (by D.A. Gettleson). 1976. A Review of Recent Benthic Investigations in the Northeast Gulf of Alaska. A report to Exxon Company, U.S.A.

Continental Shelf Associates, Inc. (D.A. Gettleson principal author). 1976-7. Physical, Chemical and Biological Oceanographic Survey for Drilling Permits, Gulf of Alaska. A report to Exxon Company, U.S.A.

Continental Shelf Associates, Inc. (D.A. Gettleson co-author). 1977. Monitoring Program for Wells #3 and #4, Lease OCS-G 2759, Block A-389, High Island Area, East Addition South Extension near East Flower Garden Bank. A report to Mobil Oil Corporation.

Continental Shelf Associates, Inc. (D.A. Gettleson principal author). 1978. Monitoring Program for Well #1, Lease OCS-G 3487, Block A-367, High Island Area, East Addition South Extension near East Flower Garden Bank. A report to American Natural Gas Production Company.

Gettleson, D.A. 1978. Ecological impact of exploratory drilling: a case study, p. 93-115. In: Proceedings-Energy/Environment '78 (Sponsored by Society of Petroleum Industry Biologists).

Continental Shelf Associates, Inc. (D.A. Gettleson, principal author). 1978. Results of a Survey of Suspected Hard Bottom Areas within Brunswick Block 1005. A report to Decora Survey System, Inc. for Transcontinental Oil Company.

Continental Shelf Associates, Inc. (D.A. Gettleson, principal author). 1978-9. Monitoring Program for Platform "A", Lease OCS-G 3061, Block A-85, Mustang Island Area, East Addition near Baker Bank. Quarterly Reports (1-4) to Continental Oil Company.

Continental Shelf Associates, Inc. (D.A. Gettleson, principal author). 1979. South Atlantic Hard Bottom Study. A final report to U.S. Dept. of Interior, Bureau of Land Management, Outer Continental Shelf Office, New Orleans, La. Contract No. AA551-CT8-25.

Gettleson, D.A. 1979. Identification and characterization of hard bottom areas on the Georgia-South Carolina outer continental shelf. Fla. Acad. Sci. 42 (Suppl. 1).

Gettleson, D.A. and R.E. Putt. 1979. Results of a monitoring program for exploratory drilling operations near the East Flower Garden Bank, Gulf of Mexico. Fla. Acad. Sci. 42 (Suppl. 1).

Continental Shelf Associates, Inc. (D.A. Gettleson, co-author). 1980. Biological Survey of Proposed Offshore Borrow Areas North of Haulover Beach Park, Dade County, Florida. A report to U.S. Army Corps of Engineers.

Gettleson, D.A. 1980. Effects of oil and gas drilling operations on the marine environment, p. 371-411. In: Marine Environmental Pollution, 1. Elsevier Scientific Publishing Company.

Gettleson, D.A. and R.E. Putt. 1979. Ecological damage assessment of hard bottom faunal assemblages, p. 135-164. In: Proceedings-Ecological Damage Assessment Conference (Sponsored by Society of Petroleum Industry Biologists).

Gettleson, D.A. and C.E. Laird. 1980. Benthic barium levels in the vicinity of six exploratory drillsites in the Gulf of Mexico, p. 739-788. In: Symposium-Research on Environmental Fate and Effects of Drilling Fluids and Cuttings.

Gettleson, D.A. et al. 1980. Environmental monitoring associated with a production platform in the Gulf of Mexico, p. 263-270. In: Proceedings-Twelfth Annual Offshore Technology Conference (Paper No. 3706).

Gettleson, D.A., et al. 1981. Environmental monitoring of three exploratory oil and gas wells drilled near the East Flower Garden Bank in the Gulf of Mexico. In: Proceedings-Thirteenth Annual Offshore Technology Conference.

Professional Societies: American Association for the Advancement of Science
American Society for Microbiology
American Society of Limnology and Oceanography
Association of Meiobenthologists
Estuarine Research Federation
Florida Academy of Sciences
North American Midwest Benthological Society
Phi Sigma

KEITH D. SPRING
Biological Oceanographer

Education: Bachelor of Science in Biological Sciences, S. U. N. Y. at Brockport, 1976. Summer program in Marine Sciences, Shoals Marine Lab, University of New Hampshire, 1976. M.S. in Biological Oceanography, Florida Institute of Technology, 1981.

Experience: August 1980 to Present: In charge of analysis and identification of biological samples from hard bottom communities of the southwest Florida shelf (BLM-Southwest Florida Shelf Study). Also responsible for analysis of bottom photos being used to quantitatively describe area. Responsible for interpretation of television/still camera data on fish populations associated with oil structures and natural reefs in the Gulf of Mexico (BLM-Gulf Reef Fish Study).

1978 to 1981: Graduate student, Florida Institute of Technology. Research involved the study of the distribution and abundance of nearshore macrobenthic populations off the central Florida east coast and the effects of wave action and the varying sediment grain size upon these populations. Performed identifications of the soft bottom fauna and computer analysis of the community structures.

Other experience: Teaching assistant for courses in sea water analysis. Extensive field and laboratory supervision of undergraduates in the collection, preservation, and chemical analysis of both estuarine and open ocean water samples. Analyses and measurements included conductivity, salinity, temperature, dissolved oxygen, pH, turbidity, nutrients, alkalinity, hydrocarbons, and trace metals.

Teaching assistant for graduate courses in the collection, preservation, and identification of estuarine and shallow water oceanic benthic fauna with experience in various collection, preservation, and taxonomic procedures.

Teaching assistant for a two week course in Tropical Island Biology. Supervised 12 students in field work on coral reef and mangrove ecology at Florida Institute of Technology research station at Deep Water Cay, Bahamas.

Technical Assistant, Continental Shelf Associates, Inc.
Duties: Sorting and identification of benthic samples from a variety of projects, including hard-bottom surveys related to oil and gas exploration on the West Florida Continental Shelf. Parallel duties have included taxonomic examination of photographic samples from the same surveys.

1979: Indian River Dolphin Study - Hubb's Sea World. Studying abundance of Bottlenose Dolphin in the Indian River, Southern Brevard County, Florida.

1979: Paradise Beach Dune Stabilization Project. Installation of "ENKA MAT" for beach dune stabilization on the Atlantic coast in Melbourne, Florida. Also participated in a one year monitoring of this system's effectiveness.

1979: Ballard Park Shoreline Stabilization Project. Testing of effectiveness of "ENKA MAT" for stabilization of shoreline along the Indian River in Melbourne, Florida.

Summer 1978: Invitational Scientist aboard USNS RANE. Assisted in geodetic positioning, statistical correlation, bottom photography, standard oceanographic measurements, & optical measurements. TELEPROBE Section.

Summer 1977: Island Manager: Interpretation of island ecology and marine biology to the visiting public at Boston Harbor Islands State Park.

Professional Societies: Marine Technology Society - FIT
Massachusetts Audubon Society

Publications and Reports: Continental Shelf Associates, Inc. (K.D. Spring, Contributing Author). 1980. Environmental Report (Exploratory Plan), Gulf of Mexico (MAFLA), Pensacola Area, Block 973 (OCS-G 3886). Mobil Oil Exploration and Producing Southeast, Inc.

Professional Interests: Coral Reef and Benthic Ecology
Underwater Photography

DAVID B. DELATER
Marine Technician

Education: Attended Florida Institute of Technology's Underwater Technology Program 1976-1977.

Experience: November 1980 to Present: Continental Shelf Associates, Inc. Involved with various CSA survey tasks. Navigator for the biological cruise of the Southwest Florida Shelf Ecosystems Study. Participated in box core, trawl, dredge and water bottle samplings. Conducted a water and sediment sampling survey for hydrocarbons, metals, nutrients and water quality data in the St. Lucie River Estuary. Assisted with an inspection and servicing of a tanker in the Port of Palm Beach under CSA's Diving Division. Responsible for all CSA in-house mechanical equipment repair, servicing and maintenance.

April 1980 to November 1980. Third Engineer M/V GOLDEN VENTURE Port of Palm Beach. Prepared M/V for extensive offshore salvage operation. Organized complete overhaul of ships main engines and generators, installation of 671 GM Generator and AC electrical system. Also responsible for all shipboard crane operations.

April 1980 to August 1980. Port Everglades Ship Sales and Charters, Fort Lauderdale, Florida. Worked as a commercial diver conducting salvage operations, hull cleaning and hull inspection services.

January 1978 to April 1980. Sea Quest/Divers. Operations Manager/Commercial Diver. Supervisor for diving operations involved with dam inspection and repair covering western U.S. for Bureau of Reclamations and Corps of Engineers. Specialized in high altitude diving to assist in mountain mining operations search and recovery. Agent for Sea Quest to establish an off-shore research project and commercial salvage operation in south Florida.

Professional 5,000 Ton Commercial Captain and Engineering License.
Certifications:

RICHARD M. HAMMER, Ph.D
Oceanographer

- Education: Bachelor of Science in Fisheries and Wildlife, Michigan State University, 1971. Master of Science in Oceanography, Texas A & M University, 1974. Doctor of Philosophy in Marine Biology, University of Southern California, 1980.
- Course on Regulation of Coastal Zone Use in Louisiana, 1980.
- Experience: September 1980 to Present: Continental Shelf Associates, Inc. Directed and prepared over 50 scientific reports dealing with environmental and socio-economic aspects of oil and gas activities in the entire Gulf of Mexico. Coordinated corporate marketing and proposal efforts, particularly in OCS areas. Senior editor.
- 1979 - 1980: Institute for Marine and Coastal Studies, University of Southern California. Zooplankton consultant on research directed toward providing a rapid assessment of small-scale variability of zooplankton biomass and distribution, both vertical and horizontal, using ultra-high frequency underwater acoustics.
- 1976 - 1979: Harbors Environmental Projects, University of Southern California. Zooplankton consultant during monitoring studies in the Los Angeles Harbor.
- 1977: Department of Biology, University of Southern California. Participant in a zooplankton research expedition to the Gulf of California, Mexico.
- 1975 - 1976: Smithsonian Oceanographic Sorting Center, Smithsonian Institution. Records manager, scientific photographer, and editorial assistant for the "Proceedings of the Third Antarctic Research Symposium."
- 1974: Sea Grant Program, Texas A&M University. Science writer, photographer, and advisory services consultant for Texas and the Gulf of Mexico region.
- 1974: Junior Museum of Natural History, Bryan, Texas. Instructor for oceanography and ecology classes.
- 1973 - 1974: Systematics Collection of Marine Organisms. Department of Oceanography, Texas A & M University. Assistant curator of marine animals collected from the continental shelf and deep sea regions of the Gulf of Mexico and Caribbean Sea.
- 1973 plus other short terms: TerEco Corporation, College Station, Texas. Consultant for environmental baseline studies in the U.S. Virgin Islands and Gulf of Mexico. Literature research of all aspects and the sampling, systematics, and data analysis of the zooplankton and neuston.

1972: Department of Oceanography, Texas A & M University.
Member of a research team concerned with sampling and
photographing the deep sea benthic community of the Gulf of
Mexico.

1971 - 1973: Department of Biology, Texas A & M University.
Teaching assistant for courses in general biology.

Professional Interests: Impacts oil and gas activities on the marine environment.
Zooplankton ecology and systematics, particularly of the
Copepoda; behavior and vertical migration of demersal
zooplankton; underwater photography.

Selected Publications: Hammer, R. M. 1980-1981. Over 50 scientific reports dealing
with environmental and socio-economic aspects of oil and gas
activities in the Gulf of Mexico region. For: Amihail USA,
Inc.; Anadarko Production Company; Chevron USA, Inc.; Conoco
Inc.; Exxon Company, U.S.A.; Gulf Oil Exploration and
Production Company; Mobil Oil Exploration and Producing
Southeast Inc.; Ocean Production Company; and Sohio Petroleum
Company.

