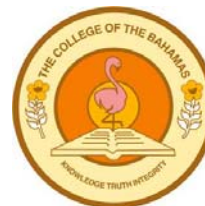


The College of The Bahamas

VICE PRESIDENT RESEARCH, GRADUATE PROGRAMMES,
& INTERNATIONAL RELATIONS

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Established 1974

SELECTED RESEARCH PROJECTS AT THE COLLEGE OF THE BAHAMAS

FOCUS ON EDUCATION

1. Linda Russell (Assistant Professor, School of Education)

Research Focus--The Impact of Mentoring and Coaching High School English Teachers in Their Teacher Research Activities

Description--The objectives of this study are (1) to provide a mentoring and coaching programme for in-service teachers; (2) to develop a teacher mentor and coaching centre as a resource for student and in-service teachers; and (3) to incorporate the findings into the curriculum. There is prototype of a learning center (2 workstations) contained within the researcher's office. Last academic year, she incorporated the learning resource center into her curriculum on a trial basis. She has qualitative data based on comments made by students regarding the use of the resource center from this last semester. She has also made visits to a school on Eleuthra Island and one in New Providence. Both schools have agreed to participate in her study and to participate in the mentoring programme that she wishes to pilot. This study is innovative because it challenges the existing paradigm that teachers experience isolation and lack of appropriate guidance once they leave the practicing teacher phase of their training.

2. Dr. Evelyn McCollin (Assistant Professor, School of Social Sciences)

Research Focus--Establishing a History Resource Center at The College of The Bahamas

Description--The objectives of this research are to (1) improve student attitudes towards the study of history; (2) improve academic achievement in history; and (3) encourage faculty to integrate curriculum enhancement modules in their course. The researcher is interested in establishing a pilot history resource centre that provides appropriate "hands-on" activities and other materials. She is going to begin identifying materials for use in the center and also to investigate the placement of the materials on-line so students can have access to these activities remotely. It is envisioned that this study could function as a pilot that incorporates the concept of the "library without walls." Eventually this would be a cost effective way to distribute learning materials to students across the campuses of The College of The Bahamas, and the wider educational system.

3. Vicente Roberts (Counselor); Susanne Newbold (Counselor); Stanley Smith (Counselor), Department of Counseling & Health Sciences

Research Focus--Resiliency in students at risk so as to facilitate retention and successful matriculation during their final year in high school and first year in college.

Description--The Bahamas, Guyana and Jamaica are the focus of an OAS funded research project that in year one (2007-08) seeks to assess students skills set and identify those students at risk; and increase the number of students successfully completing their senior year in high school and freshmen year in a post-secondary institution. During the second year of the study, peer facilitators will assist in addressing academic deficiencies and psychosocial issues. Peer tutors will provide support by assisting students with academic difficulty. The Bahamas will train 20 peer tutors while Jamaica and Guyana will train 10 peer facilitators each.

It is envisioned that timely and relevant support will prevent unnecessary failures and dropouts during the freshmen year.

4. Dr. Janet Patterson (Lead Researcher, Assistant Professor, School of Sciences & Technology)

Research Focus--Investigating the Relationship Between Student Participation in a Mathematics Enrichment Programme and Performance in College Level Mathematics Courses and Selection of Career Choices

Description—The objectives of this study are to (1) conduct a summer student enrichment programme for promising mathematics students for three years (at the end of grades 9, 10, and 11); (2) evaluate progress made in each summer workshop; and (3) evaluate the academic success of participating students in year one of college mathematics and determine their career choices. The researchers identify ninth grade students who participate in a mathematics enrichment programme. It is envisioned that summer workshops will be conducted during three summers. The first session began during the summer of 2007. The students will be followed through their first year at The College of The Bahamas to track their performance level and career choices.

5. William Fielding (Lead Researcher, Director of Planning)

Research Focus--Faculty survey of student engagement (on-going)

Description--This study seeks to ascertain the views of faculty as to how engaged are students at the College; engagement is considered to be an indicator of quality. Improving the quality of the student experience at the College is one of the goals of the Strategic Plan. It will allow the College to benchmark its performance with North American colleges.

