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PROPOSAL SUBMITTED TO
DADE COUNTY
DEPARTMENT OF ENVIRONMENTAL RESOURCES MANAGEMENT

TO CONDUCT A
BISCAYNE BAY BENTHIC SAMPLING PROGRAM

BY

BIOSYSTEMS RESEARCH, INC.

11550 S.W. 108 Court

Miami, Florida 33176

(305) 238-5509

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11550 S.W. 108 Court
Miami, Florida 33176
(305) 238-5509

Biscayne Bay Benthic Sampling Program

Abstract

This benthic sampling project will be divided into two phases. During Phase I sixty sampling stations will be located and permanently marked in characteristic habitats throughout Biscayne Bay. Abiotic factors will be recorded and dredge samples collected at each station twice during the first year. Underwater photographs will be made of representative sections of the bottom and the dredge samples will be separated through a 0.6 mm sieve and preserved in the field. Seagrasses, macroalgae, and the macrofauna in the samples will be identified and catalogued. A photographic and bottled reference collection will be compiled. One sediment core sample and trawl sample will be collected at each station and analyzed. Quantitative data will be compiled and stored in a computer data base for numerical analyses. A progress report will be prepared at the end of the first six months and a final report on Phase I will be submitted at the end of the first year. During the first year of Phase II of the study five replicate dredge samples will be collected quarterly at each station selected, and analyzed taxonomically; and for seasonal abundance and diversity of macrofauna. Data collected during this phase of the study will also be stored in the computer data base and subjected to mathematical analyses. Correlation of abiotic and biotic characteristics of the sites will be determined and other multivariate analytical tests will be performed. A progress report will be completed at the end of the first six months of Phase II, and an end-of-year report on Phase II including the results of the mathematical analyses will be completed at the end of the second year of the study.

The second year of Phase II (during the third year of the study) will be a continuation of seasonal collections (quarterly) at the sites selected in the first year of Phase II. Additional multivariate analyses will be applied to the data from all three years of the study which will determine annual variation as well as seasonal variation and abiotic and biotic correlation. At the end of the second year of Phase II the data collected from the three year benthic sampling project will be interfaced with the data collected by the other studies concerning Biscayne Bay.

Introduction

This proposal is for a benthic community study to provide information that will be related to other biotic and abiotic data to develop a quantitative understanding of the ecological dynamics of Biscayne Bay. Quantitative benthic data on the major communities of Biscayne Bay are needed to:

1. determine the general trend of change in the bay (particularly since the 1970 McNulty study),
2. quantitatively evaluate the bay as a resource,
3. provide information on the bay to guide restoration planning, and
4. establish a basis on which to evaluate results of future restoration efforts.

This study will pin-point sites of high productivity that can serve as models to guide restoration designs, identify sites of different degrees of disturbance and help in the selection of promising sites for restoration efforts. The benthic study will build a data base to correlate with other factors to provide an insight into factors that damage the bay and factors that buffer the bay from damage. These studies collectively will give insight into the maximum amount of human activity the Bay can support or endure without catastrophic change.

Phase I Methodology

Scope of Phase I:

Sixty sampling stations will be established throughout Biscayne Bay after consultation with other members of the Biscayne Bay Restoration Working Team so that the results of the separate studies (turbidity, circulation, fisheries assessment) may eventually be synthesized. The sixty sampling sites distributed throughout Biscayne Bay will be visited twice in the first year (once in the wet season and once in the dry season). Approximately 120 samples will be collected and analyzed during Phase I of the study. Because of the protected nature of the study area, collecting will be done from a small craft that can be trailered. This greatly simplifies the logistics of the project.

Field:

Abiotic Factors

Depth, time of day, surface and bottom water temperatures, salinity (measured with a refractometer), oxygen, pH, and current direction and estimated speed will be recorded at each station when samples are taken. Visible signs of pollution such as oil slicks will be noted. In areas where the bottom is not visible, water clarity will be measured by Secchi disk reading.

Dredge Samples

At each station one quantitative benthic sample will be collected with a dredge, separated with a 0.6 mm sieve and preserved in buffered 10% formalin (except sponges which will be preserved separately in alcohol). A Ponar or similar type grab dredge will be used, because suction and air-lift dredges mangle the smaller, more delicate organisms so that they are not only unidentifiable but in some cases unrecognizable as separate creatures and therefore unquantifiable.

Core Samples

One core sample will be taken at each station to be analyzed for sediment composition and grain size in the laboratory.

These samples will be analyzed for percent carbonates by comparing weight before and after acidification. A supplementary core sample will be collected at each station at least once during the first year for analysis of organic content by comparing dry weight to ashed weight with water of hydration replaced (Paine, R.T. 1971)

Underwater Photographs and Quantification of Macroflora
Quantitative and qualitative descriptions of macroflora at each station will be obtained by SCUBA diver. A 0.1 meter square bottom area representative of the station will be delineated with a metal hoop placed at a random distance (1 to 10 feet) on a given compass direction from the boat anchor. This bottom area will be photographed in color using strobe light and macro-lens. The diver will then count macroalgae and seagrass blades within the 0.1 meter area. Species will be identified and coverage of blades by epiphytes will be estimated visually in the field. Macroalgae found in the 0.1 meter area and not identifiable in the field will be returned to the laboratory for identification.

Trawls

In order to fill out the species list and the reference collection, at stations selected as representative of specific habitats, one qualitative epibenthic trawl will be made to collect mobile macrobenthic organisms such as crabs, shrimp, and fish because these organisms are unlikely to be collected using a dredge. Samples so collected will be preserved in entirety and sorted and identified in the laboratory.