Hammer, R. M. 1981. Day-night differences in the emergence of
demersal zooplankton from a sand substrate in a kelp forest.
Marine Biology. In Press.

Gettleston, D. A., R. E. Putt, R. M. Hammer, and C. E. Laird.
1981. Environmental monitoring of three exploratory oil and
gas wells drilled near the East Flower Garden Bank in the Gulf
Mexico. 13th Annual Offshore Technology Conference, Houston,
Texas, OTC Paper No. 4061.

Continental Shelf Associates, Inc. (R. M. Hammer, co-author).
1981. Survey of potential live bottom areas in Elbow Blocks
565 and 566 off the west coast of Florida. Report to Mobil Oil
Exploration and Producing Southeast, Inc. 23 p.

Continental Shelf Associates, Inc. (R. M. Hammer, senior
author). 1981. Environmental Report (Plan of Exploration),
Gulf of Mexico: offshore Louisiana, Green Canyon Area, Block
134 (OCS-G 4506). Exxon Corporation. 31 p.

Continental Shelf Associates, Inc. (R. M. Hammer, senior
author). 1981. Specified sections for the Environmental
Report (Plan of Exploration) for Destin Dome Blocks 562 and
563. Sohio Petroleum Company. 84 p.

Continental Shelf Associates, Inc. (R. M. Hammer, senior
author). 1981. Environmental Report (Supplemental Plan of
Development), Gulf of Mexico: Offshore Louisiana, West Cameron
Area, Block 36 (OCS-G 2820), "F" Platform, Conoco, Inc. 33 p.

Hammer, R. M. 1980. Oceanographics and related literary compositions. Oceanographics. 80 p.

Continental Shelf Associates, Inc. (R. M. Hammer, senior author). 1980. Environmental Report (Plan of Exploration Development, and Production), Gulf of Mexico: offshore Louisiana, East Cameron Area, Block 240 (OCS-G 4101). Shell Oil Company. 108 p.

Continental Shelf Associates, Inc. (R. M. Hammer, senior author). 1980. Environmental Report (Supplemental Plan of Development/Production), Gulf of Mexico, East Cameron Area, South Addition, Block 359 (OCS-G 2567). Addendum: Response to comments of the United States Department of the Interior, Geological Survey. Anadarko Production Company. 3 p.

Continental Shelf Associates, Inc. (R. M. Hammer, senior author). 1980. Environmental Report (Exploratory Plan), Gulf of Mexico (MAFLA), Vernon Area (NG 16-6), Block 654 (OCS-G 3903). Mobil Oil Exploration and Producing Southeast, Inc. 210 p.

Hammer, R. M. 1980. Ecology of kelp forest demersal zooplankton. Ph.D. dissertation, University of Southern California. 134 p.

Hammer, R. M. and R. C. Zimmerman. 1979. Species of demersal zooplankton inhabiting a kelp forest ecosystem off Santa Catalina Island, California. Bulletin of the Southern California Academy of Sciences, 78(3): 199-206.

Hammer, R. M. 1979. Taxonomy and systematics: their significance. In: R.C. Banks (ed.), Museum studies and wildlife management. The Smithsonian Institution Press.

Hammer, R. M. 1978. Scanning electron microscope study of the spermatophore of *Acartia tonsa* (Copepoda: Calanoida). Transactions of the American Microscopical Society, 97(3): 386-389.

Hammer, R. M. 1978. Book review of "A Guide to Marine Coastal Plankton and Marine Invertebrate Larvae". DeBoyd L. Smith. Kendall Hunt Publishing Company, Dubuque, Iowa, 1977. Bulletin of Marine Science, 28(2): 392-394.

Hammer, R. M. 1977. Taxonomy and systematics: their significance. Association of Systematics Collections Newsletter, 5(3): 37-38.

Hammer, R. M. 1975. Book review of "Biota of the West Flower Garden Bank". T. J. Bright and L. H. Pequegnat. The Gulf Publishing Company, Houston, Texas, 1975. The University and the Sea, 8(1): 3.

Hammer, R. M. 1974. Distribution of phyllosoma lobster larvae (Crustacea: Decapoda: Reptantia: Scyllaridea) in the Gulf of Mexico in relation to currents and recruitment potential. Master's thesis, Texas A & M University. 215 p.

Hammer, R. M. 1974. Pelagic adaptations. Sea Frontiers, 20(1): 2-12. Cover feature article.

Hammer, R. M. 1974. Marine specimens: Gulf of Mexico. Marine Technology Society Journal, 8(10): 26-27.

Hammer, R. M. 1974. Collection features ocean oddities. The University and the Sea, 7((4): 6-8. Cover feature article.

Hammer, R. M. 1973. Zooplankton. In: A bio-environmental study of the southern aspect of St. Croix, U.S. Virgin Islands. Brown & Root Report, ER-0828, 1973.

Hammer, R. M. Biology and ecology of Texas and the Gulf of Mexico. In: Texas and the Gulf of Mexico: A General Guide to Marine Science in the Texas Gulf Coast Region. Sea Grant Program, Texas A & M University, 65 pp. Submitted.

Hammer, R. M. Day-night differences and the effect of light on migration of kelp forest demersal zooplankton from Macrocystis pyrifera holdfasts. In preparation.

Hammer, R. M. Removal trapping of kelp forest demersal zooplankton from Macrocystis pyrifera holdfasts. In preparation.

Hammer, R. M. 1973 - 1980. Over twenty-five photographic publications, including front covers.

Professional Societies: American Association for the Advancement of Science
Sigma Xi, The Scientific Research Society
Society of Systematic Zoology
Association of Systematics Collections
Western Society of Naturalists
International Oceanographic Foundation

MARYJON LARGE
Marine Biologist

Education: Bachelor of Science in Biological Sciences, 1980.

Experience: October 1980 to Present: Sorting and identification of biological samples from hard bottom communities of the Southwest Florida Shelf Study (BLM - Southwest Florida Shelf Study (BLM - Southwest Florida Shelf Study).

February 1980 to May 1980: Benthic ecology survey of the Indian River at Volkaria Inlet, Florida.

Professional Societies: Audobon Society

Professional Interests: Marine Ecology

RUSSELL EUGENE PUTT
Oceanographer

Education: Bachelor of Science in Biology, Texas Christian University, 1974. Master of Science in Oceanography, Texas A & M University, Tentative 1981.

Experience: August 1978 to Present: Continental Shelf Associates, Inc. Program Manager for one year environmental assessment of the impact of dredging operations on nearby coral reefs at Port Everglades, Ft. Lauderdale, Florida (1980-81). Participant in permitting process that included Exploratory Plans, Environmental Reports and Hard Bottom Field Surveys for ten oil and gas lease tracts in the eastern Gulf of Mexico (Chief Scientist on three major cruise efforts) (1979-81). Co-chief scientist for Gulf Reef Fish Study (BLM-funded) which determined the most appropriate sampling devices for remotely assessing reef fish and compared fish populations between oil and gas platforms and natural hard bottom. Major participant in data analysis and report phases of study (1980-81). Responsible for interpretation of television/still camera data collected during major environmental surveys both in the South Atlantic Bight (BLM funded South Atlantic Hard Bottom Study) and Gulf of Mexico (BLM funded Southwest Florida Shelf Ecosystems Study) (1978-81). Project coordinator for BLM/CSA investigations of petroleum exploration drilling sites, Key West, Florida (1979). Project Manager of underwater chlorine minimization study for Florida Power and Light Company Dania Power Plant (1979). Chief Scientist on three cruises making environmental assessments of exploratory drilling near the East Flower Garden Bank in the Gulf of Mexico (1978). Chief Scientist during six oceanographic cruises supporting a monitoring program for an oil and gas development/production platform near Baker Bank in the Gulf of Mexico (1978-81). Served as Photographer/biologist for CSA underwater inspection and engineering surveys. Responsible for proposal and report preparation.

1978: Oceanographic Research Assistant, Texas A&M University. Responsible for all diving operations during (BLM funded) East Flower Garden Coral Reef Monitoring Study. Biological/Diving Consultant for (LGL Environmental Research Consultants, Ltd.) study of fish populations associated with oil platforms in the northwestern Gulf of Mexico. Became certified as Emergency Medical Technician (EMT).

1977: Oceanographic Research Assistant, Texas A&M University. Project Divemaster on two cruises to study topographic highs (banks) on the Texas-Louisiana Continental Shelf. Research submersible and scuba reconnaissance of communities associated with the banks was performed. Environmental Diving Consultant for (LGL Environmental Research Consultants Ltd.) assessments of fish and epifaunal populations within Buccaneer Oil Field.

1976: Co-author/Lecturer, "Scientific Diving Techniques", Texas A&M University. Biological/Diving Consultant for environmental assessment of exploratory drilling near the East Flower Garden Coral Reef (Marine Technical Consulting Service). Program Manager for study of Buccaneer Oil Field fish and epifaunal populations (funded by Texas A&M Sea Grant). Field Biologist/Project Divemaster for (American Petroleum Institute) study of drilling mud component effects on coral health and behavior, Carysfort Reef, Key Largo, Florida. Reef biologist/Project Divemaster for Cayman Island Coral Reef Disease Study, British West Indies.

1975: Project Divemaster - Marine Archeology Field Program for Texas Antiquities Committee, Port Mansfield, Texas. Responsible for management, training and supervision of all diving personnel and operations. Became certified as a diving instructor by the National Association of Underwater Instructors (NAUI).

1974: Oceanographic Technician/Diver Marine Biomedical Institute; Galveston, Texas. Responsible for organization and management of the center's marine systematics collection along with dive support and launch control for Nekton Gamma Research submersible operations during studies of the West Flower Garden Bank. Marine Technician for (Menteth Corporation) BLM Texas Outer Continental Shelf Mapping Cruises I and II.

1973: Laboratory Research Assistant during parasitological analysis for Power Plant Thermal Effluent Study (TGU Research Foundation).

1972: Research diver for Northwestern Gulf Mollusk Survey by the Houston Museum of Natural Science. Oceanographic Technician/Diver for Faunal Survey of Flower Garden Coral Reefs.

Publications and Reports: Putt, R.E. (manuscript). A Quantitative Study of Fish Populations Associated with a Platform within Buccaneer Oil Field, Northwestern Gulf of Mexico. Masters Thesis. Texas A & M University.

Bright, T.J. et al. (R.E. Putt, contributing author) 1978. South Texas Topographic Features Study. A final report to U.S. Department of Interior, Bureau of Land Management Outer Continental Shelf Office, New Orleans, La.

Continental Shelf Associates, Inc. (R.E. Putt, contributing author). 1978-9. Monitoring Program for Platform "A", Lease OCS-G 3061, Block A-85, Mustang Island Area, East Addition near Baker Bank. Quarterly Reports (1-9) to Continental Oil Company.

Continental Shelf Associates, Inc. (R.E. Putt, contributing author) 1979. Monitoring Program for Well #1, Lease OCS-G 3487, Block A-367, High Island Area, East Addition, South Extension near East Flower Garden Bank. A report to American Natural Gas Production Company.

Continental Shelf Associates, Inc. (R.E. Putt, contributing author) 1979. South Atlantic Hard Bottom Study. A final report to U.S. Department of Interior, Bureau of Land Management Outer Continental Shelf Office, New Orleans, La.

Gettleson, D.A. and R.E. Putt. 1979. Results of Monitoring Program for Exploratory Drilling Operations Near the East Flower Garden Bank, Gulf of Mexico. Florida. Academy Sci. 42 (Suppl. 1).

Gettleson, D. A. and R. E. Putt. 1979. Ecological Damage Assessment of Hard Bottom Faunal Assemblages. In: Ecological Damage Assessment, Society of Petroleum Industry Biologists.

Gettleson, D. A., C. E. Laird, R. E. Putt and R. E. Abbott. 1980. Environmental Monitoring Associated with a Production Platform in the Gulf of Mexico. In: Proceedings Twelfth Annual Offshore Technology Conference.