6. Dr. Ruth Sumner (Associate Professor) and Maryann Lotmore (Assistant Professor), School of Education

Research Focus--Development of a Literacy Handbook

Description--For some time now the achievement of graduates of the educational system in the area of literacy has been a matter of concern throughout the country. A growing number of private agencies, to which graduates go in search of jobs, have observed that far too many of them lack even the most basic of skills, being unable to accurately complete job applications. Accepting that a major contributor to this problem is the preparation of teachers to deal with this problem, this handbook is being developed as a means of providing teachers with skills to manage literacy challenges across the educational system: pre-primary, primary and secondary.

7. Dr. Lincoln Marshall (Associate Professor and Executive Director, Culinary & Hospitality Management Institute)

Research Focus--Bahamian Student Values of Tourism Careers

Description--Data are being collected from secondary school students in New Providence, with the expectation to expand to the Family Islands. The results of this research would produce the first empirical findings of the attitudes of secondary school students' attitudes about the tourism industry.

8. Dr. Faith Butler (Assistant Professor); Janice Munnings (Associate Professor); Veronica Ferguson (Assistant Professor), School of Education; Tonya Gibson (Researcher I, Research, Graduate Programmes & International Relations); William Fielding (Director, Planning) Charles Major and Brenda Bain, Ministry of Education, Youth Sports & Culture, Planning Unit)

Research Focus--Student, Teacher and Parent Attitudes

Description--The Ministry of Education, Youth, Sports and Culture has approached The College of The Bahamas to partner with a research project which will seek to find out how students, teachers and parents feel about a variety of significant issues affecting the education system and them as users of the system. The

general objectives of this research project are to (a) identify the strengths and weaknesses of our education system from the perspective of students, teachers and parents; and (b) offer recommendations for improving the education system. More specifically, the research project will seek to ascertain the opinion of respondents on several key issues including, but not limited to (a) School Management and Administration; (b) Quality of the Instructional Programme; (c) Financing and Budgeting in Education; (d) Interpersonal relationships; (e) Community relations; (f) Attitudes of key actors toward schooling and learning; (g) Assessment and Evaluation; (h) remuneration, Benefits and Rewards.

9. Sonya Wisdom (Assistant Professor and Director, Graduate Programmes)

Research Focus--Study of curriculum and instruction, with a particular focus on the curriculum decisions that teachers make

Description--This research focuses on how and why pre-service teachers decide what part(s) of a prescribed national primary school science curriculum to teach and what the role of a primary science methods course is in supporting their curriculum decisions. In particular, the study seeks to determine the aspects of a primary science methods course that encourage pre-service teachers to teach environmental science to their future students.

10. Dr. Suzanne Newbold, Counselor, Department of Counseling & Health Sciences)

Research Focus--Enhancing the Enrollment of Male Students in The College of The Bahamas

Description--The objectives of this study are to (1) assess students' learning styles, attitudes toward education and their desire for enrollment in a tertiary level institution; (2) analyze information related to preferred learning styles of male students; and (3) explore the sources of financial pressure for student from the perspectives of both students and teachers. This project involves the surveying of male students in grades 8-11 to determine factors deterring them from enrolling in college. In addition, their learning style, attitude towards education, and desire to enroll in college will be evaluated. A compilation of innovative strategies and suggestions for curricula modification will be made based on preliminary findings. The researcher posits that should a programme be established that enhances the enrollment of males in college, this should improve career opportunities, quality of life and a reduce criminal/deviant behavior in adult, educated males.

FOCUS ON SOCIAL ISSUES

11. William Fielding (Director of Planning)

Research Focus--The link between domestic violence and animal abuse

Description--The link between domestic violence and animal abuse: The Bahamas has been identified as having a high incidence of domestic violence. This research has established the link between animal cruelty and domestic violence in The Bahamas, a link which exists elsewhere. This link gives officials another way by which at households at risk of suffering from domestic violence can be flagged. Studies elsewhere have indicated the importance of monitoring those who are cruel to animals as they are at greater risk of harming people than those who do not abuse animals.

12. Dr. Pandora Johnson (Associate Professor and VP Outreach) and William Fielding (Director, Planning)

Research Focus--Haitian Immigration in the Turks and Caicos Islands

Description--Continuous turbulence in Haiti has resulted in its be a content source of substantial emigration to neighbouring countries, in particular The Bahamas and the Turks and Caicos islands. Through the collection of primary data and the analysis of existing information, and conducting surveys of migrant households, this study seeks to gauge the dimension and impact of Haitian migration in the Turks and Caicos Islands. It employs the methodology used in a similar study carried out in The Bahamas in 2005.