Laboratory:

Sorting

Samples returned to the laboratory will be washed clear of formalin and separated into major taxa (mollusks, decapods, amphipods, isopods, echinoderms, sponges, polychaetes, fishes, algae, etc.) under binocular dissecting microscopes by trained and experienced personnel. Abundance and biomass (wet weight)

will be determined for each of the above taxa. Wet weight/dry weight ratios will be determined when not available in the literature so that results from this study may be more easily related to other studies in which dry weights are given.

Identification

Mollusks, decapods, amphipods, isopods, echinoderms, fishes, macroalgae, and seagrasses will be identified to the species level by authorities in these groups. Sponges, polychaetes, and crustacea other than those above will be identified to at least the family level. Remaining organisms will be identified to order, class, or phylum.

Reference Collection

A reference collection of organisms will be established. Organisms will be preserved in clear glass jars with black phenolic caps, catalogued, and deposited according to the DERM's specification. A photographic reference collection will also be prepared either as color slides or as black and white prints depending on the preference of DERM. These collections will be presented to DERM at the end of the contract period.

Data Storage and Retrieval

Data from this benthic study will be stored in a data base on computer for analysis. If the Dade County computer facility has the capability to receive telephone-transmitted data, this data base can be transferred to the County computer via telephone at any time, but will also be available in printed form whenever needed.

Phase I Reports

A progress report on Phase I will be prepared and submitted to DERM at the end of the first six months of the project. The final report of Phase I will include descriptions of the sampling sites and a map of their locations. It will include results of the quantitative and qualitative studies of the abiotic characteristics and the sedimentology of the sites, and

a phylogenetic list of all plants and animals collected. It will also include, in matrix form, the results of preliminary correlation analyses of biomass, relative abundance, other biotic factors, and abiotic factors. The correlation matrices will show relative abundance (or biomass) of each animal and plant group versus relative abundance (or biomass) of other organisms, abundance of organisms versus sediment characteristics, turbidity, depth, and vegetation type and density. To the extent possible, the report will address changes that have occurred in the benthos of Biscayne Bay since the time of the McNulty (1970) study. The final report of Phase I will include recommendations to fine tune the sampling design for Phase II of the study. These recommendations will concern locations of the sites, number of stations, and reasons for their selection.

Phase II Methodology (First Year)

Scope of Phase II (First Year):

Based on analysis of data from Phase I of the study, the appropriate number of stations and their locations will be selected, using the methods of Pentico (1981). In this phase of the study, seasonal abundance and diversity of macrofauna will be determined and correlated with abiotic (including seasonal variables) and biotic characteristics of the sites. Five replicate quantitative samples will be collected at each station and analyzed according to the methodology described in Phase I. An estimated 75 samples per quarter will be collected and analyzed. Abundance of organisms and Shannon-Weaver diversity indices will be determined for each station at each season and collectively throughout the year. Multivariate analysis techniques will be used to analyze results of this study (relevant data from associated studies will be included, where useful and available) to maximize the descriptive information obtained from the data.

Phase II Reports:

A progress report on Phase II will be completed and submitted to DERM at the end of the first six months of Phase II which will cover all work completed at that time. A final year-end report on Phase II will be submitted to DERM at the end of the second year of the project. The final year-end report on Phase II will include the results of the computer analyses of the data collected during Phases I and II.

Phase II Methodology (Second Year)

Scope of Phase II (Second Year):

Phase II (Second Year) will continue the collection and analyses of benthic samples quarterly as carried out during the first year of Phase II. An estimated 75 samples per quarter will be collected and analyzed. Quantitative data so gathered will be added to the data base and subjected to numerical analyses directed not only at discovering seasonal variation and correlation of abiotic and biotic characteristics of the sites but also directed at determining annual changes in the bottom communities of the Bay. The information gathered should provide an indication of proper restoration projects and other Bay management policies. Additional effort will be made to interface the data collected from the three year benthic study with data collected by the other parts of the study, specifically those concerned with the water circulation, water quality, and fish resources of the Bay. The resulting data base should serve as a yardstick to measure future changes in the Bay.

Phase II (Second Year) Reports:

As in Phases I and II (First Year), a progress report on Phase II (Second Year) will be prepared at the end of six months and the final report will be completed at the end of the year. The final report will include the results of all phases of the study and the numerical analyses of the data. The numerical analyses will include a number of multivariate techniques, including multiple regressions, analysis of variance and covariance, principal components analysis and factor analysis.

The final report will also include recommendations concerning compiling data from all projects of the Biscayne Bay study into one data base and numerical analyses of the data.

Literature Cited

McNulty, J. K. 1970. Effects of abatement of domestic sewage pollution on the benthos, volumes of zooplankton, and the fouling organisms of Biscayne Bay, Florida. University of Miami Press, Coral Gables, Florida.

Paine, R.T. 1971. The measurement and application of the calorie to ecological problems. Ann. Rev. Ecol. Syst. 2: 145-164.

Pentico, D. W. 1981. On the determination and use of optimal sample sizes for estimating difference in means. The American Statistician. 5(1): 40-43.

BUDGET

Phase I.

	1st 6 mos	2nd 6 mos	Annual
Materials:	\$4,000	\$1,000	\$5,000
Collecting:	\$5,000	\$5,000	\$10,000
Sorting:	\$2,000	\$2,000	\$4,000
Identification:	\$4,500	\$4,500	\$9,000
Outside consultants:	\$1,000	\$4,000	\$5,000
Sediment analysis and Biomass:	\$2,000		\$2,000
Data processing-secretarial:	\$1,000	\$1,000	\$2,000
Overhead 10%:	\$1,950	\$1,750	\$3,700
TOTALS (Year one)	\$21,450	\$19,250	\$40,700

Phase II.