Continental Shelf Associates, Inc. (R. E. Putt, Co-Author) 1980. Video and Photographic Reconnaissance of Phleger and Sweet Banks. Northwestern Gulf of Mexico. A final report to U.S. Department of the Interior, Bureau of Land Management Outer Continental Shelf Office, New Orleans, Louisiana.

Continental Shelf Associates, Inc. (R. E. Putt, Principal Author) 1980. Gulf of Mexico OCS Area Study of Oil and Gas activities on reef fish populations - summary cruise report. A report to U.S. Department of the Interior, Bureau of Land Management Outer Continental Shelf Office, New Orleans, Louisiana.

Continental Shelf Associates, Inc. (R. E. Putt, Contributing Author) 1980. Live-bottom survey Charlotte Harbor Block 144 and 145. A report for Gulf Oil Exploration and Production Company.

Gettleson, D. A., R. E. Putt, R. M. Hammer and C. E. Laird. 1981. Environmental monitoring of three exploratory oil and gas wells drilled near the East Flower Garden Bank in the Gulf of Mexico. In: Proceedings Thirteenth Annual Offshore Technology Conference.

Professional Interests: Coral Reef Ecology, Environmental Assessment Techniques
Project Management

Professional Societies: Phi Sigma National Honor Society
National Association of Underwater Instructors

RICHARD A. SHAUL, JR.
Marine Biologist

Education: Bachelor of Science in Biological Sciences/Marine, Florida Institute of Technology (1979). Tentative Master of Science in Biological Sciences/Marine, Florida Institute of Technology. August 1981.

Experience: May 1981 to Present: Marine Technician, quantitative faunal analysis of 35 mm photographic samples from hard bottom communities of the Southwest Florida Shelf (BLM Southwest Florida Shelf Study).

1979 to 1981: Graduate Student, Florida Institute of Technology, Research involving a description of the distribution and movements of juvenile coral reef fish assemblages in the vicinity of the Marine Field Facility of the Department of Biological Sciences, Florida Institute of Technology at Deep Water Cay, Bahamas.

Other Experience: Teaching Assistant acting as the Diving Supervisor for the Department of Biological Sciences, F.I.T. Duties included the maintenance of departmental boats and marine field equipment, instruction of F.I.T. Safe Diving Class, maintaining complete records of all F.I.T. dives and divers and general overseeing of SCUBA and marine field operations within the Department of Biological Sciences. Teaching Assistant - duties included the maintenances of the Marine Field Facility at Deep Water Cay, Bahamas including upkeep of laboratory, generator, SCUBA equipment and boats. Teaching Assistant for courses in Plant Physiology - duties included the preparation and teaching of labs dealing with various aspects of plant physiology including the use of the Gilson respirometer, Warburg apparatus, high speed centrifuge and spectrophotometers. Teaching Assistant for courses in Comparative Vertebrate Anatomy. Duties included the preparation and teaching of labs dealing with the dissection of representative classes of vertebrates. Interviewer, Market Facts Inc. Duties included interviewing fisherman for a study conducted by Market Facts Inc., as requested by National Marine Fisheries Services in an attempt to access marine recreational fishing occurring in the U.S. and territories.

Professional Societies: Beta Beta Beta Biological Society, F.I.T.

Professional Interests: Marine Ecology, Ichthyology.

M. JOHN THOMPSON
Marine Ecologist

Education: Master of Science, Florida Atlantic University, Boca Raton, Florida, 1972. Major: Marine Biology.
Bachelor of Science, University of Tampa; Tampa, Florida, 1969. Major: Biology; Minor: Chemistry.

Experience: October 1980 to Present: Continental Shelf Associates, Inc., Tequesta, Florida. Marine Ecologist, responsible for the preparation of outer continental shelf Environmental Reports, subject to Federal Regulation 30 CFR 250.34-3 governing offshore oil and gas exploration and development. Also worked on environmental statute compliance for Major Port facilities development. Wrote major sections of reports on various Government contracted research programs, and assisted in preparation of grant proposals and contract bids, and scientific publications.

January 1976 to March 1979: Principal Investigator, Harbor Branch Foundation, Inc., Ft. Pierce, Florida. Supervised and managed groups of scientist and engineers (2 to 5) in conjunction with support personnel (10 to 30) depending on specific project needs. Coordinated various environmental monitoring remote sensing projects utilizing airborne electro/optical sensors, and submarine mapping operations using side scanning sonar. Reported directly to the Director of Science Division. Responsible for entire project planning and implementation including budget, cost effectiveness, time table, equipment procurement and/or design, and preparation of reports and procedural manuals.

October 1972 to December 1975: Field Laboratory Manager, Worked in conjunction with the Smithsonian Institution. Coordinated the efforts of 5 technicians involved in environmental assessment and impact research on Florida's coral reefs. Collected data from technicians, made evaluations and determinations, and prepared reports for Principal Investigator level scientists in charge of project. Also involved in business functions such as budget controls, equipment procurement, recruiting and training, various other duties.

August 1970 to October 1972: Research Assistant, Florida Atlantic University, Boca Raton, Florida. Involved in environmental impact research on coral reefs in relation to Army Corps of Engineers projects.

May 1970 to August 1970: Fisheries Biological Technician, National Marine Fisheries Service, St. Petersburg, Florida. Duties encompassed analyzing collected data and preparing environmental impact reports for the Army Corps of Engineers.

Professional Interests: Effects of resource development on marine ecosystems; energy flow patterns in Caribbean coral reefs; application of remote sensing technology to marine resource inventory.

Publications and Reports: Courtenay, W. R., Jr., D. J. Herrema, M. J. Thompson, W. P. Azzinaro, and J. von Montfrans, J. 1972. Ecological monitoring of twobeach nourishment projects in Broward County, Florida. *Shore and Beach*, 40(2): 8-13.

Courtenay, W. R., Jr., D. J. Herrema, M. J. Thompson, W. P. Azzinaro, and J. von Montfrans. 1974. Ecological monitoring of beach erosion control projects, Broward County, Florida, and adjacent areas. Technical Memorandum No. 41 U.S. Army Corps of Engineers, Coastal Engineering Research Center. 87 p.

Thompson, M. J. 1974. Burrowing and burrow-associated behavior in the dusky jawfish, Opistognathus whitehursti. M.S. Thesis. Florida Atlantic University. 116 p.

Thompson, M. J. 1974. Validation of water penetration film. Proceedings of the Florida Keys Coral Reef Workshop, October 21-22, 1974: 8-10.

Thompson, M. J. 1974. The Caribbean underworld. *Caribbean Review*, 6(4): 7-8.

Thompson, M. J. and R. T. Wolcott. 1976. Remote sensing services. In: D.K. Young (ed), Indian River Coastal Zone Study Annual Report 1975-76. Vol. I: 5-19.

Thompson, M. J. 1976. Photomapping and Species Composition of the Seagrass Beds in Florida's Indian River Estuary. Harbor Branch Foundation, Technical Report No. 10, Harbor Branch Foundation, Ft. Pierce, Florida, p. 34.

Thompson, M. J. and T. W. Schmidt. 1977. Validation of the species/time random count technique sampling fish assemblages at Dry Tortugas. Proceedings: Third International Coral Reef Symposium. University of Miami, Florida. pp. 283-289.

Lawson, R. A., M. J. Thompson, and W. R. McCluney. 1977. Determination of upwelling spectral radiance in Fort Pierce Inlet, Florida. *Proceed. Amer. Soc. Photogrammetry*. Fall Technical Meeting. pp. 204-216.

Jones, R. S., and M. J. Thompson. 1978. Comparison of Florida reef fish assemblages using a rapid visual technique. *Bull. Mar. Sci.* Vol. 28(1): 159-172.

Thompson, M. J. 1978. Species composition and distribution of seagrass beds in the Indian River Lagoon, Florida. *Florida Sci.* 41(2): 90-96.

Thompson, M. J. Variations in the spectral signature of a subtropical estuarine inlet. 1978. Proceed. Amer. Soc. Photogrammetry. Fall Technical Meeting. pp. 568-577.

Thompson, M. J., L. E. Gilliland, and J. E. Mendlein. 1978. Bathymetric mapping of three selected areas on the southeastern Florida continental shelf. Harbor Branch Foundation, Technical Report No. 27, Harbor Branch Foundation, Ft. Pierce, Florida, p. 54.

Thompson, M. J., L. E. Gilliland, and L. K. Rosenfeld. 1979. Light scattering and extinction in a highly turbid coastal inlet. Estuaries, 2(3): 164-171.

Thompson, M. J. and L. E. Gilliland. 1979. Topographic mapping of shelf edge prominences off Southeastern Florida. Southeastern Geology, 21(2): 155-164.

Professional Associations: American Society of Photogrammetry, American Society for the Advancement of Science, American Registry of Radiological Technologists.

ASSOCIATE CONSULTANTS

RESUME
July 13, 1979

Stephen Michael Blair
5006-A Abaca Drive
Fort Pierce, Florida 33450
Phone Number: 305-464-5723
S.S.#: 105-44-0635

Personal Information

Date of Birth: November 2, 1952
Place of Birth: Syracuse, New York
Height: 6 ft. 0 in.
Weight: 187 lbs.
General Health: Excellent
Marital Status: Married
Name of spouse: Paula L.
Name and Age of Children: Stephen M. - 3 yrs. 7 months
Kimberly E. - 6 months

Education

Graduate

Institution: University of New Hampshire
Durham, New Hampshire 03824
Dates of Attendance: September '75 to December '78
Field of Study: Marine Botany
Degree: Master of Science in Botany, December '78

Undergraduate

Institution: Franklin Pierce College
Rindge, New Hampshire
Dates of Attendance: September '71 to May '75
Field of Study: Biology and Marine Science
Degree: Bachelor of Arts - Magna Cum Laude, in Biology
May '75

Employment and Experience

Employer: Harbor Branch Foundation
RR1, Link Port, Fort Pierce, Florida 33450
Dates of Employment: October 23, 1978 to present
Title: Research Assistant
Job Description: Identify and preserve algal samples
taken from the Florida continental shelf;
care and maintenance of herbarium.

Employer: St. George's School
Newport, Rhode Island
Dates of Employment: June '78 to Aug. '78; June '77 to
Aug. '77; June '76 to Aug. '76.
Title: Instructor of Marine Botany
Job Description: Instruct an introductory course in Marine
Botany (with laboratories) and advise
students in independent projects dealing with
Marine Botany
Reason for Leaving: Termination of Summer Program.

Employer: Town of Kittery, Department of Parks and Recreation
Kittery, Maine
Dates of Employment: October 1, 1977 to June 30, 1978
Title: Marine Botanist
Job Description: Establish and maintain a sampling program that will yield data to be used in a comprehensive environmental report for the purpose of aiding in the environmental management of the area.

Employer: The Jackson Estuarine Laboratory
RFD 1, Adams Point
Durham, New Hampshire 03824
Dates of Employment: May '77 to June '77 and May '76 to Sept. '76
Title: Lab Technician.
Job Description: Collection, identification and preservation of algae.
Reason for Leaving: Better job opportunities.

Employer: University of New Hampshire, Botany Department
Durham, New Hampshire 03824
Dates of Employment: Sept. '75 to June '77
Title: Teaching Assistant.
Job Description: Prepare, direct, and instruct laboratories;
Feb. '76 to June '77 - Teaching assistant in General Botany
Sept. '75 to Dec. '75 - Teaching assistant in Plant Physiology.
Reason for Leaving: Completion of degree requirements (academic)

Employer: Normandeau's Environmental Consultants
Portsmouth, New Hampshire 03801
Dates of Employment: Dec. 76 to Jan. 77
Title: Presorter
Job Description: Sorting and identification of algal samples.
Reason for Leaving: Laid off due to financial cut backs.

Research and Publications.