13. Maggie Turner (Associate Professor); Shirley Curtis (Assistant Professor); Doreen Butler (Lecturer), School of Nursing & Allied Health Professions

Research Focus--The social and economic profile of the elderly in Jamaica, The Bahamas, Barbados, Guyana, Suriname and Trinidad and Tobago

Description--This study examined the economic, health and social profiles of the elderly and the patterns of their utilisation of health services. Legislation, policies, programmes and budgets which addressed the rights of the elderly were identified for each country. Focus groups were facilitated in The Bahamas between February and March 2008. The preliminary findings suggest that there is a need for further research to determine how best each country in the study might improve access to and development of related services for the elderly.

14. William Fielding (Director of Planning)

Research Focus--Animal - human interactions, with particular reference to dogs

Description-- Areas of interest include the ways humans care for and use domestic pets. The long-term objective of this research is to provide policy makers and educators with information to allow them to make decisions which will raise the level of animal welfare in the country. Current research focuses on the fate of puppies produced as a result of back-yard breeding and the impact which this activity has on the dog population. The results suggest that regulating breeding would be useful not only as a means of improving animal welfare but also as a means of controlling the dog population in New Providence. Previous research topics have included the use of dogs for household security, the response of tourists to seeing roaming dogs and the attitudes and actions to owned and unowned dogs.

FOCUS ON THE ECONOMY

15. Dr. Olivia Saunders (Associate Professor, School of Business)

Research Focus-- Bahamian economy, specifically with respect to economic development issues

Descriptions--Project 1: working title--'Beyond Sun and Fun: The Economy of The Bahamas'. For this project, the researcher is seeking to provide an in-depth understanding of the Bahamian macroeconomy. Trends and levels in the national accounts, employment data, household income, income distribution, and fiscal operations will be examined and discussed. Project 2: working title--'The Bahamas in the World Economy'. For this project the researcher will go behind the numbers in the country's balance of payments to explain domestic economic conditions and the influences of international events. Project 3: working title--'The First Decade of an Independent Economy: The Bahamas'. For this project, the researcher will examine three areas, including government policy, institutions and external influences that affected the growth and development of the Bahamian economy during the first decade of independence. The researcher will seek to explain the foundations laid during these early years so as to provide a source for constructive discussions for policy makers, academics, historians, students and others.

16. Dr. Silvius Wilson (Assistant Professor, School of Social Sciences)

Research Focus--Poverty, Culture, and Nutrition in a Comprehensive Approach To Sustainable Development In The Caribbean

Description--The aim of the research is to explore the impact of poverty, culture, and the state of nutrition on people's choice and life chances in select Caribbean states. These factors are examined within the context of regional trends in human resources development and national strategy for growth. The analysis will explore country profile in: health and wellness, level of education/training, democracy, community/public sphere participation, environmental preservation, and the extent to which these are factored in policy decisions aimed at facilitating sustainable development.

FOCUS ON THE SCIENCES

17. Dr. Carlton Watson (Assistant Professor, School of Sciences & Technology)

Research Focus--Pulsed laser deposition (PLD) of Zirconium Co-doped ZnO

Description--This research project can be divided into a fundamental and an applied strand. The fundamental strand seeks to understand the nature by which p-type doping in ZnO occurs. This is still not very well understood and is the source of some controversy. The second strand will produce p-type ZnO thin films to be used in the fabrication of wide band-gap semiconductors, photovoltaic cells and lasers.

18. Dr. Kenneth Cartwright (Associate Professor, School of Sciences & Technology)

Research Focus-- Digital communications.

Description-- Presently, the researcher is supervising a BSET Electrical Engineering Technology student in his senior design project, entitled, *Finding the Maximum Impedance Resonant Frequency of a Practical Parallel Resonant Circuit without Calculus*. The goal of this research is to find a non-calculus way of deriving this known result in Electrical Engineering. This is an example of studies to clarify well known results to make them more accessible to students. For example, how the root-mean-square (rms) value of voltages (or currents) can be obtained for many waveforms without calculus or how the maximum power transfer theorem can also be derived without calculus. These published projects should help students who have not yet had the opportunity to learn calculus, or who are weak in the subject, or for those students who just want an alternative viewpoint. When this present work is completed, I intend to return to my work on blind phase estimation in digital communication.