First Year

Materials:	\$1,000	\$1,000	\$2,000
Collecting:	\$5,000	\$5,000	\$10,000
Sorting:	\$3,750	\$3,750	\$7,500
Identification:	\$6,250	\$6,250	\$12,500
Outside consultants:	\$1,500	\$1,500	\$3,000
Data processing-secretarial:	\$1,500	\$1,500	\$3,000
Overhead 10%:	\$1,900	\$1,900	\$3,800
TOTALS (Year two)	\$20,900	\$20,900	\$41,800

Phase II.

Second Year

Materials:	\$1,000	\$1,000	\$2,000
Collecting:	\$5,000	\$5,000	\$10,000
Sorting:	\$3,750	\$3,750	\$7,500
Identification:	\$6,250	\$6,250	\$12,500
Outside consultants:	\$1,500	\$1,500	\$3,000
Data processing-secretarial:	\$2,000	\$4,000	\$6,000
Overhead 10%:	\$1,950	\$2,150	\$4,100
TOTALS (Year three)	\$21,450	\$23,650	\$45,100

PERSONNEL

Dr. Peter Schroeder (Co-principal investigator)
Estuarine Ecology, Marine Angiosperms,
Macroalgae, Data Analysis

Dr. Patsy A. McLaughlin (Co-principal investigator)
Decapod Crustacea exclusive of Brachyurans,
Stomatopods, Barnacles

George Darcy
Echinoderms, Fishes, Mollusks, Polychaetes

Rafael Lemaitre
Brachyuran crabs

Sara-Ann F. Treat
Isopods

James D. Thomas
Amphipods

* See attached curricula vitae.

WORK SCHEDULE

Work Schedule Phase I

	1981----- 1982-----	
	Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul	
	[Late Wet] [Dry Season] [Early Wet] *	
Select Stations **	-	
Establish Stations	-----	
Collect Wet Season Samples	-----	
Analyze Wet Season Samples	-----	
Collect Sediment Samples	-----	
Analyze Sediment Samples	-----	
Collect Dry Season Samples	-----	
Analyze Dry Season Samples	-----	
Enter Data in Data Base	-----	
Statistical Analyses	-----	
Prepare Progress Report	-----	
Prepare Final Report Phase I	-----	

- * Unfortunately seasonal changes in rainfall do not always coincide with the seasons as indicated.
- ** Selection of stations made in consultation with other members of the Biscayne Bay Restoration Working Team.

Work Schedule Phase II First Year

	1982----- 1983-----	
	Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul *	
	[Late Wet] [Early Dry] [Late Dry] [Early Wet]	
Select Stations **	-	
Collect Wet Season Samples	-----	-----
Analyze Wet Season Samples	-----	-----
Collect Dry Season Samples		----- -----
Analyze Dry Season Samples		----- -----
Enter Data in Data Base	-----	-----
Statistical Analyses	-----	-----
Prepare Progress Report		-----
Prepare Year-end Report Phase II		----- -----

* Unfortunately seasonal changes in rainfall do not always coincide with the quarterly seasons as indicated.

** Selection of Phase II stations will occur primarily during Phase I.

Work Schedule Phase II Second Year

	1983-----	1984-----	
	Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul		*
	[Late Wet] [Early Dry] [Late Dry]		[Early Wet]
Collect Wet Season Samples	-----		-----
Analyze Wet Season Samples	-----		-----
Collect Dry Season Samples		----- -----	
Analyze Dry Season Samples		----- -----	
Enter Data in Data Base	----- -----		
Statistical Analyses	----- -----		
Transfer Data Base to DERM			---
Prepare Progress Report		-----	
Prepare Final Report Phase II		----- -----	

* Unfortunately seasonal changes in rainfall do not always coincide with the quarterly seasons as indicated.

BIOSYSTEMS RESEARCH, INC.

Biosystems Research is a small Florida corporation founded in 1977. It is owned exclusively by Joan Browder and Peter Schroeder and was created as a vehicle for biological research for its owners. As such it has engaged in restoration projects, water quality analysis, and data analysis. Specifically some passed projects included:

Mangroves Restoration at Cocoplum for Arvida Corporation.

Water Quality Analyses for Arvida Corporation including the following quantitative tests:

Dissolved oxygen, Salinity, pH, Turbidity, BOD, Carbon, Organic content, Phosphates, Sulfates, Kjeldahl nitrogen, Ammonia nitrogen, Organic nitrogen, Zinc, Copper, Lead, Cadmium, Manganese, Mercury, Chromium, Oil and grease, and others.

Created various data base and analytical programs for Everglades National Park, Research Center.

Present projects (June 1981) include:

Mangrove restoration along aqueduct in Florida Keys for Latex Corporation.

Water analyses in Cocoplum canal system for Arvida Corporation.

Biosystems Research owns two trailable outboard motor boats, two small trucks, analytical equipment needed for water analyses, computer facilities with Fortran, Pascal, Algol and Basic. The company has available working space, microscopes needed for identifying certain marine organisms, collecting equipment, sieves, etc. and access to its own library and other libraries containing the literature concerning Biscayne Bay; its flora and fauna. In short, Biosystems Research has the tools needed to carry out this project as proposed. Although the company, itself, has not engaged in a benthic analysis project of this magnitude before, all of the personnel associated with Biosystems Research, Inc. in this proposal have. The co-principal investigators have had wide experience in the analysis of tropical and subtropical estuarine benthic samples and a long and ardent interest in Biscayne Bay in particular (see curricula vitae). Because Biosystems Research is a small business, it carries none of the excess baggage accumulated by some of the larger organizations and therefore is able to do more for less.