- 1979. "Biosystematic Investigations of selected species of Chaetomorpha Kutzing (Cladophorales; Chlorophyta)" (with A. C. Mathieson and D. P. Cheney), in preparation
- 1978. "A Biosystematic Study of Selected Species Within the Genera Chaetomorpha Kutzing and Rhizoclonium Kutzing" Thesis. University of New Hampshire, Durham, New Hampshire.
- 1975. "A Descriptive and Ecological Survey Comparing the Winter Algal Community of Beaufort, North Carolina Region to the Algal Community Found in the Jaffrey Point, New Castle, New Hampshire Region." Undergraduate thesis. Franklin Pierce College, Rindge, New Hampshire

References

Dr. Arthur Mathieson, Professor of Botany at the University of New Hampshire and Director of the Jackson Estuarine Laboratory, Adams Point, Durham, New Hampshire 03824

Dr. Ernani Menez, Curator Phycological Section, Oceanographic Sorting Center, Smithsonian Institution, Washington, D.C. 20560

Dr. Nathaniel Eiseman, Research Scientist, Harbor Branch Foundation, RR 1, Link Port, Fort Pierce, Florida 33450

RESUME

RICHARD GRANT GILMORE, JR.
1815 Hedden Place
Vero Beach, Florida 32960
305-562-9156

birth date: January 8, 1947
Oceanside, CA

married: August 23, 1969

Harbor Branch Foundation, Inc.
RR 1, Box 196
Ft. Pierce, FL 33450
305-465-2400 Ext. 112

wife: Marilyn Aleguas

children: Richard Grant, III
May 25, 1972
Jonathan Randal
October 12, 1974

REFERENCES:

Dr. Robert S. Jones

Director, Johnson Science Laboratory
Harbor Branch Foundation, Inc.
RR 1, Box 196
Fort Pierce, Florida 33450
305-465-2400

Mr. Charles R. Lunceford,

Division Director
Arts and Science Division
Indian River Community College
3209 Virginia Avenue
Fort Pierce, Florida 33450
305-464-2000

Dr. Robert H. Gore,

Smithsonian Institution
Fort Pierce Bureau
RR 1, Box 194-C
Fort Pierce, Florida 33450
305-465-2400

Dr. Tsen Chen Wang,

Harbor Branch Foundation, Inc.
RR 1, Box 196
Fort Pierce, Florida 33450
305-465-2400

EMPLOYMENT:

Harbor Branch Foundation, Inc.

- (a) From November 1971 to August 1974, I initiated and directed qualitative and systematic ichthyological studies throughout the Indian River lagoon and vicinity for the Harbor Branch Foundation.
- (b) From August 1974 to January 1976, I directed ecological and fishery field operations within the Indian River lagoon and adjacent waters, compiled data and the analysis thereof for publication. Two to four people were supervised during these studies.

- (c) From February 1976 to date, I have directed the Indian River Coastal Zone Study Fish Program for the Harbor Branch Foundation. This program entails both qualitative and quantitative ichthyological studies within the Indian River lagoon, its tributaries and on the adjacent continental shelf. This is a practical baseline study and an overall faunal analysis. The study entails collecting in numerous marine and freshwater habitats using various net types, ichthyocides, traps, SCUBA and submersibles. Subsequent data analysis indicates overall fish distribution and productivity relative to various environmental variables. Two to three people are supervised in the current studies.

Indian River Community College, Ft. Pierce, Florida

I currently hold the rank of Assistant Professor at Indian River Community College teaching both general biology and ecology courses part-time. I was initially hired as an Instructor in May, 1973. I hold the Rank II Florida Teaching Certificate (No. 344259). From 1973 to present I have taught several courses in ecology, general biology and regional fisheries and fish biology.

Florida Institute of Technology, Melbourne, Florida

During the Winter-Spring term, 1975, I taught a graduate ichthyology course, B-5600-E1 for the Biology Department, Florida Institute of Technology. 1976 to date member of the adjunct graduate faculty. Have served on three graduate committees and served as committee chairman for masters student 1976-1977.

National Aeronautics and Space Administration

During the summer, 1971, I participated in a NASA medical experiment at the Naval Aerospace Medical Institute, Naval Air Station, Pensacola, Florida.

Miscellaneous

I have acted as a subcontracted Consultant with Ecological Consultants, Inc., Pensacola, Fla. and with Continental Shelf Associates, Inc., Tequesta, Fla.

EDUCATION:

Master of Science Degree in Biology - concentration in marine biology and fish biology - University of West Florida, Pensacola, Florida. Graduate grade point average - 3.81.

Bachelor of Science Degree in Biology - University of West Florida. Undergraduate grade point average in the sciences - 3.1.

PROFESSIONAL SOCIETY MEMBERSHIP:

American Fisheries Society, 1970 to 1977
American Society of Ichthyologists and Herpetologists, 1970 to date
American Society of Zoologists, 1972 to 1977
American Institute of Biological Sciences, 1969 to 1974
Florida Academy of Sciences, 1968 to 1974, 1978 to date

INCIDENTAL CERTIFICATIONS:

National Association of Underwater Instructors (NAUI)
YMCA, Florida Skindivers Association (FSDA), SCUBA certifications, (1966)
Power Aquadron Small Boat Handling certification; (1972)

PERSONAL INTERESTS:

Local ecology, flora and fauna
Drawing, painting and carving. Bibliophile. Natural history collections in paleontology and malacology.
Aeronautical history

PUBLICATIONS:

Published:

Gilmore, R.G. 1972. Observations on the behavior and feeding habits of the Atlantic needlefish, Strongylura marina (Walbaum) and the halfbeak, Hyporhamphus unifasciatus (Ranzani)--Suborder Exocoetoidei. Quart. J. Fla. Acad. Sci., 35, Supplement No. 1:15(abstract).

Gilmore, R.G. 1973. Ecological and zoogeographical aspects of the fishes of the Indian River region of Florida. Quart. J. Fla. Acad. Sci., 36, Supplement No. 1:8(abstract).

Gilmore, R.G. and R.H. Gore. 1974. Observation on a sea urchin capturing a juvenile mullet. Fla. Sci., 37(1): 52-56.

RESUME

RICHARD GRANT GILMORE

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Gilmore, R.G. 1977. Fishes of the Indian River lagoon and adjacent waters, Florida. Bull. Fla. St. Mus., 22(3): 101-147.

Gilmore, R.G. 1977. Notes on the opossum pipefish, Oostethus lineatus from the Indian River lagoon and vicinity, Florida. Copeia 1977(4): 781-783.

Gilmore, R.G., J.K. Holt, R.S. Jones, G.R. Kulczycki, L.G. MacDowell III, and W.C. Magley. 1978. Portable tripod drop-net for estuarine fish studies. Fish. Bull., 76(1): 285-289.

Gilmore, R.G. 1978. The current status of the fish fauna of the Indian River lagoon. Proceedings Brevard Water Resources Conference. Vol. 1: 137-151.

Gilmore, R.G., K.H. Bullock and F.H. Berry. 1979. Hypothermal mortality in marine fishes of south, central Florida, January, 1977. Northeast Gulf Sci., Vol. 2(2): 77-97.

Gilmore, R.G. 1979. Varicus marilynae, a new gobiid fish from Florida. Copeia 1979, No. 1: 126-128.

Dodrill, J.W. and R.G. Gilmore. 1978. Land birds in the stomachs of tigersharks Galeocerdo cuvieri (Peron and Lesueur. The AUK, Vol. 95(3): 585-586.

Dodrill, J.W. and R.G. Gilmore. 1979. First North American continental record of the longfin mako (Isurus paucus Guitart Manday). Fla. Sci. 42(1): 52-58.

Manuscripts completed and in presubmission review:

Gilmore, R.G. Subtropical fish community changes due to lethal low temperature effects. 19 ms pages.

Gilmore, R.G., P.H. Hastings and G.R. Kulczycki. Crystalline rotenone as a reliable and effective fish toxin. 8 ms pages.

Dodrill, J.W., R.G. Gilmore and S. Springer. Observations on the early intra-uterine development of the sand tiger shark Odontaspis taurus Rafinesque. 23 ms pages.

PROFESSIONAL PAPER PRESENTATIONS:

April, 1972, Annual Florida Academy of Science Meeting.
Title: Observations on the behavior and feeding habits of the Atlantic needlefish, Strongylura marina (Walbaum) and the halfbeak, Hyporhamphus unifasciatus (Ranzani) -- suborder Exocoetoidei.

March, 1973, Annual Florida Academy of Science Meeting.
Title: Ecological and zoogeographic aspects of the fishes of the Indian River region of Florida.

June, 1976, Seminar to the Ichthyology Section, Museum of Natural History, Smithsonian Institution, Washington, D.C. Title: Fishes of the Indian River lagoon and vicinity, east central Florida.

September, 1976, Annual Meeting of the American Fisheries Society, Detroit, Michigan. Title: Comparative quantitative estuarine fish studies using seine and drop-nets.

November, 1976, Annual Meeting of the Southeastern Estuarine Research Society, Brunswick, Georgia.
Title: Comparative quantitative estuarine fish studies using seine and drop-nets.

March, 1977, Invited seminar, Oceanography Department, Florida Institute of Technology, Melbourne, Florida.
Title: Fish fatality due to cold lethal water temperature, Indian River lagoon and vicinity.

June, 1977, Annual National Meeting of the American Society of Ichthyologists and Herpetologists, Gainesville, Florida. Title: Subtropical fish community changes due to lethal low temperature effects.

TECHNICAL REPORTS:

Wilcox, J.R. and R.G. Gilmore. 1978. Some hydrological data from the Indian River between Sebastian and St. Lucie Inlets, Florida, January 1972. February 1975. Harbor Branch Foundation, Inc. Tech. Rept. No. 17.

UNPUBLISHED RESEARCH PAPERS:

Masters Thesis: Comparison of the halfbeak, Hyporhamphus unifasciatus and the Atlantic needlefish, Strongylura marina, with regard to cephalic nerve patterns and relative brain size as related to feeding behavior and associated phenomena (Pisces: Exocoetidae, Belontiidae).

Indian River Coastal Zone Study Annual Reports (Harbor Branch Foundation - Smithsonian Institution Consortium).

1973-1974 Annual Report. Gilmore, R. Grant, Jr. A regional description and checklist of fishes of the Indian River. p. 119-183.

1974-1975 Annual Report. Jones, R.S., R.G. Gilmore, G.R. Kulczycki, W.C. Magley and B. Graunke. Studies of the fishes of the Indian River coastal zone. p. 57-88.

1975-1976. Annual Report. Gilmore, R.G., G.R. Kulczycki, P.A. Hastings and W.C. Magley. Studies of fishes of the Indian River lagoon and vicinity. p. 133-147.

INFORMAL PROFESSIONAL PRESENTATIONS:

Numerous informal and formal presentations to various groups (e.g. American Institute Fisheries Research Biologists, Local 206 Planning Council, Power Squadron, Audubon Society, Garden Club, etc.)

REFEREE FOR PREPUBLICATION MANUSCRIPTS:

I have reviewed submitted manuscripts for the Department of Natural Resources Marine Laboratory, St. Petersburg, Florida, the Florida Scientist, and Northeast Gulf Science.

CURRENT RESEARCH DIRECTION:

Primary research activities to date have centered around the biology of fishes. This includes anatomical, behavioral and taxonomic studies besides in depth ecological studies. Initial Harbor Branch fish investigations were of a qualitative nature specifically to delineate the local fauna, however, the distribution, numerical abundance trophic interactions between these fish species and their biotope preferences are the primary emphasis of current studies. These studies include the ichthyofaunas of freshwater tributaries, mangrove high marsh impoundments, seagrass beds and deep reef formations visited with the aid of a submersible.

Curriculum Vitae

Name: Walter M. Goldberg, Ph.D.

Date and Place of Birth: 9 January, 1946; Fitchburg, Mass.

Marital Status: Married; Rosalie C. Goldberg-Electronics
Technician, AT & T Longlines
One Child, Ian Jeffery, Born 1/30/79

Home Address: 6450 S.W. 73 Street
South Miami, Florida 33143

Education: The American University, Washington, D.C.: 1964-1968

B.S., Biology.