19. Dr. Kenya Ward (Assistant Professor, School of Sciences & Technology)

Research Focus--Diabetes Pancreatic Research

Description--Research studies have explored the effects of free fatty acids and adipokines on pancreatic beta-cell gene expression, viability and function. The effect of common oral hypoglycaemic drugs and naturally occurring antioxidants on pancreatic beta-cell viability has also been observed. Studies in biomedical research have involved many molecular and analytical methods including cell culture using immortalised rat and mice beta-cell lines, Western blotting, RT-PCR, ELISA, Fluorescent microscopy and Immunohistochemistry. Further research is required to determine the generalisability of research findings to populations in the Caribbean.

20. Dr. Janet Patterson (Assistant Professor); Greta Kemp (Lecturer), School of Sciences & Technology; and Dr. Brendamae Cleare (Associate Professor and Dean, Faculty of Pure & Applied Sciences)

Research Focus--The importance of the use of brackets in Mathematics

Description--The researchers argue that brackets are as important to the Language of Mathematics as commas are to the English Language. They posit further that students are usually oblivious of the role of brackets in mathematics, suggesting that mathematics teachers need to emphasise the importance of this element of 'punctuation' in mathematics just as English language teachers must emphasise the use of commas. To highlight the importance of the use of brackets in Mathematics, researchers compare its use to the use of commas in English. They advance a theory which they seek to support through a review of the literature, highlighting errors that result from the improper use of brackets in mathematics. Such errors they argue are analogous to the communication errors that result from the improper use of commas. Other uses of brackets in mathematics are being examined.

FOCUS ON CULTURE

21. **Tonya Gibson (Researcher I, Research, Graduate Programmes & International Relations); Tracey Thompson (Assistant Professor, School of Sciences & Technology); Willamae Johnson (Director of Libraries & Media Services); Audrey F. Dean-Wright (Associate Professor, School of Communication & Creative Arts); Jackson Burnside (Architect, Burnside & Associates)**

Research Focus--Bahamian Cultural traditions

Description--This project is still in its conceptual phase is focusing on elements that would enhance the ability of the country to preserve its rich and diverse cultural traditions. The premise is that to preserve these cultural traditions, more research must be conducted, documented and disseminated to the general public. Documentation and dissemination of such information raises awareness of Bahamian culture, and informs and contributes to policy formulation and the development of educational materials. Early discussions have focused on the establishment of an institution that would benefit students, teachers, professors, local and international research scholars, schools and institutions of higher learning, government, the Bahamian community (including various businesses) as well as visitors to The Bahamas. The overall objectives of the institute would be to (a) develop a national cultural research agenda; (b) develop a National Catalogue on cultural research; (c) increase knowledge base on Bahamian culture through the conduct and dissemination of research on all aspects of the Bahamian society (i.e., food ways, dress, artistic expression, music, story-telling, riddles and rhymes, sings, festivals, rituals, religion, craft etc.); (c) provide opportunities for faculty and students to engage in collaborative multi-disciplinary research; and (d) develop an Oral History Archive.

FOCUS ON THE ENVIRONMENT

22. **Lionel Johnson (Assistant Professor); Dr. Marlene Jackson (Assistant Professor); Sandra Phillip-Burrows (Assistant Professor); Dr. Marcia Mundle (Assistant Professor); Dr. Karra Reddy (Associate Professor); Joyanne Thompson (Assistant Professor), School of Sciences & Technology**

Research Focus-- The Development of a Stakeholder Assessment Report to support the Expansion of the West Side of Andros as a Protected Area of Andros Island

Description--Given the unique physical environment of the West side of Andros and its importance to species such as snapper, spiny lobster, tarpon and bonefish, considerable attention has been paid to the area in more recent times. Such attention has focused on the development of a comprehensive strategy to promote the establishment of an expanded protected area to protect it from potential threat. The major thrust of the research involved the conduct and analysis of a stakeholder survey completed by the users of marine and terrestrial resources. The survey was intended to assess the knowledge of resource users regarding fish and other invertebrate stocks and built partnerships with persons whose livelihood depend on the resources of the west side. The methodology employed included town meetings, surveys and one-on-one interviews, focusing on user insights regarding the marine and terrestrial environments, park extension and park management.