CURRICULUM VITAE

4/21/81

NAME: Peter Brett Schroeder

ADDRESS: 11550 S.W. 108th Court, Miami, FL 33176

PHONE: home: (305) 238-5509 office: (305) 253-1294

PLACE OF BIRTH: Washington, D.C. BIRTH DATE: 6/23/32

MARITAL STATUS: Married to Dr. Joan A. Browder

EDUCATION:

University of North Carolina (Political Science, B.A.)
1950 - 1954.

Columbia University in N.Y. City (International Affairs
and East Asian Studies) 1954 - 1957, 1959 - 1960.

University of Miami (Special student in Biology)
1967 - 1968.

Puerto Rico Nuclear Center (Oak Ridge Associated
Universities Laboratory Participant) 1972 - 1974.

University of Miami (Biology, Ph.D.) 1969-1975.

DISSERTATION TITLE: Thermal Stress in Thalassia testudinum.

POSITIONS AND APPOINTMENTS:

Scientific Translator-bibliographer. National Agricultural
Library. U. S. Department of Agriculture. Washington
D. C.
1960 - 1965.

Duties included translation and abstracting
scientific publications in Chinese, Japanese,
and Korean.

Graduate Teaching Assistant. Department of Biology. University
of Miami. Coral Gables, Florida.
1968 - 1972.

Duties included preparing and teaching laboratory
sections in Developmental Biology, Embryology, and
Ecology. In addition, it included organizing, co-
ordinating, and teaching laboratory sections of
courses in Ecology and Systematics, preparing
lectures in techniques of remote sensing analysis of
vegetation communities; preparing and presenting
lectures on histology to nursing students, and
organizing and conducting field trips to the Dry
Tortugas, the Florida Everglades, the Big Cypress
Swamp, and various Florida Keys includingignum

Vitae Key.

Laboratory Participant. Radioecology Division. Puerto Rico
Nuclear Center. Mayaguez, P. R.
1972 - 1974.

Duties includes participation in the preparation of environmental impact statements associated with selecting sites for nuclear power stations. This work involved preparing inventories of marine organisms at different locations on the coast of Puerto Rico; making and interpreting aerial photographs; the study of current patterns using aerial dye drops. Research at the Puerto Rico Nuclear Center also included analysis of the effects of a thermal effluent on marine organisms in Quayanilla Bay in Puerto Rico. This research included biomass and productivity measures in the field, and microcosm experiments employing gamma emitting radionuclides in the laboratory. The latter research led to a new approach to computer analysis of gamma emission spectra involving matrix inversion, and determined that the probable cause of symptoms of thermal stress in certain marine organisms resulted from the disruption of their osmoregulatory function.

Research Assistant. Center for Wetlands. University of
Florida.
1975.

Duties included participation in preparation of a Wetlands Atlas, and involved computer search of the scientific literature. Aerial photography of wetland areas in Florida was also involved.

Research Associate. Department of Microbiology. University
of Miami.
1975 - 1978.

Research involved mineral cycling in tropical seagrass communities by means of microcosm experiments studying the uptake and release rates of cadmium-109, cobalt-60, cesium-137, iron-59, manganese-54, sodium-22, strontium-85, and zinc-65 by marine organisms as affected by temperature and salinity. This research explored the flow through nearshore marine environments of radiopollutants, heavy metals and micronutrients; and the effect of temperature and salinity on osmoregulation in marine plants. Data from these experiments were incorporated into mathematical models which were simulated on a microcomputer.

Research Associate. Rosensteil School of Marine and
Atmospheric Science. University of Miami
1978.

Research described above finished in this position.

President. South Florida Environmental Research Foundation.
1978 - present.

This organization is a public supported non-profit research and education foundation organized to promote a quantitative approach to ecological research in south Florida. It has offered a graduate level course in Conceptual and Simulation Modelling of Environmental Systems at cost to graduate students in science and professional people with a scientific background and presented this ten lecture course to the senior scientific personnel at everglades National Park.

LANGUAGES;

Some spoken knowledge of Spanish and Mandarin.
Reading knowledge of Spanish, French, Chinese, and Japanese.

MILITARY:

U. S. Army. Pfc. Intelligence Analyst (MOS 962.20).
Honorable discharge. 1957 - 1958.

CERTIFICATIONS AND LICENSES:

SCUBA Diver. PADI Certificate.
Airplane Single and Multiengine Land. Approx. 500 hrs.

HONORS AND AWARDS:

Oak Ridge Associated Universities Laboratory
Participant. 1972 - 1974.

PROFESSIONAL AND HONORARY ORGANIZATIONS:

Sigma Xi
Florida Academy of Sciences
Botanical Society of America
American Institute of Biological Sciences
American Association for the Advancement of Science
American Society of Plant Physiologists
Society for Computer Simulation

TEACHING SPECIALIZATION:

Mathematical Modelling and Computer Simulation of
Biological and Ecological Systems.
Mathematical, Population, and Systems Ecology.
Plant Physiology.
Radiation Biology and Radioecology.
Wetlands, Estuarine, and Marine Ecology.
Computer Analysis and Data Storage in Biology.

Numerical Taxonomy.