Florida Atlantic University, Boca Raton, Florida. 1968-1970. M.S.,
Zoology, Ecology

Thesis: Some aspects of the ecology of the reefs off Palm Beach
County, Florida, with emphasis on the Gorgonacea and
their bathymetric distribution. 108 pp. Advisor:
Dr. Sheldon Dobkin

University of Miami, School of Marine and Atmospheric Sciences,
Miami, Florida. 1970-1973. Ph.D., Marine Science

Dissertation: The chemistry, structure and growth of the
gorgonian and antipatharian coral skeleton.
82 pp. Advisor: Dr. Charles E. Lane

Societies: American Association for the Advancement of Science
American Society of Zoologists
Western Society of Naturalists
Health Physics Society
American Society of Limnology and Oceanography

Honors, Fellowships, etc.:

The American University, undergraduate scholarship.
Florida Atlantic University, teaching assistantship
University of Miami, teaching assistantship
(both assistantships in invertebrate zoology and
marine biology)

Upjohn Research Fellow, 1970-1973 (fellowship from
Upjohn Pharmaceuticals).

Oak Ridge Faculty Fellowship, 1975

Listed in Who's Who in the South and Southwest (1980)

Tools of Research:

Histochemical and Histological techniques
Electron microscopy

Radioisotope methodology and radiography

Oceanographic technique

Certification for decompression SCUBA diving (100 hour
NAUI)

Post-Doctoral Training and Experience:

Summer Post-Doctoral Associate in Biochemistry,
Papanicolaou Cancer Research Institute 1973.

Oak Ridge Associated Universities Summer Faculty
Research Fellowship: Neutron activation analysis
of coral skeletons. Puerto Rico Nuclear Center
1975.

Assistant Professor, Department of Biological Sciences,
Florida International University 1973-1977.

Associate Professor 1977 to present. Tenure awarded
1978.

Professional Activities:

Courses presently taught:

Biological Oceanography (OCB 3010)
Fundamentals of Ecology (PCB 3043)
Marine Invertebrate Zoology (ZOO 3203)
Coral Reef Ecology (OCB 5635)

Research Interests:

Coral Biology - especially the chemistry, structure
and morphogenesis of the gorgonian and black coral
skeleton (see publications)

Coordinator: Marine Science Program, Florida International
University - 1979-present

Marine Biological Consulting Firm:

Coral Reef Associates, Inc., W. Goldberg, Director

Departmental, University and State-wide Committees:

Chairman, University Radiation Safety Committee 1979-
present

Chairman, Human Resources Committee 1976-1979

Member, Departmental Curriculum Planning Committee
1976-1978

Member, Graduate Faculty, School of Technology
1976-present

Ship-time Proposal Reviewer and Member of the Advisory
Council, Florida Institute of Oceanography
1978-present

Consultantships:

Department of Environmental Regulation, State of Florida:
Testified as expert witness and helped prepare legal
briefs on the impact of operation of nuclear power
plants on the coastal marine environment (1975)

Consultantships: (CONTINUED)

U.S. Department of Commerce: Researched and wrote reports incorporated in the first fishery management plan for coral resources in United States coastal waters (1979)
Manuscript Reviewer: Bulletin of Marine Science (1979)
Proposal Reviewer, NSF 1979 (Systematic Biology)
Coastal Erosion Office, Environmental Quality Control Board of Broward County (1980), Biological Effects of Beach Restoration

Thesis Supervision:

M.S. Thesis Committee (1978-1979) Charles M. Courtney.
Title: A Limnological Description of Lake Marco Shores - A Manmade Brackish Water Lake (169 pp).

Grants and Related Activities:

Atomic Energy Commission Travel and Support Grant for project on uptake of radioiodine by corals: Eniwetok, Marshall Islands 1974.
Faculty Development Grant, Florida International University, 1976 - \$750.00
Shiptime Grants, State University System Institute of Oceanography and Florida Institute of Oceanography Proposals Funded with W.M.G. as chief scientist R/V Bellows, 1977-1980 - \$22,000
\$47,000 National Science Foundation Grant: Cell Biology and Pathology of a Gorgonian Coral Infected by a Green Alga.
W. Goldberg, P.I.
J. Makemson, Co P.I.
1980-1982

Publications:

1971. A note on the feeding behavior of the snapping shrimp Synalpheus fritzmuelleri Coutiere (Decapoda, Alpheidae). Crustaceana, 21 (3): 318-20.
1973. The ecology of the coral-octocoral communities of the southeast Florida coast: Geomorphology, species composition and zonation. Bulletin of Marine Science, 23 (3): 465-488.
1973. Ecological aspects of salinity and temperature tolerances of some reef-dwelling gorgonians from Florida. Caribbean Journal of Science, 13 (3-4): 173-177.
1974. With R.D. Hamilton. The sexual cycle in Plexaura homomalla. In: Prostaglandins from Plexaura homomalla: ecology, utilization and conservation of a major medical marine resource (F.M. Bayer and A.J. Weinheimer, eds.). Studies in tropical oceanography #12, University of Miami press. pp. 58-61.

Publications: (CONTINUED)

1974. Evidence of a sclerotized collagen from the skeleton of a gorgonian coral. Comparative Biochemistry and Physiology, 49 (3B): 525-29.

1976. A comparative study of the chemistry and structure of gorgonian and antipatharian coral skeletons. Marine Biology, 35: 253-267.

1977. Complete separation of iodotyrosine-iodohistidine-iodide mixtures on thin layer plates with a single solvent system. J. Chromatography 134: 246-248.

1977. Radioiodine as an Indicator of Skeletogenesis in Gorgonian and Antipatharian Corals. In: Proc. 3rd Intl. Coral Reef Symp. Miami 1: pp. 511-516.

1978. Chemical Changes Accompanying Maturation of the Connective Tissue Skeletons of Gorgonian and Antipatharian Corals. Mar. Biol. 49: 208-210.

1979. Shelf Temperatures and Reef Growth on the South-East Florida Coast. Nature 278: 669-670.

In Press 1980. Fluorescent Compounds from the Connective Tissue Skeleton of A Gorgonian Coral and Their Possible Role in Cross-Linking. Comp. Biochem Physiol.

Reports:

1975. Marine Ecological Considerations. An evaluation of Florida Power and Light Company Environmental Impact Report, pp. 74-88. In: Final Report - Review of Application for Site Certification for the State of Florida: Florida Power and Light Company St. Lucie Plant #2. D.F. Jackson (ed.) 450 pp.

1975. A comparative study of iodine fixation by gorgonian and antipatharian corals with an annotated systematic list of specimens collected from Eniwetok, Marshall Islands. Summary report of research activities - Mid-Pacific Marine Laboratory.

1979a. A review of the coral resources of the United States and the territorial waters of the Gulf of Mexico (1) the corals of the continental shelf 31 pp.

Curriculum Vitae
Walter M. Goldberg

Reports: (CONTINUED)

1979b. Trophic-level interactions and limitations to the distribution of corals. 48 pp.
Reports submitted to Gulf of Mexico Fisheries Management Council, U.S. Department of Commerce.

1980. Impact of beach restoration on the coral communities of South Broward County, Florida. 25 pp.

MARGARET O. HALL
Marine Botanist

Education: Bachelor of Science in Biology, Furman University, 1975.
Master of Science in Marine Biology, University of South Carolina, August 1979.

Experience: Fall 1977 to Present: Research assistant in Marine Botany, Harbor Branch Foundation, Inc. Technical Assistant Continental Shelf Associates, Inc. for algae identifications. Duties have included algae identifications for the IIM South Atlantic Study.

Fall 1975 to Fall 1977: Teaching assistant at the University of South Carolina. 2 semesters each of audio-tutorial biology, anatomy for nursing students, and microbiology.

Spring 1977. Student research: Ecology of the benthic macrophytes in a southeastern temperate salt marsh; productivity, biomass, and community structure.

Spring 1976. Student research: The effect of increased nitrate and phosphate levels on the growth rate of Skeletonema costatum.

Winter 1975. Independent study: The effects of temperature acclimation and cadmium on the respiration rates and critical thermal maxima of the fresh water grass shrimp, Palaemonetes paludosa.

Fall 1974. Student research: Hemoglobin as an indicator of speciation in mice.

Professional Interests: The population dynamics of phytoplankton and macroalgae; the interaction of algal populations with other populations in the community; the role of benthic microalgae in the benthic meiofaunal food web; reproductive strategies of marine organisms.

Professional Societies: Estuarine Research Federation
Southeastern Estuarine Research Society
Phycological Society of America

RAFAEL LEMAITRE
Marine Biologist

Education: 1969 - Bachiller, Lycee Francais Louis Pasteur, Bogota Columbia.
1972-1977 - Marine Biologist, Fundacion Universidad Jorge Tadeo Lozano. Thesis: "Notas sobre una coleccion de crustaceos, decapodos Brachyura de aguas someras en la costa del Caribe alrededor de Cartagena. I. Familia Xanthidae."
1977 - Graduate student, Florida International University, Miami, Florida, School of Technology. Course work completed for the Master of Science Degree in Environmental and Urban Systems. Degree is now pending finalization of thesis (estimated graduating time: Fall quarter 1980). Thesis: (in preparation) Ecology and morphology of two brachyuran crab species Neopanope texana (Stimpson) and N. packardii (Kingsley) from Anclote Anchorage, west coast of Florida.

Experience: Present: Student, Florida International University. Technical Assistant, Continental Shelf Associates, Inc., for crustacean identifications.

1978: Part of scientific personnel for Florida International University on a 1-week cruise on board the R/V Bellows to Cay Sal Banks (Bahamas), in charge of reporting the decapod crustaceans.

1978: Planting of seedlings of the turtle grass Thalassia testudinum and the Cuban shoal grass Halodule wrightii in several areas of Biscayne Bay, Florida, under directions of Dr. Anita Thorhaug, Florida International University, Department of Biological Sciences.

1977 to 1978: Sampling, sorting, and preparation of a report on the animal communities of restored seagrass beds in the vicinity of Florida Power and Light Company's plant at Turkey Point, Biscayne Bay, Florida, under directions of Dr. P. A. McLaughlin, Florida International University, Department of Biological Sciences.

1972 to 1977: Participant on numerous ecological surveys on Bahia de Cartagena and adjacent areas as part of undergraduate training exercises.

Publications and Reports: McLaughlin, P. A., S. F. Treat, A. Thorhaug and R. Lemaitre (in press). The animal community of a restored seagrass (Thalassia testudinum) bed. Aquatic Botany.

Lemaitre, R. (in press) Shallow-water crabs (Decapoda Brachyura) collected in the southern Caribbean near Cartagena, Colombia. Bulletin of Marine Science.

Lemaitre, R. and J. Garcia-Gomez. A new species of Pagurus with a study of the morphological variations. (in preparation).

Lemaitre, R. The decapod crustaceans from Cay Sal Banks (Bahamas). (in preparation).

Professional Societies: International Oceanographic Foundation
Biological Society of Washington
Society of Systematic Zoologists
American Society of Zoologists
The Crustacean Society

CURRICULUM VITAE of Patsy A. McLaughlin

Date of Birth: May 27, 1932

Place of Birth: Seattle, Washington

Marital Status: Married (Emanuel J. McGeorge)

Dependents: None

Social Security Number: 536-36-0034

Home Address: 8520 SW 125th St., Miami, Florida 33156; Telephone (305) 238-9207

Business Address: Department of Biological Sciences, Florida International University, Tamiami Campus, Miami, Florida 33199; Telephone (305) 552-2201.

Education: B.A. 1957 University of Washington, Seattle, Washington (Zoology).

M.Ph. 1969 The George Washington University, Washington, D. C.
(Zoology; Marine biology emphasis).

Ph.D. 1972 The George Washington University, Washington, D. C.
(Zoology; Marine biology emphasis).