23. **Lionel Johnson (Assistant Professor); Dr. Marlene Jackson (Assistant Professor); Sandra Phillip-Burrows (Assistant Professor); Dr. Marcia Mundle (Assistant Professor); Dr. Karra Reddy (Associate Professor); Joyanne Thompson (Assistant Professor), School of Sciences & Technology**

Research Focus—Andros Crab Project

Description--Edible land crabs belonging to the genus *Cardisoma* are found throughout the archipelago of The Bahamas and are an important part of Bahamian cuisine. The island of Andros which is the largest of the Bahama chain is generally believed to possess the largest population of land crabs. There is very little documented information on the genus, hence the need for a comprehensive study of the biology and economics of the species. The College of The Bahamas in its quest to address national needs has begun a

study that would, once fully funded, focus on the life histories of the species; the sustainability of the Andros populations given the harvesting pressures; and the contribution to the economic development of the island.

FOCUS ON SUSTAINABLE ISLAND LIVING

24. Lionel Johnson (Lead Researcher, Assistant Professor, School of Sciences & Technology)

Research Focus--Development Projects and Land Use Conflicts in The Bahamas

Description--This study focuses on the conflicts and feelings of resentment arising out of the denial of beach access to many local residents. Comparisons from other jurisdictions, Caribbean and Pacific island states, are being reviewed as the researchers assess the emotional attachment of Bahamians to various beaches and coastal areas on New Providence (including Paradise Island); and identify the location of restricted access points.

25. Jessica Minnis (Associate Professor) and Yvette Pintard-Nwery (Assistant Professor) School of Social Sciences

Research Focus--Challenges of Development and Sustainability: The Role of Civil Society

Description--The research focuses on the challenges of development and sustainability in The Bahamas as it pertains to land use and the role of civil society in preserving the environment, culture and heritage. The aim is to analyze the environmental and heritage issues brought to the fore with the proposed development of the Clifton Cay Project in 1998/9. The Project sought to utilize beach front, historical plantation land for a gated community. The protests of civil society at that time and its ability to thwart the proposed Clifton development are reviewed in light of existing and proposed developments in The Bahamas.

FOCUS ON THE MARINE AND ENVIRONMENT

26. Marine & Environmental Studies Institute

A. *The National Queen Conch Population Survey (Lead Researchers, Lester Gittens, Department of Marine Resources and Dr. Kathleen Sealey, Associate Professor and Director, Marine & Environmental Studies Institute)*

The Queen Conch (*Strombus gigas*) is considered to be one of the most important fisheries in the Caribbean. In terms of total landed weight, it is second only to the spiny lobster fishery. The National Queen Conch Population Survey is a collaborative effort between The College of The Bahamas, Marine & Environmental Studies Institute and the Department of Marine Resources that was initiated in fall 2006. This project will span several years and is intended to cover most of the major Queen Conch fishing areas organized by bank system in The Bahamas. The overall goal is to gather data on Queen Conch densities, population structure and habitat associations throughout the archipelago necessary to: evaluate the status of populations in relatively shallow waters (less than 20m); identify critical Queen Conch nursery areas that may need protection from over-fishing; and, update management strategies. Surveys involve a team of SCUBA divers that employs a system of underwater transects and a stratified random sampling protocol, which uses both Land-Sat7 habitat maps of shallow water marine habitats and existing maps of high-use conch fishing areas based on fisherman interviews.

B. The Reef Fish Landings Surveys and Grouper Reproduction Project (Lead Researchers, Dr. Kathleen Sealey Associate Professor and Director, Marine & Environmental Studies Institute and Nicole Cushion, Research Associate)

The Grouper Reproduction Project is a collaborative effort involving the University of Miami, The College of The Bahamas, Marine & Environmental Studies Institute and the Department of Marine Resources. Partly a continuation of the 1998-2001 Nassau Grouper Fecundity Project, this project aims to obtain fishery and reproductive biology information on three local grouper species of significant commercial importance: the Nassau Grouper (*Epinephelus striatus*); the Red Hind (*Epinephelus guttatus*); and, the Yellowfin Grouper (*Mycteroperca venenosa*). By following the full-moon lunar cycle, grouper samples are obtained monthly in New Providence with the goal of collecting data critical to gaining insight on: spawning seasonality and duration; approximate size at sexual maturity; and, age and size distributions for each species. The grouper spawning aggregation seasonal closure has raised concern for the increased fishing pressure on other reef fishes, including other species of groupers, snappers, grunts, parrotfishes and triggerfishes. This project now includes monthly surveys of landings at Montagu ramp with fishermen interviews to estimate the total biomass and species composition of fishes removed from Bahamian reefs.