PUBLICATIONS:

- 1961 (with L.T.C. Kuo) Communist Chinese Monographs in the USDA Library. Nat. Agr. Library. USDA. 87 pp.
- 1962 Japanese Serial Publications in the National Agricultural Library. Nat. Agr. Library. USDA. 197 pp.
- 1963 (with L.T.C. Kuo) Communist Chinese Periodical in the Agricultural Sciences. Nat. Agr. Library. USDA. 33 pp.
- 1973 Study on the effect of heated water on turtle grass, Thalassia testudinum Konig, in Guayanilla Bay. pp. 304-319. In: 1972 Annual Report Aquirre Power Project. PRNC. P.R. 162 pp.
- 1974 (with S. Kolehmainen and F. Martin) Thermal studies on tropical marine ecosystems in Puerto Rico. pp. 409-442. In: Environmental Effects of Cooling Systems at Nuclear Power Plants. Proceedings of a symposium held at Oslo, August 26-30, 1974.
- 1975 Thermal Stress in Thalassia testudinum. Ph.D. Dissertation. University of Miami, Coral Gables, Florida. 157 pp.
- 1977 (with A. Thorhaug) A comparison of the biological effects of heated effluents from two fossil fuel plants: Biscayne Bay, Florida, in the subtropics; Guayanilla Bay, Puerto Rico, in the tropics. pp. 133-164. In: S. Lee and S. Sengupta (eds.) Waste Heat Management and Utilization. Proceedings of a conference held at Miami Beach, Florida, May 9-11, 1977.
- 1978 (with A. Thorhaug and N. Blake) The effects of heated effluents from power plants on the seagrass, Thalassia testudinum, quantitatively comparing estuaries in the subtropics to the tropics. Marine Poll. Bull. 9:181-187.
- 1980 (with J. Browder) A microcomputer stochastic simulation model of seed dispersion of Melaleuca quinquenervia. pp. 27-43. In: V. Boyd et al. (eds.) The 13th Annual Simulation Symposium. Proceedings of a symposium held at Tampa, Florida, March 19-21, 1980.
- 1980 (with A. Thorhaug) Trace metal cycling in tropical-subtropical estuaries dominated by the seagrass Thalassia testudinum. Amer. J. Bot. 67(7): 1075-1088. REFEREED.

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 Indo-Pacific 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 environmental resources, as well as curator of the departmental invertebrate collections.

1975 - 1977: Director, Applied Marine Ecological Services, Inc.'s Sorting Center, Miami, Florida.

Under a contract with Florida Power Corporation, Applied Marine Ecological Services, Inc., undertook an indepth survey of the benthic animals and seagrasses in Anclote Anchorage in the vicinity of the power company's discharge canal. I was responsible, in part, for the planning and initial proposal for the contract, and subsequently for the establishment and direction of a sorting facility for the processing and identification of the animals collected (in excess of 1000 samples). My responsibilities included the hiring, training and supervision of laboratory personnel; development of sorting procedures and techniques; arrangement for identification and training programs by taxonomic experts; verification of the general identifications of all marine invertebrates collected; personnel management; compilation of data for computer analyses; presentation of reports and testimony; and personally for the identifications of all decapod crustaceans and cirripeds in the collections.

1973 - 1975: Research Assistant Professor, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL.

Principal research was concerned with the systematics and morphology of the pagurid fauna of the tropical western and subarctic north Atlantic, under the auspices of the National Science Foundation and the Norwegian Research Council for Science and the Humanities. Additional responsibilities included occasional lectures on crustacean morphology and systematics; identification of and consultation on decapod crustaceans and cirripeds; student advisor and principal investigator for student research proposals.

1969 - 1973: Research Associate, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL.

Primary research was devoted to taxonomic and morphological studies on western Atlantic hermit crabs. Supplemental studies included work on the comparative morphology of complementary males in sessile cirripeds; routine identifications of pagurid and cirriped collections; and cataloging and curatorial maintenance of the collections. Concurrently (1969 - 71) I was completing my research studies on the north Pacific hermit crabs which were the topic of my doctoral dissertation.

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

As supervisor for invertebrates I was responsible for the training and supervision of 18 technicians in the sorting and preliminary identifications of benthic invertebrates processed by the Center. This training included my giving informal classes in invertebrate zoology, and instruction in curatorial methods, record maintenance and cataloging. In addition I was responsible for the preparation of proposals for grants and contracts; the purchase of supplies and equipment; the 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; field collecting; preliminary development of data retrieval systems; review of proposals and manuscripts; and record maintenance and cataloging.

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

My responsibilities, as associate investigator for a National Science Foundation grant, included the 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 preparation of reports; and the routine identifications of Pacific barnacles.

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 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 invertebrates found in the stomach contents of bearded and ringed seals from the Chukchi Sea.

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

Duties included the identification of benthic invertebrates co-existing with the Alaskan king crab, *Paralithodes camtschatica*, and studies of the crabs' ecology; planning and conducting studies on the food habits of the 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).

Editorial Reviewer for:

Bulletin of Marine Science
Journal of Biogeography
Journal of Morphology
Marine Biology

Contributor:

"Marine Fauna and Flora of Bermuda", in press.
"Marine Invertebrates of Scandinavia", in preparation
"Reef and Shore Fauna of Hawaii", in preparation

Honors:

American Men and Women of Science
Research Associate, National Museum of Natural History (1980-1983)

Honorary Societies

Phi Sigma
Sigma Xi

Professional Societies:

American Association for the Advancement of Science
American Society of Zoologists
Biological Society of Washington
Crustacean Society -- Chairperson, Finance Committee
Florida Academy of Science
Gulf and Caribbean Fisheries Institute
Society of Systematic Zoology
Southern California Academy of Science
Western Society of Naturalists

Consulting Responsibilities:

Applied Marine Ecological Services, Inc., 1977 - present.
Atalanta Corporation, New York, N. Y., 1972 - 1974
Beaver Street Fisheries, Inc., Jacksonville, FL, 1974.
Bernice P. Bishop Museum, Honolulu, Hawaii, 1973 - present.
Boyce Thompson Research Institute, Yonkers, N. Y., 1974.
Dauphin Island Sea Laboratory, University of Alabama, 1978 to present.
Florida State Department of Natural Resources, 1974 to present.
Friends of the Everglades, 1979 to present.
Great American Crab Company, Orlando, FL, 1976 - 1978.
Instituto de Investigaciones Marinas de Punta de Betin, Santa Marta,
Colombia, 1975 - present.
Instituto Oswaldo Cruz, Rio De Janeiro, Brazil, 1973 - present.
Mote Marine Laboratory, Sarasota, Florida, 1979 - present.
National Museum of Natural History, Smithsonian Institution, Washington,
D. C., 1973 - present.
National Oceanographic & Atmospheric Administration, 1968 - 1969, 1972 -
present.

Consulting Responsibilities (cont.):

Post Buckley Schuh & Jernigan, Miami, Florida, 1979 - present.
Smithsonian Institution, Ft. Pierce Bureau, Ft. Pierce, FL, 1979 - present.
Smithsonian Oceanographic Sorting Center, Washington, D. C. 1979 - present.
Stone and Webster Engineering Co., Boston, Mass., 1979.
Raytheon Corporation, 1975 - 1976.

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, Galapagos Islands and Peru.
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.
1980 Ecological sampling of invertebrates and fishes, Watson Island,
and Florida Keys.

University Graduate Committees:

- Master's thesis committee for Cathv A. Salmons, Department of Biology
University of Miami, co-chairperson (Cirripedia), 1975.
- Master's thesis committee for Julio Garcia-Gomez, Rosenstiel School of
Marine & Atmospheric Science, University of Miami, co-chairperson (Paguridae),
1978.
- Master's thesis committee for Charles M. Courtney, School of Technology,
Florida International University, chairperson (Environmental and Urban
Systems, Limnology), 1979.
- Master's thesis committee for Sara-Ann F. Treat, School of Technology,
Florida International University, chairperson (Environmental and Urban
Systems, Isopoda), 1979.
- Master's thesis committee for Rafael Lemaitre, School of Technology, Florida
International University, chairperson (Environmental and Urban Systems,
Brachyura), current.
- Master's thesis committee for W. Neil Gillies, School of Technology, Florida
International University, chairperson (Environmental and Urban Systems,
Amphipoda), current.
- Doctoral dissertation committee for John C. Markham, Rosenstiel School of
Marine and Atmospheric Science, University of Miami, (Bopyridae), 1974.
- Board of Examiners (Ph.D.), S. Ajmal Khan, Centre of Advanced Study in
Marine Biology, Annamalai University (India), chairperson (Decapoda, Anomura),
1978.
- Doctoral dissertation committee for Sara-Ann F. Treat, University of South
Florida, major professor and co-chairperson (Ecology and Biogeography of
Florida Isopoda), current.

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, CA, National Science Foundation sponsored, October 23 - November 3, 1978, participant.

Crustacean workshop, American Society of Zoologists, Richmond, VA, December 30, 1978, invited paper.

14th Pacific Science Congress, Rhabarovsk, USSR, August 20 - 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. Heard). 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 tortuosa* 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. L. 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 J. P. 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 into a *Thalassia testudinum* restoration site. *Florida Scientist*, 41: 19 (abstract) (with A. Thorhaug).
- 1979a. *Megabalanus vesiculosus* (Darwin) [Cirripedia, Thoracica] from Brazil, with a redescription of the species. *Revista Brasileira 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: Oxyrhyncha). *Crustaceana*, Supplement 5: 47-54 (with W. T. Yang).
1980. "Comparative morphology of Recent Crustacea". W. H. Freeman and Company, San Francisco, California, 177 pp.
- 1981a. 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*, 31(1): 1-30.
- 1981b. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda:

Paguridae), with the descriptions of new genera and species: Part II. *Rhodochirus* McLaughlin and *Phimochirus* McLaughlin. Bulletin of Marine Science, 31(2):

- In press The animal community of a restored seagrass (*Thalassia*) bed. Environmental Conservation (with S. F. Treat, A. Thorhaug, and R. Lemaitre).
- In press Comparative morphology of crustacean appendages. In: L.G. Abele (ed.), "Biology of the Crustacea", vol. 1, chap. 7. Academic Press, New York.
- In press Systematic methods in crustacean research. In: L.G. Abele (ed.), "Biology of the Crustacea", vol. 1, chap. 11. Academic Press, New York (with G. T. Taylor and M. L. Tracey).
- In press Internal anatomy. In: L.H. Mantel and D.E. Bliss (eds.), "Biology of the Crustacea", vol. 2, chap. 1. Academic Press, New York.
- In press The 'provenzanoid' group of hermit crabs (Crustacea, Decapoda, Paguridae) in the western Atlantic, Caribbean, and Gulf of Mexico. Part III. *Pagurus protuberocarpus*, a new species from the southern Caribbean. Bulletin of Marine Science.
- In press The 'provenzanoid' group of hermit crabs (Crustacea, Decapoda, Paguridae) in the western Atlantic, Caribbean, and Gulf of Mexico. Part IV. A review of the group, with notes on variation and abnormalities. Bulletin of Marine Science (with R. Lemaitre and J. García-Gómez).
- In press Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part III. *Agaricochirus* McLaughlin, *Enallopagurus* McLaughlin, and *Enallopaguroopsis* McLaughlin. Bulletin of Marine Science.