Language Proficiency: French - good reading knowledge
German - fair reading knowledge
Russian - fair reading knowledge

Positions Held:

1975 to present: Research Scientist/Scholar and Courtesy Professor (1977-present), Courtesy Associate Professor (1975-1977), Department of Biological Sciences, Florida International University, Miami, Florida.

Duties of this position are primarily research and teaching. Current research deals with continuing studies in pagurid systematics and comparative morphology, for which the incumbent has been awarded two research grants from the National Science Foundation, and with assessment and monitoring studies of impacted marine and estuarine environments. Research programs just concluded include a study of the invertebrate and fish populations in the area of Biscayne Bay to be impacted by a proposed expansion of the Port of Miami; a Sea Grant funded study of the invertebrate and fish communities associated with restored seagrass beds in southern Biscayne Bay; and a commercially funded study of the nutritional requirements of the land hermit crab *Coenobita clypeatus*. The incumbent was principal investigator for the latter two programs and co-principal investigator for the former. Supplemental research programs include systematic, morphological and ecological studies on Scandinavian, Hawaiian and IndoPacific pagurids and on selected groups of barnacles. Academic responsibilities include teaching three graduate level courses, "Principles of Systematic Zoology", "Biological Monitoring of Freshwater Ecosystems" and "Biology of Crustacea"; thesis supervisor for graduate students and supervisor for undergraduate and graduate project laboratory students. Additional responsibilities include: undergraduate and graduate student advisement; departmental advisor for marine development and Sea Grant programs; manuscript reviewer for several scientific journals; and consultant to state and local departments and environmental groups on development programs affecting marine resources.

Primary research was devoted to taxonomic and morphological studies of the western Atlantic species of the hermit crab diogenid genus *Paguristes*. Supplemental studies included work on the morphology of complemental males in sessile cirripeds; routine identifications of pagurid and cirriped collections; and cataloging and curatorial maintenance of the collections.

1969 - 1970: Research Assistant, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida.

Research included preliminary studies on morphological variation in pagurids, systematic studies on pagurids and cirripeds, and work with larval rearing and maintenance of marine organisms in the laboratory.

1965 - 1968: Supervisor for Invertebrates, Smithsonian Oceanographic Sorting Center, Smithsonian Institution, Washington, D. C.

Primary responsibilities of this position included training (including semi-formal course instruction) and supervision of 18 technicians in the sorting and preliminary identifications of invertebrate collections processed by the Center; training of technicians in curatorial methods, record maintenance and cataloging; preliminary development of data retrieval systems; preparation of proposals for grants and contracts; purchasing of supplies and equipment; coordination of the Center's Invertebrate Advisory Committees; correspondence and personal communication with specialists on curatorial techniques and specimen processing; participation in international conferences on oceanography and curatorial techniques; and review of proposals and manuscripts.

1963 - 1965: Zoologist, Department of Oceanography, University of Washington, Seattle, Washington.

Responsibilities, as associate investigator for a National Science Foundation grant, included: development of new techniques for evaluating diagnostic characters, i.e., quantitative methods, used for the first time in barnacle taxonomy; assessment of the applicability of numerous multivariate statistical techniques to taxonomic studies, and the supervision of computer processing of morphological data; data analyses; and the preparation of reports and proposals.

1960 - 1963: Assistant Zoologist, Department of Oceanography, University of Washington, Seattle, Washington.

Responsibilities of this position included: the sorting of midwater trawl samples and the identification and study of euphausiid collections from the eastern North Pacific; evaluation of gear selectivity and fishing efficiency of the midwater trawl; determination of population densities of euphausiids in the study area; development of procedures for enumeration of barnacle settling rates, and subsequent sampling for determination of growth rates and spawning frequencies; and the supervision of the sorting and curatorial maintenance of the departmental amphipod collections.

1961 - 1962: Consultant, Marine Mammal Biological Laboratory, Seattle, Washington.

Duties consisted of the analysis and identification of the invertebrate

fauna found in the stomach contents of bearded and ringed seals collected in the Chukchi Sea.

1957 - 1960: Fisherby Biologist (Research), Seattle Biological Laboratory, Bureau of Commercial Fisheries, Seattle, Washington.

Duties included the identification of benthic invertebrate fauna co-existing with the Alaskan king crab (*Paralithodes camtschatica*); planning and conducting studies on the food habits of the king crabs; analyses of stomach contents; studies on the relationships between shell condition and molting frequencies; maintenance of tag release and recovery data; and preparation of quarterly and annual reports.

1951 - 1955: Airborne Radar Mechanic, U.S. Air Force (WAF)

Consulting Responsibilities

Applied Marine Ecological Services, Inc., 1977 - present.
Atalanta Corporation, New York, N. Y., 1972 - 1974.
Beaver Street Fisheries, Inc., Jacksonville, Florida, 1974.
Bernice P. Bishop Museum, Honolulu, Hawaii, 1973 - present
Boyce Thompson Research Institute, Yonkers, N. Y., 1974
Florida State Department of Natural Resources, 1974 - present.
Instituto de Investigaciones Marinas de Punta de Betin, Santa Marta, Colombia, 1975 - present.
Instituto Oswaldo Cruz, Rio de Janeiro, Brazil, 1973 - present.
National Oceanographic & Atmospheric Administration, 1968-69, 1972 - present.
Raytheon Corporation, 1975 - 1976.

Honorary Societies

Phi Sigma
Sigma Xi

Professional Societies

American Association for the Advancement of Science
American Society of Zoologists
Biological Society of Washington
Florida Academy of Sciences
Gulf and Caribbean Fisheries Institute
Society of Systematic Zoology
Southern California Academy of Science
Western Society of Naturalists

Honors:

American Men and Women of Science

Field Experience

- 1961 - 62 Short cruises aboard university vessels.
1962 Friday Harbor Laboratories (summer).
1966 Southeastern Pacific Biological and Oceanographic Program, Cruise 16 to Ecuador, Peru and the Galapagos Islands.
1974 Bellairs Research Institute of McGill University, Barbados, W.I.
1976 - 77 Quarterly sampling for ecological study in Biscayne Bay, FL.
1978 Ecological sampling of invertebrates and fishes, Port of Miami.
1979 Open-water diving certification.

University Graduate Committees:

- Master's thesis committee for Cathy A. Salmons, Department of Biology University of Miami, co-chairman (Cirripedia), 1975.
- Master's thesis committee for Julio Garcia-Gomez, Rosenstiel School of Marine and Atmospheric Science, University of Miami, co-chairman (Paguridea), 1978.
- Master's thesis committee for Charles M. Courtney, School of Technology, Florida International University, chairman (Limnology), 1979.
- Master's thesis committee for W. Niel Gillies, School of Technology, Florida International University, chairman (Amphipoda), current.
- Master's thesis committee for Rafael Lemaitre, School of Technology, Florida International University, chairman (Decapoda, Brachyura), current.
- Master's thesis committee for Sara-Ann F. Treat, School of Technology, Florida International University, chairman (Isopoda), 1979.
- Doctoral dissertation committee for John C. Markham, Rosenstiel School of Marine and Atmospheric Science, University of Miami (Bopyridae), 1974.
- Board of Examiners (PhD) for S. Ajmal Khan, Centre of Advanced Study in Marine Biology, Annamalai University (India), chairman (Decapoda, Anomura), 1978.

Workshops, Conferences, Symposia and Congresses:

- "Hermit crabs as pets - to be or not to be", Florida International University, Sea Grant symposium, September 30, 1977, coordinator.
- Barnacle workshop, Scripps Institution of Oceanography, La Jolla, California, National Science Foundation sponsored, October 23 - November 3, 1978, participant.
- Crustacean workshop, American Society of Zoologists, Richmond, Virginia, December 30, 1978, invited paper.
- 14th Pacific Science Congress, Rhabarovsk, USSR, August 10 - September 5, 1979, invited participant.

Publications:

See attached list.

Publications:

1960. Stomach contents of Bering Sea king crabs. Special Scientific Report (Fisheries), No. 293, 5 pp. (with J. F. Hebard). Reprinted, 1961, International North Pacific Fisheries Commission Bulletin No. 5.
1963. Survey of the benthic invertebrate fauna of the eastern Bering Sea. Special Scientific Report (Fisheries), No. 401, 75 pp.
- 1965a. A redescription of the euphausiid crustacean, *Nematoscelis difficilis* Hansen, 1911. Crustaceana, 9(1): 41-44.
- 1965b. Unique occurrence of complemental males in a sessile barnacle. Nature, London, 207: 1107-1108 (with D. P. Henry).
1967. A revision of the subgenus *Solidobalanus* Hoek (Cirripedia: Thoracica), with the description of a new species with complemental males. Crustaceana, 12(1): 13-38 (with D. P. Henry).
1972. Comparative morphology of complemental males in four species of *Balanus* (Cirripedia: Thoracica). Crustaceana, 22(1): 13-30 (with D. P. Henry).
- 1973a. Remarks on the presumed hybridization between two European species of *Pagurus* (Crustacea: Decapoda: Paguridae). Journal of the Marine Biological Association, U. K., 53(2): 563-568.
- 1973b. On the status of *Pagurus mertensii* Brandt, with the descriptions of a new genus and two new species from California (Crustacea: Decapoda: Paguridae). Bulletin of the Southern California Academy of Science, 72(3): 113-136 (with J. Haig).
- 1974a. The hermit crabs (Crustacea Decapoda, Paguridea) of northwestern North America. Zoologische Verhandelingen, No. 130, 396 pp.
- 1974b. The genus *Paguristes* (Crustacea: Decapoda: Diogenidae) from the western Atlantic. Part I. The *Paguristes tortugae* complex, with notes on variation. Bulletin of Marine Science, 24(1): 165-234 (with A. J. Provenzano, Jr.).
- 1974c. A new species of hermit crab of the genus *Nematopagurus* (Crustacea: Decapoda: Paguridae) from Hawaii. Proceedings of the Biological Society of Washington, 84(23): 245-256 (with J. H. Brock).
- 1975a. The genus *Paguristes* (Crustacea: Decapoda: Diogenidae) from the western Atlantic. Part II. Six new species. Bulletin of Marine Science, 24(4) [1974]: 885-938 (with A. J. Provenzano, Jr.).
- 1975b. On the identity of *Pagurus brevidactylus* (Stimpson) (Decapoda: Paguridae), with the description of a new species of *Pagurus* from the western Atlantic. Bulletin of Marine Science, 25(3): 359-376.

- 1975c. The morphology of unique structures on the spines of a deep-water Hawaiian hermit crab (Crustacea: Decapoda: Paguridae). Journal of Zoology, London, 176: 519-526 (with C. E. Lane).
- 1975d. The barnacles of the *Balanus amphitrite* complex (Cirripedia, Thoracica). Zoologische Verhandelingen, No. 141, 254 pp. (with D. J. Henry).
- 1975e. A new Hawaiian hermit crab of the genus *Trizopagurus* (Crustacea: Decapoda: Diogenidae), with notes on its behavior. Pacific Science, 29(3): 259-266 (with J. Baily-Brock).
- 1975f. The larval development of *Labidochirus splendescens* (Owen) (Crustacea: Decapoda: Paguridae). Crustaceana, 30(1): 271-289 (with C. F. Nyblade).
- 1976a. A new species of *Lightiella* (Crustacea: Cephalocarida) from the west coast of Florida. Bulletin of Marine Science, 26(4): 593-599.
- 1976b. A new Japanese hermit crab (Crustacea: Decapoda: Paguridae) resembling *Pagurus samuelis* (Stimpson). Crustaceana, 30(1): 13-26.
- 1977a. Review: Newman, W. A. and A. Ross -- Revision of the balanomorph barnacles; including a catalog of the species. Crustaceana, 32(1): 189-190.
- 1977b. Benthic biology. Vol. 6, In: Florida Power Corporation. Post-operational ecological monitoring program, 1976. Final Report, Anclote Unit No. 1. St. Petersburg, Florida (with A. Thorhaug and M. A. Roessler).
1978. Preliminary report on recolonization of invertebrates onto a *Thalassia testudinum* restoration site. Florida Scientist, 41: 1 (abstract) (with A. Thorhaug).
- 1979a. *Megabalanus vesiculosus* (Darwin) [Cirripedia, Thoracica] from Brazil, with a redescription of the species. Revista Brasileira de Biologia, 39(1): 37-41 (with D. Lacombe).
- 1979b. Restoration of *Thalassia testudinum*: animal community in a maturing four-year-old site; preliminary results. Proc. 5th Annual Conference on Restoration of Coastal Vegetation in Florida, pp. 149-161 (with A. Thorhaug).
- 1979c. Development of the epipodite of the second maxilliped and gills in *Labinia erinacea* (Crustacea: Brachyura: Oxrhyncha). Crustaceana, Supplement 5: 47-54 (with W. T. Yang).
- 1980a. "Comparative morphology of Recent Crustacea". W. H. Freeman and Company, San Francisco, California, 177 pp.
- In press Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species. Part 1. Ten new genera of the Paguridae and a redescription of *Tomopagurus*. A. Milne Edwards and Bouvier. Bulletin of Marine Science.
- In press Comparative morphology of crustacean appendages. In: L. G. Abele (ed.), "Biology of Crustacea", vol. 1, Academic Press, New York.