C. The Poultry Research Unit (Lead Researchers, Justin Taylor, Manager, Poultry Research Unit and Dr. Patricia Grant-Johnson, Assistant Professor, School of Sciences & Technology)

The College of The Bahamas completed the construction of a fully-automated poultry production Poultry Research Unit in mid-2004. The poultry production facilities were incorporated into the Marine and Environmental Science Institute as the Poultry Research Unit (PRU) in 2006. The mission of PRU is to carry out research and training programmes focused on sustainable agricultural practices for The Bahamas. Over the past two years, the PRU was charged to develop better small production models to improve the nutritional value of broiler chickens as well as reduce the environmental impacts of intensive poultry farming. The programmes initiated at the Poultry Research Unit are designed to improve animal health and animal husbandry practices; improve bio-security protocols appropriate for agriculture in The Bahamas; increase production and product quality using pro-biotic feed additives while minimizing the use of antibiotics; investigate value-added practices in the use of production waste and manure in advanced composting technologies; and reduce environmental impacts of agriculture in The Bahamas by innovative ways to reduce, re-use and recycle. The PRU is charged with producing case studies, outreach materials and scientific publications that address the technical, economic and environmental aspects of poultry production and other agribusinesses in The Bahamas. The PRU was funded with an initial grant from the Freedom Foundation to initiate training and research for sustainable agriculture on tropical islands.

D. The National Response Plan to the Lionfish Invasion on the Bahamian Coast (Lead Researchers, Nicola Smith, Research Assistant and Dr. Kathleen Sealey, Associate Professor and Director, Marine & Environmental Studies Institute)

The Commonwealth of The Bahamas faces significant challenges in the management and protection of marine resources over the 1,200 kilometer-long archipelago. Stressors on the marine environment include over-fishing, marine and terrestrial sources of pollution, climate change and invasive species. Invasive species are non-native species that become established in a new environment and proliferate and spread in ways that may noticeably impact native populations, species or entire ecosystems. Biological invasions are one of the leading threats to biodiversity worldwide. The recent introduction of the venomous Indo-Pacific lionfish (*Pterois volitans/miles* complex) to the western Atlantic Ocean is an ongoing exotic species range expansion with unknown consequences for Caribbean and Atlantic fisheries and ecosystems. The College of The Bahamas, Marine and Environmental Studies Institute in collaboration with the Department of Marine Resources is creating a long-term national lionfish response plan that entails a partnership between both local and regional government and non-governmental agencies. The plan focuses on research, invasion management and policy development, and educational initiatives to understand the implications of the establishment of lionfish in The Bahamas while building a body of stakeholders that can contribute to the conservation and management of marine resources. Preliminary research will address questions surrounding which types of near shore habitats are more susceptible to invasion as well as lionfish diet niches while initial

invasion management and policy development include the creation of an archipelago-wide lionfish sightings reporting system and distribution database. Future education efforts involve raising awareness among local fishing and recreational diving communities about lionfish invasion management options.

E. Coastal Water Quality and Storm Water Management on New Providence (Lead Researchers, Stacey Jennings, Research Associate and Dr. Kathleen Sealey, Associate Professor and Director, Marine & Environmental Studies Institute)

The carbonate geology of The Bahamas has a critical role in moving pollutants from the land to the sea. Small islands on large shallow carbonate banks can support limited groundwater supplies in lenses of freshwater floating on the underlying seawater. All wells that either draw up fresh water or discharge wastewater are subject to tidal influences and seasonal changes (recharge) in the depth of the freshwater lens. The result is a constant source of land-based pollution to the adjacent marine environment. The Government of The Bahamas is obliged to consider the impact of flooding on residential areas and businesses, and thus the injection wells are a critical component for protecting people and their property. However, what can be done to minimize the pollution impacts during the seasonal rainfall events? The solution may likely include some changes in land use and waste disposal. An integrated storm water management research project was initiated in 2008 with Tufts University WSSS (Water: Systems, Society and Solutions) graduate programme to examine the socio-economic, institutional and environmental impacts of the problem and suggest both policy and engineering solutions that rely on the process of Integrated Water Resources Management (IWRM). An IWRM approach consists of a number of components, among them: identification of planning principles; general description of the problem; development of multi-dimensional socio-economic, institutional, and environmental indicators to measure the problem; data collection and analysis to characterize the problem using the multidimensional indicators; development of alternatives; evaluation of alternatives, using indicators; agreement on recommendations for implementation of solutions; and initiation of plans for post-implementation monitoring and evaluation.