GEORGE H. DARCY

WORK ADDRESS: National Marine Fisheries Service
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HOME ADDRESS: 17911 S.W. 92 Ct.
Miami, Fla. 33157
PHONE: (305) 235-8602

PERSONAL INFORMATION: Born August 16, 1951, Chicago, Illinois; married.

EDUCATION:

GRADUATE: University of Miami, Rosenstiel School of Marine and Atmospheric Science; M.S. in Marine Biology, June, 1978; currently enrolled in doctoral program.

Dissertation (Ph.D.): "Ecology of the Mollusks of Anclote Anchorage, Florida"

Thesis (M.S.): "Ecology of the crested goby, Lophogobius cyprinoides (Pisces: Gobiidae), in southern Florida"

Courses: Biology-Zoology (24 semester hours), Oceanography (4), Fisheries Science (3), Biometrics-Computers (5), Biological Illustration (2).

Honors: Maytag Fellowship.

UNDERGRADUATE: University of Rochester, Rochester, New York; B.A. Biology with High Honors, 1973.

Relevant Courses: Biology-Zoology (36 semester hours), Ecology (16), Limnology-Oceanography (8), Chemistry (16), Math (12), Geology (4), Business Administration (4).

Honors: Chester A. Dewey Award for Excellence in Biology, 1973; New York State Regents Scholarship, 1969-73; Dean's List, 1970-73; Rochester Prize Scholarship, 1969.

SECONDARY: Pittsford High School, Pittsford, New York; Regents Diploma, 1969.

EXPERIENCE:

Apr. 1978- Fisheries Biologist, National Marine Fisheries Service, Southeast
Present: Fisheries Center, Miami, Florida.

Prepares special reports, species synopses, and abstracts for the Office of Fisheries Management, including preparing and reviewing research needs. Critically reviews fishery management plans including editing and reviewing information included in the plans. Searches out and retrieves literature and data pertinent to U.S. fishing interests. Assists in determining surplus fish stocks.

Mar. 1977- Consultant to Florida Bio-Consultants, Inc., Coral Gables, Florida.
Oct. 1977:

Impact study of effects of desalinization effluent on shallow-water benthic communities. Responsible for hiring and supervising sorters. Identifications of all invertebrates and fishes collected in the monthly sampling program.

Jan. 1976- Assistant supervisor, Applied Marine Ecological Services, Inc., Miami,
Jan. 1977: Florida.

Impact study of effects of heated powerplant effluent on benthic communities. Responsible for all identifications of fishes, mollusks, echinoderms, and cephalochordates collected in the benthic sampling program, and included study at the U.S. National Museum. Supervised technicians and sorting operations, and developed field and laboratory sorting procedures. Analyzed and interpreted data on fish distribution as affected by powerplant effluent.

Summer 1975: Field and Laboratory Assistant, Controlled Environmental Pollution Experiment (CEPEX), Vancouver Is., British Columbia, Canada.

Responsibilities included the operation of small boats and the collection of marine plankton, as well as general laboratory duties.

Sept. 1973- Graduate Student, RSMAS, University of Miami, Miami, Florida.
May 1978:

Completed extensive coursework and conducted independent thesis research on fish ecology, including field and lab studies of morphology, growth, life history, food habits, larval stages and temperature and salinity tolerances of an estuarine fish. Included statistical analysis of morphometry and growth.

1970- Limnological laboratory and field assistant, University of Rochester,
1972: Rochester, New York.

Extensive field collection and lab analysis of water samples and benthic sediments using pH meters, oxygen meters, benthic grabs, salinometers, transmissometers, spectrophotometers, etc.

Other Consulting Responsibilities: Univ. Miami/INDERENA Colombia, 1981, impact of pollutants and seasonality of benthic organisms in Cartagena Bay, Colombia; Fla. Internat. Univ., 1980, impact of sand dredging off Broward Co., Fla.; Applied Mar. Ecol. Serv., Inc., 1979, potential impact of Watson Is. development, Biscayne Bay, Fla.; Deltona Corp., 1978, impact of sand dredging off Marco Is., Fla.; Iver Brook, 1978, impact of naval bombing off Vieques Is., Puerto Rico; Fla. Internat. Univ., 1978, seagrass restoration in Biscayne Bay, Fla.; Applied Mar. Ecol. Serv., Inc., 1978, impact of proposed port enlargement, Miami, Fla.; Mariculture, Ltd., 1974, impact of mariculture effluent on bottom communities, Grand Cayman, B.W.I.

Teaching Experience: Teaching Assistant, University of Miami, 1978, laboratory instructor for marine undergraduate course.

Guest Lecturer, Florida International University, Miami, Fla., 1977, 1978, presented lectures on fish and mollusk ecology and taxonomy.

Field Experience:

1981: University of Miami, RSMAS/INDERENA Colombia, trawl and grab survey of Cartagena Bay, Colombia.

1976: Applied Marine Ecological Services, Inc., Anclote Field Site, Florida.

1973-76: University of Miami, RSMAS, ichthyological sampling.

1975: Biological field assistant, CEPEX, Vancouver Is., British Columbia.

1974-1975: University of Miami, deepsea trawling survey of the fishes of Tongue-of-the-Ocean, Bahamas; two cruises.

1974: Mariculture, Ltd., Grand Cayman, B.W.I., survey of effects of mariculture wastes on benthic, littoral and fish populations.

1972: West Indies Laboratory, St. Croix, U.S. Virgin Islands, extensive field work and sampling of reef, grassbed, and littoral communities.