- In press Systematic methods in crustacean research. In: L. G. Abele (ed.) "Biology of Crustacea", vol. 1, Academic Press, New York (with G. Taylor and M. Tracey).
- Submitted The animal community of a restored seagrass (*Thalassia*) bed. Aquatic Botany (with S. F. Treat, A. Thorhaug and R. Lemaitre).
- Submitted A new species of *Allodardanus* (Crustacea: Decapoda: Diogenidae) from the western Atlantic. Proc. Biol. Soc. Washington (with R. Gore).
- In press Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part II. *Rhodochirus* McLaughlin and *Phimochirus* McLaughlin. Bull. mar. Sci.
- In Prep. Crustacean internal anatomy. In: L. H. Mantel and D. E. Bliss (eds.) "Biology of Crustacea" vol. 2, Academic Press, New York
- In Prep. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part III. *Agaricochirus* McLaughlin, *Enallopagurus* McLaughlin, and *Enallopaguropsis* McLaughlin.

Paula Mae Cowles Mikkelsen, Malacologist
508-B South 22nd Street
Ft. Pierce, Florida 33450
Tel. (305) 464-2085

PLACE OF BIRTH: Lewiston, Maine

DATE OF BIRTH: November 17, 1953

PRESENT NATIONALITY: U.S. Citizen

SEX: Female

EDUCATION

<u>INSTITUTION AND LOCATION</u>	<u>DEGREE</u>	<u>DATE</u>	<u>FIELD</u>
Florida Institute of Technology Melbourne, Florida 32901	(15 graduate hours)	1975- 1976	Biology
Bates College Lewiston, Maine 04240	B.S.	1976	Biology

ACADEMIC

UNDERGRADUATE

Vertebrate Anatomy & Physiology (4)
Paleontology (3)
Chemistry: inorganic, organic,
 biological, physical
Physics
Calculus
Liberal Arts

GRADUATE

Comparative Animal Physiology
Marine Biology (8)
Radiological Health
Taxonomy (audit)

ACADEMIC ACHIEVEMENTS

UNDERGRADUATE

Publication: Minkoff, E.C., P.M. Mikkelsen, W.A. Cunningham, and
K.W. Taylor. 1979. The facial musculature of the opossum
(*Didelphis virginiana*). J. Mammalogy 60(1):46-57.
(Research completed in 1974)

Tutored in genetics and chordate anatomy.

Four-year recipient of Bates Benjamin Scholarship, awarded annually
according to financial need and academic achievement.

CURRENT RESEARCH INTERESTS

Taxonomy and systematics of Bullidae (Gastropoda: Opisthobranchia).
Survey of the Euphausiid Crustacea of the Indian River Coastal
Zone, Florida.

PROFESSIONAL SOCIETIES

American Malacological Union
Conchologists of America

EMPLOYMENT EXPERIENCE

Nov. 1978 to present:

Museum Technician
Indian River Coastal Zone Museum
Smithsonian Institution, Ft. Pierce Bureau
Ft. Pierce, Florida 33450

Collection, preservation, photography, and
cataloging of marine and freshwater vertebrate
and invertebrate specimens. Personal research
involves systematics of the Mollusca, especially
those of the southeastern United States and the
Caribbean.

Oct. 1978 to Dec. 1978: Consultant in Malacology
Continental Shelf Associates
Tequesta, Florida 33458

Identification of a molluscan collection from off
the Georgia coast.

Apr. 1978 to Nov. 1978: Assistant Museum Technician
Indian River Coastal Zone Study Reference Museum
Smithsonian Institution, Ft. Pierce Bureau
Ft. Pierce, Florida 33450

Temporary position to aid in museum clean-up and
reorganization.

Jan. 1976 to Apr. 1978: Librarian, Medical Research Institute
Florida Institute of Technology
Melbourne, Florida 32901

Responsible for all aspects of operation in a small
research library of approximately 2,000 volumes.

PERSONAL

Married: Paul S. Mikkelsen, August 3, 1973

No children.

Outside interests: Enjoy all aspects of study of the natural environment,
including snorkeling and the collection, preservation, and identification
of all types of marine life, with special interest in molluscan systematics,
maintaining a personal malacological collection of over 800 species.
Member, Astronaut Trail Shell Club, Melbourne, Florida 32935

REFERENCES

Available on request.

March 1980

SHIRLEY A. POMPONI

CURRICULUM VITAE

PERSONAL

Address: 16 Merryweather Drive
Cambridge, Maryland 21613

Date of Birth: July 19, 1949

Citizenship: U.S.A.

EDUCATION

- 1971 A.B. (summa cum laude) Biology, College of St. Elizabeth,
Convent Station, N.J. 07961
- 1974 M.S. Biological Oceanography, University of Miami, Rosenstiel
School of Marine and Atmospheric Science, Miami, Florida
33149
- 1977 Ph.D. Biological Oceanography, University of Miami, Rosenstiel
School of Marine and Atmospheric Science, Miami, Florida
33149

HONORS, AWARDS AND GRANTS

- 1971 Brooks Award, Northeastern Region, Beta Beta Beta Biological
Honor Society
- 1971 Kappa Gamma Pi, National Catholic College Women's Honor Society
- 1974 Grant-in-aid, Principles of Benthic Community Analysis (short
course), Comparative Sedimentology Laboratory, RSMAS
- 1975/76 Bader Fund Award, University of Miami, RSMAS
- 1976 American Business Women's Association grant, Stephen Bufton
Memorial Educational Fund
- 1976 U.S. National Museum Pre-doctoral Grant-in-aid
- 1976/77 Fritz Koczy Fellowship, University of Miami, RSMAS
- 1976/77 National Science Foundation Grant for Support of Doctoral
Dissertation Research in the Field Sciences
- 1978 F.G.W. Smith Prize for Outstanding and Original Dissertation
Research in Marine Science, University of Miami, RSMAS

HONORS, AWARDS AND GRANTS (continued)

- 1979 Office of Naval Research Contract (#NONR N00014-79-C-0395) for investigation of physiological and biochemical aspects of sponge bioerosion of limestones
- 1979 American Business Women's Association Chapter Woman of the Year
- 1979 American Business Women's Association National Top Ten Women of the Year

EMPLOYMENT

- June 1978 - September 1979 Research Associate, University of Miami, RSMAS, Miami, Florida
- January - June 1978 Research Associate Post-doctoral, University of Miami, RSMAS, Miami, Florida
- June 1974 - January 1975 Research-Administrative Assistant, Sea Grant Advisory Services, University of Miami, Miami, Florida

RESEARCH EXPERIENCE AS PRINCIPAL OR CO-INVESTIGATOR

- 1975-present Investigation of physiological and biochemical aspects of excavation of CaCO_3 substrates by boring sponges; Principal Investigator; National Science Foundation; Office of Naval Research
- 1978-present Analysis of biofouling communities on concrete cylinder treated with various anti-foulants; Principal Investigator; Civil Engineering Laboratory, Department of the Navy
- 1976-1979 Analysis of effects of sewage effluent and toxic substances on growth, reproduction, and physiology of sessile marine invertebrates; development of invertebrate bio-assays for control and monitoring studies of ocean outfalls; Co-investigator; Environmental Protection Agency
- 1971-1974 Systematic application of cytological and cytochemical characteristics of the Haliclonidae and Callyspongiidae (Porifera, Demospongiae, Haplosclerida); M.S. research

RESEARCH EXPERIENCE AS GRADUATE RESEARCH ASSISTANT

- 1976 Scanning electron microscope analysis of succession of periphytic microorganisms (primary fouling communities) on metal and glass surfaces in seawater; Office of Naval Research

RESEARCH EXPERIENCE AS GRADUATE RESEARCH ASSISTANT (continued)

- 1973 Analysis of effects of herbicides used in mangrove defoliation
 in South Vietnam on estuarine ecology and fisheries;
 National Academy of Science
- 1972/73 Data analysis of billfish survey (Atlantic, Gulf of Mexico,
 Caribbean): catch/effort, length-weight frequencies, etc.;
 Gulf and Caribbean Fisheries Institute
- 1972 Data analysis of Biscayne Bay sport fishing survey; American
 Fisheries Society

TEACHING EXPERIENCE

- 1979 Co-instructor, Geology of Tropical Marine Environments,
 University of Miami, Comparative Sedimentology Laboratory
- 1976-79 Graduate level instruction: courses and lectures in physiological
 adaptations of marine invertebrates to the environment;
 bioerosion; sponge physiology; sponge systematics
- 1975 Co-instructor, Sedimentology of South Florida, West Virginia
 University
- 1975 Teaching Assistant, Geology of Tropical Marine Environments,
 University of Miami, Comparative Sedimentology Laboratory
- 1973-76 Teaching Assistant, University of Miami, RSMAS:
 Introduction to Marine Biology (4 semesters)
 Advanced Marine Biology (3 semesters)
 The Caribbean Marine Environment (1 semester)

PROFESSIONAL ACTIVITIES

Papers Presented at Meetings

- 1975 Symposium on Biology of Sponges, sponsored by Society for
 Developmental Biology, Albany Medical College, Albany, N.Y.
- 1976 Florida Academy of Sciences Annual Meeting, Eckerd College,
 St. Petersburg, Florida
- 1976 Ninth Annual Symposium on Scanning Electron Microscopy, sponsored
 by IIT Research Institute (Chicago), Toronto
- 1977 Third International Coral Reef Symposium, Miami, Florida

PROFESSIONAL ACTIVITIES (continued)

Papers Presented at Meetings

1978 International Colloquium on Sponge Biology, sponsored by
CNRS, Paris

Workshops

1978 NOAA workshop for establishment of Key Largo Marine Sanctuary

Service to Scholarly Journals and Editorial Boards

1976-79 Reviewer of manuscripts submitted to journals

1977 Editorial Assistant, Proceedings, Third International Coral
Reef Symposium, Miami, Florida

1978 Editorial Assistant, Proceedings, Second International Conference
on Toxic Dinoflagellate Blooms, Miami, Florida

Service to Government Agencies

1978-79 Proposal reviewer for National Science Foundation; NOAA Sea Grant

PROFESSIONAL AND HONORARY MEMBERSHIPS

Royal Microscopical Society, Fellow
Kappa Gamma Pi, National Catholic College Women's Honor Society
Beta Beta Beta, Biological Honor Society
American Business Women's Association

CERTIFICATIONS

1972 SCUBA diving certification, NAUI

1974 Principles of Benthic Community Analysis, University of Miami,
Comparative Sedimentology Laboratory, Certificate of
Participation in Short Course

1976 Medical and Physiological Aspects of Recompression Therapy,
U.S. Department of Commerce, NOAA, Certificate of Training

1978 Advanced SCUBA diving certification, YMCA

PUBLICATIONS

- 1976 1. Pomponi, Shirley A. A cytological study of the Haliclonidae and the Callyspongiidae (Porifera, Demospongiae, Haplosclerida). In: Aspects of Sponge Biology, Harrison and Cowden, eds., Academic Press, N.Y., pp. 215-235.
2. Pomponi, Shirley A. An ultrastructural study of boring sponge cells and excavated substrata. In: Proc. 9th Ann. SEM Symp., O. Johari, ed., IIT Res. Inst., Chicago, Part VIII, pp. 569-575.
- 1977 3. Pomponi, Shirley A. Etching cells of boring sponges: an ultrastructural analysis. In: Proc. III Int. Coral Reef Symp., Vol. 2 Geology, D.L. Taylor, ed., Miami, pp. 485-490.
4. Pomponi, Shirley A. Excavation of calcium carbonate substrates by boring sponges: ultrastructure and cytochemistry. Ph.D. Dissertation, Univ. Miami, 133 pp.
- 1979 5. Pomponi, Shirley A. Ultrastructure of cells associated with excavation of calcium carbonate substrates by boring sponges. Journal of the Marine Biological Association of the United Kingdom, 59(3): 777-784.
6. Pomponi, Shirley A. Cytochemical studies of acid phosphatase in etching cells of boring sponges. Journal of the Marine Biological Association of the United Kingdom, 59(3): 785-789.