FOCUS ON THE GERACE RESEARCH CENTRE

27. Gerace Research Centre

At the Gerace Research Centre there currently are **58 active biology** and **32 active geology projects**. Here is a selection:

- a. Eric Cole. St. Olaf College. **“Life history of the Scaly Pearl Oyster, *Pinctada longisquamosa*”**. Scaly Pearl Oysters from different ponds on San Salvador follow different sex-determination pathways (Mermaid Pond: all individuals begin life as males, then half metamorphose into females a year later; versus Little Granny Pond: oyster mature directly with a 50/50 male/female population). This project is focused on if this change in pathway is a response to evolutionary pressures driven by regular hurricane induced population crashes or a physiological adaptation in response to environmental conditions (resource availability; environmental estrogens).
- b. Craig Tepper & Benjamin Greenstein. Cornell College. **“Discrimination between species of the hydrozoan millepora using morphologic and genetic analyses”**. Defining a species, and on what grounds (ecology, morphology, genetics), has long been a problem in biology. This project on morphologically and ecologically diverse fire coral has been focused on whether multiple species have been hybridizing to create a diversity of forms, or if a single species simply expresses itself in different forms depending upon environment. Their findings tend to support the latter, which contrasts with results found for other types of corals in the Caribbean in which genetic data supports the existence of many more species than morphology would seem to indicate are present.

- c. Steffi Schwabe. College of Charleston. **“Microbial abundance and identification in rocks and water and their role in the formation of secondary porosity (including caves) in The Bahamas”**. This project is focused on isolating and identifying the bacteria which is found in meteoric and subsurface waters, and to identify the environmental changes they generate. Related to this is an examination of what sustains the bacteria in the subsurface—do they remove the organic material locked into the rocks or do they have to wait for new material brought in by recent rainfalls?
- d. Doug Gamble. U. North Carolina-Wilmington. **“A Field Evaluation of San Salvador Island's Climatology”**. As part of this project a network of weather stations has been established on San Salvador. The climatological data have been applied to several different projects on the island (karst processes, microbiology of inland lakes, distribution of invasive tree species, and water resource development), as well as toward testing the claim that small islands with low relief will experience little spatial variability in precipitation.
- e. R. Lawrence Davis. U. of New Haven. **“Hydrology of San Salvador: Relationships between inland lakes, conduits, the ocean and groundwater”**. This long-term project has focused on understanding the “plumbing” of San Salvador, including how the various inland lakes may be connected, how the ocean connects with some of the lakes, and the location of the freshwater lens. As part of this project the location of caves has been put into the present and past hydrologic setting of San Salvador, as well as surveys of ground water chemistry and the impact of development (Club Med) on well fields.

Among the active projects conducted at The Gerace Research Centre are a number of student research projects. Much of them by Master and PhD students. Here are some representative student projects being conducted at the GRC:

- a. Nyssa Silbiger. U. North Carolina-Chapel Hill. **“How sponges directly and indirectly affect nearby organisms through their excretion of bioavailable nutrients”**. This project is particularly relevant as it has bearing on the ability of coral reefs to recover from the types of disturbance they have encountered over the last 20 plus years. Certain sponges excrete nutrients which help bacteria and algae thrive while hurting the ability of hard coral to recover. This study proposes to examine how exactly this is occurring.
- b. Christopher Martin. U. California-Davis. **“Divergence in morphology and performance within a young radiation of *Cyprinodon* pupfishes on San Salvador Island, Bahamas”**. Evolutionary transitions towards new adaptive peaks (filling new niches; key innovations; etc.) are still relatively poorly understood. This is largely due to the rarity of catching evolution “in the act”. Three pupfish morphotypes on San Salvador represent a unique opportunity for such study.
- c. Dorien McGee. U. of South Florida. **“Testing a biological model of carbonic-acid driven cave dissolution with stable carbon isotope tracing”**. The majority of research into the formation of caves in limestone has focused on how abiotic factors (temperature, pH, mineral saturation, etc.) govern rates of dissolution. There is however debate as to whether these factors alone are sufficient or if bacterial mediation plays a significant role. This project is examining the relative contributions of the different abiotic and biotic factors in dissolved CO₂ production in caves.