1970: University of Rochester, limnological field assistant.

1970-1979: Field collection of mollusks and invertebrates: U.S. Virgin Is., South Carolina, Massachusetts, Maine, Florida, Cayman Islands, Bermuda, west coasts of U.S. and Canada.

OTHER SKILLS: NAUI-certified SCUBA diver; biological illustration; reading knowledge of German, some French.

PROFESSIONAL SOCIETIES: American Institute of Fisheries Research Biologists; American Malacological Union; American Society of Ichthyologists and Herpetologists

PUBLICATIONS:

1980. Comparison of ecological and life history information on gobiid fishes, with emphasis on the southeastern United States. NOAA Tech. Memo. NMFS-SEFC-15. 53p.

1978. Ecology of the crested goby, Lophogobius cyprinoides (Pisces: Gobiidae), in southern Florida. M.S. Thesis, Univ. Miami, Coral Gables, Fla., 283p.

1974. Cleaning preferences of the gobies Gobiosoma evelynae and G. prochilos and the juvenile wrasse Thalassoma bifasciatum. Copeia, 1974(2):375-379.

In Press. Annotated bibliography of the conch genus Strombus (Gastropoda, Strombidae) in the western Atlantic Ocean. NOAA Tech. Rep. NMFS SSRF.

In Press. Food habits of the crested goby, Lophogobius cyprinoides, in two Dade County, Florida, waterways. Bull. Mar. Sci.

CURRICULUM VITAE OF Rafael Lemaitre

Date of Birth: January 18, 1952

Place of Birth: Cartagena, Colombia

Marital Status: Married (Rossana Lemaitre)

Dependents: one child (age 2 1/2 years)

Type of Visa: Resident Alien (Alien Number 21110142)

Social Security Number: 263-81-9712

Home Address: 322 NW 107 avenue, #12, Miami, FL 33172; Telephone (305) 551-1096

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

Education: Bachiller 1970 Liceo Frances Louis Pasteur, Bogota, Colombia.

Marine Biologist 1976 Universidad Jorge Tadeo Lozano, Bogota and Cartagena, Colombia. Thesis: "Notas sobre una colección de crustáceos decápodos Brachyura de aguas someras en la costa del Caribe alrededor de Cartagena, Colombia. I. Familia Xanthidae".

Education: 1969 Bachiller (High School), Liceo Frances Louis Pasteur, Bogota, Colombia.

1972-1977 Marine Biologist, Universidad Jorge Tadeo Lozano, Bogota and Cartagena, Colombia. Thesis title: "Notas sobre una colección de crustaceos decapodos Brachyura de aguas someras en la costa del Caribe alrededor de Cartagena, Colombia. I. Xanthidae".

1977-1981 Master of Science in Environmental and Urban Systems, School of Technology, Florida International University, Miami, Florida. Thesis title: "The distribution and morphological variations of the crabs (Decapoda, Brachyura, Xanthidae) Neopanope packardii (Kingsley) and Neopanope texana (Stimpson) at Anclote Anchorage, Florida".

1981- Ph.D. Candidate (Admission applied for Fall of 1981), Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Coral Gables Florida.

Positions Held:

1981 Consultant for Continental Shelf Associates, Tequesta, Florida. Identification of brachyuran crabs.

1980 Research Assistant^S on the assessment of the potential offshore sand borrow sites for Broward County. Sorting and identification of the brachyuran crabs.

1979 Research Assistant^S on the impact study of the expansion of the Port of Miami done for the Port Authority and the engineering firm of Post Buckley Schuh & Jernigan, Inc. Sampling, sorting and identification of the brachyuran crabs.

1977-1978 Research Assistant on the survey of the animal communities of restored seagrass beds in the vicinity of Florida Power and Light Company's plant at Turkey Point, Biscayne Bay, Florida. Sampling, sorting and identification of the brachyuran crabs.

1975-1976 Professor of General Biology (Secondary), Colegio John F. Kennedy, Cartagena, Colombia.

Field Experience:

1975-1977 Participant on numerous ecological surveys of Bahia de Cartagena and adjacent areas as part undergraduate training and sampling for Thesis.

1977-1978 Quartely sampling in the area of Turkey Point, Biscayne Bay, Florida.

1978 Sampling of invertebrates and fishes, Port of Miami.

1978, 1979, 1980 Crustacean Biologist on board the R/V Bellows during three cruises to Cay Sal Banks, Bahamas. Sampling included deep-water, mid-water and shallow fauna.

Professional Societies:

American Society of Zoologists
Biological Society of Washington
Crustacean Society
Crustacean Club

Publications:

1981. Shallow-water crabs (Decapoda, Brachyura) collected in the southern Caribbean near Cartagena, Colombia. *Bulletin of Marine Science* 31(2):
- In press The animal community of a restored seagrass (*Thalassia*) bed. *Environmental Conservation* (with P. A. McLaughlin, A. Thorneau, and S. F. Treat).
- In press The 'provenzanoid' group of hermit crabs (Crustacea, Decapoda, Paguridae) in the western Atlantic, Caribbean, and Gulf of Mexico. Part II. *Pagurus gymnodactylus*, a new species from the Gulf of Mexico and a comparison with *Pagurus annulipes* (Stimpson). *Bulletin of Marine Science*.
- In press The 'provenzanoid' group of hermit crabs (Crustacea, Decapoda, Paguridae) in the western Atlantic, Caribbean, and Gulf of Mexico. Part IV. A review of the group, with notes on variations and abnormalities. *Bulletin of Marine Science* (with P. A. McLaughlin and J. García-Gómez).