In press

7. Pomponi, Shirley A. Ultrastructure and cytochemistry of the etching area of boring sponges. Proc., Int. Colloquium on Sponge Biology, CNRS, Paris, France.
8. Pomponi, Shirley A. Cytological mechanisms of calcium carbonate excavation by boring sponges. International Review of Cytology (Bourne & Danielli, eds.), 65.

In preparation

9. Pomponi, Shirley A. Cytochemical and biochemical investigations of carbonic anhydrase in etching cells of boring sponges. Journal of the Marine Biological Association of the United Kingdom.
10. Pomponi, Shirley A. and Dennis L. Taylor. A photogrammetric method for measuring rates of sponge boring in vitro. Limnology and Oceanography.

CURRICULUM VITAE

Name: Richard Lincoln Turner

Address: Department of Biological Sciences
Florida Institute of Technology
Melbourne, Florida 32901

Telephone: (305) 723-3701, Ext. 262

Place and Date of Birth: Brockton, MA
4 July 1947

Married: To Diane R. (two children)

Present Position:

Assistant Professor, Department of Biological Sciences, F.I.T., Sept. 76
to present

Education:

B.A., University of Maine, Orono, June 69 (Zoology)
M.S., University of Maine, Orono, August 71 (Zoology)
Ph.D., University of South Florida, Tampa, December 77 (Biology)

Professional and Honorary Societies:

American Society of Zoologists
Biological Society of Washington
Florida Academy of Sciences
Phi Beta Kappa (Inactive)
Phi Kappa Phi (Inactive)
Phi Sigma (Inactive)
Sigma Xi

Fellowship and Awards:

Graduate Council Fellow, Biology, University of South Florida, Sept. 73-
June 74, Sept. 74-June 75.

Sigma Xi, Outstanding Graduate Student Research Award, University of
South Florida, May 76.

Prior Teaching Experience:

Teaching Assistant, Zoology, University of Maine, Sept. 69-June 70, Sept. 70-
June 71.

Teaching Assistant, Biology, University of South Florida, Sept. 71-June 73,
Sept. 75-Sept. 76.

Other Professional Experience:

Research Assistant, Zoology, University of Maine, NSF Grant GA-1405 to D. Dean and J. H. Dearborn, June-August 69.

NSF Summer Trainee, Zoology, University of Maine, June-August 70.

Laboratory Aide, Division of Invertebrates, Marine Research Laboratory, Florida Department of Natural Resources, St. Petersburg, June-August 72.

Consultant to Smithsonian Institution, Department of Invertebrate Zoology (re: Systematics of the sea-star genus Acanthaster), May 74.

Chairman, Biological Sciences Section, Florida Academy of Sciences, May 78-May 79 (chairman-elect, May 77-May 78).

Research Supervisor, Science and Engineering Summer Research Participation Program for High-Ability Secondary School Students, F.I.T., June-July 78.

Faculty Senator, Biological Sciences, F.I.T., September 78 to present.

Coordinator, Biological Sciences seminar programs, F.I.T., November 78 to present.

Secretary, F.I.T. Club, Sigma Xi, January 79 to present, and delegate to Annual Meeting (79).

Grants:

NSF Grant GB-34211, Bermuda Biological Station (Ultrastructure of epidermal glands in juveniles of a coelom-brooding sea cucumber, Synaptula hydriformis), 1974.

Sigma Xi, Grant-in-Aid of Research, University of South Florida (Assimilation of nutrients by developmental stages of the coelomic-brooder Synaptula hydriformis (Echinodermata: Holothuroidea)), 1974..

Research Equipment Fund, School of Science and Engineering, F.I.T. (Nutritional aspects of disc regeneration in the brittlestar Ophiophragmus filigraneus), 1977.

NSF Grant SER78-14013, Instructional Scientific Equipment Program, F.I.T., (Improvement of Instruction in Marine Ecology), 1978.

Military Status:

Honorable discharge, 5 June 1977 (Cpt., U.S. Army Reserve).

Publications:

1. Turner, R. L. 1970. Quicklime: effects on soft-bodied marine organisms. *Science* 168:606-607.
2. Turner, R. L., and J. H. Dearborn. 1972. Skeletal morphology of the mud star, Ctenodiscus crispatus (Echinodermata: Asteroidea). *J. Morphol.* 138:239-262.
3. Turner, R. L. 1974. Post-metamorphic growth of the arms in Ophiophragmus filograneus (Echinodermata: Ophiuroidea) from Tampa Bay, Florida (USA). *Mar. Biol.* 24:273-277.
4. Turner, R. L., E. F. Lowe, and J. M. Lawrence. 1975. Isosmotic intracellular regulation in the freshwater palaemonid shrimp Palaemonetes padosus (Crustacea: Decapoda). *Physiol. Zool.* 48:235-241.
5. Lowe, E. F., and R. L. Turner. 1976. Aggregation and trail-following in juvenile Bursatella leachii pleii. *Veliger* 19:153-155.
6. Prim, P., J. M. Lawrence, and R. L. Turner. 1976. Protein, carbohydrate, and lipid levels of the adult body wall of Actinopyga agassizi, Synaptula hydriformis and Pentacta pygmaea (Echinodermata: Holothuroidea). *Comp. Biochem. Physiol.* 55B:307-309.
7. Turner, R. L. 1976. Sexual difference in latent period of spawning following injection of the hormone 1-methyladenine in Echinaster (Echinodermata: Asteroidea). *Gen. Comp. Endocrinol.* 28:109-112.
8. Turner, R. L., and J. C. Rutherford. 1976. Organic, inorganic, and caloric composition of eggs, pentaculae, and adults of the brooding sea cucumber Cucumaria curata Cowles (Echinodermata: Holothuroidea). *J. Exp. Mar. Biol. Ecol.* 24:49-60.
9. Turner, R. L., and J. H. Dearborn. 1979. Organic and inorganic composition of post-metamorphic growth stages of Ophionotus hexactis (E. A. Smith) (Echinodermata: Ophiuroidea) during intraovarian incubation. *J. Exp. Mar. Biol. Ecol.* 36:41-51.
10. Turner, R. L., and J. M. Lawrence. 1979. Volume and composition of echinoderm eggs: implications for the use of egg size in life-history models. In S. E. Stancyk, ed., Reproductive ecology of marine invertebrates. Belle W. Baruch Lib. Mar. Sci. 9:25-40.
11. Turner, R. L., and C. E. Meyer. 1980. Salinity tolerance of the brackish-water echinoderm Ophiophragmus filograneus (Ophiuroidea). *Mar. Ecol. Progr. Ser.* (In press.)

Papers Read: (*invited papers)

1. Summers, R. G., L. H. Colwin, A. L. Colwin, and R. Turner. 1971. Fine structure of the acrosomal region in spermatozoa of two echinoderms, Ctenodiscus (starfish) and Thyone (holothurian). Marine Biological Laboratory, Woods Hole, 26 August. (Abstract published in Biol. Bull. 141:404.)
2. Turner, R. L. 1973. Release mechanisms for gametes and juveniles of the hermaphroditic coelom-brooder Synaptula hydriformis (Echinodermata: Holothuroidea). American Society of Zoologists, Houston, 28 Dec. (Abstract published in Amer. Zool. 13:1337-1338.)
3. Lawrence, J., K. Erwin, and R. Turner. 1974. Stomach contents of Luidia clathrata (Asteroidea). Florida Academy of Sciences, Orlando, 2 March. (Abstract published in Florida Scientist 37 (Suppl. 1):8.)
4. Turner, R. 1974. Significance of egg-size in echinoderm development. Florida Academy of Sciences, Orlando, 23 March. (Abstract published in Florida Scientist 37 (Suppl. 1):8.)
5. Turner, R. L. 1974. Ultrastructure and function of epidermal glands during intracoelomic development of a brooding sea cucumber. American Society of Zoologists, Southeastern Regional Meeting, Division of Invertebrate Zoology, St. Petersburg, 21 August.
6. Turner, R. L., and E. F. Lowe. 1975. Aggregation and trail-following in juvenile Bursatella (Gastropoda: Anaspidea). Florida Academy of Sciences, Lakeland, 21 March. (Abstract published in Florida Scientist 38 (Suppl. 1):5-6.)
7. Turner, R. L., and J. C. Rutherford. 1975. Caloric content and organic composition of eggs and pentaculae of the brooding holothuroid Cucumaria curata. American Society of Zoologists, Corvallis, 18 August. (Abstract published in Amer. Zool. 15:787.)
8. Turner, R. L., and J. D. Murdoch. 1976. Potential of arms as a nutrient source for disc regeneration in a brittlestar. American Society of Zoologists, New Orleans, 3 June. (Abstract published in Amer. Zool. 16:228.)
- * 9. Turner, R. L., and J. M. Lawrence. 1977. Volume and composition of echinoderm eggs: implications for the use of egg size in life-history models. "Reproductive ecology of marine invertebrates," S. E. Stancyk, chairman. Belle W. Baruch Institute for Marine Biology and Coastal Research, Georgetown, S.C., 12 May.
10. Turner, R. L., and J. H. Dearborn. 1977. Composition of post-metamorphic growth stages in a viviparous brittlestar. American Society of Zoologists, Toronto, 29 December. (Abstract published in Amer. Zool. 17:935.)

11. Stirts, H. M., and R. L. Turner. 1978. Effect of salinity on survival and molting of larval Emerita talpoida (Crustacea: Anomura). Florida Academy of Sciences, Orlando, 14 April. (Abstract published in Florida Scientist 41 (Suppl. 1):12.)
12. Turner, R. L. 1978. Salinity tolerance of the brittle star Ophiophagus filigraneus and its implications for maintenance of community structure in seagrass beds of the Indian River. Second Annual Brevard Water Resources Conference, Melbourne, 14 September.
13. Turner, R. L., and C. E. Meyer. 1978. Salinity tolerance of a brackish-water echinoderm. American Society of Zoologists, Richmond, 30 December. (Abstract published in Amer. Zool. 18:665.)
14. Campbell, D. B., and R. L. Turner. 1979. Comparative skeletal and ossicle morphology of sibling species of Echinaster (Echinodermata: Asteroidea) from the west coast of Florida. American Society of Zoologists, Tampa, 30 December. (Abstract published in Amer. Zool. 19:1009.)
15. Turner, R. L., 1980. Disc autotomy in brittlestars: predator-avoidance mechanism? Florida Academy of Sciences, Tampa, 24 March. (Abstract published in Florida Scientist 43 (Suppl.1):15.)